

# **Final Report**

**from the examination of the aviation accident no  
192/2010/11**

**involving the Tu-154M airplane, tail number 101,  
which occurred on April 10<sup>th</sup>, 2010**

**in the area of the SMOLENSK NORTH airfield**

*The accident was investigated by the Committee for Investigation of National Aviation Accidents with the aim to establish the circumstances and cause, and to formulate preventive recommendations.*

*Acting pursuant to the Aviation Law of July 3<sup>rd</sup>, 2002, art. 140 of the Decree by the Minister of Defense of May 26<sup>th</sup>, 2004 on the organization and proceedings of the Committee for Investigation of National Aviation Accidents, in particular pursuant to § 12 thereof, “the Committee shall not pass judgment on blame and responsibility”. Hence, any attempts to use this Report for any purpose other than prevention of accidents and serious incidents in aviation may lead to misconception and misintepretation.*

*The Report has been executed in the Polish language. Other language versions have been drawn up solely for information purposes.*

## ***General overview***

|  |  |
|--|--|
| Incident type:                           | <b>ACCIDENT</b>  |
| Type and model of the aircraft involved: | <b>Tu-154M AIRPLANE</b>                                      |
| Aircraft identity code:                  | <b>PLF 101</b>   |
| Aircraft commander:                      | <b>AIR FORCE PILOT</b>                                       |
| Flight commissioned by:                  | <b>OFFICE OF THE PRESIDENT OF<br/>THE REPUBLIC OF POLAND</b> |
| Aircraft user:                           | <b>36 SPECIAL AIRLIFT REGIMENT</b>                           |
| Incident location:                       | <b>VICINITY OF THE SMOLENSK<br/>NORTH AIRBASE</b>            |
| Incident date and time:                  | <b>April 10<sup>th</sup>, 2010 at 06:41:07,5 UTC</b>         |
| Extent of aircraft damage:               | <b>DESTRUCTION</b>   |
| Injuries to the crew and passengers:     | <b>FATAL</b>   |

## Table of acronyms and abbreviations

|                     |   |
|---------------------|---|
| 13 eltr             | 13 Airlift Squadron;  |
| 36 splt             | 36 Special Airlift Regiment ;   |
| ABSU                | autopilot system of the Tu-154M plane;  |
| AFTN                | ground-based telecommunication system for aviation  |
| AIP FR i WNP        | Aeronautical Information Publication of the Russian Federation<br>and Countries of The Commonwealth of Independent States;                  |
| APP                 | APPROACH (airport traffic control);   |
| APM (APP-90P)       | truck-mounted projectors;   |
| ARK                 | radio compass;  |
| ATC                 | Air Traffic Controller;   |
| ATM-QAR             | quick access flight recorder;   |
| ATS                 | Air Traffic Services;   |
| AUP                 | Airspace Use Plan;  |
| BAMSO, RUDKA, ASKIL | codenames of navigation waypoints;  |
| BL                  | flight safety;  |
| BOR                 | Government Protection Office;   |
| BOZ                 | crew briefing room;   |
| BRL                 | inner non-directional beacon, inner NDB;  |
| BSKL                | inner air traffic control station;  |
| CAVOK               | airport weather conditions – horizontal visibility over 10 km,<br>cloud base above 1500, no weather phenomena or cumuliform<br>rain clouds; |
| CDU                 | Computer Display Unit ;   |
| CH SZ RP            | Hydrometeorological Center of the Polish Armed Forces;  |
| CLK                 | Central Forensic Laboratory;  |
| CO                  | Moscow Operations Center (callsign LOGIKA);   |
| COP                 | Air Operations Center;  |
| CPL(A); MEP(L)      | designation of a crew member licence or certifications entered in<br>such license;  |
| CRM                 | Crew Resource Management;   |
| DA(DH)              | Decision Altitude (Decision Height);  |

|               |  |
|---------------|--|
| DBL           | commanding officer of the 21350 military unit in Tver (callsign ZELEZNIAK);  |
| DELIVERY      | controller issuing clearance for transit;  |
| DIFR          | flight regulations: day, IFR;  |
| DIMC          | flight conditions: day IMC;  |
| DK            | taxiway, TWY;  |
| DML           | meteorologist on duty;   |
| DMW           | Naval Command;   |
| DO SZ         | Operations Command of the Armed Forces;  |
| DRL           | outer non-directional beacon, outer NDB;   |
| DRL           | omnidirectional radar;   |
| DS            | runway, RWY;   |
| DSP           | Air Force Command;   |
| DSZ           | Foreign Affairs Department;  |
| DTWA          | flight conditions: day, difficult weather conditions;  |
| DVMC          | flight conditions: day, ground visibility;   |
| DW            | East Department;   |
| DWL           | Air Command;   |
| DWLiOP        | Air Force and Air Defense Command;   |
| DZWA          | flight conditions: day, ordinary weather conditions, DVMC;   |
| EASA          | European Aviation Safety Agency;   |
| EU-OPS 1      | technical specifications and administrative procedures for conducting commercial transport issued by the European Council; |
| EGPWS         | Enhanced Ground Proximity Warning System;  |
| ELT           | Emergency Locator Transmitter (automatic rescue radio)   |
| EPSC          | ICAO code of the Szczecin-Goleniów airport;  |
| EPWA          | ICAO code of the Warszawa-Okęcie airport;  |
| FAP NGEA GosA | commissioning standards for state aerodromes of the Russian Federation;  |
| FAP PP GosA   | federal regulations for conducting flights by the Russian Federal Aviation;  |
| FAP REA       | aerodrome operating manual of the Russian Federal Aviation;  |
| FIS           | Flight Information Services;   |

|                 |   |
|-----------------|---|
| FL              | Flight Level;   |
| FMS             | Flight Management System;   |
| FSO             | Federal Protection Service of the FR;   |
| GCKRL           | Main Air Traffic Control in Moscow;   |
| GDK             | main taxiway;   |
| GKL             | traffic control group;  |
| GROUND          | ground traffic controller;  |
| HEAD            | designation of VIP flights carrying one of the following:<br>President of the RP, Prime Minister, Speaker of the Sejm of the<br>RP, Speaker of the Senat of the RP; |
| ICAO            | International Civilian Aviation Organization;   |
| IFR IR(A)       | certification for IFR flights on airplanes;   |
| IFR IR(H)       | certification for IFR flights on helicopters;   |
| IFR             | Instrument Flight Rules;  |
| ILS             | Instrument Landing System ;   |
| IMC             | Instrument Meteorological Conditions;   |
| INOP            | Military Airport Operating Manual;  |
| Instrukcja NAMS | meteorological services manual of the RF Armed Forces;  |
| IOL-2008        | Polish Air Force flight organization manual;  |
| IOLP-2005       | Polish Air Force test flight organization manual;   |
| ITWL            | Air Force Institute of Technology;  |
| IUL             | aircraft flight manual;   |
| IW SZ           | Armed Forces Support Inspectorate;  |
| IWsp. SZ        | Armed Forces Support Inspectorate;  |
| JAA             | Joint Aviation Authorities ;  |
| JAR FCL 1       | Joint Aviation Requirements Flight Crew Licence;  |
| Jeppesen        | a company that publishes aviation maps, approach charts, and<br>other aviation-related information, which are used by flight<br>crews in a controlled airspace;     |
| JW 2139         | military unit no. 2139 – 36 Regiment;   |
| KBI             | Incident Investigation Committee;   |
| KBN-1-1         | maintenance flight recorder;  |
| KG ŻW           | Military Police Headquarters;   |
| KL              | SMOLENSK NORTH air operations controller;   |

|             |   |
|-------------|---|
| KNS-4U      | neon coded airfield lighting device;  |
| KORSAŽ      | SMOLENSK NORTH callsign;  |
| KOSS        | airplane and helicopter test flight committee;  |
| KPB         | stopway, overrun area;  |
| KPRP        | Office of the President of the RP;  |
| krl TWR     | airport traffic controller;   |
| KSB         | approach zone controller;   |
| KSL         | landing zone controller;  |
| KTA         | airport control point (geometrical center of the runway);   |
| KTN         | navigator's checkride;  |
| KTP         | pilot's checkride;  |
| KTR         | SD traffic controller;  |
| LKSL        | Aviation Equipment Control Laboratory;  |
| LMT         | Local Mean Time;  |
| LSM         | airfield meteorological station;  |
| ŁUCZ-2MU    | airfield lighting system;   |
| MAK         | Interstate Aviation Committee of the RF;  |
| MARS-BM     | cockpit voice recorder;   |
| MCC         | Multi Crew Cooperation;   |
| MDA(MDH)    | Minimum Descent Altitude (Minimum Descent Height);  |
| METAR       | dispatch from an airport on the present weather conditions as observed and measured by a qualified met station personnel; |
| METEO (M)   | weather station manager at SMOLENSK NORTH;  |
| Minister ON | Minister of National Defense;   |
| MKiDN       | Ministry of Culture and National Heritage;  |
| MŁP-14-5    | crash-proof flight recorder;  |
| MON         | Ministry of National Defence (MoND);  |
| MSD         | permanent stations;   |
| MSRP        | on-board flight recorder (records flight parameters);   |
| MSZ FR      | Ministry of Foreign Affairs of the RF;  |
| MSZ         | Ministry of Foreign Affairs;  |
| NDB         | non-directional beacon;   |
| NIMC        | flight conditions: night, IMC;  |

|                |  |
|----------------|--|
| NOSIG          | a code used in METAR/TAF weather dispatches from the airfields which means that no significant changes occurred in the weather conditions specified in the dispatch; |
| NOTAM          | Notification To Aircrew Members;   |
| NTWA           | flight conditions: night, difficult weather conditions;  |
| NVMC           | flight conditions: night, ground visibility;   |
| NZP            | dangerous weather phenomena;   |
| NZWA           | flight conditions: night, normal weather conditions NVMC;  |
| O              | speciality designation: AVIONICS;  |
| OCA/H          | Obstacle Clearance Altitude/Height;  |
| OKL            | objective traffic control;   |
| PAR + 2 × NDB  | radar-based landing system involving two non-directional beacons;  |
| PAR            | radar-based landing system;  |
| PAŻP           | Polish Aeronautical Agency;  |
| PCN            | pavement class code;   |
| PD             | Diplomatic Protocol;   |
| PiS            | specialty designation: AIRFRAME AND POWERPLANT;  |
| PKL            | traffic controller assistant;  |
| PKW            | Polish Military Contingent;  |
| PLF 031        | callsign of the Jak-40 044 airplane;   |
| PLF 101        | callsign of the airplane with the President of the RP on board;  |
| PŁD            | SMOLENSK SOUTH airport controller;   |
| PPH-8          | apron for helicopters #8 WPL;  |
| PPS-9          | apron for airplanes #9 WPL;  |
| PRŁ            | precision approach radar;  |
| Prognoza TREND | short-term forecast (for 2-3 hours) attached to METAR dispatches from some airports;   |
| Ps             | pre-flight servicing;  |
| PSzLT-73       | transport aviation training program;   |
| Q              | CO operations officer;   |
| QFE            | atmospheric pressure at the airport level;   |
| QNH            | atmospheric pressure adjusted to sea level;  |
| Radiostacja HF | UHF radio;   |

|                |   |
|----------------|---|
| Radiostacja KF | short-wave radio;   |
| RL-2006        | flight manual from 2006;  |
| RM             | Council of Ministers (government);  |
| RO-86          | maintenance documentation;  |
| ROPWiM         | Council for Commemoration of War Efforts and Martyrdom;   |
| RSP + OSP      | radar-based landing system and two guiding beacons;   |
| RSP-6M2        | radar-based landing system;   |
| RSZ            | corps of the Armed Forces;  |
| RVSM           | Reduced Vertical Separation Minimum between FL290 and 410;  |
| RW             | radio altimeter;  |
| RWD            | part of document signature;   |
| SD             | SMOLENSK NORTH command station;   |
| SDO            | senior operations officer on duty;  |
| SELCAL         | short-wave radio selective call;  |
| SG WP          | General Staff of the Polish Armed Forces;   |
| SID            | Standard Instrument Departure;  |
| SIGWX          | large area weather forecast in graphical format;  |
| SIL            | flight engineering service;   |
| SK-42          | cartography system in use in the Russian Federation;  |
| SOP            | standard operation procedures;  |
| SP             | aircraft;   |
| SSP-1          | airfield lighting system;   |
| STAR           | Standard Arrival;   |
| STL            | Aircraft Maintenance Section;   |
| SZTORM         | dispatch on dangerous weather phenomena or threshold weader conditions at the weather station (not necessarily at airport) specifying the time of occurrence; |
| SYNOP          | weather station dispatch transmited at predefined intervals from a weather stytion (every 3 hours in international traffic);                                  |
| SZ RP          | Armed Forces of the Republic of Poland;   |
| TAF            | weather forecast for airport;   |
| TAWS           | Terrain Awarness Warning System (system which warns about dangerous proximity to ground);   |
| TCAS           | collission warning equipment;   |



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| TWA      | difficult weather conditions;                                |
| TWR      | control tower;   |
| UHF      | UHF radio band;  |
| UNS-1D   | FMS block;   |
| URE      | specialty designation : RADIO AND ELECTRONICS;               |
| USL      | approach system using two NDBs;                              |
| UTC      | universal time;  |
| VHF      | very high frequency band;                                    |
| VFR      | flight regulations governing flights with ground visibility; |
| VMC      | flight conditions with visibility;                           |
| VOR DME  | navigational aid with rangefinder;                           |
| WA       | weather conditions;  |
| WAŻNY    | designation of flights with state VIPs on board;             |
| WBE-SWE  | digital pressure altimeter;                                  |
| WGS84    | cartography system;  |
| WISP-75T | radar-based landing system indicators;                       |
| WKLL     | Military Aeronautical Medicine Commission;                   |
| WM       | minimum weather conditions;                                  |
| WMO      | World Meteorological Organization;                           |
| WPL      | military airport;  |
| WSOSP    | Air Force Academy;   |
| XUBS     | SMOLENSK NORTH airfield callsign;                            |
| ZBL      | air operations safety group;                                 |
| ZDBL     | airbase deputy commanding officer;                           |
| ZOOP     | Presidential Organization and Support Team;                  |
| ZWA      | regular weather conditions;                                  |

## Executive summary

On April 10<sup>th</sup>, 2010, during the approach to the SMOLENSK NORTH airfield, the Tu-154M airplane tail number 101 had an accident resulting in death of the crew and passengers.

Investigation into the accident was conducted by the State Aviation Accident Investigation Committee which was established by virtue of the decision by the Minister of Defense pursuant to Art. 140 para 1 of the Aviation Law of July 3<sup>rd</sup>, 2002. The members of the Committee were:

- |           |  |
|-----------|--|
| Chairman  | • Jerzy Miller, M.Sc.Eng.                      |
| Deputy    | • Col. Pilot Mirosław Grochowski, M.Sc.Eng.    |
| Chairman  |  |
| Secretary | • Agata Kaczyńska, M.Sc./MA                    |
| Members:  | • Lt. Col. Pilot Robert Benedict, M.Sc.Eng.    |
|           | • Lt. Col. Bogusław Biernat, M.D.              |
|           | • Lt. Col. Dariusz Dawidziak, M.Sc.Eng.        |
|           | • Maj. Leszek Filipczyk, M.Sc.Eng.             |
|           | • Bogdan Fydrych M.Sc.Eng.,                    |
|           | • Wiesław Jedynak, M.Sc.                       |
|           | • Prof. Ryszard Krystek, D.Sc.Eng.             |
|           | • Maj. Artur Kułaszka, M.Sc.Eng.               |
|           | • Agnieszka Kunert-Diallo, Ph.D.               |
|           | • Maciej Lasek, Ph.D.                          |
|           | • Krzysztof Lenartowicz, M.Sc.Eng.             |
|           | • Piotr Lipiec, M.Sc.Eng.                      |
|           | • Edward Łojek, M.Sc.Eng.                      |
|           | • Comd. ret. Pilot Dariusz Majewski, M.Sc.Eng. |
|           | • Lt. Col. Dariusz Majewski, M.Sc.Eng.         |
|           | • Władysław Metelski, M.Sc.Eng.                |
|           | • Lt. Col. Sławomir Michalak, Ph.D.            |
|           | • Lt. Col. ret. Mirosław Milanowski, M.Sc.Eng. |

- Lt. Col. Cezary Musiał, M.Sc.Eng.
- Lt. Col. Janusz Niczyj, M.Sc.Eng.
- Maciej Ostrowski, M.Sc.Eng.
- Col. ret. Jacek Przybysz, M.Sc.Eng.
- Maj. ret. Jerzy Skrzypek, M.Sc.Eng.
- Kazimierz Szostak, M.Sc.Eng.
- Waldemar Targalski, M.Sc.Eng.
- Col. Olaf Truszczyński, D., Ph.D.
- Col. Mirosław Wierzbicki, M.Sc.Eng.
- Col. ret. Pilot Andrzej Winiewski, M.Sc.Eng.
- Wiesław Wypych, M.Sc.Eng.
- Marek Żylicz, D.Sc.
- Stanisław Żurkowski, Ph.D.

## DESCRIPTIVE PART

### 1. FACTUAL INFORMATION

#### 1.1. History of the Flight

On March 9<sup>th</sup>, 2010, the President of the Republic of Poland Organizational Support Team placed an order with the 36 Special Airlift Regiment (henceforth ~~the~~ 36 Regiment”) for two flights to SMOLENSK on April 10<sup>th</sup>, 2010, performed by a Tu-154M and a Yak-40 aircraft.

In order to obtain diplomatic permit for such flights, the 36 Regiment sent notes (*clarises*) to the Ministry of Foreign Affairs which notes were forwarded to the 3<sup>rd</sup> European Department of the Russian Federation on March 22<sup>nd</sup>, 2010. Beside standard information, the notes contained a request to have current aerodrome charts and procedures accessible as well as a escort crew (a guide navigator) sent to Warsaw to lead the Smoleńsk-bound flight of the presidential Tu-154M.

Towards the end of March, the Russian side turned to the Polish Embassy with a question whether the request for Russian leader navigators was being sustained. On 31.03.2010, the 36 Regiment directed a request to the Chief of Military Air Traffic Service Office of The Polish

Armed Forces, forwarded to the Polish Embassy in Moscow, to cancel the leader navigator order on the grounds that a Russian speaking crew was assigned for the flight to SMOLENSK. The Russian side accepted the resignation from such escort crew service.

The diplomatic notes in respect of the Yak-40 (PLF 031) and the Tu-154M (PLF 101) flights to and landing at SMOLENSK NORTH were sent over to the 36 Regiment via the Polish Embassy in Moscow on 9<sup>th</sup> April. The notes were short of approach charts and procedures of the SMOLENSK NORTH aerodrome.

Eventually the Tu-154M aircraft had its crew composed on the day before the flight and later that day preliminary preparation for the flight took place. The crew was briefed on the day of departure. The Tu-154M aircraft was maintained according to procedures and was technically cleared for a HEAD status flight on 10.04.2010.

On the day of contemplated flight the crew members reported for the flight at their Regiment between 2:00<sup>1</sup> and 3:25. Since 4:21 all the crew was on board awaiting passengers. The flight plan had the takeoff scheduled for 5:00.

The first group of passengers embarked the Tu-154M aircraft at 04:41. At 05:07, the President of Poland and the First Lady arrived in the presidential car at the aircraft, accompanied by officers of the Government Security Office (BOR). Embarkation of last passengers was at 05:08. The aircraft took off at 05:27. It had 96 persons on board, including 4 crew members, 4 flight attendants and 88 passengers.

The flight to SMOLENSK was performed on FL330 via BAMSO, RUDKA and ASKIL waypoints. At 06:14:15 (about 28 minutes before scheduled time of arrival) while progressing in the Belarusian airspace the cockpit received from MIŃSK CONTROL information about weather conditions at SMOLENSK NORTH aerodrome, reading: „*Polish Air Force one zero one, for information, at zero six one one SMOLENSK visibility: four zero zero meters, fog*”. After passing the ASKIL waypoint, the crew contacted MOSCOW CONTROL, afterwards the SMOLENSK NORTH Military Aerodrome Air Traffic Controller (further called Aerodrome Controller), call sign KORSAZ.

Following this initial radio contact with the Aerodrome Controller at 06:24:32, the aircraft received a next message about the weather conditions at the SMOLENSK NORTH aerodrome, reading: „*Papa Lima Foxtrot one two zero one, KORSAZ, fog, visibility four hundred meters. “.... на Корсаже туман, видимость четыреста метров”* and advise that

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<sup>1</sup> UTC time has been accepted for this Report. The difference between Warsaw time and UTC was +2 hours, and +4 hours between Moscow time (mandatory for the site of crash) and UTC.

there were no weather conditions for landing. The Commander asked and was cleared for an initial approach. At the same time, the aircraft commander of the Yak-40 (PLF 031), which landed at SMOLENSK NORTH about an hour earlier, passed over to the co-pilot of Tu-154M his assessment of weather conditions: –Visibility 400 m, cloud base much below 50 meters, and informed about two missed approaches of an Iluszyn-76 after his Yak-40’s landing.

At 06:26:18, the Tu-154 M the aircraft’s commander (CC) shared the information about unfavourable weather conditions at SMOLENSK with the diplomatic protocol director, quote: –Fog has appeared just now and under the existing conditions we cannot make it” (meaning a landing). We’ll make one attempt, one approach, probably for no good. You can now begin to think what decision to take and do.” To the protocol director’s words: „Well, then, we have a problem”, CC explained: „We could hold for about half an hour and then go to an alternate airport.” Afterwards he named two airports that could be taken into account, viz. MINSK and WITEBSK. The director left the cockpit to brief the President on the situation.

The aircraft was descending and at 500 meters entered the SMOLENSK NORTH landing circuit. At 06:30:33, the diplomatic protocol director appeared in the cockpit for a moment to say: –As for now, no decision from the President about what we do next.”

Progressing along downwind to the base leg, the crew configured the aircraft for landing. At the time, the Aerodrome Controller asked if the crew had ever landed at that military aerodrome. Before beginning to make the turn to the base leg, the purser reported to CC cabin readiness for landing. To a command from the Aerodrome Controller the Commander turned onto the base leg and continued approach to Runway 26 (RWY26). When the aircraft was on the base before the final leg, the Aerodrome Controller advised the crew to be ready to make a go-around when at 100 meters. Then, the Commander-in-Chief of the Polish Air Force entered the cockpit and CC reported that the Yak-40 aircraft’s CC advised on runway visibility which was 200 meters.

At about 14.5 kilometers from threshold of RWY 26, the aircraft took the turn onto the final. When the aircraft was about 10 km from the threshold of RWY26, the Military Air Traffic Controller of Landing Zone (further called Controller of Landing Zone) informed that they were entering the glide path: –One Hundred and One, distance ten, entering glide path.” From that moment on, the Controller of Landing Zone would keep the crew informed of their position<sup>2</sup> relative to glide path and centreline of RWY26.

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<sup>2</sup> The crew of Tu-154M received from the Controller of Landing Zone information on proper position of the aircraft relative the glide path and centreline of RWY26. Confirmations of proper position were transmitted at distances identified by the Controller of Landing Zone as 8, 6, 4, 3 and 2 km from the threshold of RWY26.

The aircraft was slightly climbing and at 130 m above the glide path when it was 8.3 km from RWY26 threshold, 65 meters to the left of runway extended centerline. At that moment, the Controller of Landing Zone called: ~~–Eight~~, on track, on glide path.”

When the aircraft was 7.4 km from threshold of RWY26, the Aerodrome Controller cleared the aircraft to continue approach.

The aircraft began its final descent when it was about 1 km from the Outer NDB. When overflying the outer NDB, the aircraft was 426 meters above the aerodrome’s elevation. 12 seconds after passing the Outer NDB, the TAWS system generated the ~~–FERRAIN AHEAD~~” warning. A moment later, CC set his WBE-SWS altimeter to the standard pressure<sup>3</sup> of 1013 hPa. It caused TAWS to receive wrong data and, in effect, the system inhibited generation of warnings, assuming that the aircraft was higher up than in reality. The aircraft was approaching at about 310 km/h at the rate of descent of about 8m/s.

When the aircraft was about 4.6 km from the threshold of RWY26, 60 m above the glide path and 130 m to the left of runway centerline, the Controller of Landing Zone called: ~~–Four~~ on track, glide path”.

When the aircraft was about 3.5 km from the threshold of RWY26, 35 m above the glide path and 100 m to the left of runway centerline, the Controller of Landing Zone called: ~~–Three~~ on track, glide path”.

When at 3 km from the threshold of RWY26 and about 180 m above airport elevation, the TAWS system started again and continued to generate warnings until the aircraft rolled to the left side after it had lost a section of its left wing 3.5 seconds before striking the ground.

At 06:40:41.5, the Controller of Landing Zone called:”Two on track, glide path”. At the time, the aircraft was about 2.5 km from the threshold of Rwy26, 20 m below the glide path and 80 m to the left of runway centerline.

At 06:40:52, when the aircraft was at 39<sup>4</sup> m above aerodrome elevation (91 m above the ground) and about 1.7 km from the threshold of RWY26, CC commanded: ~~–Odchodzimy na drugie zajście~~” (Making a go-around). The co-pilot read back: ~~–Odchodzimy~~” (Going around) at 06:40:53. Then, at 06:40:54, when at 66 m above the ground (23 m above the aerodrome’s

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<sup>3</sup> This action made the aircraft’s altimeter indicate an altitude, which is used by the TAWS system, higher by 168 meters.

<sup>4</sup> The flight altitude in the approach phase has been assessed on the basis of calculations carried out by the Commission.

elevation and 1538 m from runway threshold) and at the speed of 277 km/h a warning sounded that the critical altitude setting on radio altimeter was reached.

A second later, the Controller of Landing Zone called out to the Tu-154 M: „Горизонт 101”<sup>5</sup> („level flight 101”) (14 m above aerodrome elevation, at 1459 m from RWY26 threshold, when the aircraft was 70 m below the glide path and to the left of runway centerline). The Aerodrome Controller called: „Контроль высоты, горизонт” (height check, level flight) when the aircraft was 2 m above aerodrome elevation, 28 m above the ground, 200 m before the Inner NDB, 75 m below glide path and 65 m to the left of runway centerline. Just then, CC began a go around. Due to inertia, the aircraft was still losing height and at 06:41:00.5, when the aircraft was 1099 m from RWY26 and 5 m below the elevation of RWY26, it experienced the first strike against a terrain obstacle (at 10 m from the ground and sheared off the top of a birch that was in a depression near the Inner NDB, however, not receiving any damage that might bear on its airworthiness.

After flying another 244 meters, there were more encounters with trees and shrubs. Although the aircraft began to ascend slowly, yet, due to terrain configuration the aircraft’s height above the ground dropped from 10 m in the vicinity of Inner NDB to 4 m in the area of young trees and shrubs.

At 06:41:02.8, when 1.1 m above the aerodrome’s elevation and 855 m from RWY26 threshold, the aircraft struck the trunk of a birch, 30-40 cm in diameter, losing some 1/3<sup>rd</sup> part of the left wing. In effect, the aircraft veered to the left.

At 06:41:05, the Aerodrome Controller commanded: „Уход на второй круг!” (Go-around!). The aircraft was at the time 698 m from RWY 26 threshold, still veering to the left.

The strike against the ground occurred at 06:41:07.5, in the overturned position. Directly before the fall, the aircraft was sliding at a 10-12° angle, on heading 240° and at 260 km/h.

In the aftermath of the crash, all persons on board the aircraft lost their lives on the spot.

## 1.2 Injuries to persons

| Injuries     | Crew | Passengers | Others |
|--------------|------|------------|--------|
| Fatal        | 8    | 88         | -      |
| Serious      | -    | -          | -      |
| Minor (none) | -    | -          | -      |

<sup>5</sup> This command has no equivalent in Polish or English aviation radio telephony.

### 1.3 Damage to aircraft

The aircraft was totally destroyed on impact with the ground.

### 1.4 Other damage

Striking terrain obstacles and impacting the ground, the aircraft caused such damage:

- broken power line,
- many broken trees and shrubs along the final phase of the flight,
- woodland devastation, about 52 m wide and 165 m long on the site of aircraft's fall.



Photo 1. A satellite photo of the site of crash.

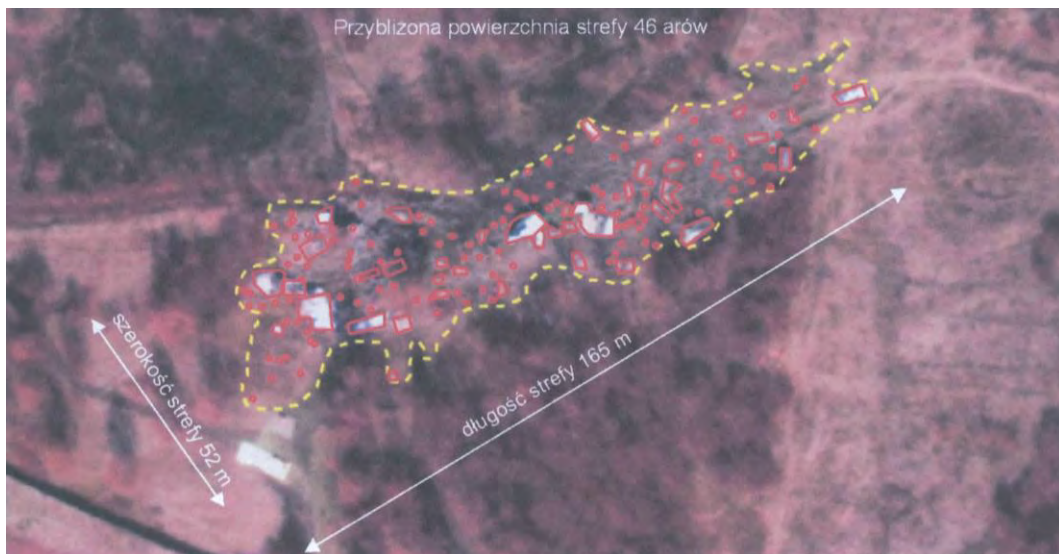


Fig.1. A sketch of damage caused by the aircraft<sup>6</sup> striking the ground. (dotted area)

<sup>6</sup> The material from the analysis of searching the site of Tu-154M crash, based on satellite data and prepared by SmallGIS company to an order from the District Military Prosecution Office in Warsaw.



## 1.5 Personnel information

### 1.5.1 Flight personnel

#### 1.5.1.1. Aircraft Commander (CC)

A military pilot, male, aged 36, a military transport pilot<sup>7</sup> 1st class since 1.01.2009, licensed for Tu-154M and Yak-40, licence awarded by Commander-in-Chief of the Polish Air Force's order no.Z-91 of 25.05.2009.

The pilot underwent medical check on 11.01.2010, valid<sup>8</sup> until 11.01.2011 and obtained a Medical Certificate First Class which stands for fitness<sup>9</sup> for flying.

The pilot obtained the following ratings and qualifications:

- 1) to fly as Commander of Tu-154M by daylight and at night under IMC according to IFR (Order no. Z-137/2008 pt 3 of 15.07.2008 and Order no. Z-173/2008 pt 4 of 4.09.2008) in the minimum conditions:
  - a) for landing:
    - ILS CAT I - overcast 8/8; cloud base 60 m; visibility 800 m;
    - PAR + 2 × NDB - overcast 8/8; cloud base 100 m; visibility 1200 m;
    - PAR - overcast 8/8; cloud base 120 m; visibility 1500 m;
    - 2 × NDB - overcast 8/8; cloud base 120 m; visibility 1800 m;
    - 1 × NDB - overcast 8/8; cloud base 250 m; visibility 4000 m;
  - b) for takeoff:
    - with centerline lighting: overcast 8/8; cloud base 0 m; visibility 200 m;
    - without centerline lighting:
      - with runway edge lights; overcast 8/8; cloud base 0 m; visibility 400 m;
      - without runway edge lights: overcast 8/8; cloud base 0 m; visibility 500 m.
- 2) of PIC on Tu-154M by daylight and at night under VMC according to VFR and IFR (Order no. Z-118/2008 pt 1 of 18.06.2008 and Order no. Z-173/2008 pt 3 of 4.09.2008 r.),

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<sup>7</sup> The pilot also had a commercial pilot licence for fixe-wing aircraft CPL(A), issue by Polish CAA on 21.10.2008, valid till 21.10.2013, with ratings for piston multi-engine aircraft MEP(L), valid till 30.04.2009. According the endorsement in the Licence, the pilot had a rating for RTF in the English and the Polish languages. He had Class I civil "flight physicals" valid till 28.01.2011 and Class 2 „physicals" valid till 11.01.2015 (without restrictive endorsements).

<sup>8</sup> In the findings of WKLL there is no date of validity, this question is codified in "Air Units of Polish Armed Forces' Rules of Flight Operations" (RL-2006) § 43 item 3: "Periodical medical examinations ("flight physicals") are administered once a year and are valid for 12 months from issue. The flight personnel who hold expired flight physicals certificates must not perform any flights."

<sup>9</sup> According ordinance of Minister of National Defence of 10.05.2004 on certification of ability for professional military service and jurisdiction and procedure of military medical committees on such matters (J.o.L. no. 133 item 1422 of June 14, 2004).

- 3) of a Class III test pilot in Tu-154M (Order no. Z-240/2008 of 10.12.2008),
- 4) of a navigator by daylight and at night in Tu-154M (Order no. 20/2002 of 25.01.2002),
- 5) permit to conduct flights marked WAŻNY (VIP) as PIC on Tu-154M (Order no. Z-176/2008 of 09.09.2008),
- 6) of PIC on Yak-40 by daylight and at night under VFR and IFR (14.11.2006, 9.05.2007 r. in keeping with his logbook).
- 7) to use radio telephony networks of Poland's Armed Forces in Polish air space (The Polish Air Force High School Commandant's Order no. 172 of 5.10.2007).

**Pilot proficiency check and navigational proficiency check**

| Tu-154M     |                                 |                           |                               |                      |               |            |                        |                         |
|-------------|---------------------------------|---------------------------|-------------------------------|----------------------|---------------|------------|------------------------|-------------------------|
| BY DAY      |                                 |                           |                               |                      |               |            |                        |                         |
| Seat /L,R / | ZONE <sup>10</sup> /exercise #/ | Engine failure simulation | SYSTEM /exercise no./ Subject | ROUTE /exercise no./ | Date of check | Valid till | Check pilot            | Real weather conditions |
| L           |                                 |                           | exercise no. 40/ILS           | exercise no.60       | 16.06.08      | 16.06.10   | Squadron Leader        | Cloudless /10           |
| L           |                                 |                           | Ex.# 100/ILS                  | ex.#. 114            | 11.07.08      | 11.07.10   | Squadron Leader        | 8/60/0.8                |
| AT NIGHT    |                                 |                           |                               |                      |               |            |                        |                         |
| Seat /L,R / | ZONE /exercise #/               | Engine failure simulation | SYSTEM /exercise #/subject    | ROUTE /exercise #/   | Date of check | Valid till | Check pilot            | Real weather conditions |
| L           |                                 |                           | ex # 155/ILS                  | ex # 170             | 04.08.08      | 04.08.10   | Squadron Leader        | Cloudless /10           |
| L           |                                 |                           | ex # 203/ILS                  | ex # 217             | 03.09.08      | 03.09.10   | Squadron Leader        | 8/60/0.8                |
| Yak-40      |                                 |                           |                               |                      |               |            |                        |                         |
| BY DAY      |                                 |                           |                               |                      |               |            |                        |                         |
| Seat /L,R / | ZONE /exercise #/               | Engine failure simulation | SYSTEM /exercise #/subject    | ROUTE /exercise #/   | Date of check | Valid till | Check pilot            | Real weather conditions |
| L           | 15                              |                           |                               |                      | 10.03.08      | 10.03.10   | Squadron Leader's Dpty | cloudless /8            |
| AT NIGHT    |                                 |                           |                               |                      |               |            |                        |                         |
| Seat /L,R / | ZONE /exercise #/               | Engine failure simulation | SYSTEM /exercise #/subject    | ROUTE /exercise #/   | Date of check | Valid till | Check pilot            | Real weather conditions |
| L           |                                 |                           |                               | Ex.#. 217            | 17.03.08      | 17.03.10   | Squadron Leader's Dpty | 8/100/1                 |
| R           |                                 |                           | Ex.#. 265/ILS                 | Ex.#. 217            | 17.03.08      | 17.03.10   | Squadron Leader's Dpty | 4/sr/10                 |

<sup>10</sup> The document, delivered by the 36 Regiment states that the pilot was credited for his piloting skills (Polish Practical Test Standard) in a Cat.III test flight to the zone, performed on 10.12.08. According to IOLP-2005, that flight cannot be qualified as such. A detailed analysis in this respect was contained in Chapter 2.2.Crew Training Effects.

The pilot's total flight hours:

| Type of aircraft  | Flying time [hours:minutes] |               |             |              |
|-------------------|-----------------------------|---------------|-------------|--------------|
|                   | Total                       | As CC         | As co-pilot | As navigator |
| All aircraft      | 3531:38                     | <b>608:53</b> |             |              |
| Tu-154M           | 2906:55                     | <b>492:21</b> | 1794:08     | 620:26       |
| Yak-40            | 433:56                      | 116:32        | 317:24      |              |
| TS-11 Iskra       | 190:47                      |               |             |              |
| the last 90 days  | 54:30                       |               |             |              |
| the last 30 days  | 17:07                       |               |             |              |
| the last 24 hours | did not perform any flights |               |             |              |

He performed his last flight before the fatal flight on 7.04.2010, as co-pilot on Tu-154M to SMOLENSK.

According to the provision of § 15 item 9 RL-2006: *In case no Pilot Proficiency Check has been performed in the zone on a specific type of aircraft, validity of all qualifications to conducting flights on such aircraft type is suspended until such missing check is carried out, subject to item 12 (undone night time Proficiency Check suspends the night flights qualification. To sustain the qualification for daytime flights (in absence of a night check ride) it requires carrying out such a check by day. On 10<sup>th</sup> April 2010, the pilot did not have current qualifications for flying Tu-154M or Yak-40 as CC.*

#### 1.5.1.2 Co-pilot

A military pilot, male, aged 36, since 01.01.2009, obtained a military transport pilot 1st class licence on Yak-40 transport aircraft; the licence was awarded in Commander-in-Chief of the Polish Air Force's Order no. Z-91, of 25.05.2009.

The pilot underwent medical check on 17.12.2009, valid until 17.12.2010 and obtained a Medical Certificate First Class which stands for fitness for flying.

The pilot obtained the following ratings and qualifications:

- 1) to fly Tu-154M as a co-pilot by day; by night in visual meteorological conditions (VMC) according to VFR and IFR (Orders no. Z-246/2008 item 8 of 18.12.2008 and no. Z-98/2009 item 2 of 21.05.2009),
- 2) to fly Tu-154M as a co-pilot by day and by night in IMC under VFR and IFR (Orders no. Z-250/2008 item 3 of 24.12.2008 r. and no.Z-99/2009 item 3 of 22.05.2009),
- 3) to fly as PIC on Yak-40 by day and night in VMC and IMC under VFR and IFR,
- 4) perform flights marked „WAŻNY” (VIP) on Tu-154M (Order no.Z-99/2009 item 4 of 22.05.2009), as co-pilot.

According to the provision in RL-2006 § 23 item 12, the pilot had the qualification to conduct flights at the minima of PIC<sup>11</sup>.

**Pilot proficiency check and navigational proficiency check**

| <b>Tu-154M</b>  |                     |                           |                               |                    |               |            |                        |                         |
|-----------------|---------------------|---------------------------|-------------------------------|--------------------|---------------|------------|------------------------|-------------------------|
| <b>BY DAY</b>   |                     |                           |                               |                    |               |            |                        |                         |
| Seat /L, R/     | ZONE /Exercise no./ | Engine failure simulation | SYSTEM /Exercise no./ Subject | ROUTE /Exercise #/ | Date of check | Valid till | Check pilot            | Real weather conditions |
| R               |                     |                           | ex.#. 255/ILS                 |                    | 17.12.08      | 17.12.10   | Flight Leader's Dpty   | 4/ŚR/10                 |
| R               |                     |                           | ex.#. 260/ILS                 |                    | 23.12.08      | 23.12.10   | Flight Leader's Dpty   | 8/100/1                 |
| <b>BY NIGHT</b> |                     |                           |                               |                    |               |            |                        |                         |
| Seat /L, R/     | ZONE /Exercise no./ | Engine failure simulation | SYSTEM /Exercise no./ Subject | ROUTE /Exercise #/ | Date of check | Valid till | Check pilot            | Real weather conditions |
| R               |                     |                           | Ex.# 265/ILS                  |                    | 20.05.09      | 20.05.11   | Flight Leader's Dpty   | 4/ŚR/10                 |
| R               |                     |                           | Ex.# 270/ILS                  |                    | 21.05.09      | 21.05.11   | Flight Leader's Dpty   | 8/300/3                 |
| <b>Yak-40</b>   |                     |                           |                               |                    |               |            |                        |                         |
| <b>BY DAY</b>   |                     |                           |                               |                    |               |            |                        |                         |
| Seat /L, R/     | ZONE /Exercise no./ | Engine failure simulation | SYSTEM /Exercise no./ Subject | ROUTE /Exercise #/ | Date of check | Valid till | Check pilot            | Real weather conditions |
| L               | 15                  | 14.05.08                  |                               |                    | 14.05.08      | 14.05.10   | Flight Leader's Dpty   | Bch/10                  |
| L               |                     |                           | 100/ILS                       |                    | 24.06.08      | 24.06.08   | Squadron Leader's Dpty | 8/300/3                 |
| L               |                     |                           |                               | 114                | 24.06.08      | 24.06.08   | Squadron Leader's Dpty | 8/300/3                 |
| <b>BY NIGHT</b> |                     |                           |                               |                    |               |            |                        |                         |
| Seat /L, R/     | ZONE /Exercise no./ | Engine failure simulation | SYSTEM /Exercise no./ Subject | ROUTE /Exercise #/ | Date of check | Valid till | Check pilot            | Real weather conditions |
| L               |                     |                           | 203/ILS                       |                    | 30.09.08      | 30.09.10   | Squadron Leader's Dpty | 7/200/2                 |
| L               |                     |                           |                               | Ex.# 217           | 30.09.08      | 30.09.10   | Squadron Leader's Dpty | 7/200/2                 |

The pilot's total flight hours:

<sup>11</sup> RL-2006 § 23 item 12: „In the case of multi-person crew, the minimum meteorological conditions are those of aircraft commander”.

| Type of aircraft         | Flying time [hours:minutes] |        |             |              |
|--------------------------|-----------------------------|--------|-------------|--------------|
|                          | Total                       | As CC  | As co-pilot | As navigator |
| All aircraft             | 1909:08                     | 222:23 |             |              |
| Tu-154M                  | 475:06                      |        | 193:32      | 281:34       |
| Yak-40                   | 1219:34                     | 222:23 | 997:11      |              |
| TS-11 Iskra              | 187:15                      |        |             |              |
| PZL-130 Orlik            | 20:48                       |        |             |              |
| M-28 Bryza               | 6:25                        |        |             |              |
| During the last 90 days  | 58:10                       |        |             |              |
| During the last 30 days  | 35:27                       |        |             |              |
| During the last 24 hours | Did not perform any flights |        |             |              |

He performed his last flight before the fatal day, on 2.04.2010, as co-pilot.

According to the provision in § 15 item 9 RL-2006 **on 10<sup>th</sup> April 2010, the pilot did not have current qualifications for flying Tu-154M as co-pilot.**

### 1.5.1.3 Aircraft navigator

An aircraft pilot, male, aged 32, obtained a licence of military pilot Class 2 on PZL-130 training aircraft on 1.01.2009, awarded in Commander-in-Chief of the Polish Air Force's Order no.Z-91 of 25.05.2009.

The pilot underwent medical check on 24.11.2009, valid until 24.11.2010 and obtained a Medical Certificate First Class which stands for fitness for flying.

The pilot obtained the following ratings and qualifications:

- 1) to fly as a co-pilot on Yak-40 by day and night in VMC and IMC under VFR and IFR,
- 2) to use the Polish Armed Forces' radio telephony networks in Polish air space (The Polish Air Force High School Commandant's Order no.WSOSP no. 62 of 6.04.2006),
- 3) confirmation of his competence to fly on Tu-154M aircraft as a navigator (Order no. Z-9/2010 item 3 of 14.01.2010),
- 4) permit to fly on Tu-154M aircraft as a navigator (Order no. Z-9/2010 item 3 of 14.01.2010),

According to the provision in RL-2006 § 23 item 12, the pilot-navigator was allowed to perform flights in minimum atmospheric conditions applicable to a CC.

### Pilot proficiency check and navigator proficiency check

| Yak-40      |                   |                           |                               |                    |               |            |                           |                         |
|-------------|-------------------|---------------------------|-------------------------------|--------------------|---------------|------------|---------------------------|-------------------------|
| DAY         |                   |                           |                               |                    |               |            |                           |                         |
| Seat /L,R / | ZONE /Exercise #/ | Engine failure simulation | SYSTEM /Exercise no./ Subject | ROUTE /Exercise #/ | Date of check | Valid till | Check pilot               | Real weather conditions |
| R           |                   |                           |                               | ex.#. 114          | 23.07.09      | 23.07.10   | Senior Squadron Navigator | 8/300/3                 |
| R           | ex.#. 248         | Yes                       |                               |                    | 26.11.09      | 26.11.10   | Regiment Cdr.             | Cloudless/ 10           |
| R           |                   | 256                       |                               |                    | 06.01.10      |            |                           | 8/200/3                 |
| NIGHT       |                   |                           |                               |                    |               |            |                           |                         |
| Seat /L,R / | ZONE /Exercise #/ | Engine failure simulation | SYSTEM /Exercise no./ Subject | ROUTE /Exercise #/ | Date of check | Valid till | Check pilot               | Real weather conditions |
| R           |                   |                           | 270/ILS                       |                    | 29.11.09      | 29.11.10   | Senior Squadron Navigator | 6/400/4                 |

Total flight hours:

| Type of aircraft  | Flying time [hours:minutes] |       |             |              |
|-------------------|-----------------------------|-------|-------------|--------------|
|                   | Total                       | As CC | As co-pilot | As navigator |
| All aircraft      | 1063:18                     |       |             |              |
| Tu-154M           | 58:19                       |       |             | 58:19        |
| Yak-40            | 302:15                      |       | 302:15      |              |
| TS-11 Iskra       | 251:13                      |       |             |              |
| PZL-130 Orlik     | 451:31                      |       |             |              |
| The last 90 days  | 60:34                       |       |             |              |
| The last 30 days  | 12:15                       |       |             |              |
| The last 24 hours | 2:10                        |       |             |              |

He performed his last flight before the fatal day, on 9.04.2010 as co-pilot on a Yak-40; and, as a navigator he performed his last flight on a Tu-154M on 24.01.2010 .

The documentation in the 36 Regiment, and his personal pilot-navigator documentation, does not disclose any entry as to his passing a navigational proficiency check or completing navigation skills training on a Tu-154M in the air. In this connection, **the pilot did not have current rating awarded<sup>12</sup> under RL-2006 § 13 item 6 to fly as a navigator of Tu-154M aircraft.**

<sup>12</sup> The Order of the Day of the Cdr. of Military Unit JW 2139, of 14.01.2010, had such paragraph: **“I confirm that** (rank, full name) **has qualifications** to do flight duties in a Tu-154M as a navigator. At the same time, I permit the aforesaid person to do flight duties of a navigator in Tu-154M with **“VIPs on board”** though said pilot was not awarded a **flight navigator certificate** to perform as a navigator on Tu-154M.

#### 1.5.1.4 Flight engineer

A male, 37 of age. Underwent medical check on 16.11.2009, valid until 16.11.2010, which describe his fitness for flight duties for C II.

The flight engineer was holding a certificate applicable to Tu-154M, awarded in Order of the Day no.Z-253/2008, of 31.12.2008. This rating was validated on 08.12.2009 due to performing a flight wherein the aircraft Commander<sup>13</sup>, who was acting Squadron Leader, confirmed to have carried out a check of flight engineer's competencies on a Tu-154M.

According to the provision in RL-2006 § 23 item 12, he was allowed to perform flights in minimum meteorological conditions applicable to a CC.

Total flight hours:

|                   | Flying time [hrs.:min]  |
|-------------------|-------------------------|
| All aircraft      | 329:16                  |
| Tu-154M           | 329:16                  |
| The last 90 days  | 46:35                   |
| The last 30 days  | 7:10                    |
| The last 24 hours | Did not perform flights |

The last flight the engineer did was on 29.03.2010, i.e. on the day preceding the fatal day.

On the day of crash, the engineer **was holding a valid rating** for performance as a flight engineer on Tu-154M aircraft.

#### 1.5.2 Cabin crew details

##### 1.5.2.1 The purser

A woman, 29, with the 36 Regiment since 16.02.2009, holding the post of a flight attendant. She was holding a Medical Certificate of examination which she underwent on 11.01.2010, valid till 11.01.2011.

Total of flights:

|  |                     |
|--|---------------------|
| Number of flights performed during the last 6 months | 79 flights          |
| Number of flights performed during the last 90 days  | 40 flights          |
| Number of flights performed during the last 30 days  | 11 flights          |
| The date of last flight preceding the fatal date     | 9.04.2010. (Yak-40) |

She had qualifications to perform her duties.

<sup>13</sup> The sources that describe the training process, awarding ratings and their prolongation are the following: RL-2006 and „The Principles of Training and Checking Competencies of Flight Engineers, also, Admitting Engineering and Aviation Specialists to Fly as Members of the Crew.” There is contradiction in these documents as to who has capacity to award and validate flight engineers' rating. It said „The principles of training...” in item 5.1 the indication is to an instructor to flight engineers, whereas in RL-2006 § 12 item 25 – to the appointed aircraft commander with a rating of an instructor. A flight engineer's competencies are difficult to check, or hardly possible, due to location of flight engineer's place of work.

### 1.5.2.2 Flight attendant

A female, 23, with the 36 Regiment since 16.02.2009, holding the post of flight attendant. She was holding a Medical Certificate of examination which she underwent on 12.02.2010, valid till 12.02.2011.

Total of flights:

|  |                    |
|--|--------------------|
| Number of flights performed during the last 6 months | 83 flights         |
| Number of flights performed during the last 90 days  | 47 flights         |
| Number of flights performed during the last 30 days  | 15 flights         |
| The date of last flight preceding the fatal date     | 9.04.2010 (Yak-40) |

She had qualifications to perform her duties.

### 1.5.2.3 Flight attendant

A female, 25, with the 36 Regiment since 1.12.2008, holding the post of flight attendant. She was holding a Medical Certificate of examination which she underwent on 22.03.2010, valid till 22.03.2011.

Total of flights:

|  |                    |
|--|--------------------|
| Number of flights performed during the last 6 months         | 98 flights         |
| Number of flights performed during the last 90 months        | 49 flights         |
| Number of flights performed during the last 6 months 30 days | 22 flights         |
| The date of last flight preceding the fatal date             | 9.04.2010 (Yak-40) |

She had qualifications to perform her duties.

The above-named cabin personnel underwent the following training sessions in the FTO/TRTO<sup>14</sup>Centre:

- 1) on 19.12.2009, training carried out by the Crew Recruitment and Training Service of LOT Polish Airline, in the scope of:
  - CRM – Crew Resources Management;
  - DGR – Dangerous Goods Regulations;
  - Civil aviation security;
  - Case of health collapse on board of a plane;
  - Rules of giving first aid.
- 2) On 16.01.2010, a training session on: „Emergency situation procedures applicable to Tu-154M and Yak-40 aircraft”.
- 3) on 11.02.2010, a training session in:

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<sup>14</sup> Training was ordered by the 36 Regiment’s Commander in order to ensure proper standard of inflight service.



- General procedures – emergency procedures;
- Performing under threat, fire extinguishing;
- Discussing performance during landing outsider airports, ditching and survival in water.

#### **1.5.2.4 An officer of Government Security Office**

A woman, 35, with the Government Security Office (BOR), deployed on the flights of the 36 Regiment, at the same time an extra member of the crew for direct handling of VIP passengers. She was holding a Medical Certificate of examination which she underwent on 18.05.2009, valid till 18.05.2010.

Total of flights performed:

|  |            |
|--|------------|
| Number of flights performed during the last 6 months | 18 flights |
| Number of flights performed during the last 90 days  | 11 flights |
| Number of flights performed during the last 30 days  | 2 flights  |
| The date of last flight preceding the fatal date     | 8.04.2010  |

On 24-25.04.2008 she underwent training in cabin personnel duties, held in the 36 Special Airlift Regiment, entitled: „Training of BOR security officers in cabin personnel duties”, which was compatible with the Regiment’s training program. As of 01.06.2008, she was permitted to perform the above mentioned duties.

On 17.07.2009, she took part in training with the use of water rescue equipment on the premises of the 36 Regiment. During 11 and 12.03.2009, she underwent recurrent training arranged for cabin personnel by the Crew Recruitment and Training Service of LOT Polish Airlines, and 8<sup>th</sup>, 15<sup>th</sup> and 23.03.2010 she underwent recurrent training organized by LOT Polish Airlines, too.

She had qualifications to perform her duties.

### **1.5.3 Personnel of the Military Air Traffic Service Unit of SMOLENSK NORTH Aerodrome**

#### **1.5.3.1. Aerodrome controller performing duties as visual and approach zone controller**

A male, aged 48, military unit no. 06755, Commandant’s Deputy, obtained the qualification to control flights in the no.06976 military unit’s Commander’s Order no.62, of 10.02.1999.

On 10.09.2001, in the no.15401 military unit’s Commander’s Order no.172 he obtained the qualification of air traffic controller instructor.

He underwent his last medical examination on 13.04.2009 – Aviation Medical Examination Commission at Military Unit 25969 and was classified fit for air traffic controller.

The last check of his competencies as air traffic controller was carried out on 04.06.2009 at the SMOLENSK NORTH Aerodrome.

He has been Aerodrome Controller at SMOLENSK NORTH Aerodrome for 10 years.

Air Traffic controlling during the last 12 months:

As Aerodrome Controller:

in 2009 – 40 shifts (38 in VMC weather conditions, 2 in IMC weather conditions);

in 2010 – 12 shifts (12 in VMC weather conditions).

The Aerodrome Controller arrived at the aerodrome between 03:00 and 03:15 and underwent a medical examination before beginning his shift.<sup>15</sup> Within preparation for his duties:

- 1) he inspected the runway and taxiways. He found them in serviceable, which state he confirmed with an entry in the Aerodrome Handover Book.
- 2) he found out current the weather and familiarised with the forecast. No worsening of weather was forecast;
- 3) he was reported by the communication personel-on-duty on readiness of means of radiotechnical equipment to receive aircraft;
- 4) he recommended that support equipment be in readiness to receive aircraft (steps, fire engine, etc.);
- 5) he went to the Near Post of Air Traffic Service where he found that equipment installed therein was serviceable, then, he briefed the personels that were assigned to cater for flights on that day.

The information about inbound flights was passed to the Near Post of Air Traffic Service by flight dispatcher (Yak-40 and Il-76) and by the operation officer (Tu-154M):

- Il-76 at 04:46:45;
- Jak-40 at 04:53:24;
- Tu-154M at 05:42:31.

It is not known when exactly the Aerodrome Controller finished his job on 10.04.2010. The last radio call with his voice was recorded at 08:41:06, his last telephone conversation – at 08:43:03.

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<sup>15</sup> According to “Medical examination register” register of periodic medical examinations (“flight physicals”).

### **1.5.3.2. Controller of Landing Zone**

A male, aged 32, senior assistant to the Aerodrome Controller of Military Unit 21350, obtained the qualifications to controlling flights in 2004 after finishing a Central Course for Officers, in the specialisation —Assistant to Aerodrome Controller” in the Training for Combat Use and Retraining Centre in Iwanowsk— Order no. 375 from the Commander of Unit 06976 of 11.11.2004.

He underwent his last medical examination on 2.09.2009 and was classified fit for air traffic.

The last check of his competencies of controlling flights was on 10.03.2010 at IWANOWO airport and he was classified fit for controlling flights from the position of Controller of Landing Zone.

The last check of his skills of a Controller of Landing Zone was on 10.02.2010 at TWER airport, day – night, in VMC.

The last check of his performance as a Controller of Landing Zone took place on 20.08.2009 at TWER airport, day – night, in IMC.

He has been occupying the post of Assistant to Aerodrome Controller since 2004. He did his military service in Unit 21350 in Twer.

Controlling flights during the last 12 months:

as Controller of Landing Zone:

in 2009 – 2 work shifts in VMC;

in 2010 – 7 shifts, including 10.04.2010 (2 in IMC, 5 shifts in VMC).

As Controller of Approach Zone:

in 2009 – 27 shifts (13 in IMC; 16 in VMC);

in 2010 – 9 shifts (7 in IMC; 2 in VMC)

### **1.5.4 Aircraft maintenance personnel**

#### **1.5.4.1 General information related to aviation technical and engineering staff (Polish abbreviation SIL) of the 36 Regiment, authorised to carry out maintenance tasks on Tu-154M aircraft**

The maintenance personnel in the 36 Regiment, authorised to work on Tu-154M aircraft consisted of 28 persons as at 10.04.2010. of whom, 27 finished technical schools or other military technical colleges. One ground mechanic, a civilian employee, did not finish any

military technical school, however, he was admitted to one-man maintenance tasks having been provided required training and passing examinations.

After theoretical and practical training and passing missionary exams, each ground mechanic/engineer in the maintenance services (SIL) obtained required qualifications to maintain Tu-154M aircraft in his specialisation (the 36 Regiment Commander's Order).

Work experience of SIL personnel designated to perform maintenance services on Tu-154M aircraft:

- years, from 1 to 5 15 persons,
- years from 6 to 10 3 persons,
- years from 11 to 15 10 persons.

#### **1.5.4.2 The mechanics of the engineering service (SIL) who prepared the Tu-154M, tail no.101 for the 10<sup>th</sup> of April 2010 flight.**

1) airframe and engines (PiS), appointed for tasks by the **Manager of Airframe and Engines**:

a) **senior mechanic of the PiS Section**– supervises jobs in the scope of airframe and engines;

educated in these specialisations – at the Air Force Technical School in Zamość, 1995,  
experience in the maintenance of Tu-154M aircraft – 15 years;

hours of maintenance on the Tu-154M, no.101; for the flight<sup>16</sup> on 10.04.2010: from 02:00 to 03:40;

b) **aircraft mechanic no.1 (PiS)** – performed most maintenance tasks on the airframe and engines;

educated in this specialisation – at the Air Force Petty Officers School, Dęblin, 2006,  
experience in the maintenance of Tu-154M aircraft – 3 years;

hours of maintenance on the Tu-154M, no.101; for the flight<sup>17</sup> on 10.04.2010: from 02:00 to 03:30;

2) avionics; appointed for work by the **O flight leader**:

a) **senior technician of the O flight** – supervised aircraft avionics maintenance;

educated in this specialisation – at the Air Force Technical School in Zamość, 1990,  
experience in the maintenance of Tu-154M aircraft – 14 years;

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<sup>16</sup> The PiS Flight's senior technician's statement: –Signature in the Service Log certifies jobs done”.

<sup>17</sup> In his statement, the technician did not specify at what time he finished his servicing tasks, but, the senior technician of the PiS Flight did in his statement.

hours of maintenance on the Tu-154M, no.101; for the flight on 10.04.2010: from 02:00 to 03:00;

b) **technician of the O no.1** – performed aircraft avionics maintenance services of fittings and fixtures;

educated in this specialisation – at the Air Force Technical School in Zamość, 1994,  
experience in the maintenance of Tu-154M aircraft – 11 years;

hours of maintenance on the Tu-154M, no.101; for the flight on 10.04.2010: from 02:00 to 03:00;

3) radio electronics, appointed to work by **URE flight leader**:

a) **senior aircraft technician of URE no.1** – supervised aircraft radio electronics equipment;

educated in this specialisation – at the Air Force Technical School in Zamość, 1993,  
experience in the maintenance of Tu-154M aircraft – 4 years;

pre-departure maintenance of the Tu-154M, no.101 for the flight on 10.04.2010: from 02:30 to 03:00;

b) **senior aircraft maintenance petty-officer for servicing URE no.1** - maintained radio electronic equipment;

educated in this specialisation – at the Air Force Petty Officers School, Dęblin, 2006,  
experience in in the maintenance of Tu-154M aircraft – 2 years;

hours of maintenance on the Tu-154M, no.101, for the flight on 10.04.2010: 02:30-03:00;

Also, engaged in the aircraft's preparation for the flight was a **senior flight engineer**, according to the "Instruction on HEAD Flight Operations", Warszawa, WLOP 408/2009.

Besides, according to the above mentioned Instruction, the predeparture check of the aircraft was supervised by a **Senior Diploma Engineer (Radio Electronics), with the Aviation Technological Section of the 36 Regiment**, He arrived at the Unit at 03:42.

## Aircraft information



Photo 2. The Tu-154M no 101 in a landing configuration

### 1.6.1 General

|                             |  |
|-----------------------------|--|
| Manufacturer                | <i>Куйбышевский Авиационный Завод, USSR, Aircraft Factory, Kuybyshev</i>               |
| Type and model              | Tupolev Tu-154M, 90A837  |
| Manufacturer number         | 90A837   |
| Date of manufacture         | 29.06.1990   |
| Nationality                 | The Republic of Poland   |
| Registration no.:           | 101  |
| Certificate of registration | Entry in the military register of aircraft, Defence Ministry, no.: Sz-428, 24.01.2005. |
| User                        | 36.Special Airlift Regiment  |

By the decision of Chief Controller of the „ОАО Авиакор-Авиационный Завод” factory, dated 21.12.2009, the aircraft was declared airworthy for atmospheric conditions 30 × 350 m (for Cat.II airports, according to ICAO).

### 1.6.2 The aircraft’s history

The Tu-154M aircraft, no.101, part no.90A837 was handed off to the user by the manufacturer along with the Aircraft Operations Manual in the Russian language („*Ту-154М. Руководство по летной эксплуатации*”). The manual was up to date on the day of accident, however, it was never translated into the Polish language. **The 36 Regiment also used the outdated, Polish-language manual of operations of Tu-154M aircraft, once used by LOT Polish Airlines. Last updates were entered in 1994.**

|                                 |                                       |
|---------------------------------|---------------------------------------|
| Total flight hours (FH)         | 5142 FH 12 min, no.of landings – 3907 |
| FH since last overhaul          | 140 FH. 43 min, no.of landings – 77   |
| FH since last maintenance check | 26 FH 36 min, no.of landings – 16     |

Overhauls:

I – major overhaul: carried out in the aviation factory „Внуковский Авиаремонтный Завод № 400 ГА” („ВАРЗ-400”), Moscow, Russia, finished on 20.11.1996;

II - major overhaul: carried out in the aviation factory „Внуковский Авиаремонтный Завод № 400 ГА” („ВАРЗ-400”), finished on 20.05.2003;

III - major overhaul: carried out in the aviation factory ОАО „Авиакор-Авиационный Завод”, in Samara, Russia, finished on 21.12.2009;

Service life limitations since last overhaul:

- a) service life total – 30 000 h/15 000 landings/25 years 6 months;
- b) service life between overhauls – 7500 h/4500 landings/6 years;

After the last overhaul the aircraft was handed off to its user in the passenger cabin configuration, called SALON, adapted to carry 90 passengers.

The aircraft has been maintained according to the following publications: „Ту-154М. Регламент технического обслуживания. Издание второе. Часть 1. Оперативные формы технического обслуживания, № 76-II/90603-Ф-00I-0. Дополнительно на самолет № 837” and „Ту-154М. Регламент технического обслуживания. Издание второе. Часть 2. Периодические формы технического обслуживания, № 76-II/90603-Ф-00I-0. Действительно на самолет № 837”, further called „RO-86” which is an acronym of „Регламент Обслуживания” – published in 1986, which stands for the equivalent of uniform sets of maintenance procedures (in fact maintenance programme) that are mandatory for most aircraft types in use with aviation of Polish Armed Forces.

On 07.01.2010, according to the provisions of the instruction on handling HEAD status flights and on the basis of the verification test flight’s programme for the Tu-154M („Program oblotu weryfikacyjnego samolotu Tu-154M”), a Commission appointed by the the Commander-in-Chief of the Polish Air Force (Order no. Z 3 of 16.01.2009) carried out an airworthiness check of the no.101 Tu-154M.

The last check (1K<sup>18</sup>) of the Tu-154M no.101 was carried out according to RO-86 by maintenance personnel of the 1<sup>st</sup> Flight of the 36 Regiment. The check was finished on 23.03.2010.

On 06.04.2010, on this Tu-154M nr 101 the maintenance personnel of the 36 Regiment, performed line maintenance checks B + P<sub>S</sub> (B – main check, P<sub>S</sub> – pre-departure check) according to RO-86. Having finished these tasks still the same day, in accordance with the Framework Program for a commisary test flight of Tu-154M (variant A, H = 31 000 ft), acting on the basis of Flight Order no.66/06/102(285). The Commission performed a test flight of the Tu-154M no.101 in advance of contemplated numerous flights with take-offs and landings away from the permanent disposition place. The test flight was manned by the commission from the 36 Regiment, appointed by the Order no.Z 2 from the Commander-in-Chief of the Polish Air Force, dated 15.01.2010. In the post-flight Report („*Protokół lotu komisyjnego*”), the Commission made an entry that the aircraft was prepared for a HEAD status flight, quote: „*Samolot jest przygotowany do wykonania lotu o statusie HEAD*”.

On 08.04.2010, during a flight from Prague to Warszawa the Tu-154M, no.101, suffered a bird strike which caused some damage to the surface of the radome. The damage was repaired on 09.04.2010 by personnel of the 36 Regiment, untrained in repair methods and techniques of elements and assemblies made of composites, in disagreement with the guidelines determined by Tu-154 SRM – Structural Repair Manual (*Руководство по капитальному ремонту*). The repair did not bear on the fatal crash.

For the flight on 10.04.2010 the aircraft was prepared in keeping with these documents:

- 1) „*Instrukcja służby inżynieryjno-lotniczej lotnictwa Sił Zbrojnych RP. Cz. I*”, DWLiOP, sygn. WLOP 21/90, Poznań 1991 (Instructions for the Engineering Personnel of the aviation of Polish Armed Forces, Part I, published in 1991 in Poznań by the Air and Air Defence Forces Command, at no. WLOP 21/90);
- 2) „*Instrukcja organizacji lotów statków powietrznych o statusie HEAD*”, sygn. WLOP 408/2009, Warszawa 2009 (Instruction on HEAD Flight Operations);
- 3) „RO-86”<sup>19</sup>.

Directly before the flight, line maintenance checks A<sub>2</sub> + P<sub>S</sub> were performed (P<sub>S</sub> means PDC – Pre Departure Check).

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<sup>18</sup> The 1K check is carried out after every 4 months ±15 days; the flight hours between this check and the day of crash was 26 hours and 36 minutes, no.of landings: 16.

<sup>19</sup> Instead of mandatory RO-86” service after „*по встрече (BC)*”, „*по обеспечению стоянки (OC)*” and after „*по обеспечению вылета (OB)*”, P<sub>S</sub> and P<sub>P</sub> checks, or their combination, were carried out in the 36 Regiment.



It was confirmed that on 10.04.2010 the status of the Tu-154M nr 101 was the following:

- all of the required maintenance tasks (heavy, structural checks, line checks, airworthiness directives & service bulletins) were performed,
- service life limitations between overhauls (airframe, engines) were not exceeded,
- personnel of the 36 Regiment properly carried out all<sup>20</sup> mandatory servicing tasks (including PDC) during direct preparation for the flight.

### 1.6.3 Engines

| Type of engine<br>Engine manufacturer      | „NPO Saturn”<br>General<br>Partnership.<br>Soviet Union | „NPO Saturn”<br>General<br>Partnership.<br>Soviet Union | „NPO Saturn”<br>General<br>Partnership.<br>Soviet Union |
|--|---|---|---|
| Location on aircraft                       | 1 (left)  | 2 (central)   | 3 (right)   |
| Engine no.                                 | 59319012423   | 59249012426   | 59219012414   |
| Date of manufacture                        | 31.03.1990  | 24.11.1990  | 21.03.1990  |
| Service life limitations (FH,<br>FC)       | 24 000 FH<br>11 100 FC                                  | 24 000 FH<br>11 100 FC                                  | 24 000 FH<br>11 100 FC                                  |
| Flight hours FH<br>Number of cycles FC     | 4262 FH 46 min<br>2492,6 FC                             | 7067 FH 25 min<br>3761,6 FC                             | 3991 FH 16 min<br>2470,6 FC                             |
| Service life between<br>overhauls (FH, FC) | 5000 FH<br>2310 FC                                      | 5000 FH<br>2310 FC                                      | 5000 FH<br>2310 FC                                      |
| FH after last overhaul                     | 147 FH 04 min   | 147 FH 04 min   | 147 FH 04 min   |
| FH after last check                        | 29 FH 02 min  | 29 FH 02 min  | 29 FH 02 min  |
| Number of overhauls                        | 4   | 3   | 4   |
| Period between overhauls                   | 6 years   | 6 years   | 6 years   |
| Date of the last overhaul                  | 28.08.2009  | 26.08.2009  | 25.08.2009  |
| Installed on aircraft                      | 23.12.2009  | 23.12.2009  | 23.12.2009  |

### 1.6.4 Fuel

The last refuelling of Tu-154M no.101 before the accident took place in Warsaw on 09.04.2010, done by technical personnel of the 36 Regiment. The aircraft was filled in with 9518 liters of Jet A-1 fuel, 0.806 kg/l in density. The Jet A-1 type of fuel complies with the list of fuels acceptable to aircraft manufacturer („Ту-154М. Руководство по летной эксплуатации”).

<sup>20</sup> Because the 36 Regiment had not the document, entitled „Заклучение о возможности и условиях дальнейшей эксплуатации самолета Ту-154М борт. № 101 (зав. № 90А837)”, of 14.11.2006, and the Commission did not obtain it from any other sources, the scope of tasks which should be done is unknown. Probably, the document had required that a/c user should do certain inspections and/or maintenance tasks.

The post-accident laboratory tests of fuel samples taken from the fuel pump which was used to refuel the aircraft in Warsaw showed that the fuel met quality requirements (Report No. WK-2913-55-143-10). Results of tests of fuel samples, taken from the aircraft's wreckage and carried out in Russia (*ЗАКЛЮЧЕНИЕ № 55-2010 / ЦС ГСМ-АП*), confirmed good quality of the fuel in the aircraft's tanks.

After replenishing, the aircraft was holding in its tanks the total of 18 672 kg of fuel, see the ops manual (*„Książka obsługi statku powietrznego Nr 101”*, 90A837, Register of In-coming Documents, RWD 343/14, pages 20/109), distributed as follows:

| Tank no.       | Fuel quantity [kg] |
|----------------|--------------------|
| #1 (one tank)  | 3 300              |
| #2 (two tanks) | 4 000              |
| #3 (two tanks) | 5 372              |
| #4 (one tank)  | 6 000              |
| Total          | 18 672             |

### 1.6.5 Aircraft loading

On 06.04.2010, the 36 Regiment's technical personnel changed the certified passenger cabin configuration by redoing the 8-seater cabin no. 3 so as to accommodate 18 seats. **The change was not agreed with the aircraft's manufacturer.** In the new layout of the cabin, the aircraft had a 100-passenger seat configuration. Such configuration was not in compliance with: *„Ту-154М. Руководство по летной эксплуатации. Книга первая”*, chapter „2. Общие эксплуатационные ограничения”, sub-chapter „2.4. Максимальное количество людей на борту”, page 2.9. (June 25/90), table 2.4.1. The document that was received at the 36 Regiment's Register of In-coming Documents was registered at no. 88/10, entitled *„Самолет Ту-154М. Руководство по загрузке и центровке. Дополнение к руководству по загрузке и центровке самолетов Ту-154М борт. (зав.) № № 101 (90А837) и 102 (90А862) Спецотряда Польской республики в вариантах компоновок »Салон« на 90 и 89 пассажирских мест”* *Руководство по загрузке и центровке. Дополнение к руководству по загрузке и центровке самолетов Ту-154М борт. (зав.) № № 101 (90А837) и 102 (90А862) Спецотряда Польской республики в вариантах компоновок »Салон« на 90 и 89 пассажирских мест”* did not provide for such change, nor did the loadsheet. So configured, the aircraft flew on 7, 8 and 10 April 2010.

|                                       |            |
|---------------------------------------|------------|
| Max.takeoff weight                    | 100 000 kg |
| Max.landing weight                    | 80 000 kg  |
| Takeoff weight on the day of accident | 84 883 kg  |
| Weight at accident                    | 77 886 kg  |

### **1.6.6 Procedures, limitations and aircraft systems**

In keeping with the Aircraft Operations Manual („*Ту-154М. Руководство по летной эксплуатации*”), chapter 2.2.1(3), the weather minima for landing in the RSP + OSP system (radiolocation landing system and two homing beacons) are: decision height<sup>21</sup> 100 m, runway visibility 1200 m (100 × 1200).

The Tu-154M no.101 was equipped with, among other systems, the ABSU (Automatic Board Control System) -154-2, Terrain Awareness Warning System (TAWS) and the Flight Management System FMS (UNS-1D).

## **1.7 Meteorological information**

### **1.7.1 Synoptical situation<sup>22</sup>**

On 10.04.2010, SMOLEŃSK NORTH was in a high pressure wedge extending from western Syberia, through Russia, the Moscow region, central Ukraine, as far as the Black Sea. The axis of the wedge was along a meridian in a rather small distance (about 100 km) to the east of Smoleńsk. The low-pressure area to the north of the Caspian Sea was moving onto Samara and, at the same time, it remoulded the axis of high-pressure wedge and made it NE-SW. This system carried moist air from Low Volga Region to Kursk and Smoleńsk regions. The change of the wedge axis changed the direction of the flow of masses in lower layers of the atmosphere from north-eastern and eastern to south-eastern (advection from the 135° direction at a speed of 25-30 km/h.). Continental polar air of constant balance was flowing. Due to ageing of the high-pressure system in the near-ground layer, inversion appeared to the height of about 500 m. In the Smoleńsk area the near-ground air was additionally provided a substantial dose of moisture from numerous broads of the Dniepr River and with rest of snow melting in the woods. Another stimulant which contributed to creation of fog in the early hours of 10.04.2010 was particles of smoke (functioning as additional nuclei of water steam condensation) from smouldering meadows and waistland in Smoleńsk area.

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<sup>21</sup> Because it is a non-precision approach (NDB), the more proper term is “minimum letdown height”.

<sup>22</sup> The chapter shows the synoptical situation over Poland, Belarus, the Ukraine, and western Russia.

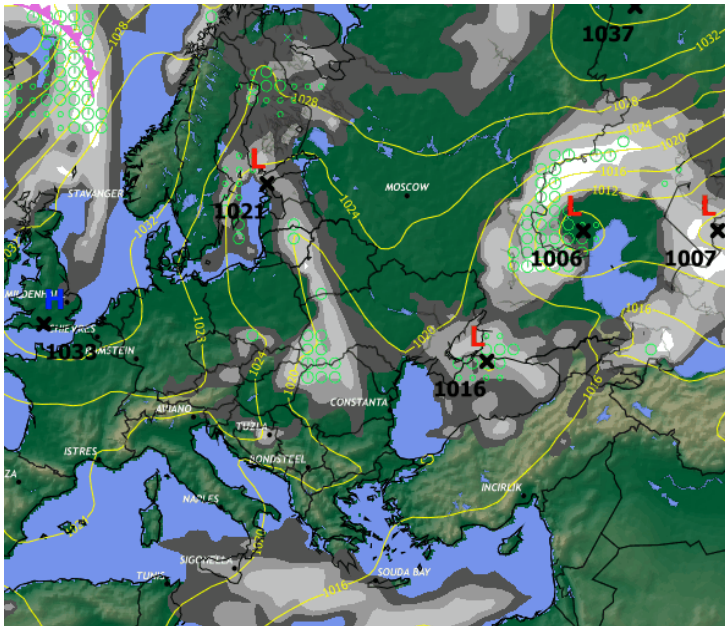


Fig. 2. Fragment of the 21 OWS AF US synoptical map Sembach at 06 UTC on 10.04.2010.

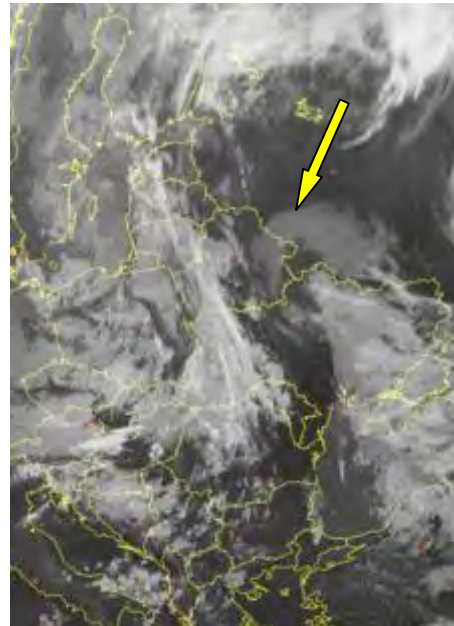


Fig. 3. A photo from Meteostat 9 satellite at 6:45 in infrared band, the Smoleńsk region is show by arrow

### 1.7.2 Weather forecast<sup>23</sup> for SMOLENSK NORTH aerodrome

- 1) the prognosis, prepared by the weatherman-on-duty (DML) of the 36 Regiment to sit Yak-40 and Tu-154M planes: cloud cover 3-4/8, stratus through broken clouds, ceiling 200-300 m and 5-7/8 through medium and high clouds, visibility 3000-5000 m;
- 2) the prognosis, prepared by hydrometeorological centre of the Polish Armed Force (CH SZ RP) :
  - to sit the Yak-40: cloud cover 5-7/8 through stratus (St), base 90-150 m, visibility 600-1500 m in vanishing fog and heavy mist;
  - to sit the Tu-154M: clouds through St clouds, with their ceiling at 150 m, in 1000-3000 m visibility in mist;
- 3) the prognosis, prepared at 01:30 in the Met Office at Twer Air Base (providing weather synopsis for SMOLENSK NORTH): the shortest horizontal visibility 3000-4000 m, the lowest clouds' base 600-1000 m. At 05.15 the prognosis was corrected and most unfavourable meteorological conditions anticipated that lowest clouds' base would be 150-200 m and 1500-2000 m horizontal visibility at the ground.

<sup>23</sup> The prognoses, described in items 2 and 3 were neither forwarded to the crew before departure nor at the time when the crew contacted the Aerodrome Controller Manager of SMOLEŃSK NORTH aerodrome.

### 1.7.3 Prognoses for alternate airports

The Terminal Aerodrome Forecast (TAF) prognoses for airports in MOSCOW and MINSK, compiled on Friday, 09.04.2010 before 17:00 hours and transmitted to all airports via the Aeronautical Fixed Telecommunication Network (AFTN) (available to Yak-40 and Tu-154M before their departure from WARSZAWA):

|                                    | <b>MOSCOW UUEE<sup>24</sup><br/>07:00-09:00</b> | <b>MINSK UMMM<br/>07:00-09:00</b> |
|------------------------------------|---|-----------------------------------|
| <b>Visibility</b>                  | 3000 m  | >10 000 m                         |
| <b>Cloud cover</b>                 | 5-7/8   | 5-7/8                             |
| <b>Cloud base</b>                  | 210 m   | 450 m                             |
| <b>Weather phenomena</b>           | Mist  | Nil                               |
| <b>Wind direction<br/>Velocity</b> | Changeable, 3 m/s                               | S 5 m/s                           |

The TAF weather message for Witebsk, available from 05:52, i.e. when the Tu-154M was already airborne:

|                                     | <b>WITEBSK UMII<br/>06:00-09:00</b> |
|-------------------------------------|-------------------------------------|
| <b>Visibility</b>                   | At times 2000 m                     |
| <b>Clouds</b>                       | 3-4/8                               |
| <b>Cloud base</b>                   | 150 m                               |
| <b>Weather phenomena</b>            | Mist                                |
| <b>Wind direction,<br/>velocity</b> | SE 4 m/s                            |

### 1.7.4 Meteorological documentation in the crew's possession

Prior to departure, the crew received the following meteorological documentation from the aerodrome weatherman-on-duty):

- 1) A satellite photo of Europe in infrared rays from 04:00 (10.04.2010), black and white, with contours of states and seashores;
- 2) A map from radar surveillance (CAPPI) from the POLRAD system from 04:00 hours (10.04.2010 r.), in colour, with contours of state borders and rivers;
- 3) A set of results from aerological probes from 00:00 from the weather stations: Legionowo, Łeba, Wrocław i Lindenberg (Germany) with wind velocities and directions on the levels: 1, 3, 5, 7, 9, 12 km, also, annotation on air jets (table – computer printout);

<sup>24</sup> The airport was not named in the flight plan of the Tu-154M as alternate, however, it was suggested in the conversation of the co-pilot of Tu-154M and the commander of Yak-40.

- 4) A set of TAF and METAR reports from airports on the way: WARSZAWA, WITEBSK, MIŃSK, MOSKWA-SZEREMIETIEWO from 03:30 i 04:00 (body of text – computer printout);
- 5) A set of TAF i METAR met reports from airports: GDAŃSK REBIECHOWO, MIŃSK, WILNO, GOMEL, MOSCOW-WNUKOWO, MOSCOW-DOMODIEDOWO, MOSCOW-SZEREMIETIEWO;
- 6) Two charts of wind velocity and direction for Europe and eastern Atlantic, including a prognosis of wind on flight levels FL300 (around 10 km) and FL240 (around 7.2 km) recent on 10.04.2010 12:00 hours, from RMSC OFFENBACH;
- 7) two SIGWX charts for Europe and eastern Atlantic, including prognosis of cloud cover, air jets, turbulence and icing conditions on flight levels from FL100 (around 3 km) to FL450 (around 13.5 km) recent on 10.04.2010 for 06:00 and 12:00 hours, from WAFC LONDON.

The materials of items 3 and 4 were signed by the aerodrome weatherman-on-duty and a crew member, whereas items from 5 to 7 were not signed. Discussion of usability of this documentation is contained in the analytical part of the report.

#### 1.7.5 Weather conditions at alternate airports

| 05:00 hours               | MOSCOW UUEE   | MIŃSK UMMM                     | WITEBSK UMII |
|---------------------------|---------------|--------------------------------|--------------|
| General visibility        | 5000 m        | >10 000 m                      | no message   |
| Cloud cover, lowest layer | Nil           | CAVOK (sky and visibility OK)  | no message   |
| Cloud cover, basic layer  | 1-2/8, 6000 m | >1500 m                        | no message   |
| Weather phenomena         | mist          | nil                            | no message   |
| Weather TREND             | NOSIG         | NOSIG (No significant changes) | no message   |

| 05:30 hours               | MOSCOW UUEE | MIŃSK UMMM                    | WITEBSK UMII          |
|---------------------------|-------------|-------------------------------|-----------------------|
| General visibility        | 5000 m      | >10 000 m                     | 4000 m                |
| Cloud cover, lowest layer | Nil         | CAVOK (sky and visibility OK) | nil                   |
| Cloud cover, basic layer  | clear sky   | >1500 m                       | No significant clouds |
| Weather phenomena         | Nil         | nil                           | mist                  |
| Weather TREND             | 5000 m      | >10 000 m                     | 4000 m                |

| <b>06:00</b>              | <b>MOSCOW<br/>UUEE</b>         | <b>MIŃSK<br/>UMMM</b> | <b>WITEBSK<br/>UMII</b> |
|---------------------------|--------------------------------|-----------------------|-------------------------|
| General visibility        | >10 000 m                      | >10 000 m             | 4600 m                  |
| Cloud cover, lowest layer | CAVOK (sky and visibility OK)  | CAVOK                 | nil                     |
| Cloud cover, basic layer  | >1500 m                        | >1500 m               | No significant clouds   |
| Weather phenomena         | nil                            | nil                   | Mist                    |
| Weather TREND             | NOSIG (No significant changes) | NOSIG                 | NOSIG                   |

| <b>06:30 hours</b>        | <b>MOSCOW<br/>UUEE</b>         | <b>MIŃSK<br/>UMMM</b> | <b>WITEBSK<br/>UMII<br/>07:00</b> |
|---------------------------|--------------------------------|-----------------------|-----------------------------------|
| General visibility        | >10 000 m                      | >10 000 m             | 6000 m                            |
| Cloud cover, lowest layer | CAVOK (sky and visibility OK)  | CAVOK                 | Nil                               |
| Cloud cover, basic layer  | >1500 m                        | >1500 m               | No significant clouds             |
| Weather phenomena         | nil                            | nil                   | nil                               |
| Weather TREND             | NOSIG (No significant changes) | NOSIG                 | NOSIG                             |

### 1.7.6 Time of day and lighting

The sunrise in Smolensk on the fatal day was at 03:02. The crash occurred by day, around three hours after sunrise.

## 1.8 Aids to navigation

### 1.8.1 Facilities at SMOLENSK NORTH aerodrome

SMOLENSK NORTH used to be a mutual use aerodrome of Military Unit no. 06755 WTA of the Ministry of Defence of Russian Federation and of the Aviation Experimental Station of Aeronautical Works of Smoleńsk. Navigational equipment is typical of military airfields. The aerodrome was in operation until disbandment of the 103rd Novosielsk Krasnoselsky Guard Transport Regiment in 2009. On 15.10.2009, a NOTAM was

issued, no. M2113/09<sup>25</sup>, which phased out the following nav aids: Outer NDB, Inner NDB and the navigation lighting system to Runway 08 approach.

### 1.8.1.1 Radio navigational and visual aids

On the fatal day, the nav aids at SMOLENSK NORTH were providing only the approach to RWY 26. They consisted of:

- 1) two non-directional radio beacons (NDB) with markers, which constituted radio signal points:
  - a) Outer NDB, consisting of a homing radio beacon, type PAR-10S (made in 1990) with a transmitter of radio signals, type E-615.5 (made in 1989), located (according to the approach plate) on runway extension at a distance of<sup>26</sup> 6260 m from the threshold of RWY 26. Operational data of the Outer NDB:
    - frequency:  $f = 310$  kHz;
    - call sign: „OK”;
  - b) Inner NDB, consisting of a homing radio beacon, type PAR-10S (made in 1981) with a transmitter of radio signals, type E-615.5 (made in 1981), located on runway extension at a distance of<sup>27</sup> 1100 m from the threshold of RWY26. Operational data of the Inner NDB:
    - frequency:  $f = 640$  kHz;
    - call sign: „O”;
- 2) the radiolocation landing system RSP-6M2 (made in 1989), comprising: controller's radiolocator *DRL* (omni-range scanning) and a landing radiolocator *PRL* (precision approach radar), located 200 m to the north of runway centerline, symmetrically 1250 m from runway thresholds. The RSP-6M2 system was connected to screens mounted on Near Post of Air Traffic Service posts (WISP-75T).

The minimum range<sup>28</sup> of landing radiolocator *PRL*, subject to selected mode, was:

- 1 km – ACTIVE or Selection of Moving Targets;
- 1.5 km – PASSIVE.

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<sup>25</sup> The M-series NOTAMs are not popular outside the Russian Federation, hence, unavailable in the global networks of aviation information exchange.

<sup>26</sup> According to the assessment of the Commission, Outer NDB was situated 6270 m from the threshold of RWY26.

<sup>27</sup> According to the assessment of the Commission, Inner NDB was situated 1065 m from the threshold of RWY26.

<sup>28</sup> According to „Protokół kontroli z powietrza” (Report on Aerial Observation) of 25.03.2010.



The minimum range of the landing radiolocator *PRL* was:

- 45 km – ACTIVE;
- 24 km – Selection of Moving Targets ;
- 28 km – PASSIVE;

3) Visual nav aids:

- navigation lighting, deployed with the use of Łucz-2MU appliance (made in 1991), according to SSP-1 schematic, without blinking lights;
- a coded neon airport lamp, type KNS-4U (made in 1983), located at Inner NDB. Emitted light – red. Mode of operations of the blinking lamp – 30-60 blinks per minute;
- two lamp stations APP-90P, mounted on vehicles positioned to form a “gate” for daylight configuration.

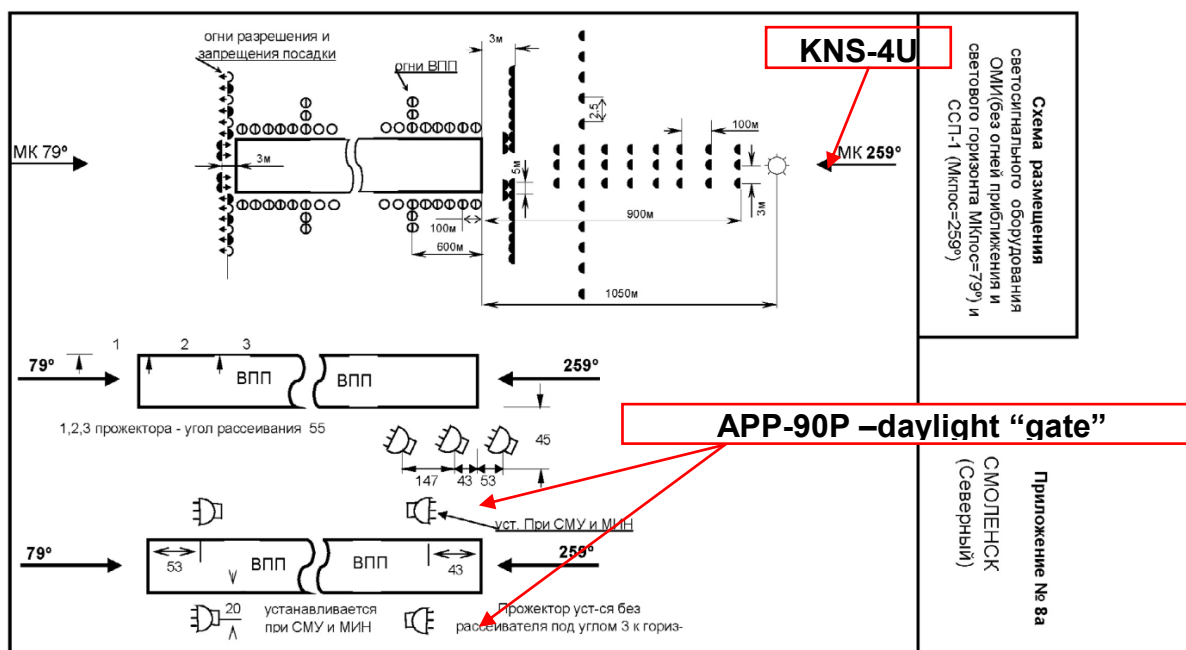


Fig. 4. Diagram of the layout of nav aids at SMOLENSK NORTH aerodrome

According to the “Report on in-flight Inspection” carried out on 25.03.2010 by an An-12 aircraft from Military Unit 2150, the above-named equipment was serviceable for supporting flights without limitations. Serviceability of mentioned above equipment for supporting flights was also confirmed in “The Act of Technical inspection of SMOLENSK NORTH Aerodrome’s Suitability to Receive Special Flights”, issued on 5.04.2010.

### 1.8.2 Maps and approach charts

The crew had at their disposal approach charts of SMOLENSK NORTH, which were copies of materials passed off to Polish Embassy in Moscow by the Ministry of Foreign

Affairs of Russian Federation. On 09.04.2009, that outpost forwarded<sup>29</sup> said materials to the Military Air Traffic Service Office of The Polish Armed Forces which passed them to the 36 Regiment.

### 1.8.3 Aids to navigation aboard the Tu-154M aircraft

The airborne equipment of the Tu-154M, no.101, which the crew used for navigation and approach to landing on 10.04.2010, comprised such components:

- a set of instruments in the cockpit;
- Very High Frequency radio stations;
- sets of radiocompasses and omni-range radio beacons and distance measuring equipment receivers (VOR/DME);
- a Flight Management System (FMS);
- a GPS receiver;
- the Terrain Awareness and Warning System (TAWS);
- integrated automatic control system (ABSU)

#### 1.8.3.1 Aircraft commander's instruments



Photo 3. Aircraft commander's instruments

1. **Altimeter WBE-SWS** – an electronic indicator, integrated into the aerodynamical data centre, shows barometric true and relative altitudes. Works with TAWS and FMS systems. Indications in [m] or [ft].

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<sup>29</sup> According to a statement by an employee of the Polish Embassy in Moscow, made on 5.05.2010, a representative of the Polish Dep. at the Ministry of Foreign Affairs of the Russian Federation informed on 05.04.2010 that procedures for the year 2010 are just like those from 2009.

2. **Altimeter UWO-15M1B** – an electromechanical indicator of barometric altitude from the set of air-related signals SWS-PN-15-4B. Indications in [m].
3. **Airspeed indicator KUS-730/1100-2** – a two-needle indicator of true and instrument velocities of flight. Indications in [km/h].
4. **Airspeed indicator US-I6** – an electromechanical indicator of instrument velocity, is a component of the *ABSU (INTEGRATED AUTOMATIC CONTROL SYSTEM)* system, designed to work with the AT-6-2 autothrottles. Is equipped with a movable, panel PN-6 controlled marker of applied speed. Indications in [km/h].
5. **Mach number indicator UM-1-0.89** – an electromechanical indicator of Mach number from the set of air-related signals SWS-PN-15-4B, designed to present Mach number.
6. **Variometer IVA-81A** – an electronic indicator with an LCD matrix. Beside the rate of climb/descent, it gives indications of the Traffic Collision Avoidance System (TCAS). Indications in [m/s].
7. **Variometer WR-75 PB** – a mechanical indicator of aircraft's vertical speed. Indications in [m/s].
8. **Radioaltimeter's indicator UW-5M** – an electronic indicator of true altitude (above terrain). Additionally, it signals dangerous flight height (alert height, better known as decision height) preset by the crew with a tag. The alert height is displayed on the indicator with yellow light, the aural warning is heard in the cockpit loudspeaker and in headphones of crew members. Indications in [m].
9. **Attitude indicator PKP-1** – shows aircraft's attitude relative to the horizon (roll and pitch) and comprises directive indicators of the *ABSU (INTEGRATED AUTOMATIC CONTROL SYSTEM)* system.
10. **Standby attitude indicator AGR-72** – shows aircraft's attitude relative to the horizon (roll and pitch).
11. **Turn and a bank indicator EUP-53** – with artificial horizons are parts of the spatial attitude of aircraft system.
12. **Automatic Direction Finder PNP-1** – shows momentary course and preset course as well as information from the receiver of signals of the ILS.
13. **Angle of attack and stall indicator UAP-12** – shows momentary values, critical angles of aircraft's attitude as well as momentary stall.
14. **Mechanical watch ACzS.**
15. **Radio-Magnetic Indicator** – displays radiocompass's indications (RDF) as well as aircraft's course.

### 1.8.3.2 Navigator's instruments



Photo 4. Navigator's instruments

1. **Altimeter/variometer KAV-485** – a combined barometric pressure altimeter's indicator and a variometer. Indications in [ft] and [ft/min].
2. **Speed indicator USWP** – an electromechanical indicator of true speed input from the set of air-related signals system SWS-PN-15-4B. Can also indicate cruising speed, working with the doppler speed/drift sensor system DISS. Indications in [km/h].
3. **Heading course indicator USz** – an element of TKS-2P course indication system.
4. **Indicator**, integrated into control panel PPI-4B – indicator of Bendix-King RDR-4B aircraft weather radar.
5. **Multi-function indicator MFD-640** – for displaying TAWS and FMS generated data. Can work with the weather radar.
6. **CDU (Control Display Unit – screen and control panel) UNS-1D**. The UNS-1D is an element of the Flight Management System (FMS) which uses GPS and a built-in data base of waypoints and airports that serve air navigation.
7. **Indicators ITE** – the D-30KU engine indications of revolutions of High Pressure compressor.

### 1.8.3.3 Co-pilot's instruments



Photo 55. Co-pilot's instruments

1. **Altimeter WBE-SWS.**
2. **Altimeter WM-15PB** – mechanical, for measuring and showing barometric altitude (QNH). Indications in [m].
3. **Speed indicator KUS-730/1100-2.**
4. **Speed indicator US-I6.**
5. **Speed indicator KUS-EK** – two-needle, mechanical, for measuring and showing Indicated Air Speed and True Air Speed. Indications in knots [kn].
5. **Machmeter MS-1M** – mechanical, for expressing speed in Mach numbers.
6. **Variometer IVA-81A.**
7. **Radioaltimeter's indicator UW-5M.**
8. **Attitude indicator PKP-1.**
9. **Automatic Direction Finder PNP-1.**
10. **Radio-Magnetic Indicator RMI.**

### 1.8.3.4 Flight engineer's instruments



Photo 6. Flight engineer's instruments

1. **Altimeter WM-15PB.**
2. **Airspeed indicator KUS-730/1100-2.**
3. **Variometer WR-30PB** – a mechanical indicator of aircraft vertical speed. Indications in [m/s].

### 1.8.3.5 Overhead panel



Photo 7. Overhead panel

1. **SELCAL panel** – a system of selective tuning in VHF and HF waves.
2. **Transponder TRA-67A and TCAS II panel.**
3. **KURS MP-70** Course Deviation control panel
4. **ARK 15M** – Automatic Radio Compass
5. **ARK 15M** – Automatic Radio Compass – set II.
6. **Radiostation VHF 1 – Baklan 20D.**
7. **Radiostation VHF 2 – Baklan 20D.**
8. **SD-75 system VOR/ILS 1 control panel.**
9. **SD-75 system VOR/ILS 2 control panel.**
10. **Course Deviation Indicator TKS-P2. panel PU-11**

### 1.8.3.6 Pedestal



Photo 8. Panels between the pilots' seats (pedestal)

1. **Panel PN-5** – an element of *ABSU* system of integrated automatic control. Serves to pass navigational data to the system of control in automatic or directive mode.
2. **Panel PU-46** – an element of *ABSU* integrated automatic control system. Serves to control aircraft in bank and pitch input channels. Also allows selection of mode in automatic setting (stabilisation referred to preset altitude, speed or Mach number).
3. **Panel PN-6** – an element of *ABSU* (integrated automatic control system). Serves to control auto-throttles AT-6-2.
4. **CDU of the FMS (UNS-1D) system.**
5. **GPS KLN89B** protective cover.

### 1.8.3.7. Bottom of pedestal



Photo 9. A panel located between the pilots seats (pedestal), bottom

1. **Course selector.**
2. **Course selector.**
3. **GPS Bendix-King KLN89B** – a device used by the navigator, unrelated to any system of the aircraft.

#### **1.8.4 The use of nav aids by ground services and aircraft crew**

During landing approach at SMOLENSK NORTH, the crew of Tu-154M, no.101, used the procedure described on approach plates as RSP + OSP<sup>30</sup>. In order to execute the procedure it was necessary to use the following airplane instruments and appliances:

- 1) attitude indicators;
- 2) barometric altimeters;
- 3) radioaltimeters;
- 4) speed indicators;
- 5) variometers;
- 6) Radio Direction Finders;
- 7) VHF radio stations;
- 8) watches.

The crew had also at their disposal such additional appliances:

- 1) Flight Management System FMS (UNS-1D);
- 2) GPS KLN89B;
- 3) Terrain Awareness and Warning System (TAWS);
- 4) ABSU – a system of integrated automatic control of an aircraft;
- 5) SW radio station.

In order to fulfill the terminal procedure (approach charts), the crew should conduct their flight on the basis of Radio Direction Finders ARK-15, with such frequencies set on: Outer NDB 310 kHz and Inner NDB 640 kHz, barometric altitude set to pressure value<sup>31</sup> QFE 745 mmHg. The Ops Manual of Tu-154M does not describe in detail crew's actions during a non-precision landing approach with the use of ABSU, however, in chapter 4.6.1.4 it has been allowed to make use of ABSU during approach with the use of bank and pitch input channels.

It appears from the findings of the Committee that final approach (after completed base leg and established on the final) was conducted with the use of FMS<sup>32</sup> which controlled the aircraft via ABSU and the aircraft was kept on a crew preset track (nav fixes 10XUB-DRL-XUBS). The CC was maintaining altitude through controlling the aircraft via ABSU from panel PU-46. The auto-throttle was controlling the engines, adjusting their revs to the preset on panel PN-6 speed of 280 km/h. The crew treated NDB setting as advisory (FMS was the source of reference of the aircraft's course).

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<sup>30</sup> An equivalent of Polish procedure USL from RSL.

<sup>31</sup> of the elevation of the runway on SMOLENSK NORTH.

<sup>32</sup> Not complying to the annex to Tu-154M ops manual with respect to FMS where autopilot has to be disconnected from this source of navigation in the case of landing approach.



From an analysis of flight recorders it appears that the crew did not use barometric altimeters for the assessment of correctness of their descent profile and ignored TAWS warning signals.

The calculated rate of descent for the 2°40' glide path and approach speed 280 km/h should be 3.41 m/s.

On the basis of the data recovered from FMS, the Committee has found that the crew put into the flight plan the fixes whose co-ordinates<sup>33</sup> originated from accessible approach charts without conversion from the SK-42 system to WGS84.

| Fixes in the FMS                                   | FMS (WGS84)             | SK-42 <sup>34</sup>     |
|--|-------------------------|-------------------------|
| OM1 (distant on 079 direction)                     | N54:49.30<br>E031:57.00 | N54:49.36<br>E031:57.02 |
| OM (distant on 259 direction)                      | N54:49.70<br>E032:08.60 | N54:49.76<br>E032:08.62 |
| 10XUB (10 NM from RWY 26)                          | N54:50.07<br>E032:18.86 | N54:50.13<br>E032:18.88 |
| XUBS (reference point (ARP) of Smoleńsk aerodrome) | N54:49.50<br>E032:01.60 | N54:49.56<br>E032:01.62 |

Adopting the co-ordinates that were expressed in the SK-42 system as WGS-84 co-ordinates caused that incorrect data were entered into the aircraft systems (GPS/FMS) of the Tu-154M. The linear shift, approximately 166 m to the South, was the result of the adoption incorrect co-ordinates from the approach charts namely SK-42 instead of WGS-84

During support approaches of Yak-40, Il-76 and Tu-154M on 10.04.2010, the Controller of Landing Zone was using the radiolocation landing system RSP-6M2 to advise pilots on:

- commencement of final approach procedure,
- entering a glide path,
- position relative to glide path and RWY centerline.

The Controller of Landing Zone was not informing the crews that the RSP-6M2 system was unserviceable or he had other difficulties which disturb him observation of approaching aircraft.

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<sup>33</sup> in the SK-42 system.

<sup>34</sup> The co-ordinates, read out from the memory of FMS (WGS84), which the Commission recalculated to co-ordinates in the SK-42 system.

## **1.9 Communications**

### **1.9.1 SMOLENSK NORTH aerodrome**

At the Near Post of Air Traffic Service for RWY26 there were three sets of VHF radio stations: basic R-845M4, part no. 2124960, made in 1990; an alternate radio station R862, part no.156323, made in 1991; and a standby radio station „Poliot-1”, part.no.7169, made in 1989.

The VHF radio station was checked in flight on 25.03.2010. According to “Report on in-flight Inspection” on 25.03.2010, parameters of the VHF radio station complied with established requirements and operations manuals and said stations were suitable for supporting aircraft without limitations. Telephone and “loud speaking” communications between services of air control and military support units were organized according to schemes of communication provided for these units. No complaints were reported in respect quality of radio communication on 10.04.2010.

The Aerodrome Controller and the Controller of Landing Zone had endorsements for the radio communication only in the Russian language and did not use procedures contained in ICAO Doc. 4444 „Air Traffic Management”, Annex 11 „Air Traffic Services” and in other manuals used by international navigation air services.

### **1.9.2 The Tu-154M aircraft**

The Tu-154M aircraft was equipped with the following radio facilities:

- 1) two VHF radio stations, type „Баклан-20Д”, for voice communications in the frequency range 118-136 MHz with channel separation 8,33 kHz;
- 2) two HF radio stations „Микрон” МК1-3в-01 for communications in the range 2-28 MHz;
- 3) a SELCAL system that supports all the aircraft’s radio stations;
- 4) a system of satellite telephony AERO-HSD+ with three cordless handsets dedicated to: cabin 1, cabin 2 and the pilots’ compartment;
- 5) one emergency locator-transmitter ARM-406P (fixed);
- 6) one emergency locator-transmitter ARM-406AC1 (portable).

From radio communication with ATC recorded with MARS-BM flight recorder it appears that both VHF radio stations were operable throughout the flight without any complains.

The crew did not use the HF radio station during the flight. The Committee is short of information whether the stations were checked during flight preparations. As the tool P12-Mk

was missing (at least since January 2005), during periodic servicing of radioelectronical appliances by personnel of the 36 Regiment the item 02.023.17 (KT 023.10.00.I „Check parameters of MIKRON radiostation with the P12-Mk tool”) was not fulfilled. The HF radio station „*Микрон*” *MK1-36-01* was alternatively checked by calling during the flight e.g. the controller of the Air Force post at KRAKÓW airport. The check, required by „RO-86” (with the use of P12-Mk tool), was carried out during periodic servicing in Russia („*BAP3-400*”).

The satellite telephone system was equipped with portable handsets which could be used by passengers and crew alike. During the Tu-154M flight on 10.04.2010, three transmissions were recorded to/from the satellite telephone, viz. at 5:15, 5:46:59 and 6:21:40. From an analysis of the aircraft’s voice recorder it seems that crew did not use the satellite telephone during the last 30 minutes of the flight.

No activation of emergency locator transmitters was recorded<sup>35</sup>.

The crew had endorsements allowing<sup>36</sup> Communication in the Polish and in the English languages.

## 1.10 The crash site

The disaster occurred during the approach to RWY26 at SMOLENSK NORTH. The strike against the ground took place between the Inner NDB and the threshold of RWY26.

SMOLENSK NORTH (code name XUBS) used to be an aerodrome of mutual use of military unit no. 06755 WTA of the Ministry of Defence of Russian Federation and of the Aviation Experimental Station of Aeronautical Works of Smoleńsk. The aerodrome was certified and had Certificate no. 86 issued as evidence of its registration and suitability for operations, dated 25.05.2006, extended to 01.12.2014<sup>37</sup>.

After it was agreed between Poland and Russia that SMOLENSK NORTH aerodrome would be the landing place for special flights on 7<sup>th</sup> and 10.04.2010, as in the cable no. 134/3/11/102 of 13.03.2010 on preparation and support of special flights of Yak-40 and Tu-154M in April 2010, among others, the following provisions were made:

- to call up a group with the tasks of controlling the flights, carrying out tests and training on the job for them to obtain endorsements to control the flights at SMOLENSK NORTH as per the stipulations of articles 216, 255-263, 271 and 562 on Federal Rules of State

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<sup>35</sup> The fixed emergency locator transmitter was disconnected due to disturbances it caused to the operations of other aircraft’s devices. Such decision was taken by the Chief of Aviation Technics of the 36 Regiment.

<sup>36</sup> Issued in keeping with the standing regulations in aviation of Polish Armed Forces.

<sup>37</sup> The Polish side was not disclosed any documents in support of this fact. The information was taken from the Final Report of MAK commission.

Aircraft's Flights {„Federalne przepisy lotnicze wykonywania lotów lotnictwa państwowego” (FAP PP GosA)} and Order 143, of 1992, by the Air Force Commander-in-Chief of the Russian Federation;

- to carry out an inspection of the aerodrome in terms of its compliance with the standards which airfields must fulfill to receive state aircraft –Norm of permission to explatation of states aerodromes” (FAP NGEA GosA 2006)};
- to conduct an in-flight inspection for chacking radio communication and radiolocation facilities as required by the Air Force Commander-in-Chief of the Russian Federation 144, of 1992;
- to arrange for radio communications according to Federal Rules of Communications in the Air Space of the Russian Federation;
- to perform flights while taking into account the requirements of item c) part AD, section III, vol. II, Aeronautical Information Publication of the Russian Federation and the Commonwealth of Independent States.

On 25.03.2010, was performed in-flight inspection of navigation and communications facilities. On 5.04.2010, a document – –The Act of Technical Inspection of SMOLENSK NORTH aerodrome – which attested compliance with –Standards of permission to explatation of states aerodromes” (standards FAP NGEA GosA-2006) and the –Manual of the usage state-airfields (FAP REA 2006”). According to said document, the aerodrome was meeting the standards of aerodrome the first class under the above-named rules.

Additionally, there was issued –The Act of Technical inspection of SMOLENSK NORTH Aerodrome’s Suitability to Receive Special Flights”. According to the document, the aerodrome was meeting the standards of the First Class I and was ready to receive special flights provided that weather minima existed:

THE AERODROME'S MINIMA FOR TAKEOFF AND LANDING ON MAGNETIC  
 COURSE 79°/259°

MC = 79°

| Aircraft category | For takeoff |      | For landing                        |                |                       |                |
|-------------------|-------------|------|------------------------------------|----------------|-----------------------|----------------|
|                   | Visibility  |      | Radiolocation landing system (RSP) |                | OPRS reversed takeoff |                |
|                   | D           | N    | Base [m]                           | Visibility [m] | Base [m]              | Visibility [m] |
| A/rotorcraft      | b.o.        | b.o. | 200                                | 2500           | 350                   | 3000           |
| A/ fixed-wing     | 0,3         | 0,3  | 200                                | 2500           | 350                   | 3000           |
| B                 | 0,3         | 0,3  | 200                                | 2500           | 350                   | 3000           |
| C                 | 0,5         | 0,7  | 250                                | 3000           | 350                   | 5000           |
| D                 | 0,5         | 0,7  | 250                                | 3000           | 350                   | 5000           |
| E                 | 0,5         | 0,7  | 250                                | 3000           | 350                   | 5000           |

MC = 259°

| Aircraft category | For takeoff |     | For landing (DAY/NIGHT) |                |          |                |          |                |
|-------------------|-------------|-----|-------------------------|----------------|----------|----------------|----------|----------------|
|                   | visibility  |     | RSP+OSP                 |                | RSP      |                | OSP      |                |
|                   | D           | N   | Base [m]                | Visibility [m] | Base [m] | Visibility [m] | Base [m] | Visibility [m] |
| A/ rotorcraft     |             |     | 100                     | 1000           | 100      | 1500           | 100      | 1500           |
| A/ fixed-wing     | 0,3         | 0,3 | 100                     | 1000           | 100      | 1500           | 100      | 1500           |
| B                 | 0,3         | 0,3 | 100                     | 1000           | 100      | 1500           | 100      | 1500           |
| C                 | 0,5         | 0,7 | 100                     | 1000           | 100      | 1500           | 100      | 1500           |
| D                 | 0,5         | 0,7 | 100                     | 1000           | 100      | 1500           | 100      | 2000           |
| E                 | 0,5         | 0,7 | 100                     | 1500           | 100      | 1500           | 150      | 2500           |

AIRCRAFT BY CATEGORY

| Aircraft category | Classified speed range | Aircraft types   |
|-------------------|------------------------|--|
| A                 | Below 169              | An-2, An-28, L-410, Jak-18, Jak-50, Jak-52, Su-26, Sm-92, Wilga, all types of helicopters              |
| B                 | 169-223                | L-29, L-39, Yak-40, Jak-42, An-24, An-26, An-30, An-72, An-74, Il-114                                  |
| C                 | 224-260                | An-32, A-50, Tu-134, Il-76, Il-78, Be-12   |
| D                 | 261-306                | Il-18, Il-20, Il-38, Il-62, Tu-134A, Tu-142, Tu-154, Tu-95, An-12, An-22, MiG-29, Su-25, Su-27, Tu-204 |
| E                 | 307-391                | Su-24, Yak-38, MiG-25, MiG-27, MiG-31, Tu-22M3, Tu-95ms  |

### 1.10.1 Geographical location and elevation

SMOLENSK NORTH AERODROME is located 3 km North of Smolensk railway station. The Aerodrome's Reference Point (ARP), is located on the center line of RWY, 1250 m from either threshold, 255 m above sea level. Its geographical co-ordinates: northern latitude 54°49'29", 032°01'34" eastern longitude. Geographical co-ordinates of the aerodrome's reference point (ARP) and as well as other co-ordinates are published in the SK-42 system.

### 1.10.2 Dimensions, directions and characteristics of the runway

The SMOLENSK NORTH aerodrome has:

- 1) a single runway (RWY), 2500 m x 49 m, concrete surface (CON); magnetic directions from approach chart or diagram <sup>38</sup> 79° i 259°; runway thresholds designation: 08 for the 79° direction, 26 for the 259° direction; PCN 38/R/C/W/T (M<sub>max</sub>-190 t) surface covering. No data of runway's sloping and cant;
- 2) two emergency strips at runway ends, 200 m long on eastern side, 250 m on western side;
- 3) two emergency strips (RSA) on the sides of runway, 25 m wide on the northern side, 50 m – on the southern side;
- 4) an alternative dirt strip with grass surface, 2100 m x 150 m, situated parallelly to the runway with man-made pavement, on the northern side, 50 m from its edge. On the eastern side, the threshold of the alternative strip is on the height of RWY26 threshold (see chart);  
**NOTE:** According to the chart (of 2005), in front of the dirt strip, on the eastern side, is a safety area 200 m in length.
- 5) nine taxiways, concrete, asphalt and concrete mixt. Taxiways width – 13.6 m i 12 m. Location: Taxiways 1, 2, 3, 4, 5, 6 and 9 are on the southern side, Taxiways 7 and 8 – on northern side of the Runway. Taxiways 1, 2, 4 and 5 connected with the main taxiway which is located parallelly to the Runway. The Pavement Classification Number (PCN) of the main taxiway is 38/R/C/W/T.

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<sup>38</sup> Magnetic declination on the crash day was 8°16', which actually gives the magnetic course of 78° and 258°.

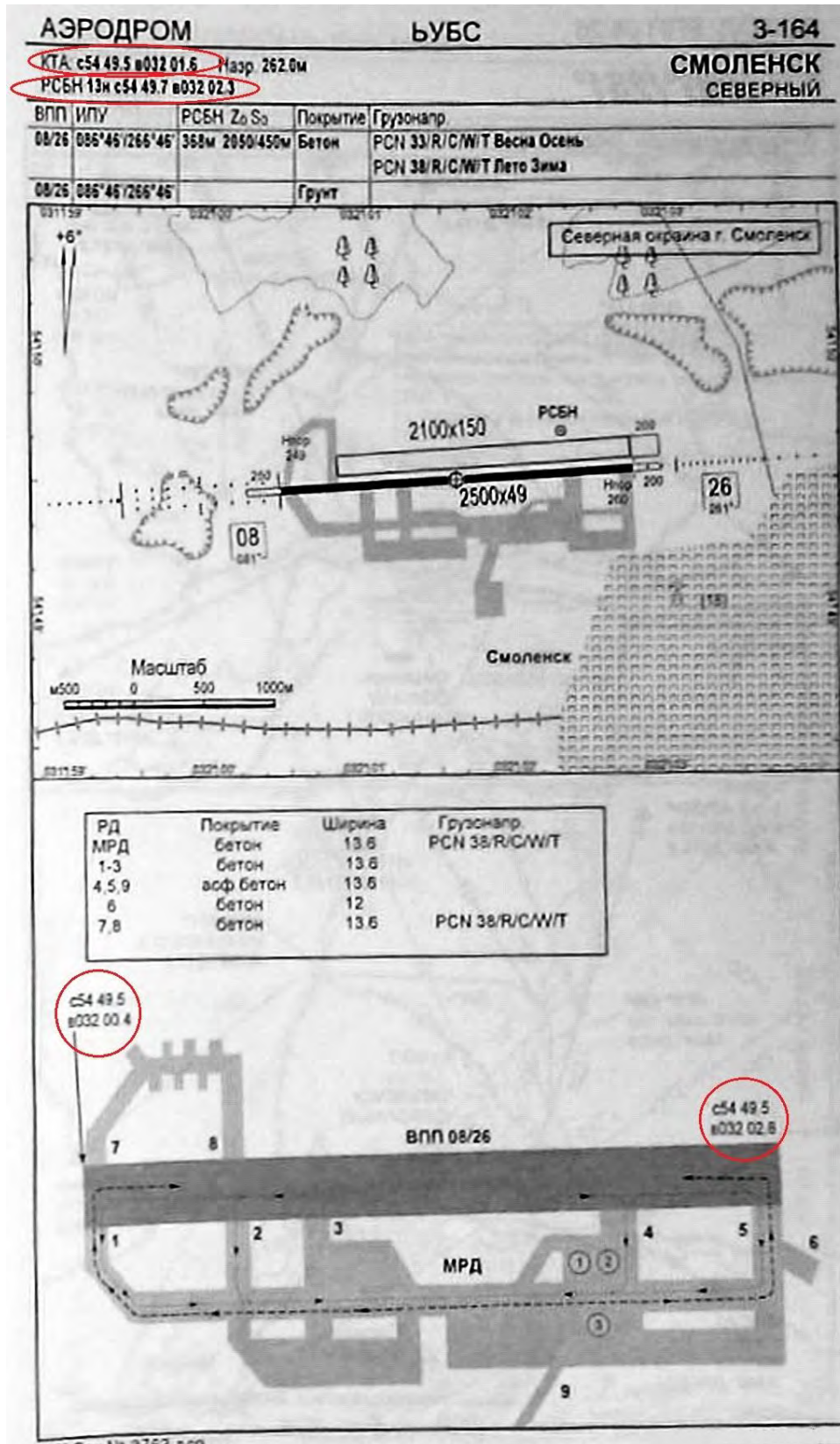


Fig. 5. Diagram of SMOLENSK NORTH aerodrome with geographical co-ordinates of thresholds and the aerodrome's Reference Point (ARP) (in the SK-42 system)



**LEGENDA:**

- 1 - droga startowa o nawierzchni sztucznej, wymiary 2500 x 49 m
- 2 - gruntowy (czołowy) pas bezpieczeństwa po stronie wschodniej, długość 200 m
- 3 - gruntowy (czołowy) pas bezpieczeństwa po stronie zachodniej, długość 250 m
- 4 - boczny pas bezpieczeństwa po stronie południowej, szerokość 50 m
- 5 - boczny pas bezpieczeństwa po stronie północnej, szerokość 25 m
- 6 - zapasowa droga startowa o nawierzchni trawiastej, wymiary 2100 x 150 m
- 7 - gruntowy (czołowy) pas bezpieczeństwa po wschodniej stronie zapasowej drogi startowej, długość 200 m

Fig.6. Layout of SMOLEŃSK NORTH with surfaces



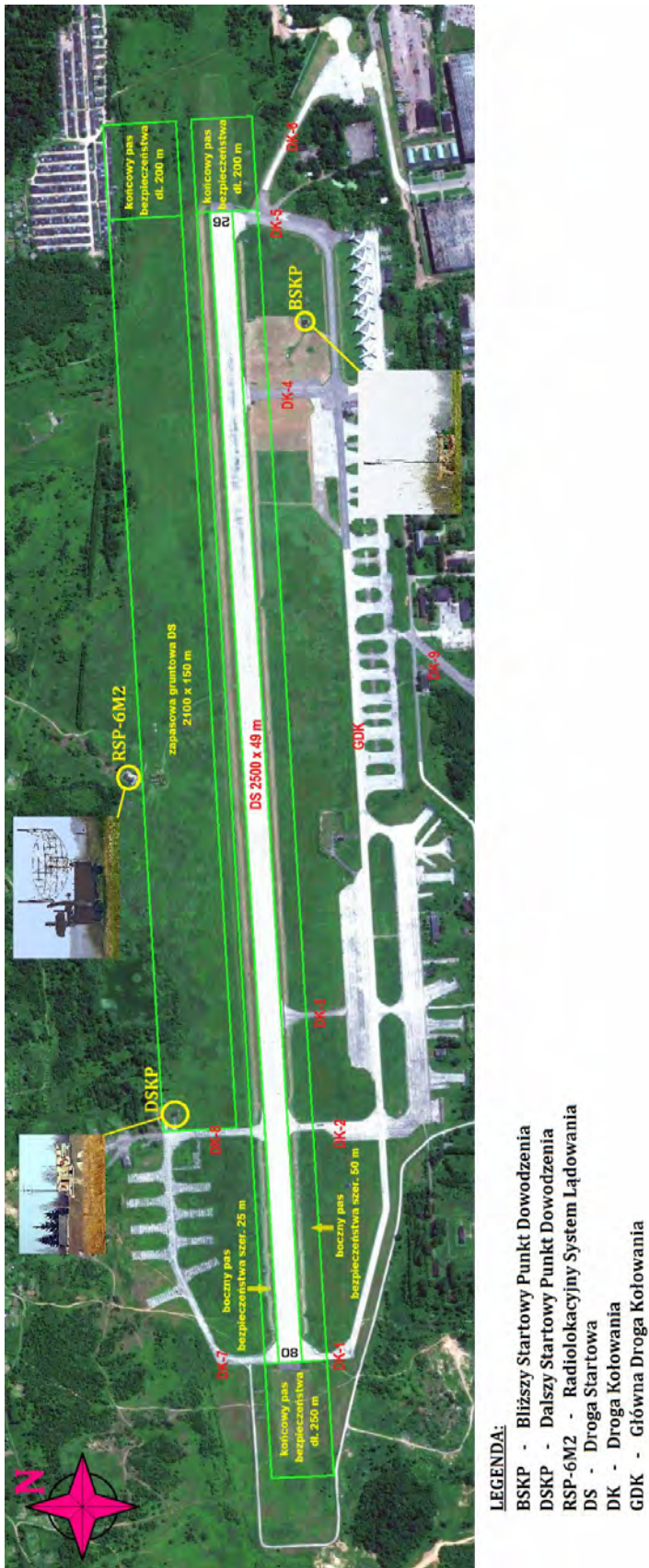


Fig. 7. Layout of SMOLENSK NORTH aerodrome's infrastructure and its ATC

The Aeronautical Information Publication of the Russian Federation and the Commonwealth of Nations does not contain any procedures for SMOLENSK NORTH or any information about this aerodrome. The only information about SMOLENSK NORTH was contained therein in the chapter GEN 3.3-6, item 7.3.5, referring to search and rescue unit.

### 1.10.3 Air traffic services

For the support of landing and takeoff operations of the Republic of Poland special flights to SMOLENSK NORTH on 10.04.2010, the Commander of Unit 06755 gave Order no.86 wherein a flight control group is named:

- 1) Aerodrome Controller,
- 2) Assistant to Aerodrome Controller -,
- 3) Controller of Landing Zone ,
- 4) Head of Air Traffic Co-ordination Post,
- 5) Two dispatchers.

The Aerodrome Controller and the Controller of Landing Zone did not have licences compatible with ICAO requirements (Annex1) and did not apply procedures from ICAO Doc 4444 „Air Traffic Management”, Annex 11 „Air Traffic Services” and in other manuals used by international navigation air services.

Personnel of the Military Air Traffic Service Unit applied the procedures mandatory in the airspace of SMOLENSK NORTH military aerodrome, i.e. the „Federal Air Regulations of State Aviation of the Russian Federation (FAP PP GosA)”, which they had been trained on.

### 1.10.4. Site of impact

The aircraft struck the ground between the Inner NDB and the threshold of RWY 26, on the left of runway centreline. Co-ordinates of the initial strike against the ground are in the table.

|   |                             |
|---|-----------------------------|
| Geographical co-ordinates (acc.to WGS-84) | N54°49'28,09"; E32°03'7,26" |
| Height above sea level                    | 253 m                       |
| Deflection from RWY centreline            | 105 m left (southward)      |



Fig. 8. Place where aircraft struck obstacles and the ground

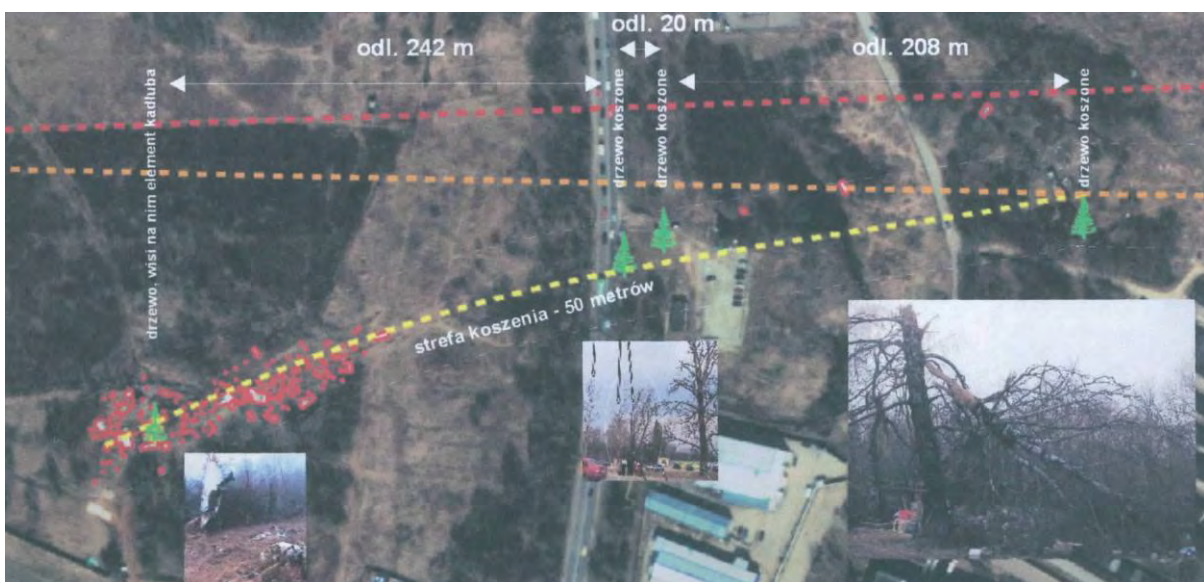


Fig. 9. Place of impact, characteristic measurements depicted.<sup>39</sup>

## 1.11 Flight Recorders

On the board of aircraft the following recording devices were built-in:

- 1) The MSRP-64M-6 system (henceforth MSRP) for recording and storing on magnetic tape parameters of operation of engines, aircraft systems and avionics during last 25 hours of flight, for an afterwards analysis. The recorded data can be used for assessment of piloting techniques and an analysis of aircraft performance.

<sup>39</sup> The material from the analysis of searching the site of Tu-154M crash, based on satellite data and prepared by SmallGIS company to an order from the District Military Prosecution Office in Warsaw.

The system records 42 analogue parameters and 55 discrete parameters. The parameters, measured by respective sensors, are sent to the write heads of the following recording devices:

- crash protected flight data recorder MŁP-14-5 in a protective shell;
- cassette recorder KBN-1-1.

Both recorders storing the same data.



Fig. 10. Locations of crash protected flight data recorder MŁP-14-5 (left photo) and KBN-1-1 (right photo)

The protective cover of crash protected flight data recorder MŁP-14-5 ensures storage of undamaged data after an accident, notwithstanding the working of:

- kerosene, petrol, extinguishing fluids, oil and greese during 5 minutes;
- temperature upto 1000 °C during 15 minutes, working on 50% of container surface;
- high loading upto 200 g;
- impact of upto 250 kg, from a height of 1 m on a surface not smaller than 1.6 cm<sup>2</sup>;
- sea water upto 36 hours.

Crash protetcted flight data recorder MŁP-14-5 was found on the spot of crash on 10.04.2010 by the Russian side. The cover had traces of mechanical damage and insignificant marks of short working of high temperature. On impact, the recorder was torn off of its mount and electrical harnasses were torn off of the main connector. Data from this recorder were readout on 11.04.2010 in Moscow in the seat of the Interstate Aviation Committee (MAK) at the presence of Polish specialists and a Polish military prosecutor. On opening the cover, it was found that the magnetic tape (storage medium) was in good condition.

The cassette recorder KBN-1-1 was found on the spot of crash by the Russian side. The recorder had distinct marks of mechanical damage to the cover, though, they were not

characteristic of high temperature working, hopeful for preservation of storage medium (magnetic tape). Readout of the data from this recorder was carried out on 14.04.2010 in Moscow, in the seat of MAK, at the presence of Polish specialists and a Polish military prosecutor.

On 31.05.2010, the Russian side handed off to Committee copies of recording from the crash protected flight data recorder MLP-14-5, also, from the cassette recorder KBN-1-1;

- 2) Quick Access Recorder ATM-QAR/R128ENC (henceforth ATM-QAR) was installed in the Tu-154M, no.101, within implementation of bulletin no.251-062-000 M T51, dated on 20.11.1991, in order to improve flight safety on the recommendation of the Commission investigating into the accident of Il-62M, tail no. SP-LBG, which commanded implementation of automated processing of engine vibration data the ATM-QAR was installed. ATM-QAR is fed in all signals from the Flight Data Recorder System (MSRP) and signals of vibrations of turbine LP and HP compressors of all the three engines – six additional analog signals. All the data are recorded in an electronic memory cassette which allows recording of data from the last 30 hours of flight.



Photo 10.Quick Access Recorder ATM-QAR on the site of crash

The memory cassette of ATM-QAR was found on the site of crash. On 20.04.2010, the data from the memory of the cassette were readout in the Air Force Institute of Technology in Warsaw, in the presence of representative of MAK, the Committee of Aircraft Accident Investigation in National Aviation (henceforth Committee), Polish Prosecutor's Office and the manufacturer's of ATM-QAR representative. The all data were retrieved;

3) recorder K3-63 is a cassette recorder for storing the following parameters:

- time;
- barometric altitude;
- Indicated Air Speed;
- normal g-load (vertical).

Recorded data are used for a swift analysis of flight parameters when there is no access to devices which enable an analysis of parameters from the MSRP system, or to the ATM-QAR recorder. The K3-63 recorder was not found;

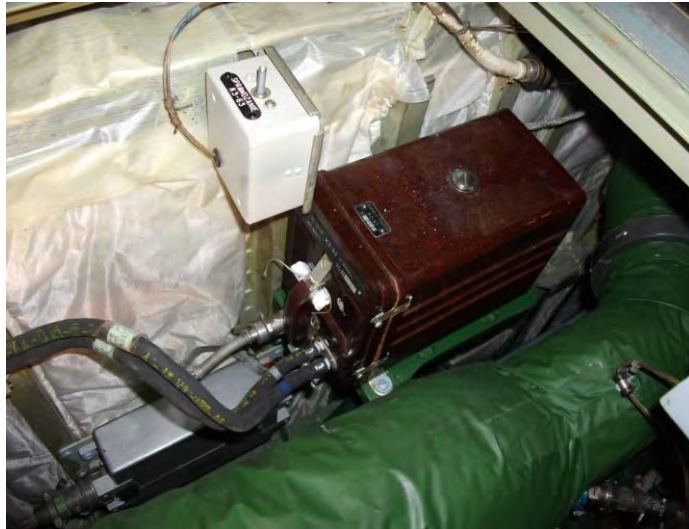


Fig. 11. The K3-63 recorder (in the Tu-154M, tail no.102)

4) voice recorder MARS-BM is installed for recording the radio, cockpit crew and aircraft's internal radio communication; it also records all sounds in the cockpit as well as pulse signals of encoded time from the MSRP system for synchronisation of recorded sounds with flight data parameters in the MSRP system; consists of two basic, single units 70A-10M, 70A-20M, a UsM microphone amplifier and three MDM-5 microphones.

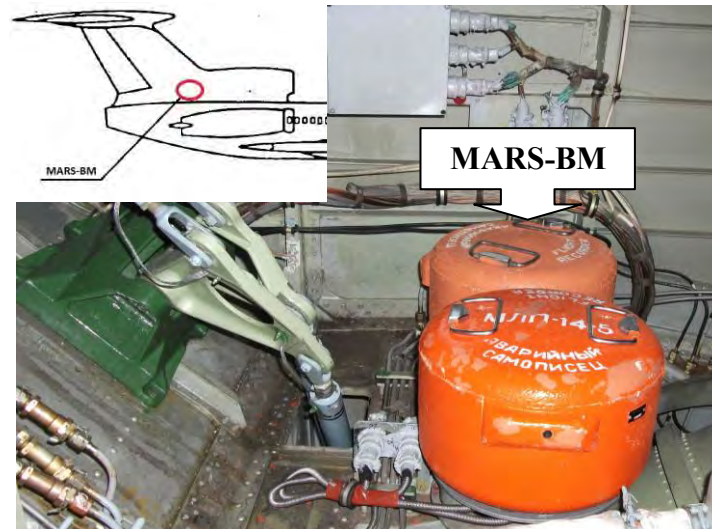


Fig.11. Location of MARS-BM voice recorder in protective cover

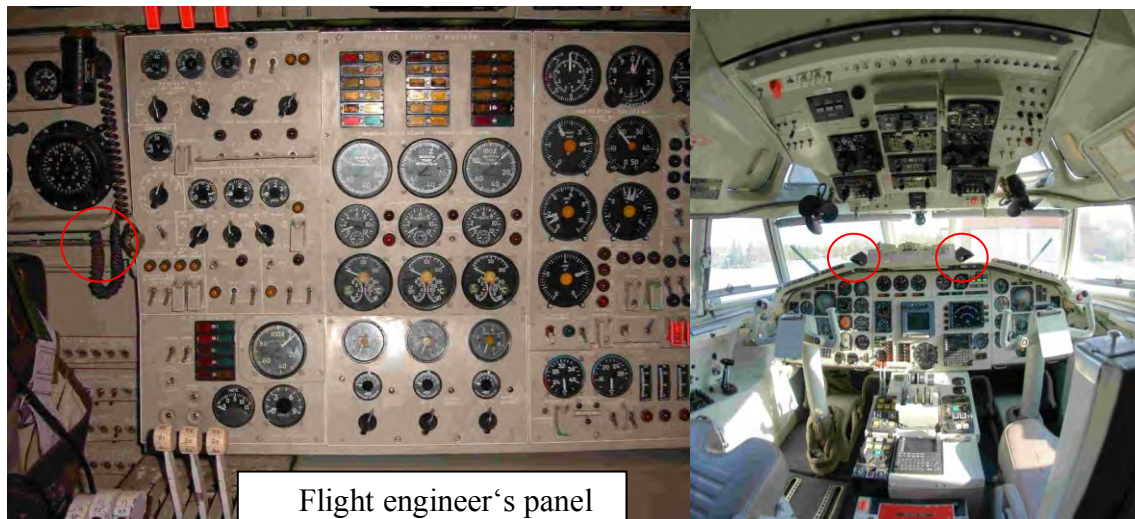


Fig. 12. Arrangement of microphones in the cockpit of Tu-154M

The 70A-10M unit ensures preservation of information in an unchanged condition after an accident notwithstanding the working of:

- sea water upto 36 hours.
- temperature surge of 1000 °C during 15 minutes, working on 50% of container surface;
- kerosene, petrol, extinguishing fluids and hydraulic fluids during 5 minutes;
- g-load upto 200 g;
- static load upto 1000 kG along two axes.

The Cockpit Voice Recorder MARS-BM ensures continuous recording of information and stores not less than last 30 minutes of recording.

The 70A-10M unit of MARS-BM voice recorder was found on 10.04.2011 on the site of crash by the Russian side.



Photo 13. Unit 70A-10M of MARS-BM voice recorder on the site of crash

Reading of the data from this recorder was carried out on 11.04.2010, in Moscow, in the seat of MAK, at the presence of Polish specialists. The data were copied and secured by representatives of Polish prosecutor's office in MAK's headquarters.

On 31.05.2010, the Russian side handed off the copy of MARS-BM voice data to the Committee.

Based on the four-channel records data of MARS-BM voice recorder, which MAK handed off, the transcription was written down and it makes a basis for an analysis of the flight progress.

## 1.12 The Wreckage

The first encounter which the Tu-154M no.101 had with a terrain obstacle was 1099 m from RWY26 threshold, 39 m to the left of its centerline, 239 m above sea level. The first encounter with the ground was 525 m from runway threshold, 100 m to the left of its centerline, 253 m above sea level.

Locations of remnants of the Tu-154M, no.101, were identified on 11-13.04.2010 after initial visual inspection of the site of crash. Terrain obstacles (trees), which suffered as they were on the track, were identified through measuring their height and shearing angle, also, their geographic co-ordinates were established. The terrain elevation was measured, and as referred to identified terrain obstacles, allowed to retrospect the aircraft's track from the Inner



NDB to place where it fell. Also, dispersion of basic components of the aircraft was measured. The relief of terrain on the last phase of the flight was determined with the measurements which the Committee took, materials obtained from the Military Geographic Center and from the Russian side<sup>40</sup>, and with the data from the Google Earth programme.

Results of measurements taken (Table 1) are presented as geographical co-ordinates, slant distance (Z), parallel (Y) and deflection (X) relative to runway threshold, the height of slashed terrain obstacles (P) and terrain elevation (H – above sea level).

A graphic scheme, which identifies the measurements taken, is depicted in Fig.12. Photo no.14 shows the scatter and identification of aircraft remnants. Fig.13 depicts the scatter of parts (items 14-25), location of terrain obstacles (items 1-13) and places of where the Tu-154M, no.101 impacted the ground (points A and B).

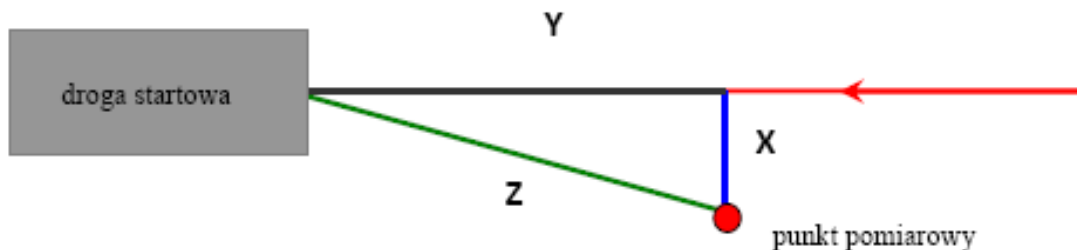


Fig. 12. Graphical scheme which identifies the measurements taken.

droga startowa - means runway,

punkt pomiarowy – means measurement point

<sup>40</sup> Кроки места авиационного происшествия с самолетом Ту-154М б/н 101 в районе аэропорта Смоленск (Северный) 10.04.2010.



| No. | Point   | N            | E           | H      | Z      | X      | Y      | P      |
|-----|---|--------------|-------------|--------|--------|--------|--------|--------|
| –   | –   | degrees      | degrees     | meters | meters | meters | meters | meters |
| 1   | First slashed birch                               | 54°49′31,21″ | 32°3′39,20″ | 239    | 1099   | -39    | 1098   | 10     |
| 2   | First group of young birches                      | 54°49′30,34″ | 32°3′29,84″ | 246    | 932    | -59    | 929    | 4      |
| 3   | Secong group of young birches                     | 54°49′30,43″ | 32°3′29,11″ | 246    | 919    | -54    | 917    | 4      |
| 4   | Birches and young poplars                         | 54°49′30,07″ | 32°3′28,09″ | 247    | 901    | -64    | 899    | 4      |
| 5   | Birch– loss of a fragment of left side wing       | 54°49′30,01″ | 32°3′25,51″ | 250    | 855    | -63    | 853    | 5,1    |
| 6   | Trees with branches about 15 cm thick             | 54°49′30,13″ | 32°3′22,87″ | 253    | 808    | -57    | 806    | 9      |
| 7   | Power line  | 54°49′30,01″ | 32°3′21,13″ | 253    | 777    | -59    | 775    | 7      |
| 8   | Spruce trees                                      | 54°49′29,77″ | 32°3′18,43″ | 254    | 729    | -64    | 726    | 13     |
| 9   | Birch   | 54°49′29,59″ | 32°3′17,29″ | 254    | 709    | -68    | 706    | 13     |
| 10  | Spruce  | 54°49′29,53″ | 32°3′16,27″ | 256    | 691    | -71    | 687    | 8      |
| 11  | Poplar  | 54°49′29,53″ | 32°3′15,13″ | 257    | 671    | -68    | 668    | 13     |
| 12  | Poplar  | 54°49′29,23″ | 32°3′13,39″ | 257    | 640    | -76    | 635    | 13     |
| 13  | Group of trees                                    | 54°49′28,99″ | 32°3′12,00″ | 255    | 616    | -82    | 611    | 10     |
| 14  | Fragment of left wing                             | 54°49′30,49″ | 32°3′19,33″ | 251    | 745    | -43    | 744    |        |
| 15  | Left elevator                                     | 54°49′28,38″ | 32°3′08,80″ | 252    | 564    | -96    | 556    |        |
| 16  | Elevator tip                                      | 54°49′27,61″ | 32°3′06,12″ | 253    | 518    | -119   | 504    |        |
| 17  | Horizontal and vertical stabilizers               | 54°49′26,89″ | 32°3′04,44″ | 253    | 493    | -140   | 473    |        |
| 18  | Engine no. 3 (right)                              | 54°49′27,07″ | 32°3′04,02″ | 252    | 485    | -134   | 466    |        |
| 19  | Passenger cabin                                   | 54°49′26,83″ | 32°3′03,48″ | 252    | 477    | -141   | 456    |        |
| 20  | Engine no. 1 (left ) and Engine no. 2 (central)   | 54°49′26,83″ | 32°3′02,40″ | 253    | 458    | -140   | 436    |        |
| 21  | Right wing  | 54°49′26,41″ | 32°3′00,90″ | 253    | 437    | -153   | 409    |        |
| 22  | Cockpit with nose landing gear                    | 54°49′26,89″ | 32°3′00,60″ | 253    | 427    | -136   | 405    |        |
| 23  | First passenger cabin                             | 54°49′26,89″ | 32°2′59,96″ | 251    | 416    | -135   | 393    |        |
| 24  | Main landing gear left                            | 54°49′27,01″ | 32°2′59,96″ | 253    | 414    | -129   | 393    |        |
| 25  | Main landing gear right                           | 54°49′26,47″ | 32°2′59,78″ | 253    | 417    | -148   | 390    |        |
| A   | Left wing's trail on the ground                   | 54°49′28,51″ | 32°3′06,36″ | 253    | 518    | -93    | 510    |        |
| B   | Left elevator's and rudder's trails on the ground | 54°49′28,09″ | 32°3′07,26″ | 253    | 535    | -105   | 525    |        |

Table 1. Co-ordinates of points measured and their distances to runway threshold

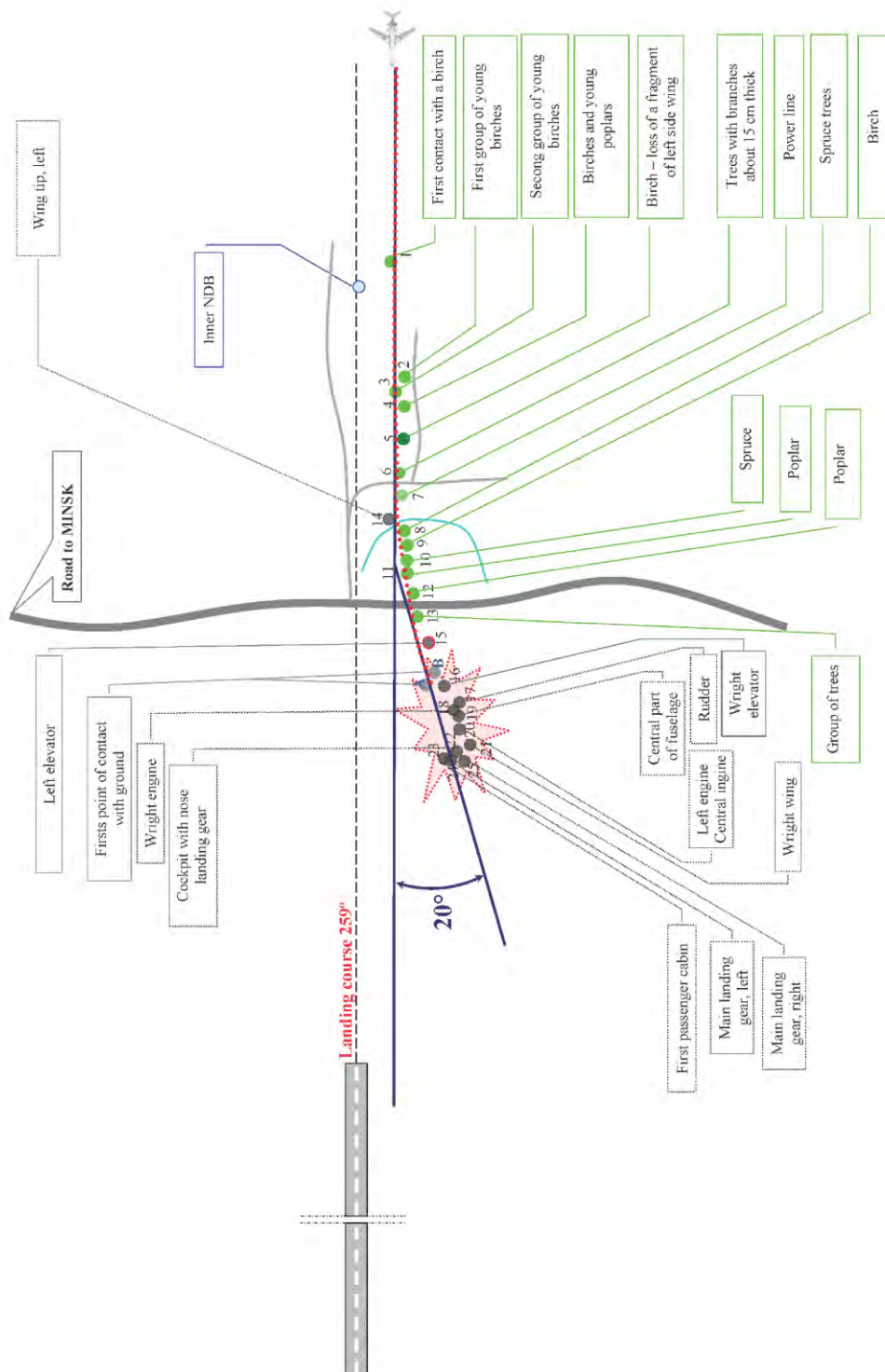


Fig. 13. Positions relative to runway threshold, of:  
 a) characteristic obstacles of terrain (points 1-13);  
 b) places of impact against ground (points A and B);  
 c) scatter of the aircraft wreckage (points 14-25)

## **1.13 Medical and pathological findings**

Aircraft Commander, co-pilot and Flight Engineer had ample rest time given prior to the flight, not shorter than 8 hours, according to provisions of RL-2006 § 17 item 2 and § 17 item 11. Navigator's rest time was around 6 hours 30 minutes.

Health condition of the flight crew of the Tu-154M had no bearing on the crash.

The cause of death of the crew was massive multiorgan trauma due to deceleration force on the impact of the aircraft against the ground and destruction of its structure.

In the flight on 10.04.2010, Navigator and Flight Engineer did not use corrective lenses recommended by Aeromedical Board. It had no bearing on their performance because it was necessary for them to have sharp vision on a short distance (upto about 1 m), while their sight imparity refered to distant vision.

### **1.13.1 Aircraft Commander**

At the moment of the airplane's impact against the ground CC was located on the left pilot seat, which was in the upside down position. His seatbelts were fastened and he was performing flight procedures.

Characteristic injuries on his hands indicate that they were clenched presumably on flight controls. His right lower limb was fully stretched forward probably attempting to counteract rapidly increasing left bank of the plane.

### **1.13.2 Co-pilot**

At the moment of the airplane's impact against the ground, co-pilot was located on the right pilot seat, which was in the upside down position. His seatbelts were fastened and he was performing flight procedures. His hands were most likely clenched on the yoke.

His right lower limb was fully stretched forward, probably attempting to counteract rapidly increasing left bank of the plane.

### **1.13.3 Aircraft navigator**

The injuries inflicted by mechanisms allow drawing a conclusion that during aircraft impact against the ground his seatbelts were fastened.

### **1.13.4 Flight engineer**

The injuries inflicted by mechanisms allow drawing a conclusion that during aircraft impact against the ground he was in his seat and his seatbelts were fastened.

## **1.14 Fire**

The only document which describes the fire extinguishing operation, which was accessible to the Committee, is the MAK's Report.<sup>41</sup> The materials in the Committee's possession did not allow:

- for any detailed evaluation of rescue operations (in the light of procedures for a case of an aircraft accident);
- to state the range of actions meant to make rescue and extinguishing action more effective;
- to state the extent of use of rescue equipment in the rescue and extinguishing action;
- to assess organization of the rescue and extinguishing action.

### **1.14.1 Preparation of support services for aircraft rescue**

Military Unit 06755 Commander's Order no.86, of 9.04.2010, on the subject of appointment of a group to control flights and a group to support landings and takeoffs of planes with the delegation of the Republic of Poland at SMOLENSK NORTH did not contain any directive to carry out a briefing with support services concerning aircraft rescue.

Transcripts of talks at ATC Near Control Place do not contain any information of any raised readiness<sup>42</sup> being declared for rescue units, or response time, viz. from initial alert to first fire engine getting to the site of crash and providing at least 50% required delivery of extinguishing agents at each place on active runway.

### **1.14.2 Source of fire and its character**

On the basis of photographs and film, it can be stated that fire broke out on impact against the ground at least in two places, engulfing aircraft remnants and part of wooded terrain. The fires were local and did not spread as the terrain was muddy, sparsely wooded, the air was moist and the wind was mild.

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<sup>41</sup> Remarks on the contents of MAK's Report were given by the Polish side in a document „Uwagi Rzeczypospolitej Polskiej jako państwa rejestracji i państwa operatora do projektu raportu końcowego z badania wypadku samolotu Tu-154M nr boczny 101, który wydarzył się w dniu 10.04.2010 r., opracowanego przez Międzypaństwowy Komitet Lotniczy MAK” (Remarks by the Republic of Poland as the State of Registration and the State of Operator on MAK Interstate Aviation Commission's Final Report from an Investigation into the Accident of Tu-154M, no. 101, on 10.04.2010).

<sup>42</sup> The state of higher readiness should be in force from the moment the visibility at the aerodrome dropped below the level predetermined by aerodrome manager. The state of readiness should be sustained until visibility improved, or aerial operations suspended.

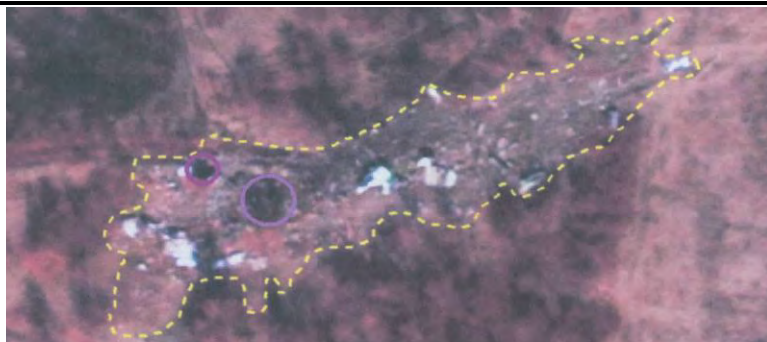


Fig. 14. Probable areas of fire<sup>43</sup>

The Russian side has not disclosed complete information about quantities and kinds of extinguishing means that were available for protection of air operations at SMOLENSK NORTH, let alone means of killing jet fuel fires and means that were actually used in this fire fighting and rescue operation.

Poland has not received any information on whether active and reserve rescue units at SMOLENSK NORTH aerodrome had at their disposal the right kind and quantity of extinguishing agents to fight a fire of a Tu-154M size aircraft.

The photographs prove that fire fighting took place. Yet, they make no grounds for assessment of conducting the fire fighting operation.



Photo 15. Fire fighting

<sup>43</sup> The material from the analysis of "Report on Searching the Site of Tu-154M Crash on Basis of Satellite Data" prepared by SmallGIS company to an order from the District Military Prosecutor's Office in Warsaw.



Photo 16. Dumping down operation and securing the site of crash

### **1.14.3 Aircraft's fuel quantity at crash**

At the time of crash, the fuel tanks of Tu-154M, no. 101, were holding around 11 tons of fuel.

## **1.15 Survival aspects**

### **1.15.1 Rescue operation**

The conduct of rescue operations is known to the Committee from MAK's final Report only.

MAK's Final Report misses information on what is the basis of the description of rescue tasks on the site of crash was made.

From entries in MAK's Final Report, chapter 1.15 it appears that:

- there was an physician-on-duty (a feldsher) at SMOLENSK NORTH;
- the first rescue team arrived at the site of crash at 6:58 (17 minutes after the crash);
- seven first-aid teams arrived at the site 29 minutes after the crash.

### **1.15.2 Operation of Tu-154M aircraft's rescue systems**

The ARM-406P emergency locator transmitter (ELT) of Tu-154M, no.101 was inoperative. The decision to have it disconnected was taken after concluding that the ELT interfered with GPS1 and GPS2 receivers in the UNS-1D system during a flight from KRAKÓW to WARSZAWA on 28.02.2010.



The decision to continue operations of the aircraft without the ARM-406P was taken by the the 36 Regiment's Chief-of-Aviation Technics who recommended that flights be carried out with the ELT<sup>44</sup> disconnected until the problem was solved by repair plant.

Disconnection of the ELT had no bearing on the conduct of search and rescue operation on 10.04.2010.

### **1.15.3 Possibilities of crew's and passengers' survival**

The configuration of the aircraft at impacting the ground created no chances of the crew and/or passenger survival.

According to the trajectory which the aircraft followed on the surface of the ground, the flightcrew were subject to impact acceleration along the  $-x$  axis (back-to-chest). Assessing the character of injuries of crewmembers' heads, chests and spines, their bodies were given a surge load not smaller than 100 g.

The cause of death of 8 members of the crew and 88 passengers was massive multiorgan trauma due to deceleration force on the impact of the aircraft against the ground <sup>45</sup>.

## **1.16. Tests and research**

For the purpose of retrospectively the course of the event, determining its causes and circumstances as well as making safety recommendations, the Committee carried out:

- 1) an analysis of actions of organs of Polish government administration, related to the organisation of the flight to Smoleńsk by a delegation on 07 and 10.04.2010 to commemorate the 70<sup>th</sup> anniversary of Katyń Massacre;
- 2) assessment of the status of SMOLENSK NORTH aerodrome in terms of safety of air operations (condition of flight support infrastructure and terrain obstacles within the approach area to RWY26);
- 3) an analysis of how the aircraft was used since its manufacture, inclusive of overhauls, repairs, modifications, operation defects and maintenance as well as a comprehensive assessment of technical condition of Tu-154M, no.101, before commencement of the flight on 10.04.2010;

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<sup>44</sup> If this aircraft fell in terrain hard to reach, or into a body of water, unserviceable LLT which otherwise would automatically send distress signals and inform of its position, might seriously hamper or make impossible any search and rescue action.

<sup>45</sup> For the assessment of crew members' bodily injuries and locations, results of medical and traseological examinations were used from MAK's report and from autopsy reports of forensic experts of Russian Federation.

- 4) an analysis of basic documentation which sets flight standards for aviation of Polish Armed Forces, for training on military transport aircraft, and for performing special flights (HEAD) with most important persons in the State („Instrukcja organizacji lotów statków powietrznych o statusie HEAD”);
- 5) an analysis of documents which govern operation of engineering services, as to coherence of their provisions and their recency regarding operations of Tu-154M aircraft in the 36 Regiment;
- 6) assessment of methodology of pilot training and technical training in the 36 Regiment;
- 7) an analysis of pilot training of the crew who flew the Tu-154M on 10.04.2010;
- 8) an analysis of operation of the section responsible for objective assessment of flight standards at the 36 Regiment in respect of uncovering irregularities in performing pilot duties;
- 9) assessment of prophylactic actions executed in the 36 Regiment;
- 10) an analysis of official supervision over the 36 Regiment by competent military authorities of the Polish Armed Forces;
- 11) assessment of the status of the Tu-154M on 10.04.2010;
- 12) an analysis of possibilities to forecast unfavourable weather conditions during planned landing, weather conditions and their changes at SMOLENSK NORTH on 10.04.2010 as well as an analysis of the way meteorological conditions were passed to the crew of Tu-154M;
- 13) an analysis of requirements, acts and circulation of information within the supervision over the flight with HEAD status;
- 14) an analysis of preparation of the 36 Regiment, including the crew of the Tu-154M, for execution of the flight on 10.04.2010 as well as of the conduct of supervision exercised by the commanding body;
- 15) an analysis of recording from CCTV at the Military Airport in respect of execution of the Tu-154M crew preparation for the flight on 10.04.2010;
- 16) an analysis of work of the Flight Control Group at SMOLENSK NORTH, including psychological assessment of the post of Flight Controller;

- 17) an expertise of the course of destruction of the Tu-154M since its first encounter with terrain obstacles;
- 18) an expertise analysis of the state of power plants, controls, indications of on-board instruments and the operations of the most important systems of the Tu-154M through an analysis of its wreckage;
- 19) an analysis of recordings from the aircraft flight data recorders and cockpit voice recorder, based on data copied from said recorders, including assessment of credibility of these recordings;
- 20) correlation of recordings saved in the MSRP system, the ATM-QAR quick access recorder and in the MARS-BM recorder;
- 21) compilation of a transcript of voices stored in the MARS-BM recorder;
- 22) transcription of radio communications, also, of talks at ATC Near Control Place, as well as a phonoscopic analysis was carried out of voices stored therein;
- 23) a quality check of fuel the aircraft was refilled with for the 10<sup>th</sup> of April 2010 flight;
- 24) assessment of the psychological profile of the crew members and of the non-members in the cockpit at the moment of impact against the ground;
- 25) a psychological analysis of crew actions in the fatal flight;
- 26) assessment of health condition and the Tu-154M crew members' rest;
- 27) an analysis of injuries to crew members of the Tu-154M;
- 28) an analysis of the aircraft balancing at the time of striking obstacles;
- 29) the expertise-report on Tu-154M crash site was used, based on satellite data, commissioned by the Military Prosecutor's Office in Warsaw;
- 30) used an opinion from the Chair of Air Navigation, the Polish Air Force Academy in the matter of the data contained in documentation of SMOLENSK NORTH;
- 31) a special flight in the other Tu-154M in the scope of performance of systems of automatic control of aircraft;
- 32) retrospection of the progress of said flight, pointing out to its critical elements;
- 33) assessment of visualisation of the aircraft on RSL system's indicators on the basis of reproduced trajectory of the aircraft;

- 34) an analysis of performance of the crew, referred to provisions in the ops manual of Tu-154M aircraft and to performance standards of flight duties;
- 35) an expertise of selected aircraft instruments;
- 36) an expertise of fragments of magnetic tape from MARS-BM recorder;
- 37) graphic representation of the last phase of Tu-154M flight;
- 38) simulation of the flight of the Tu-154M on 10.04.2010;
- 39) an analysis of clothing rags and personal belongings of the victims of the crash for unusual chemical substances.

## **1.17 Organizational and management information**

### **1.17.1 Arrangements related to the departure for Smoleńsk**

The subject of commemorating the 70<sup>th</sup> anniversary of Katyń Massacre was raised on 8<sup>th</sup> December 2009 in a meeting of the Under-Secretary of State in the Office of the President of the Republic of Poland with the Ambassador of the Russian Federation to Poland. And the possibility of the Polish President visiting Katyń was mentioned. The Russian ambassador forwarded the answer that the Russian side did not decide yet about a representative of the Russian Federation taking part<sup>46</sup>.

The next day, in the Prime Minister's Office a meeting was held with the purpose of co-ordinating governmental actions related to organization of the homage visit planned for 13.04.2010. Chief Secretary turned to the Prime Minister to call up a person authorised to organise central homage. The subject of a Polish delegation going to Katyń was not raised.

On 11.01.2010, in the Ministry of Culture and National Heritage (MKiDN) another meeting was held in the matter of organizing the homage. Present at the meeting were representatives of said MKiDN, the Ministry of Foreign Affairs (MSZ), the Council for Commemoration of War Efforts and Martyrdom (ROPWiM), and representatives of the Prime Minister's Secretariate. Preliminary dates for the anniversary commemoration visits to Katyń were suggested (for April), to Charków (for June), to Miednoje (for September) and to Bykownia (for autumn). Transportation of visitors was raised as a basic logistic problem.

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<sup>46</sup> In conclusions from the meeting it was pointed out, among other things: that „in order to avoid the possibility of the Russia „playing” which of Poland's highest authorities should take part in the coming events (...) it is advisable to arrange seniority and set up definite schedules.”

Participants agreed that it was most important to obtain from the PM a binding declaration that he would take part in the visit and the date of his possible arrival in Katyn.

A next meeting was held on 19.01.2010 in MKiDN<sup>47</sup>. Present were the Under-Secretary of State in MKiDN, the Under-Secretary of State in MSZ, the Secretary of ROPWiM, the Director of Department of Foreign Affairs (DSZ) in the Prime Minister's Office, the Director of Department of Cultural Heritage in MKiDN, and the Director of Eastern Department (DW) in MSZ. The representative of the PM's Office shared the information that the PM confirmed preliminarily his participation in the official commemoration in Katyn and accepted the 10<sup>th</sup> of April as the date of a central event. The Secretary of ROPWiM proposed that a single co-ordination Centre be set up for all official actions.

On 27.01.2010, the President's of the Republic of Poland Office notified MSZ of the President's participation in the April homage in Katyn. A copy of the letter was sent to DW MSZ, the Polish Embassy in Moscow and to the Vice-Chairman of Polish-Russian Group for Difficult Questions through DW MSZ, and to the other participants of the 19.01.2010 meeting. In the letter no definite date for the visit was given or any means of transportation were mentioned.

On 02.02.2010, still another meeting was held in ROPWiM. In the note from that meeting, made for the Chief of PM's Office, information was contained that suitable means of transportation be planned for the Katyn April event. It was stated that it was going to be a train and a special aircraft. Two scenaria of events were presented during the meeting. Both scenaria provided for the Polish President and the Prime Minister's participation. A working visit to Katyn was proposed as an initial reconnaissance and a second trip to meet the Russian counterparts and discuss details. The representative of ROPWiM and of institutions that were gathering names of all participants and forwarding their lists to MSZ put forward a request that a final list of participants be delivered not later than a month before the commemorations.<sup>48</sup>

On 23.02.2010, the Under-Secretary of the State in MSZ wrote to the Chief of the Presidential Office asking final confirmation of the President's participation in Katyn homage and his leading the Polish delegation. That same day, the Chief of the Presidential Office confirmed the President's participation as well as his Office's full readiness to co-operate,

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<sup>47</sup> Accessible materials do not reveal who was the initiator of the meeting.

<sup>48</sup> The list of participants for the visits on 07 and 10.04.2010 were altered many times and its final version was passed to the institutions interested as late as on 6th and 9.04.2010, respectively.

consult and co-ordinate actions leading to materialization of the enterprise. From the letter of the Director of 3<sup>rd</sup> European Dep. in the Russian Federation's MSZ, addressed to the Polish ambassador to Russia it seems that until 13.03.2010 the Russian side was not notified of a planned visit of the Polish President. A consecutive letter, asking immediate notification of the Russian side about the Polish President's arrival, was sent from the Polish PM's Office on 15.03.2010. Official notification of the Russian side was on 16.03.2010.

On 24.02.2010, the Polish embassy in the Russian Federation sent to the Polish MSZ a note informing about a meeting of the General Secretary of ROPWiM with representatives of the Russian side: Deputy Head of the Office for International Contacts, Regional Cooperation and Tourism, representatives of Smoleńsk regional administration, Director of the Military Cemetery Memorial Complex in Katyń and his Deputy, held on 18-19.02.2010 in Katyń. The purpose of the meeting was to present a concept how to organise the commemoration events. It was said in a note that the Secretary General of ROPWiM presented to the Russian side two concepts: 1) organisation of the events with mutual participation of the Polish PM and the Polish President, 2) organisation of two events – one, on 7.04. wherein Prime Ministers of Poland and Russia would participate, and the other, on 10.04 wherein the Polish President would participate. The Russian side stated that separate visits of Prime Minister and Polish President would be most favourable. The Russian side was informed that around 2-3.03.2010, a working group would arrive in Katyń, made up of representatives of ROPWiM, MSZ, the Government Security Office, the Presidential Office's, and reporters, for finalization of details of the PM's and the President's visits. In the note there was also a general remark that talks had been held on the subject of the aerodrome of SMOLENSK operations. No details were of the talks were indicated.

On 25.02.2010, the the Presidential Office sent to ROPWiM information that a person was appointed and made responsible for preparations of the 70th anniversary of Katyń massacre commemoration. In the letter, the scope of tasks and duties of said authorised person was not delineated in this respect. The Commission was not presented with any documents which would delineate the scope of that person's duties and competencies.

On 01.03.2010, the Eastern Department (DW) of the Office of Foreign Affairs (MSZ) sent a note to the Polish embassy in the Russian Federation with the information: „(...) because of lack of possibilities to arrange respective meetings with representatives of the Russian side, arrival of the preparation group in Smoleńsk on 3th inst. can not be executed”. Therein, there is also a request of prompt confirmation of the possibility of arrival of the

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preparation group in Moscow and in Smoleńsk/Katyń on 10-11.03.2010, or about these dates. „The persons on this group are keen to hold a meeting with governmental representatives, representatives of MSZ protocol, press service, the federal security service (FSO), passport services, consular service of the Russian Federation, authorities of Smoleńsk, the management of Katyń museum, commanding officers of Smoleńsk aerodrome, and other providers of logistics.”.

On 02.03.2010, the Polish embassy in Moscow received a letter from MSZ of the Russian Federation with a proposal of a date for a meeting with the working group<sup>49</sup>, viz.15-20.03.2010. Prior to the contemplated arrival of the preparation group, the Polish embassy in Moscow sent to the Polish MSZ RP a letter with the following information: „due to disbandment of the military unit which supported the Smoleńsk aerodrome, landing of a special aircraft carrying the Polish PM visit’s preparation group is technically impossible (lack of equipment to support flights, including tankers, lack of mobile Ground Power Units and runway pavement maintenance equipment)”.

On 11.03.2010, the Polish embassy in the Russian Federation forwarded to Polish MSZ information about a consecutive change of date of arrival of the working group. The reason of the change was a talk which a worker of the embassy had with the Director of the 3<sup>rd</sup> European Dep. of the Russian Federation. The Russian representative informed that the date of receiving the preparation group was changed, ergo, the Polish delegation might be received probably not earlier than on 02.03.2010. It remained in connection with the Russian Federation’s MSZ awaiting a decision from the Federation’s Office of Protocol on the arrangement of the visit. In the same conversation, the representative of the Russian Federation underlined that the Protocol was going to make arrangements solely for a meeting of the Polish PM and the Russian counterpart because, to that date the Russian side had not received any official note<sup>50</sup> on a visit of the Polish President. During the meeting in Smoleńsk, representation of the Russian side which was hosting the delegation, was to be composed of representatives of central authorities, including most important, i.e. the Office of Protocol of the Russian Federation, the press and security services. To the question if the preparation group might come to SMOLENSK by air, the answer was that the aerodrome in Smoleńsk might be a problem.

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<sup>49</sup> Alternatively called “preparatory group” elsewhere in letters.

<sup>50</sup> As mentioned earlier, the official notification of the Polish presidential visit to Smoleńsk was passed to the Russian side on 16.03.2010.

Still that same day (11.03.2010 r.), the Polish embassy in the Russian Federation forwarded to DW MSZ a note that the Head of the 3<sup>rd</sup> European Dep. of the Russian Federation's MSZ informed of a request from the Polish Protocol concerning the question of readiness to receive in SMOLENSK on 24-26.03.2010 r. the Polish delegation preparing the 7<sup>th</sup> of April 2010 visit of the Polish PM.

In connection with the Polish President's contemplated visit in Katyń, the Under-Secretary of the State in the Polish President's Office (KPRP), on 16.03.2010, advised MSZ of his intention to go to Moscow for 18-19.03.2010 and consult details of the commemorations. This trip did not materialise because of an earlier-planned (for 17-18.03.2010) visit of a delegation from the PM Office and the MSZ in preparation of the PM's visit due on 7.04.2010, and because the preparation group was to arrive in the following week. The Polish embassy in Moscow proposed to change the date.

The meeting, which was devoted solely to the 7.04.2010 visit, took place on 17.03.2010 in Moscow between the Chief of PM's Office and the Deputy Chief of Administration of the Russian PM. The Committee has not obtained any note on this meeting. According to the information obtained from the Chief of PM's Office, the talk was on matters of protocol only.

A note on the subject of the preparation group's visit in Moscow and Smoleńsk was written by the Council of Ministers' Office on 26.03.2010. It appears from the note that during the visit, there were discussed problems related to preparation of the 7<sup>th</sup> and 10.04.2010 visits. „It was agreed that the meeting would be devoted to preparations for the events to be held on 7.04.2010, whereas talks about the commemoration on 10.04.2010 would be held in a narrower composition after the first part of talks”. On the Polish side were: Secretary General of ROPWiM, Director of foreign affairs department (DSZ) in the PM's Office, Director of Diplomatic Protocol (PD) MSZ, Head of DW MSZ, two persons from the Governmental Centre of Information (CIR) the PM's Office, a representative of DSZ in the PM's Office, a BOR representative, three persons from the Polish embassy in the Russian Federation. The Russian side was represented by: Deputy Director of Protocol of the Russian Federation, two persons from the Russian Federation's Office of Protocol, Deputy Chief of Press Service of the Russian Federation, four persons from the Federal Security, inclusive of one who was responsible for the Polish President's visit, Head of Polish Dep. in the Russian Federation's MSZ, a Counsel in the Russian Federation's MSZ, and a representative of Smoleńsk Administration. In the course of the talks, questions of organisation and conduct of the commemorative event in Katyń was raised as well as bilateral meetings in Smoleńsk with



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the public information media present. It was agreed that: „on 5 April the Polish preparation group will arrive in Smoleńsk so that, commencing 6 April, they can oversee preparations for the visit”. Within the framework of the meeting, no local vision of SMOLENSK NORTH aerodrome was carried out. In final remarks of the report from the meeting it was written, among other: „the Russian side ensured that all aircraft would be received, and indispensable parameters would be sent in a note to the Polish MSZ”. The last part of the note lists out the matters pending solution, inclusive of: „the parameters of the aerodrome in Smoleńsk”.

On 26.03.2010, acting at the request of the preparation group, the Polish embassy in Moscow sent to the PM’s department of foreign affairs (DSZ) (and to the Traffic Control Authority) documentation of SMOLENSK NORTH. The documentation came from the 2009 archives of the Polish embassy in Moscow.

At the presence of the preparation group in Smoleńsk which, according to the provisions made on 24-26.03.2010, was supposed to directly oversee preparations for the visit, an attempt was made by officers from the Government Security Office (BOR) to reconaissance<sup>51</sup> SMOLENSK NORTH aerodrome on 6.04.2010. The Polish embassy in Moscow had not been notified of the intention of their visiting the aerodrome and could not ask the Russian side for a clearance to enter the aerodrome area. So, the BOR officers were not let in onto the area of the aerodrome.

On 17.03.2010, the Ministry of National Defence (MON) received from the Polish President’s Office a letter, reading: „(...) Mr.President would wish to have included into the commemoration ceremonies in the Katyń Forest the following persons: Polish Army Chief-of-Staff, Commander of Operations of the Armed Forces, Air Force Commander, Army Commander, Special Force Commander, Polish Navy Commander, Commander of Warszawa Garrison”. The invitation did not carry information on whether transportation<sup>52</sup> was provided for their transportation to the place of ceremonies. On 24.03.2010, MON sent to the Polish President’s Office a letter containing Defence Minister’s consent to the designated commanders’ participation (without any mention to whether transportation was secured).

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<sup>51</sup> The purpose of the reconaissance was to assess aerodrome’s preparation in terms of security. Because the preparation group did not contain any representative of the 36 Regiment or of Air Forces Command (DSP), no assessment of aerodrome’s preparation in the aspect of flight safety could be made. None of the regulations that govern performance of flights by the 36 Regiment carry imposition to make inspection flights of airport facilities or any other form of reconaissance.

<sup>52</sup> Personal invitations, issued by the presidential office (KPRP) on 25th March indicated to a special aircraft as a means of transportation.

Also, a person was appointed as responsible for co-ordination regarding participation of military forces' commanders (RSZ) in the delegation.

On 18.03.2010, the Secretariat of Sejm (lower chamber of Polish parliament) passed to the Polish President's Office a list of representatives (triplets) of each major parliamentary club to take part in the ceremonies on 10.04.2010.

On 03 and 09.03.2010, the President of the Republic of Poland Organizational Support Team (ZOO) delivered to the PM's Office, with copies to the 36 Regiment, and the Air Force Headquarters (DSP) and BOR, an order for air carriage for 10.04.2010. The order did not stipulate acceptable alternate airports.

On 15.03.2010, the PM Office approached the 36 Regiment directly with a request for reservation of a Tu-154M aircraft for a flight on 7.04.2010. On 30.03.2010, the PM Office turned again to the 36 Regiment and, at the same time, sent a copy to DSP and BOR wherein it asked reservation of three Yak-40 aircraft for 7.04.2010. Additionally, on 31.03.2010, the PM Office approached DSP with a request to consider a possibility of using three CASA C-295M aircraft for transportation on 7.04.2010.

On 31.03.2010, the PM Office sent to the Director of Protocol in MSZ a list of PM's entourage in Katyń on 7.04.2010 r. The list was divided into parts comprising: official delegation, guests whom the PM invited, representatives of the Polish-Russian Group for Difficult Questions, representatives of "The Federation of Katyń Family", accompanying persons, security officers, and military escort. The list comprised 149 persons, with no representatives of military forces (RSZ).

The list of participants to the celebrations, updated on 7.04.2010, was sent by the PM Office to DSP, 36 Regiment, and BOR on 1.04.2010. It assigned the passengers to particular aircraft: Tu-154M – 94 persons, Yak-40 – 15 persons, CASA no.1 – 39 persons, CASA no.2 – 43 persons. Another updated passenger list was remitted on 6.04.2010.

Commander of 1<sup>st</sup> Aircraft Base was sent the number of passengers for a Tu-154M for the 10<sup>th</sup> of April 2010 flight on 7.04.2010.

## **1.17.2 Flight personnel's preparation for the April 10th, 2010 flight.**

### **1.17.2.1. Flight crew appointment**

In keeping with a note (*claris* NR 050 SL: 200), which the 36 Regiment posted on 18.03.2010, concerning a request for diplomatic clearance for a flight of Tu-154M, no. 101, received by 3<sup>rd</sup> European Dep. of Russian Federation's MSZ on 22.03.2010, Leader of 1<sup>st</sup> Squadron was named as the Aircraft Commander. This nomination (in the *claris*) was not binding and allowed for a change of CC at a later stage. In the initial phase of planning the departure for SMOLENSK, Deputy Leader of 1<sup>st</sup> Squadron was appointed as CC. At his request<sup>53</sup> and in consultation with the leader of 1<sup>st</sup> Squadron, a change was made from CC to a pilot with capacity of commander of the team. From the relation between the squadron leader and his deputy it appears that CC did not raise any remarks concerning the change. He came to know of the possibility to make a flight to SMOLENSK on 10.04.2010, viz. as CC, a few days before. The co-pilot was informed of his assignment to the flight to SMOLENSK about two weeks in advance.

The final completion of the crew was on the day preceding the flight, in keeping with 1<sup>st</sup> Squadron Leader's Order 69/10/2010 of 09.04.2010, confirmed in morning Order of the Day no. 69/2010 of the Commander of Military Unit 2139. On 09.04.2010, during the morning assignment of tasks in the 1<sup>st</sup> Squadron Leader's room the tasks were assigned as to the departure for SMOLENSK on 10.04.2010. In the course of this brief, the squadron leader twice changed navigators. Originally, the only full-time navigator<sup>54</sup> in the Regiment was assigned, however, due to his having been planned for a departure for the United States and Canada on 12.04.2010, the 1<sup>st</sup> Squadron's leader decided that the flight to SMOLENSK would make shorter the preparations for a next flight. Still another airman did not have an entry visa to the Russian Federation. After checking recency of visas in terms of the flight to SMOLENSK, a pilot<sup>55</sup> was designated as a navigator; at the time when this decision was taken, said pilot was not on the premises. The squadron leader ordered to have the pilot informed of the departure a.s.a.p.

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<sup>53</sup> Family reasons.

<sup>54</sup> On 7.04.2010, his candidature was put forward by Deputy Squadron Leader and taken down in the roster.

<sup>55</sup> From the explanations given by the commander of 1<sup>st</sup> squadron it appears that CC personally asked him to assign just that navigator to the crew composition for the flight to Smoleńsk on 10.04.2010.

### **1.17.2.2. Crew preliminary preparation**

Preliminary preparation for the flight to SMOLENSK was conducted in individual course of action. From a statement of the 1<sup>st</sup> Squadron Leader come that preliminary preparation of the crew (he did not tell the crew composition) took place on 9.04.2010 in the afternoon and in the evening.

### **1.17.2.3. Crew preparation for the flight directly before**

Direct preparation for the flight was begun on 10.04.2010 at 02:00 when the flight engineer arrived because it was his duty to participate in direct preparation of the aircraft for a HEAD-status flight and, at 2:20, he took the aircraft over from SIL service. At 3:05, on the tarmac, engines were tried by the flight engineer. Direct preparation of aircraft was not attended by any representative of the Commission for Airplanes and Helicopters Test Flights (KOSS). When testing engine no.2, ground mechanics observed a leak of some unidentified fluid, so they gave a signal to interrupt testing. When the engine was shut down, the fluid was identified. It was water which most probably remained in the tail section after aircraft's washing on the day preceding the day of departure. Eventually, the engine test was finished around 3:20 and after the SIL specialists finished maintenance, the aircraft was declared technically fit for a HEAD status flight. The flight engineer remained in the aircraft awaiting other members of the crew.

At 3:25, two flight attendants boarded the plane, and a third one - at 3:38.

The aircraft Commander, the co-pilot and the navigator arrived at their military unit between 3:15 and 3:25. First, they went to the briefing room, next to the flight personnel preparation room. There, the aircraft Commander confirmed crew's readiness for the task by signing in in the task log („*Dziennik zadań*”). At 4:06, a bus pulled up by the aircraft, bringing the aircraft Commander and the co-pilot. At 4:10, the Navigator took from airport's meteorologist-on-duty (DML) the flight documentations and, a minute later, he boarded the aircraft. At 4:11, the aircraft Commander, the co-pilot and two attendants disembarked and went to the crew dispatch room (BOZ)<sup>56</sup>. From the statement of the meteorologist-on-duty it appears that the co-pilot learnt the weather around 04:20; the aircraft Commander – as the last one<sup>57</sup>. At 04:21, the aircraft Commander, the co-pilot and the two flight attendants came back on board the aircraft.

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<sup>56</sup> The time the crew had stayed in the vicinity of the Military Airport was determined on the basis of an analysis of CCTV outside the Military Airport.

<sup>57</sup> When briefing the aircraft commander on the weather, the met-on-duty (DML) informed him that according to the info from 03:00, the weather in the area of SMOLENSK aerodrome was the following: cloudless, visibility 4000 m in mist, SE wind, about 5 knots.

At 04:21, the crew was on board. Around 04:41, the first group of passengers came on board. At 04:46 the aircraft Commander came down and awaited more passengers at the passenger steps.

At 04:49, the Commander-in-Chief of the Polish Air Force arrived at the steps and the aircraft Commander reported. A moment later, Deputy Commander of the Regiment joined them. At 04:57, the Deputy said good-bye to the Air Force Commander and went to a place near BOZ where, together with a representative of KOSŚ, watched the aircraft, awaiting arrival of the Polish President.

At 05:07, the presidential car, carrying the President and the First Lady and assisting BOR security officers, pulled up. The Air Force Commander reported<sup>58</sup> to the President the aircraft crew's readiness for the flight and presented the Commander. The last boarding of passengers, door arming and steps driving away was at 05:08.

#### **1.17.2.4. Supervising crew preparation for the flight**

Preliminary briefing for a departure for SMOLENSK was individualised. According to the procedure applied in this military unit, once the Regiment's Commander accepted the Squadron Leader's proposed crew composition for the HEAD flight, at the end of the preliminary brief on 09.04.2010 at 13:00 hours, when summing up the day's assigned tasks, he confirmed the crew's and support services' readiness for the departure.

##### 36 Regiment

By order of the 36 Regiment, supervision of direct preparations for and execution of departures on 10.04.2010 r. was in the hands of Regiment's Deputy Commander. Still before his arrival at the Unit, he phoned the met-on-duty (DML) to learn the weather forecast for the planned flight. DML did not predict any threats though the weather changed from "cloudless, visibility 10 km" to "cloudless, visibility 4 km in mist". DML also reported on a Yak-40 departure for SMOLENSK.

On arriving at the Unit<sup>59</sup>, Deputy Regiment Commander went to the airport Met Office where he obtained recent info on predicted weather conditions for the time of Tu-154M landing in SMOLENSK: „in mist, in visibility 3-5 km, ceiling 200-300 m". Next, he made his way to the military airport (WPL) and reported to the Air Force Commander on crew preparations for the flight. In the talk, the Air Force Commander told the Regiment's Deputy of his wish to make a report to the President in the presence of the aircraft's Commander. After the talk, the Regiment's Deputy boarded the aircraft. In his meeting with the crew he

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<sup>58</sup> According to witnesses, the brief was standard and carried no extraordinary circumstances which might influence performance of the flight.

<sup>59</sup> At 06:02, according to the CCTV at the guardhouse.

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got confirmation of crew preparedness for the flight and, personally, he passed to the aircraft the Air Force Commander's wish of joint reporting the crew's and aircraft's readiness for the flight.

The Regiment's Deputy Commander disembarked and met the representative of KOSŚ, who reported problems with departure of a Yak-40 (due to a technical malfunctioning the aircraft was replaced by another Yak-40, tail no. 044, and the departure was delayed by 25 minutes). The KOSŚ engineer also informed that a procedure of preparing two Yak-40s, nos. 045 and 048 for a commissary inspection was begun as one of them would be made a replacement aircraft of Tu-154M (with Yak-40, no. 044, being originally a replacement aircraft<sup>60</sup> of the Tu-154M, no.101).

#### Air Forces Headquarters

Beside the supervision exercised by the Commander's Deputy of the Unit, additionally, from the Air Force Headquarters (DSP), following an order from the Air Force Chief and Air Force Deputy Chief of Training, the Chief of Air Transportation in DSP was assigned for the co-ordination of Tu-154 and Yak-40 WARSZAWA – SMOLENSK flights in the service of the Presidential Office on 10.04.2010. This supervision was confirmed in a letter approved by the Air Force Chief, faxed to the the Commander of 1<sup>st</sup> Aircraft Base, the Commander of the 36 Regiment, BOR and BOZ. From the letter it appeared that the Chief of Air Transportation in DSP was personally responsible for co-ordination of departures for SMOLENSK since 3:00 o'clock. Within his responsibilities, it was written: „co-ordination and supervision of air transport in the service of most important persons in the State (VIPs), in Air Force, in the Polish Military Contingent (PKW) and in other forces”. From what the Chief of Air Transportation in DSP said it appears that he arrived at the Military Airport (WPL) around 04:10 (with a 50-minute delay referred to the order from his superior). The Committee found that the Chief of Air Transportation in DSP was not acquainted with details of departures and did not know which aircraft was a standby aircraft<sup>61</sup> for that flight. Until the day of crash, the Chief of Air Transportation had not known that the 36 Regiment had trouble in obtaining data of SMOLENSK NORTH aerodrome, either. The Committee found that during the period of his supervision, the Chief of Air Transportation was on a supplementary leave (as per a DSP order of the week) and there was no order which would call him off from the leave.

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<sup>60</sup> Should the Tu-154M have a failure, there would be no replacement for this flight.

<sup>61</sup> From his utterance it seemed that it was a CASA C-295M in a cargo configuration. (The Commission has not found confirmation regarding this a/c in the order book for air carriage).

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## The Air Operation Center

Responsibilities<sup>62</sup> of the of Air Operation Center (COP) comprised, among other responsibilities, monitoring flights that were coded WAŻNY (Important), through gathering and analysing information on flights, monitoring takeoff and landing time of WAŻNY flights. According to the provisions of the instruction on arrangement of HEAD coded flights {„Instrukcji organizacji lotów statków powietrznych o statusie HEAD” § 4 ust. 1 the senior ops officer-on-duty (COP (SDO COP)) is responsible also for activities of subordinated manpower and equipment in the scope of safeguarding the flight of HEAD coded aircraft **in the Polish air space.**

According to the information obtained by the Committee, the controller at WPL Okęcie received, around 05:45, a phone call from one of Yak-40 crew member that weather conditions for landing in SMOLENSK NORTH are such: ceiling 60 m, visibility around 2 km. This information was passed at 06:32 to the weatherman-on-duty (DML) and to the senior ops officer (COP). At 06:22, information from the hydrometeorological centre CH SZ RP reached COP that weather at SMOLENSK NORTH worsened (on the basis of SYNOP from SMOLENSK SOUTH aerodrome). From the transcript of the talks of COP it appears that COP officers began actions aimed at notifying the crew<sup>63</sup> of Tu-154M, no. 101, about worsening of weather at SMOLENSK NORTH and establishing which landing possibilities were the closest. According to the transcript of voices in the cockpit of Tu-154M, no. 101, this information never reached them.

### **1.17.3 Documents related to arrangement of flights with HEAD status**

- 1) „Instrukcja organizacji lotów statków powietrznych o statusie HEAD”, Warszawa 2009, WLOP 408/2009 (Instruction on Arrangement of Flights with HEAD Status);
- 2) „Instrukcja organizacji lotów w lotnictwie sił zbrojnych Rzeczypospolitej Polskiej” (IOL-2008), WLOP 385/2007 (Instruction on Arrangement of Flights in Aviation of Polish Armed Forces);
- 3) „Regulamin lotów lotnictwa Sił Zbrojnych Rzeczypospolitej Polskiej” (RL-2006), Wydanie II – WLOP 370/20.(Rules of Flight Operations of Aviation of Polish Armed Forces);

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<sup>62</sup> To the Air Operation Centre Commander’s Order no.62 of 27.06.2008, on assignment of responsibilities to the posts in the Centre („Zakres obowiązków dla stanowisk służbowych (pracy) w Centrum Operacji Powietrznych”).

<sup>63</sup> The OKĘCIE airport’s controller was asked to pass this info to the crew.

- 4) *Porozumienie w sprawie wojskowego specjalnego transportu lotniczego*, Warszawa, 15.12.2004 r., (An agreement regarding special aerial transportation, made between Ministry of National Defence, Presidential Office, Sejm and Senate Secretariates, and PM's Office);
- 5) *Porozumienie między Ministerstwem Obrony Narodowej Rzeczypospolitej Polskiej a Ministerstwem Obrony Federacji Rosyjskiej w sprawie zasad wzajemnego ruchu lotniczego wojskowych statków powietrznych Rzeczypospolitej Polskiej i Federacji Rosyjskiej w przestrzeni powietrznej obu państw. Porozumienie zostało sporządzone w Moskwie w dniu 14.12.1993 r.* (An Agreement Between Minister of National Defence of Poland and Minister of Defence of Russian Federation on Mutual Military Air Traffic in Air Spaces of Both States).
- 6) *Porozumienie z dnia 18.03.2008 r. zawarte pomiędzy Biurem Ochrony Rządu a Siłami Powietrznymi* (The Agreement of 18.03.2008, between the Government Security Office of and zhe Air Force);
- 7) *Zarządzenie nr 2 Prezesa Rady Ministrów z dnia 20.01.1997 r. w sprawie specjalnego transportu lotniczego* (PM's Regulation no. 2, of 20.01.1997, on Special Aerial Transportation);
- 8) *Zbiór informacji lotniczych Federacji Rosyjskiej i the Commonwealth of Independent States (WNP) - 27.08.2009* (Aeronautical Information Publication of the Russian Federation and the Commonwealth of Independent States);
- 9) *„Instrukcja meteorologicznego zabezpieczenia lotów lotnictwa Sił Zbrojnych RP”*, WLOP 395/2008 (Instruction for Meteorological Suport of Flights of Aviation of Polish Armed Forces);

#### **1.17.4. Maintenance of the Tu-154M aircraft by the 36 Regiment**

The technical maintenance of Tu-154M aircraft in the 36 Regiment was performed by the aviation engineering service (SIL) of this unit, in the range of line maintenance and lowest level of periodical checks only. Higher level heavy checks, structural repairs of airframe and its equipment, engine overhauls and assessories as well as more serious failures were commissioned to Russian repair/overhaul facilities under supervision of OAO „Tupolev”.

The SIL service of the 36 Regiment was under command of the Chief of Aviation Technics subordinated to the Chief of the Regiment's Logistics.

The Aviation Technics unit was composed of, among others, engineers specialising in airframe and engines (PiS), avionics (O) and radio & electronics equipment (URE). Hands-on



jobs on the Tu-154M, no. 101 were done by SIL personnel, subordinated to the commander of the squad which had both Tu-154M aircraft as its inventory. The personnel of SIL also included P.E.'s and mechanics (petty officers) in PiS, O, and URE specialisations.

Servicing of the aircraft at transit airports was in the hands of technical flight personnel.

Technical maintenance of Tu-154M aircraft comprised:

1) „Ту-154М. Регламент технического обслуживания. Издание второе. Часть 1. Оперативные формы технического обслуживания. № 76-И/90603-Ф-001-0. Дополнительно на самолет № 837”

**ОПЕРАТИВНЫЕ ФОРМЫ:**

a) по осмотру и обслуживанию ( $A_1$ ,  $A_2$ , Б):

- Форма  $A_1$  (транзитная);

- Форма  $A_2$  (базовая);

- Форма Б;

b) по встрече (BC);

c) по обеспечению стоянки (OC);

d) по обеспечению вылета (OB);

2) „Ту-154М. Регламент технического обслуживания. Издание второе. Часть 2. Периодические формы технического обслуживания. № 76-И/90603-Ф-001-0. Действительно на самолет № 837”

**ПЕРИОДИЧЕСКИЕ ФОРМЫ:**

a) and after flying each:

- Форма 1 after each  $300 \pm 30$  FH;

- Форма 2 after each  $900 \pm 30$  FH;

- Форма 3 after each  $1800 \pm 30$  FH;

b) in terms of time:

- Форма 1К after each 4 months  $\pm 15$  days;

- Форма 2К after each 12 months  $\pm 1$  month;

- Форма 3К after each 24 months  $\pm 1$  month;

- Preventive maintenance (within a period of long parking );

- Seasonal maintenance.

Additionally, tasks were done (on landing gear, slats, flaps, interceptors and elevators) which were related to the number of landings during training flights:

- after each  $50 \pm 5$  landings within the scope of *Формы Б*;

- after each  $300 \pm 30$  landings within the scope of *Формы 1*;

- after each 900 ±30 landings within the scope of *Формы 2*;
- after each 1800 ±30 landings within the scope of *Формы 3*.

Detailed scope and intervals between required jobs are specified in the above-mentioned two documents, henceforth called RO-86.

Whereas, page 1 of the Maintenance Log Book of aircraft no. 101 90A837 („*Książka obsługi statku powietrznego* Nr 101 90A837”), registered under no.343/14 in RWYD at no.343/14 lists out such line maintenance tasks:

A1 –1<sup>st</sup> level;

A2 –2<sup>nd</sup> level;

B – hangar maintenance, every 15 days or 100 hours of operation, or after 100 landings;

P<sub>s</sub> – pre-departure check, which corresponds to line maintenance checks, as follows:

- по обеспечению стоянки (OC);

- по обеспечению вылета (OB)”;

P<sub>p</sub> – parking, checks corresponds to line maintenance checks, as follows:

- по встрече (BC);

- по обеспечению стоянки (OC);

- по обеспечению вылета (OB).

Line checks (P<sub>s</sub> i P<sub>p</sub>) followed the system designed by LOT Polish Airlines for their Tu-154M aircraft.

As well, tasks recommended and/or required by Service Bulletin were done on the no. 101 Tu-154M aircraft’s installations, accessories and engines. Updating of the maintenance and operation documentation was also carried out on the basis of Service Bulletins. Besides, at the 36 Regiment, such tasks were fulfilled as ordered in cable messages from the Chief of Aircraft Technologies (formerly, to the end of 2009, also ordered by Chief Engineer of Air Force) and from 2010, by the Chief Engineer of Air Force and Chief of Aircraft Technologies), also, by the Heads of: Defence Ministry Inspectorate for Flight Safety, the Flight Safety Section in the Air Forces Headquarters and, also, in urgent situations, received in cable messages and letters from the Chief Designer of „OAO Tupolev” General Partnership.

## **1.18. Complementary information**

### **1.18.1. Flights organiser**

The 36 Regiment, as part of Air Transport Force, is responsible for:

- realization of flights for the transportation of: the President of the Republic of Poland, the Prime Minister, the Speakers of Sejm (Lower Chamber of Parliament) and Senate, the Deputy Prime Minister, the Ministers of National Defence, Foreign Affairs, Interior and Administration, the Chief Secretary in the Presidential Office and PM's Office);
- performing aerial services to: National Defence Ministry, Border Guard, Air Forces Headquarters, Navy HQ, Polish Force Operations HQ, Inspectorate for Armed Forces Support, Military Police HQ;
- fulfillment of tasks within humanitarian aid arranged by the Republic of Poland and other social organisations, in keeping with directives of the Commander-in-Chief of the Polish Air Force;
- fulfillment of tasks in the scope of transportation and evacuation of Polish citizens from foreign territories in cases of endangerment, in keeping with decisions of highest authorities of the Republic of Poland;
- fulfillment of transportation tasks within the scope of SERCE (cardiac) action.

The 36 Regiment is directly subjected to the Commander-in-Chief of the Polish Air Force. Straight away, specialized supervision over the Regiment acts the Air Force Training Chief Deputy – Chief of Air Forces.

### **1.18.2. Status of the aircraft**

The Tu-154M, tail no. 101, had its name put down in the Ministry of National Defence<sup>64</sup> military aircraft register at entry no. Sz-428 dated 24.01.2005, and was operated by the 36 Regiment.

The aircraft was on an official mission and carrying the President of the Republic of Poland with a delegation. Under international rules of aviation it can not be clearly determined what status the aircraft had (due to not uniform practice in this respect). From the provisions of the parliamentary act (*Aviation Law*) of 03.07.2002 it appears that a Polish aircraft, operated by the Polish Armed Force, is considered a military aircraft. According to provisions of the Polish aviation law and the Instruction on arrangement of flights with the HEAD status, the Tu-154M was a state-owned (military) aircraft with the HEAD status.

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<sup>64</sup> According to „Prawo lotnicze” (parliamentary act) no.43 enacted on 3 July 2002.

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### 1.18.3. Status of SMOLENSK NORTH aerodrome

SMOLENSK NORTH aerodrome used to be a military base of aircraft, not complying with international standards<sup>65</sup>, recommendations and procedures of conduct.

Preparation of the aerodrome was made, based on:

- Federal aviation rules for state-owned aircraft: „Federalne przepisy lotnicze wykonywania lotów lotnictwa państwowego” (FAP PP GosA) and on the Order by the Air Force Commander-in-Chief of the Russian Federation, 1992, no.143;
- Standards of release to service of airports for state-owned aviation{–Normy dopuszczenia do eksploatacji lotnisk lotnictwa państwowego” (FAP NGEA GosA 2006)};
- Requirements of the Commander-in-Chief of Air Force of the Russian Federation, 1992, no.144 concerning inspection flights of communication facilities and means of radiotechnical support of flights.

Within their area of responsibility, the personnel of Military Air Traffic Control Unit used procedures applicable to military airport areas, which stemmed from federal aviation rules of Russian Federation „Federalne przepisy lotnicze wykonywania lotów lotnictwa państwowego Federacji Rosyjskiej (FAP PP GosA)” and the requirements of item c, section AD, part III, vol. II of the Aeronautical Information Publication contained in „Zbiór informacji lotniczej AIP FR I WNP” {Russian Federation and the Commonwealth of Independent States (WNP)}.

### 1.18.4. Activation of mobile phones aboard the aircraft

The instruction „Instrukcja postępowania personelu pokładowego w samolotach i śmigłowcach 36 specjalnego pułku lotnictwa transportowego”, 2<sup>nd</sup> edition II, Warszawa 2007,(The Instruction for Cabin Personnel Conduct in the 36 Regiment’s Aircraft and Helicopters) prohibits the use of mobile phones aboard aircraft.

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<sup>65</sup> The ground personnel and facilities at XUBS aerodrome did not comply to ICAO requirements and standards applicable to international air navigation, set forth in annexes to the Convention on International Civil Aviation, also known as the Chicago Convention, signed on 7 December 1944, like:

- Annex 1 Personnel Licencing;
- Annex 2 Rules of the Air;
- Annex 3 Meteorological Service for International Air Navigation;
- Annex 10 Aeronautical Telecommunications;
- Annex 11 Air Traffic Services;
- Annex 14 Aerodromes, Vol. I – Aerodrome Design and Operations;
- Annex 15 Aeronautical Information Services;

and Doc 4444 Air Traffic Management. XUBS aerodrome not on the lists of Aeronautical Information Publication of Russian Federation and Commonwealth of Independent Nations).

Among the mobiles found on the crash site, at least 18 were active (logged in). One belonged to a member of cabin crew, two - to workers of the Presidential Office, three to generals including Commander-in-Chief of the Polish Air Force, and one to the First Lady.

#### **1.18.5. Additional information related to the Tu-154M maintenance servicing**

As the 36 Regiment was not in possession of the document (which had to confirm some special structure inspections to be accomplished), entitled *„Заключение о возможности и условиях дальнейшей эксплуатации самолета Ту-154М борт. № 101 (зав. № 90А837)”,* of 14.11.2006, and the Committee did not obtain it from any other source, it is not possible to establish clearly what document-required tasks were not done on the Tu-154M, no. 101. This document is important in that it had to do with a towing incident at WARSZAWA-OKĘCIE airport on 09.08.2006 when the Tu-154M, no.101 suffered some damage to nose landing gear and fuselage. After inspections by representatives of *ВАПЗ-400* and personnel of the 36 Regiment, on the basis of consent given in a letter no. 387/STL of 22.09.2006, the aircraft was ferried to repair facility *ВАПЗ-400* in Moscow. On 16.10.2006, in the repair facility *ВАПЗ-400* in Moscow, inspection tasks were accomplished according to „Program ОАО Tupolew” (*„Программа работ по расчетному анализу и исследования технического состояния самолета Ту-154М зав. № 90А837 с целью определения возможности и условий его дальнейшей эксплуатации”* dated 29.09.2006 *„Программа...”* which included issuance of the above mentioned document *”Заключение...”*.

After the last overhaul, the *„Заключение...”* was specified in the decision of Chief Designer at Tupolev General Partnership repair facility, dated 10.12.2009, reading: *„extension of service life is granted on condition of (...) carrying out a periodical inspection of airframe structure, aircraft systems and accessories according to standing documentation and attachment 3 to bulletin nr 154-998БЭ-АБ and an additional inspection of fuselage structure (frames nos.5-6, and longeron nos. 34-36-34), as presented in conclusions as to further operating of the aircraft „Заключение о возможности и условиях дальнейшей эксплуатации самолета Ту-154М борт. № 101 (зав. № 90А837),dated 14.11.2006;(...)”.* There exists well-justified doubt that without accomplishment of the tasks described in the document *„Заключение...”* the aircraft should not be awarded Certificate of Release to Service (CRS).

## 2. ANALYSIS

### 2.1. An analysis of the Republic of Poland Air Force's flight rules

#### 2.1.1. Flight regulations 2006

The very basic document which regulated operations of air units of The Polish Armed Forces at the time of crash of the Tu-154M aircraft on 10.04.2010 in SMOLEŃSK is called „*Regulamin lotów lotnictwa Sił Zbrojnych RP*” (RL-2006), (Air Units of Polish Armed Forces' Rules of Flight Operations) 2<sup>nd</sup> edition (with amendments of 11.12.2008).

The document was put in force by the decision of the Minister of National Defence, taken on the basis of § 2, item 14 of Council of Ministers' ordinance<sup>66</sup> of 9th July 1996, aimed at harmonization of air units of Polish Armed Forces' rules with civil aviation rules..

Para 1 „*Zakres obowiązywania*” (extent of powers) comprises such provisions:

Item 1: Air Units of Polish Armed Forces' Rules of Flight Operations {„*Regulamin lotów lotnictwa Sił Zbrojnych Rzeczypospolitej Polskiej* (RL-2006)}, henceforth RL-2006, is the fundamental legal instrument containing air rules for military personnel of Aviation of the Polish Armed Forces,

Item 4: „Personnel Polish Armed Forces is bound to apply air traffic rules, as specified in documents prepared by civilian aviation authority, implemented for use in military aviation in the scope not covered by the RL-2006 set of rules. Obtaining and distributing respective documents is the responsibility of commanders of each kind of Armed Forces. Respective documents must be available also at organs of air information at each military aerodrome.”

In § 4 „*Dokumentacja lotnicza*” (Air Documentation), item 10 reads: „All detailed documents that lay down rules for air operations of aviation of Polish Armed Force(rules, instructions, training programs, orders, ordinance, advisories, etc.) must harmonize with the provisions of flight rules RL-2006”.

From the cited items it appears that the RL-2006 should harmonize with civilian regulations in the scope of mutual use of air space and make grounds for preparation of accompanying documents.

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<sup>66</sup> In the matter of detailed responsibilities of The Minister of National Defence , published in *Dziennik Ustaw*, no.94, item 426.

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An analysis of RL-2006 showed that the document refers solely to rules of air traffic, to writing procedures and realizing communication (Doc 8168, Doc 4444, annexes 2, 10 and 11, to „The Convention on International Civil Aviation”, to Aeronautical Information Publication (AIP) – indicated in many places as sources of rules), but absolutely disregards the structure of entities which deal in air transportation, especially when it comes to multi crews (EU-OPS1 and JAR-FCL-1 licensing rules). Analyzing the Flight Rules set (RL-2006) in a practical aspect of its use in the 36 Regiment, it should be stated that it misses regulations on safe and well organized air transportation.

Below are provisions whose content raises doubts as to feasibility of their application in the 36 Regiment which performs flights with multiple/augmented crews in transport aircraft.

§ 1 ust. 1 Air Units of Polish Armed Forces‘ Rules of Flight Operations (RL-2006) (...) is a fundamental statutory normative document comprising air rules which bind military aviation of Polish Armed Forces.

Further down, the RL-2006 is short of provisions for military flight personnel.

§ 8 item 5a „Crews of military aircraft are bound to use communications procedures of annex 10 to „The Convention on International Civil Aviation”) Doc 4444 – Air Traffic Control, Manual of radio-telephony phraseology in aviation (Doc 9432). Communications procedures for tactical and combat sorties are laid down in the instruction »*Zasady prowadzenia korespondencji radiowej w lotach taktycznych oraz bojowych*«” (rules of RTF in Tactical and Combat Flights).

The document, left unmentioned, »*Zasady prowadzenia łączności radiowej w sieciach powietrznych lotnictwa Sił Zbrojnych*” (Rules of RTF in Aviation of Armed Forces‘ Networks), temporary edition - Poznań 1999, is still a standing document in the Air Force.

§ 14 item 4 „Pilots, who fly several types of aircraft as their Commanders must, in order to sustain their endorsements for each type, observe intervals in flying each type, stipulated in Table 2”.

Concerning multi-pilot crews of transport aircraft (two pilots), this item carries no stipulation that pilots who are not commanders need to sustain endorsements. The items which relate to flights on many types of aircraft are short of limits on the number of aircraft types and rules how pilots should be appointed for such flights. The items also miss determining seating arrangement of pilots (Pilot Flying, Pilot Not Flying) in a multi crew. The rules allow flying many types of aircraft (without reservation), on various positions in the

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crew, which may lead to a situation that during the same day a pilot may fly several types of aircraft, occupying different positions in the flight crew. In the context of specific training and standards of duties in multi crew, what is missing is lack of precise regulations, affecting seriously flight safety.

Solutions are in the following items of RL-2006:

§ 14 item 16 „A flight, which a pilot executes as an aircraft commander, extends his recency for flying as a co-pilot.”

§ 15 item 3 „An aircraft commander of a multi crew plane, who is not an instructor-pilot, must do one of the rides, stipulated in Table 3, in the co-pilot’s seat.”

§ 23 item. 16 „In a multi crew, atmospheric conditions that are taken as minima for the crew, are those of aircraft commander’s.”

The provision in this item indicates that the role of a co-pilot in a multi crew of transport aircraft is marginalized (contrary to Cockpit Resource Management rules), without understanding the fact that the crew is as competent as their weakest link. Still, the regulation, published in RL-2010, does not refer to minima for the multi crew in sorties.

§ 14 item 5 „Recency of qualifications to perform instruction flights is sustained when the interval in instructor flying is not longer than 12 months. In the case of longer intervals, it is permitted to perform instruction flights after a check ~~ride~~” in the instructor’s seat in a side-by-side arrangement cockpit”.

The notion of „instructor’s seat” lacks precision. In the case of training a multi crew commander in a transport aircraft, the instructor takes the co-pilot’s seat, and, in the case of training a co-pilot – the commander’s seat.

§ 15 item 1 in Table 3, in the line referring to Class M and Class 1 pilots, is a stipulation requiring that they undergo a check ride once in 24 months.

Analyzing the pilot training documentation of the 26. Regiment, the Committee found that this provision allowed for performing flights from the end of training and obtaining pilot privileges through 24 months without any flight tests and training flights. This provision seems too liberal, does not contribute to strengthening and verifying pilots’ flying habits and checking the standard of pilots’ regular duties in multi crew transport aircraft. Such a method of ~~honouring~~” doyen pilots could be justified in the case of aircraft of a simple design, however, it is an anachronism in the case of transport aircraft. In civil air transportation such



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checks are carried out twice a year regardless of a pilot's ratings and competences. In general aviation, such checks are carried out once a year.

Additionally, the contents of the table, depicting checks carried out under Instrument Flight Rules, point out to lack of understanding of those rules, as the checks require only an IFR landing approach, whereas they leave cruising and zone flights to discretion. Pilot's competencies in cruising, his skills in elements of standard outbound and inbound flights, as well as executing holding procedures are very important and should also be checked during an IFR flight.

§ 27 item 6: „A flight in conditions which simulate poor visibility is a flight performed under Instrument Flight Rules (IFR)”.

IFR flights are associated with flight without visibility. A flight in simulated conditions of poor visibility may be performed with a safety pilot or an instructor pilot under VFR. A flight under IFR may be performed in Visual Atmospheric al Conditions (VMC) and it does not diminish effectiveness of training in such conditions.

§ 24 „Altimeter setting procedures”.

Procedures for altimeter setting absolutely disregard radio altimeter setting and say nothing of their use.

§ 36 item 5 „On board Polish military aircraft destined to carry passengers or cargo, deadheads may also be present, though unspecified in a given task:

- a) in training flights:
  - soldiers – by consent from flight organizer;
  - military employees flying on business – by consent from flight organizer;
  - military employees on trips other than business trips;
  - civilians - by consent from flight organizer;
  - cargo - by consent from flight organizer.

The Committee is of the opinion that during training flights no persons other than the training crew should be on board. The above given list of persons is too capacious and the character of flight (training) gives no substantiation.

§ 23 item 16 „During approach to landing the pilot is limited by any weather minimum whichever comes first.”

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§ 23 item 17 „The final decision whether to land must be taken by the pilot at a height determined in item 16, after approach, irrespective of earlier obtained atmospheric conditions for landing”.

§ 19 item 24 pts 4 & 5 tell when aircraft Commander is bound to abort approach on the last leg.

§ 48 „Flights in zones of dangerous weather phenomena.

1. Dangerous weather phenomena are such severe weather phenomena which hamper or make it impossible for an aircraft to take off, fly, or land irrespective of pilot’s competencies and kind of aircraft, or such which may destruct or damage an aircraft and/or equipment at the airport.
2. Dangerous weather phenomena include, among others:
  - 1) storm (including dust or sand storms);
  - 2) fog;
  - 3) intensive icing;
  - 4) strong turbulence;
  - 5) gust;
  - 6) windshear;
  - 7) tornado;
  - 8) hail;
  - 9) precipitation which reduces visibility to below minima;
  - 10) adrift dust or sand as well as dust storm or sand storm which reduce visibility to below minima;
  - 11) hilltop cloud coverage (in VFR flights).
3. It is banned to fly into dangerous weather phenomena. When an aircraft finds itself in a dangerous weather phenomena area where due to it any continuation of the flight would be hazardous, the mission should be given up and, contingent upon the situation, should fly out of such area and land at one’s own base or on an alternate aerodrome (in terrain in the case of helicopters). Aircraft Commander must report each such decision to the organ the aircraft is currently in radio contact”.

The provisions of § 23, § 19 and § 48 may raise doubts as to their interpretation. A flight in fog, mentioned in § 48 item 3, imposes interrupting any task in a situation when

continuation of the flight is impossible for safety. Paragraph 23 item 16 allows for a landing approach regardless of obtaining any earlier weather for landing. In turn, the provisions of § 19 impose interruption of descent at reaching weather minima or when the weather does not provide for a safe landing.

A flight under IFR may progress at heights up to a height determined as the decision altitude (DA), decision height (DH), or Minimum DA, Minimum DH, solely with the use of instruments' indications, and, no existence of fog can lower the safety of approach in any way. These points should be formulated in a way ensuring one meaning only.

The above used examples of provisions in RL-2006 raise in the Committee doubts of interpretation. Though, they do not stand for a complete analysis of said document. Referring to the specificity of tasks which the 36 Regiment realizes, the Committee states that RL-2006 misses provisions relating to:

- 1) the rules crew resource management (CRM) and co-operation in multi-crew aircraft that bring about shortages in training programmes in this aspect and in operations documents. Describing job tasks of all flight personnel (pilots, navigator, flight engineer) is a necessity, otherwise the crew, while seeking own solutions become vulnerable to committing errors. Non-existence of a standard does not allow to implement proper solutions in methodology of teaching, flying and in the programme of objective assessments of flying as well;
- 2) restricted access to the cockpit ("sterile cockpit"). Putting aside the aspect of anti-terrorist protection, the point is in ensuring quiet working conditions in the cockpit. The only document which regulates this issue was „Instrukcja operacji lotniczych statków powietrznych o statusie HEAD” (Instruction on HEAD Flight Operations);
- 3) categorization of airports, affecting preparation for a flight while considering the category (difficulty) of destination airport;
- 4) detailed regulations on carrying out flights on many types of aircraft. In civil air transport the possibility of flying two aircraft types has been precisely regulated, viz. alternate flying on many aircraft types and crew positions is out of the question;
- 5) qualifications to use air-ground procedural communication in Polish and English;
- 6) leaving on the ground (before departure) copies of documents attesting to maintenance checks and aircraft balancing.

The list of issues necessary to insert into RL, in the chapter on air transport has not been exhausted. Respective issues have been comprehensively described in the regulations published by: EASA: EU-OPS 1 and JAA JAR FCL 1. The simplest way for the aviation of Polish Armed Force to accomplish flight standards in the common air space is through accepting these provisions in full, and not applying the regulations selectively. From the point of safe air operations of all aircraft (not only military aircraft), it is necessary for organs of the State to impose the standard of civil aviation.

Additionally, a system of effective supervision of abiding compiled regulations should be ensured. Inspection flights (carried out since 2009 on the basis of directives of Commander-in-Chief of the Polish Air Force) might be one of the tools serving this purpose. In the new flight rules RL-2010, in § 40 it has been written:

§ 40 „Inspection flights

1. Inspection flights can be carried out by flight personnel holding a pilot 1st Class licence or Master Class licence and occupying a position named „instructor-pilot” in units of Polish Armed Force.
2. In the case of other flight personnel who do not fulfill the terms stipulated under item 1, then, on a written motion of the person interested in carrying out inspection flights, consent to carrying out inspection flights (limited by date) can be given to, respectively:
  - 1) Chief of Training, Air Force – for flight personnel of the Air Force and the Special Force;
  - 2) Chief of Airborne Units - for flight personnel of the Land Force;
  - 3) Chief of Navy Air Force – for flight personnel of the Navy.
3. Detailed rules of carrying out inspector-pilot flights are laid down by Air Force Commander.”

Inspector-pilot flights were intended as a tool for checking execution of standing regulations and rules of the Aviation of the Polish Armed Forces. In order that such a procedure might work the inspector-pilots must be prepared. However, the content of § 40 does not make any reference to any co-ordination of an inspection plan. Hence, the range and conduct of the flight depend solely on the instructor-pilot’s invention and knowledge. The Committee has not encountered any examples of motions made after any such inspection flight. This may suggest that in many cases the tasks of inspection flights were accomplished.

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Carrying out inspection flights by unprepared inspector-pilots who do not know specificity of multi crew is useless.

### **2.1.2. Instructions and rules of job tasks in a multi crew**

Military documentation lacks a formal requirement that a document be compiled and used in respect of setting a standard for job tasks for the crew. In civilian documents, specified in RL-2006, only Doc 8168 part I, item 1.1 refers to the necessity that the operator should prepare a Standard Operation Procedure (SOP).

Due to non-existence of a source document of rules for crew co-operation in Tu-154M aircraft, it was necessary to assess which documents, existing in the 36 Regiment and binding its flight personnel, may be taken as a basis of an analysis of the standard of work of flight crews.

In keeping with the information from the Minister of National Defence, given in a letter of 29.06.2010, and relating to actions recommended by the Interstate Aviation Committee, one can read that what concerns Recommendation no.2 on preparation and implementation of SOP type documents, it should be stated that, under standing regulations, documents of this type are not used in Polish Air Force, while procedures that regulate organization of tasks and their conduct are contained in the following documents of pilot training<sup>67</sup>:

- Piloting Techniques Manual;
- Flight Ordinance;
- Arrangement of Flights Instruction”.

In a letter of 04.10.2010, the 36 Regiment Cdr. gave an answer to the question from the Committee concerning the choice of documents which describe the manner of job tasks doing by the crews of Tu-154M. Documents named:

- „Regulamin lotów lotnictwa Sił Zbrojnych RP (RL-2006)” Air Units of Polish Armed Forces’ Rules of Flight Operations);
- „Instrukcja organizacji lotów w lotnictwie Sił Zbrojnych RP (IOL-2008)” Instruction on Flights Arrangement in Aviation of the Polish Armed Forces);

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<sup>67</sup> In the Commission’s opinion, SOP is a strictly operational procedure. The only documents of the list presented above, which can contain SOP contents, or its entirety, are: „Instrukcja Użytkowania w Locie” (Aircraft Ops Manual), „Instrukcja techniki pilotowania” (Piloting Techniques Manual) for a given a/c type. „Regulamin lotów...”( Flights Ordinance) is a leading document and a general one, unrelated to individual types of aircraft. „Instrukcja organizacji lotów...”(Arrangement of Flights Instruction) is a document describing the process of training and not training on any specific type. Such is the role of programmes of training.

- „*Stale procedury operacyjne 36 spl*” (Standing Operation Procedures of the 36 Regiment);
- „*Instrukcja użytkowania w locie samolotu Tu-154*” (The Operations Manual of Tu-154);
- „*Karty kontrolne czynności załogi Tu-154*” Tu-154 M Flight Personnel’s Job Task Cards);
- „*Instrukcja organizacji lotów statków powietrznych o statusie HEAD*” (Instruction on HEAD Flight Operations);
- An Order for a Flight;
- „*Program szkolenia przejściowego personelu pokładowego 36 spl dotyczący wykonywania czynności w samolocie Tu-154M*” (Flight Crew Transition Training Programme to Tu-154M);
- „*Instrukcja postępowania personelu pokładowego na samolotach i śmigłowcach 36 spl*” (Procedures of Conduct for Flight Personnel of Fixed-wing and Copter Craft in the 36 Regiment).

More information is in RL-2006, edition II, with amendments of 28.12.2008. The document, beside its own regulations, implements for the Polish military aviation crews the imperative to know and use the following civilian documents (chapter 2, p.2-08, items 5, 5a, 9):

- Annexes 2, 10, 11 to the Chicago Convention);
- Doc 8168 – aircraft operations;
- Doc 4444 – air traffic control;
- AIP Polska – AIP Poland;
- Doc 9432 - Manual of the standard ICAO radiotelephony phraseology in aviation.

The Committee has found that, beside the above named docs, the 36 Regiment also used:

- 1) „*Technologia współpracy załogi samolotu Tu-154M*” (Technology of co-operation with crews of T-154M), edited by Stanisław Heliński, Warszawa 1989 r., PLL LOT.
- 2) „*Instrukcja użytkowania w locie samolotu Tu-154M*” (Operations Manual for 154M aircraft), 1994, PLL LOT. The document bears the seal of the Military, assigning it to packet no. 2669 I. Last update - 7.02.1994.

The documents were acquired when LOT Polish Airlines handed over Tu-154M to the 36 Regiment in 1994 and were used in pilot training. The documents have not been updated since 1994 and are short of descriptions of appliances mounted on the aircraft afterwards.

The document which depicts job tasks of flight personnel of the 36 Regiment is „*Instrukcja postępowania personelu pokładowego w samolotach i śmigłowcach 36 splt*” (Procedures for Flight Personnel of Fixed-Wing and Copter Craft in the 36 Regiment), edition II, Warszawa 2007.

For assessment of standards of job tasks performed by crews the Committee used the following documentation:

- „*Regulamin lotów lotnictwa Sił Zbrojnych RP*” (RL-2006) (Air Units of Polish Armed Forces‘ Rules of Flight Operations);
- „*Instrukcja organizacji lotów w lotnictwie Sił Zbrojnych RP*” (IOL-2008) (Instruction on flights arrangement in the Polish Air Force);
- „*Instrukcję użytkowania w locie samolotu Tu-154*” (The Operations Manual of Tu-154);
- „*Instrukcję postępowania personelu pokładowego w samolotach i śmigłowcach 36 splt*” (Procedures for Flight Personnel of Fixed-wing and Copter Craft in the 36 Regiment);
- „*Karty kontrolne czynności załogi Tu-154*” (Tu-154 M Flight Personnel’s Tasks Cards);
- „*Instrukcję organizacji lotów statków powietrznych o statusie HEAD*” (Instruction on HEAD Flight Operations);
- An Order of Flight;
- „*Program szkolenia przejściowego personelu pokładowego 36 splt dotyczącego wykonywania czynności w samolocie Tu-154M*” (Flight Crew Transition Training Programme to Tu-154M).

„*Stale procedury operacyjne 36 splt*” (Standing Operation Procedures of the 36 Regiment) were published in August 2010 and have not been taken into account further in the analysis.

### **2.1.3. Tu-154 M flight personnel’s job task cards**

„*Instrukcja użytkowania w locie samolotu Tu-154M*” (The Operations Manual of Tu-154), in chapter 4.8 contains such check cards for a crew of 3 (two pilots and a flight engineer):

- 1) before pushback (4.8.2.0);
- 2) before engine start-up (4.8.2.1);
- 3) before taxiing (4.8.2.2);
- 4) during taxiing (4.8.2.3);
- 5) before ~~Hold~~ short of runway” (4.8.2.4);
- 6) after ~~Line up and wait~~” (4.8.2.5);
- 7) before commencing descent (4.8.2.6);
- 8) after pressure setting (4.8.2.7);
- 9) before 3<sup>rd</sup> turn or at 25-20 km (4.8.2.8);
- 10) for passing over Outer NDB (4.8.2.9).

In chapter 4.8.3 is a precise description of how to make check cards and two are named, however, without specimens:

- 1) At 15 miles from runway (named in chapter 4.8.3.8 – no specimen of the card);
- 2) After landing (named in chapter 4.8.3.8 – no specimen of the card).

At the 36 Regiment, two cards (specified below) have been prepared; making changes in their configuration in relation to the aircraft ops manual:

- 1) before pushback and engine start-up;
- 2) before beginning g taxiing;
- 3) after beginning taxiing;
- 4) short of runway;
- 5) on runway;
- 6) before commencing descent;
- 7) after reaching transition altitude;
- 8) after extending undercarriage and wing flaps.

They were adapted to crew augmented by a navigator.

The cards were prepared by the 36 Regiment and, although different in form, comprised all elements necessary (recalled in Ops Manual) to check at particular stages of a flight.

## **2.2 Airmanship of Tu-154M crews**

Training in Yak-40 and Tu-154M aircraft in the 36 Regiment was carried out on the basis of the programme „*Program szkolenia lotnictwa transportowego*” (PSzLT-73) (Training in Transport Aviation), and training in leadership was carried out according to the plan „*Planu przyśpieszonego szkolenia grupy pilotów /dowódców załóg/ lotnictwa*



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*transportowego na samolotach pasażerskich*” (A Plan of Accelerated Training of Groups of Pilots and Commanders on Passenger Liners, as part of the training plan PSzLT-73.

### **2.2.1. The aircraft commander**

In 1997, immediately after graduation from WSOSP in Dęblin, this pilot began service in the 36 Regiment. He was trained for the position of a co-pilot in Yak-40 and was rated on 8.03.1999.

In 2001, he began navigational training for Tu-154M and obtained the Navigator's Licence on 25.01.2002.

On 2001, he also began transition training for a co-pilot of Tu-154M, crowned with a Night Instrumental Atmospheric al Conditions (NIMC) rating on 19.08.2002. Since then the pilot did most flights in a Tu-154M as a navigator or a co-pilot. After finishing the Tu-154M transition course, he flew Yak-40 planes very rarely<sup>68</sup> which ended in temporary loss of ratings and a necessity to revalidate them.

#### **2.2.1.1. Training for a Yak-40 aircraft commander rating**

On 4.08.2005, the pilot began training to become a commander of Yak-40 and crowned it with ”check rides”:

- a) Day Instrumental Atmospheric al Conditions (DIMC) (exercise 114 and 100 according to PSzLT-73) – 14.11.2006, with endorsements enabling flights under various landing systems at such minima: lighting – 300 m/3 km, in radio location landing system – 300 m/3 km and ILS – 300 m/3 km;
- b) NIMC (exercise 203 and 217 according to PSzLT-73) – 9.05.2007, with endorsements enabling flights under various landing systems at such minima: lighting – 200 m/2 km, in a radio location system – 80 m/1 km and ILS – 60 m/0.8 km.

An analysis of training documentation and the pilot’s personal log indicates that his commander rating training in Yak-40 was not steady and the process was not supervised:

- 1) breaks in the training process:
  - a) from 25.08. to 6.12.2005 (3 months and 10 days);
  - b) from 8.12.2005 to 3.07.2006 (6 months and 24 days) – during this period, the pilot did flights in Yak-40 as a co-pilot.

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<sup>68</sup> The pilot did not perform daylight flights during 10 months and 8 days from 30.04.2003 to 8.03.2004 nor night flights during 13 months and 7 days.

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The continuation of the training process after the breaks was not complying „*Metodyką wznawiania nawyków z pilotami wykonującymi loty na samolotach transportowych*”<sup>69</sup> (Methodology of Recurrent Pilot Training on Transport Aircraft) as revalidating rides were not carried out;

- 2) the pilot obtained ratings higher than motioned by the examiner, awarded in an Order of the Day of the 36 Regiment Cdr., of 11.05.2006, quote: On finishing his training and passing, on 14.11.2006, the check ride in a YAK-40 aircraft according to exercise 114 PSzLT-73 for a „very good” mark, I give my consent his [rank and name] day-to-day day flying under IFR as Commander in such atmospheric conditions:

- with lighting secured: cloud cover 8/8, base 100, visibility 1;
- with a radio location system: cloud cover 8/8, base 80, visibility 1;
- under ILS system: cloud cover 8/8, base 60, visibility 0.8.

The squadron leader (examiner) motioned that the pilot receive endorsement of weather minima for landing with the use of the various landing aid systems: **lighting secured 8/300 m/3 km, radio location landing 8/300m/3 km and ILS 8/300 m/3 km** (according to his motion in chapter 6 of „*Osobisty dziennik lotów*” (Pilot’s Logbook) which was the basis for his certification)<sup>70</sup>;

- 3) the files of the squadron and the pilot’s records therein are short of entries of his taking check rides under Day Visual Atmospheric Conditions DVMC (exercise 60/40) and under night NVMC (exercise 170/155), that may suggest that **such exercises were not done** (for comparison, in commander entrants training for Tu-154M all check rides were acknowledged after each of the stages: DVMC, DIMC, NVMC and NIMC)<sup>71</sup>;
- 4) the pilot was rated to perform flights in conditions below the night minima without earning day minima, which conduct does not comply with § 23 RL-2006 „*Warunki minimalne statku powietrznego, lotniska i pilota*” (Aircraft, Airfield, and Pilot Minima) where in item 13 it is said that obtaining night rating by a pilot or Commander must be preceded by a day rating, quote: „*Nabycie dopuszczeń do określonych wartości WM pilota (dowódcy statku powietrznego) w nocy musi być poprzedzone ich nabyciem w dzień*” ;

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<sup>69</sup> Enclosure to the Air Force Cdr’s Ordinance no. pf 55 of 16.04.1977 – an integral part of PSzLT-73.

<sup>70</sup> According to the rules (RL-2006 § 14 item 5) a pilot cannot be awarded a higher rating (to lower weather minima) than the minima at which he performed a flight test.

<sup>71</sup> The above names are equivalent of DZWA-DVMC, DTWA-DIMC, NZWA-NVMC, NTWA-NIMC, respectively. Henceforth, names used presently will be applied down the document.

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- 5) The Committee found non-compliance of the atmospheric conditions that were entered into chapters 5 and 6 in the Pilot's Logbook with the real atmospheric conditions prevailing at those airports during takeoff and landing operations. It also refers to **check rides according to exercises 114 and 100** performed on 14.11.2006 at atmospheric conditions 6/300 m/3 km (according to entries in the Pilot's Logbook. In reality, the atmospheric conditions on that day, both in KRAKÓW and in WARSZAWA (the airports named in the Pilot's Logbook, part 6, at take-off at 15:00 local time and at landing at 15:45 local time were such: visibility above 10 km in insignificant cloud cover. Although the flights were performed in very good atmospheric conditions, in part 5 of the Pilot's Logbook or in the Squadron's register of flights, there is no mention of **view limiting devices or cockpit blinding**. The like irregularities were found in the check rides (according to exercises 217 and 203) performed on 9.05.2007. In the Pilot's Logbook, in parts 5 and 6, we find: atmospheric conditions **8/60 m/0.8 km** (overcast, cloud base 60 m, visibility 800 m). In fact, the atmospheric conditions at the airport at the time of take-off at 21:06 local time and at landing at 22:01 local time were very good (CAVOK). Here, too, although the flights were performed in very good atmospheric conditions, part 5 of the Pilot's Logbook and the Squadron's register carry no entry of **how long the cockpit was blinded;**
- 6) on 12.10.2006, according to the Pilot's Logbook, the pilot made a flight in a Yak-40 as **PIC** in the left-side seat on the route EPWA-EPSC—EPWA in atmospheric conditions, 8/100 m/1 km (DIMC). The pilot earned the PIC rating in DIMC as late as on 14.11.2006, i.e. a month after performing the above mentioned flights, so, supposedly he did the flights on Yak-40 on 12.10.2006 without a PIC rating. Said flights could not be done as PIC training flights from the captain's seat because the pilot in the co-pilot's seat did not have an instructor-pilot rating. Additionally, atmospheric conditions for each of the flights were different, whereas in the pilot's papers it stands that atmospheric conditions were the same;
- 7) The Committee did not find explicitly what the sequence of exercises in PIC training on Yak-40 in the night was, because **the exercises** in the Pilot's Logbook, part 5, **carry no numbers**.

#### **2.2.1.2. Aircraft commander training in a Tu-154M aircraft**

On 10.06.2008, the pilot began his recurrent training as Commander of a Tu-154M and performed in DVMC **14 flights during 4 hours and 20 minutes**. The Committee found

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infringement of provisions in PSzLT-73 (page 10 item 5), because the maximum flight time in training short flights (e.g. circling) or flights which require much concentration must not exceed 3hs 30 min. Performing so many different flights incorporating different exercises in one day is, from the point of view of aviation methodology, unacceptable and does not bring any expected training goals.

- 1) The pilot finished his training in **DVMC** on 16.06.2008 in a check ride according to exercises 60 and 40 PSzLT-73 flying from EPGD (GDAŃSK-RĘBIECHOWO) to UKBB (KIJÓW—BORISPOL). In part 5 in the Pilot's Logbook the entry of atmospheric conditions of this flight reads 3/8 clouding, medium visibility 10 km, while in part 6 the atmospheric conditions are stated as cloudless /10 km. Referred to the examination according to the two exercises, the Committee draw attention to that:
  - a) two different check rides (according to two different exercises) were combined into one;
  - b) both in the Pilot's Logbook and in the Squadron's files there is no record of the time of flight with view limiting devices, which is not in line with the contents of exercise no. 40 PSzLT-73;
- 2) The pilot began training in **DIMC** on 23.06.2008, performing 11 flights to/from WROCLAW airport in very good atmospheric conditions (the Pilot's Logbook and the Squadron's records give cockpit blinded periods).

The pilot passed his check ride in DIMC, performed according to exercises 114 and 100, on 11.07.2008 in a flight from KATOWICE do BELGRADE where landing was in very good atmospheric conditions. In such a situation, the pilot should make a landing approach using view limiting devices, uncovering the view at a minimum descent altitude (MDA). Because the Pilot's Logbook as well as the Squadron's files are short on an entry about the time when view limiting devices were in use, in the Committee's opinion it is evident that provisions of PSzLT-73 were infringed. Another irregularity was combining the two examination flights into one;

- 3) On 28.07.2008, the pilot began training in **NVMC**, which he finished on 4.08.2008, passing the check ride according to exercises 170 and 155. Between finishing training in NVMC and commencing training in NIMC the pilot performed flights as a co-pilot in Tu-154M;

- 4) he began recurrent PIC training in **NIMC** on 2.09.2008 and finished with a check ride on the next day according to exercises 217 and 203. These training flights were made from/to BYDGOSZCZ Airport where prevailing atmospheric conditions were very good (CAVOK). The entry in the Pilot's Logbook says: atmospheric conditions 8/8/60 m/0.8 km). Because the Pilot's Logbook as well as the Squadron's records are short of information on the time of use of view limiting devices, it can be assumed that on the last stage of PIC training the check rides were made in very good atmospheric conditions without blinding the cockpit, uncovered at Minimum Decision Altitude (MDA).

From the pilot's personal documentation it appears that the flights on 3.09.2008, operated from/to BYDGOSZCZ and WARSZAWA airports were under the **ILS system** – whereas as per PSzLT-73, the flights should be performed according to exercises 196, 197 and 202:

- a) exercise 196 – a training flight in clouds for the purpose of controlling descent and making calculations for flights with the method „deflection by a set angle”, „standard turn”, „big rectangle”, „shortened big rectangle” and „two 180° turns”;
- b) exercise 197 – a training flight in clouds for the purpose of controlling descent and making calculations for landing with the use of Radio Direction Finder, impulse radio beacon, or radiolocation;
- c) exercise 202 – a training flight in clouds for the purpose of controlling descent and making calculations for landing in a radio locator system.

Summing up the PIC training on Yak-40 and Tu-154M aircraft, the Committee states that:

- daylight check rides, performed according to exercise 35, as well as night rides according to exercise 150 with lighting secured under the USL system, with the use of view limiting devices, were either overlooked or left unrecorded;
- during training in DIMC and NIMC, the stage of training according to the light securing system was overlooked (no records of exercises or exams in the light securing system, viz. daylight exercise no. 86, night exercise no.190);
- during training in DIMC and NIMC, the stage of the so called „*podwyższone minimum*” (more restrictive) was partly overlooked (no records of exercises or exams, viz. daylight exercise no.90, night exercise no.195). According to directives and methodological guidelines to these exercises:
  - day ... Fill in flight results into Pilot's Logbook and Navigator's Logbook, endorsing admittance to training in DTWA in weather minima”;

- night: „...Based on the flights performed, the examiner-pilot agrees for the pilot to begin night training in NVMC at weather minima and makes endorsement of flight results in the Pilot’s Logbook ...”;
- in the course of pilot training in DIMC and NIMC in weather minima, training in a more restrictive minimum („*podwyższone minimum*”) was overlooked – see the remarks under the bullet directly above;
- flights were carried out inconsistently with directives contained in PSzLT-73;
- PIC training on Yak-40 and Tu-154M was carried out according to contents of exercises, contained in PSzLT-73, outdated in relation to standing procedures and radio navigational facilities of airports;
- entries of atmospheric conditions that were made in flight documentation did not correspond with real atmospheric conditions in which the flights were conducted;
- there were no grounds for an Order of the Day Z-173/2008 for 4.09.2008, by the 36 Regiment Cmd. to grant the rating for approach under the radio location landing system;
- entries in personal documentation were not made in a uniform manner.

#### **2.2.1.3. Training for a Class III test pilot rating**

A Class III test pilot rating for Tu-154M aircraft was awarded in a day’s order of 10.12.2008 on the basis of a check flight of the same day performed in MOSCOW.

As per the Squadron’s register of flights, this flight was conducted within the limit called „prace własne” (one’s own jobs) without assigning any number to this exercise or describing the character of the flight (e.g. a trial flight, a test flight). The pilot was performing as the Pilot Flying in the co-pilot’s seat under the command of a PIC who did not have a Class III test pilot rating or an instructor-pilot rating for Tu-154M aircraft.

According to instruction no.IOLP-2005 „*Instrukcja organizacji lotów próbnych w lotnictwie Sił Zbrojnych Rzeczypospolitej Polskiej*” (Instruction on Arrangement of Test Flights in the Aviation of Polish Armed Forces), ... authorised to conduct test rides for the Class III test rating are test pilots with an instructor rating or, in shortage of pilots with instructor qualifications for a given aircraft type, it is permitted for two instructor-pilots of a given aircraft type to check each other’s ride, interchangeably as examiner and examinee.

Confronted with the above-mentioned regulations, none of the conditions was fulfilled, therefore, **such rating must not have been conferred upon the pilot.**

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The pilot's personal documentation lacks sign-offs for his attendance in consecutive stages of theoretical and practical training. Under Enclosure 7 item 3 IOLP-2005 „*Wzór wpisu uprawnień do dokumentacji osobistej*” (Specimen of Endorsement in Personal Documentation) it is required to obtain such endorsements.

In the Squadron's register of flights, times of takeoff and landing operations were written as local time (Polish time). On 10.12.2008, the Tu-154M taxied for a flight at 13:50 local time, the engines were shut down after flight at 15:50 local time (time difference between Moscow and Warszawa was two hours). With the use of sunrise and sunset tables, the Committee established that on 10.12.2008 the sun set in Moscow at 15:57 (landing was at 17:50), which means that the check ride was carried out in night hours – infringement of § 3 item 1, IOLP-2005:

Aircraft check flights should be conducted by daylight in atmospheric conditions specified in trial flights programmes, though not worse than VMC conditions („*Loty próbne kontrolne SP należy wykonywać w dzień w warunkach atmosferycznych określonych w programach lotów próbnych, jednak nie gorszych niż w VMC*”).

Besides, the date on which the pilot's Class III test pilot rating was announced in the Order of the Day of 36 Regiment Cmd. (the day of departure) arises doubts because termination of the flight was at 17:50 (15:50 LMT), i.e. after working hours at the 36 Regiment, **therefore it is not much probable that such information should be contained in the Order of the Day of that particular day.**

The Committee also found that the list of qualifications and ratings of flight personnel („*Wykaz uprawnień i dopuszczeń personelu latającego*”), in Enclosure 2 to the 36 Regiment Cmd. Order no.2 of 04.01.2010 **does not specify any such rating by the pilot's name in the Test Flights box („Loty próbne”).**

#### **2.2.1.4. Pilot's ratings – training, qualifications, piloting techniques**

##### 1) training flights

One of most important elements in the flight training process is to sustain piloting habits at a proper level. Proper level can be accomplished through:

- Simulator training – making use of flight simulators' possibilities in imitating emergency situations;
- systematic training flights according to properly chosen exercises (as per training programme), whose fulfillment enables crews to keep up their piloting habits on a proper level as well as crew co-operation, etc.;

- a combination of the two methods.

According to PSzLT-73 part 1.2., Methodological Guidelines, item 14-18, it is banned to practise any emergency situations in flights with passengers. The Committee has analysed upkeep of piloting habits which, according to the methodological guidelines of PSzLT-73 and RL-2006 should be hammered in in training flights. It was especially important as full flight simulation was not implemented to training on Yak-40 and Tu-154M aircraft.

In an analysis of the Pilot's Logbook („*Osobisty dziennik lotów*”) and in the register of flights in the Squadron, the Committee found **that during 2009 and 2010 he did not do any training flights in a Tu-154M (nor in a Yak-40 in 2010)** beside regular operation tasks. He did not perform flights where he could systematically practise landing with one engine inoperative or make use of various landing systems (required by PSzLT-73), either.

On 21.01.2009, in a Yak-40 aircraft the pilot performed:

- exercise 167 – one flight;
- exercise 153 – descent under the Instrument Landing System;
- exercise 154 – landing approach under the radio location system (actually, the flight was under ILS).

The last training flight which the pilot performed in a Yak-40, involving a one engine inoperative landing was on **10.06.2008** according to exercise no. **33**. Since than, there have been no records of practising this element. He performed this element on a **Tu-154M** on **28.07.2008** during PIC training, exercise **149** (night). Since that day he has **not practised this element** to the day of crash.

## 2) Ratings to land in atmospheric conditions

The ratings, awarded to the pilot to perform as PIC in minimum atmospheric conditions on Tu-154M in daylight and at night in IMC under IFR:

### a) for landing:

- ILS CAT I - cloud cover 8/8; base 60 m; visibility 800 m;
- PAR + 2 × NDB - cloud cover 8/8; base 100 m; visibility 1200 m;
- PAR - cloud cover 8/8; base 120 m; visibility 1500 m;
- 2 × NDB - cloud cover 8/8; base 120 m; visibility 1800 m;
- 1 × NDB - cloud cover 8/8; base 250 m; visibility 4000 m;

### b) for takeoff:

- with centerline lights: cloud cover 8/8; base 0 m; visibility 200 m;
- with centerline lights:



- with runway edge lights: cloud cover 8/8; base 0 m; visibility 400 m;
- without runway edge lights: cloud cover 8/8; base 0 m; visibility 500 m.

According to § 14 RL-2006 (with amendments made in 2008), table no.2 and item 11 in connection with item 10, **in order to sustain a rating and skills in minimum atmospheric conditions**, the pilot had to **perform a real or simulated flight once in four months**. Non-performance of such flight meant automatic deprivation of such ratings.

On the basis of an analysis of entries in the Pilot's Logbook „*Osobisty dziennik lotów*” and in the Squadron's register of flights, the Committee has stated that:

- in 2006, the pilot performed all landing approaches (227) under the ILS system;
- of the total of 266 landing approaches in 2007, there were 260 approaches under ILS, three under VOR DME (26.04., 20.05., 20.12., Tu-154M co-pilot's seat) and three with lighting secured under USL (two on 13.02. and one on 12.03.).
- from January to May 2008, the pilot performed approach operations only with the use of ILS. In June, out of 33 landing approaches the pilot performed three under NDB (on 23.06.), the others under ILS. Next approaches with the use of NDB were recorded in September, six. During that period, i.e. from June to September the pilot engaged in PIC training for Tu-154M and landing approaches belonged now to the training programme;
- in 2009, the pilot performed four approaches under NDB, others under ILS.

From the above summary it appears that most of the landing approaches which the pilot performed were under the ILS system.

On the basis of Pilot's Logbook „*Osobisty dziennik lotów*” and the Squadron's register of flights, the Committee found that the pilot made entries of atmospheric conditions (**cloud base 60 m, visibility 800 m**) when landed under ILS, which figures did not correspond with real atmospheric conditions at airports of landing. Below are entries made since his PIC training for Tu-154M PIC rating finished:

- a) **11.09.2008 r., SZCZECIN (EPSC) landing at 9:57 (LT), 8:57 (UTC);**  
EPSC 110730Z 31006KT 3000 BR BKN002 16/16 Q1015  
(visibility 3000 m, mist, general cloud amount 5-7/8 at cloud base 200 ft ~ 60 m)  
EPSC 110800Z 33006KT 6000 SCT004 BKN006 17/17 Q1015  
(visibility 6000 m, general cloud amount 3-4/8 cloud base 400 ft ~ 120 m and 5-7/8 cloud base ~ 180 m)

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b) **29.10.2008 r., SZCZECIN (EPSC) landing at 8:40 (LT), 7:40 (UTC);**

EPSC 290730Z 00000KT 2000 -RA BR SCT001 BKN023 05/05 Q1010

(visibility 2000 m in light rain, in mist, general cloud amount 3-4/8, cloud base at 100 ft ~ 30 m and 5-7/8 at ~ 700 m)

EPSC 290800Z 00000KT 3000 -RA BR FEW001 BKN033 06/06 Q1010

(visibility 3000 m, light rain, mist, general cloud amount 1-2/8, cloud base at 100 ft ~ 30m and 5-7/8 at ~ 1000 m)

c) **2.11.2008 r., WARSZAWA-OKĘCIE (EPWA) landing at 18:50 (LT), 17:50 (UTC);**

EPWA 021730Z 05005KT 360V100 2500 BR **BKN001** 07/06 Q1023 BECMG  
3000 BR BKN003

(visibility 2500 m, mist, cloud amount 5-7/8 cloud base 100 ft ~ 30 m and next  
visibility 3000 m, mist, and 5-7/8 base ~ 90 m)

EPWA 021800Z 06004KT 020V100 2500 BR **BKN002** 07/06 Q1023 BECMG  
3000 BR BKN003

(visibility 2500 m, mist, cloud amount 5-7/8 cloud base 200 ft ~ 60 m and next  
visibility 3000 m, mist and 5-7/8 base ~ 90 m)

d) **5.11.2008 r., LUBLANA (LJLJ) landing at 21:00 (LT), 20:00 (UTC);**

LJLJ 051930Z VRB01KT 1200 0500SE **R31/0400N** BCFG BR **BKN001** 11/11  
Q1019 NOSIG (No Significant change)

(general visibility 1200 m, along RWY31 400 m toward north, fog (patches), mist,  
general cloud amount 5-7/8 cloud base 100 ft ~ 30m)

LJLJ 052000Z VRB01KT 1200 0600SE **R31/0600V900N** BCFG BR **BKN001**  
11/11 Q1019 NOSIG

(general visibility 1200 m, along RWY31 600 to 900 m toward north, fog (patches),  
mist, cloud amount 5-7/8 cloud base 100 ft ~ 30 m )

e) **22.11.2008 r., KIJÓW-BORYSPIL (UKBB) landing at 08:56 (LT), 06:56 (UTC);**

UKBB 220630Z 10005MPS 6000 -SHRA SCT004 SCT009CB BKN012 02/02  
Q0984 TEMPO 1000 SHSNRA

(general visibility 6000 m, occasional light rain, general cloud amount 3-4/8 at cloud  
base ~ 120 m, storm cloud base ~ 270 m, and 5-7/8 at cloud base 360 m, occasional  
visibility 1000 m in passing sleet)

UKBB 220700Z 11004MPS 3700 -SHRA BKN005 BKN008CB 02/02 Q0983  
TEMPO 1000 SHSNRA

(general visibility 3700 m, weak occasional rain, general cloud cover 5-7/8 base ~ 150 m and ~ 5-7/8 Cumulonimbus Cloud (Cb) at 240 m base, occasional visibility 1000 m in occasional sleet)

- f) **18.12.2008 r., WROCŁAW-STRACHOWICE (EPWR) landing at 12:45 (LT), 11:45 (UTC);**

EPWR 181130Z 29007KT 1800 -RADZ BR *BKN002* OVC003 04/03 Q1016  
(visibility 1800 m, light rain /drizzle, mist, general cloud amount 5-7/8, cloud base 200 ft ~ 60 m and 8/8 at 90 m)

EPWR 181200Z 31008KT 2000 -RADZ BR *BKN003* OVC004 04/04 Q1016  
(visibility 2000 m, light rain/drizzle, mist, cloud amount 5-7/8 base 300 ft ~ 90 m and 8/8 at cloud base 120 m)

- g) **9.01.2009 r., GDAŃSK-REBIECHOWO (EPGD) landing at 20:25 (LT), 19:25 (UTC);**

EPGD 091900Z 28009KT 5000 BR *BKN001* 02/01 Q1021  
(visibility 5000 m, mist, general cloud amount 5-7/8 cloud base 100 ft ~ 30 m)

EPGD 091930Z 28008KT 2000 BR *BKN001* 02/01 Q1022  
(visibility 2000 m, mist, general cloud amount 5-7/8 cloud base 100 ft ~ 30 m)

- h) **21.02.2009 r., KRAKÓW-BALICE (EPKK) landing at 09:15 (LT), 08:15 (UTC);**

EPKK 210800Z 06008KT 6000 SCT046 *BKN060* M07/M09 Q1026  
(visibility 6000 m, general cloud amount 3-4/8 cloud base 4600 ft ~ 1400 m and 5-7/8 base 1800 m)

EPKK 210830Z 06007KT 6000 SCT046 M07/M09 Q1027  
(visibility 6000 m, general cloud amount 3-4/8 cloud base 4600 ft ~ 1400 m)

- i) **29.06.2009 r., KRAKÓW-BALICE (EPKK) landing at 06:25 (LT), 04:25 (UTC);**

EPKK 290400Z 26007KT 1800 BR *BKN002* 17/17 Q1015  
(visibility 1800 m, mist, general cloud amount 5-7/8 cloud base 200 ft ~ 60 m)

EPKK 210430Z 28005KT 240V320 2500 BR *BKN004* 18/17 Q1015  
(visibility 2500 m, mist cloud amount 5-7/8 cloud base 400 ft ~ 120 m)

- j) **9.11.2009 r., GDAŃSK-REBIECHOWO (EPGD) landing at 14:13 (LT), 13:13 (UTC);**

EPGD 091300Z 10012KT 1600 -RA BR *OVC001* 05/04 Q1011  
(visibility 1600 m, light rain, mist, cloud amount 8/8 cloud base 100 ft ~ 30m)

EPGD 091330Z 10012KT 1000 R29/1800 -RA BR *VV002* 05/05 Q1011

(visibility 1000 m, along RWY29 1800 m, light rain, mist, vertical visibility 200 ft ~ 60 m)

k) **10.11.2009 r., WARSZAWA-OKECIE (EPWA) landing at 00:57 (LT), 23:57 (UTC);**

EPWA 092330Z 13006KT 1900 -DZ BR *OVC001* 08/08 Q1011 BECMG 1500  
(visibility 1900 m, small drizzle, mist, overcast at base 100 ft ~ 30 m and next visibility 1500 m)

EPWA 100000Z 12005KT 100V160 1700 -DZ BR *OVC001* 08/08 Q1011  
BECMG 1500

(visibility 1700 m, weak drizzle, mist, overcast at base 100 ft ~ 30 m and next visibility 1500 m)

l) **11.02.2010 r., BRUSSELS (EBBR) landing at 16:16 (LT), 15:16 (UTC);**

METAR EBBR 111450Z 03015KT 9999 BKN040 M02/M06 Q1015;  
(visibility above 10 km, general cloud amount 5-7/8 at base 4000 ft ~ 1200 m)

METAR EBBR 111520Z 03013KT 9999 BKN022 M02/M06 Q1015;  
(visibility above 10 km, cloud amount 5-7/8 at base 2200 ft ~ 660 m)

From the above summary it also appears that in seven cases of landing operations the atmospheric conditions were below acceptable for a given approach or airport (2.11.2008, 5.11.2008, 18.12.2008, 9.01.2009, 29.06.2009, 9.11.2009, 10.11.2009).

It appears that on the day of crash the pilot **did not have recency for landing as a PIC of Tu-154M in atmospheric conditions:**

- **under ILS**, in the flight on 11.02.2010, during the landing operations in BRUSSELS (at 16:16 LT, 15:16 UTC) the recorded atmospheric conditions did not reflect real conditions. Because the flight had a HEAD status, the pilot could not perform a landing approach in simulated conditions (blinded cockpit), which was a condition of rating recency extension ;
- **with the use of procedure for a landing approach under NDB** (a radio transmitter used as navigational aid). The last flight, recorded as performed according to this procedure, took place on 21.12.2009, to SAMARA in very good atmospheric conditions (cloudless, visibility 10 km);

- 
- **with the use of procedure for a landing approach under VOR DME** – such rating has never been awarded to the pilot; the last such approach the pilot performed in 2007;
  - **with the use of PAR** – the pilot has never made an approach with the use of this radar;
  - **with the use of radio-location device RSL (Polish name: RSP)** – such rating has never been formally awarded to the pilot; the last approach with the use of RSL the pilot did on 8.08.2005 in the co-pilot's seat, according to exercise no.39.

### 3) recency of piloting proficiency

On the basis of entries in Pilot's Logbook „*Osobisty dziennik lotów*” and in the Squadron's register, the Committee states that from the time of beginning training on Yak-40 and Tu-154M aircraft **the pilot's competencies to fly into a zone as PIC have not been checked**. The last documented checks of his techniques in piloting to a zone:

- a) 11.05.2007, in the right hand seat, DIFR exercise 248, Tu-154M,
- b) 14.05.2006, in the right hand seat, DIFR exercise 248, Yak-40.

According to the provisions of § 15 item 9 RL-2006: „*W przypadku niewykonania KTP w strefie na danym typie SP zawieszają się ważność wszystkich uprawnień do wykonywania lotów na tym typie SP – do czasu wykonania brakującej kontroli, z zastrzeżeniem ust. 12*” (In the case of non-performance of Practical Test Standard check rides (Polish KTP) in a zone on a given aircraft type, all recencies become suspended for the given aircraft until performing the missing rides, subject to the reservation contained in item 12; **on 10.04.2010, the pilot did not possess PIC recency for Tu-154M and Yak-40 aircraft**).

#### 2.2.1.5. Pilot training in civilian ratings

The pilot revalidated, as to 21.10.2008, his civilian pilot licence CPL(A), issued by the Civil Aviation Office (ULC - Polish civil aeronautics administration) until 21.10.2013. In the course of this revalidation the pilot earned a PIC rating for multi-engine piston aircraft (MEP(L) with validity until 30.04.2009.

Under the rating endorsed in the Licence, the pilot had an add-on English and Polish languages air-ground radio communications rating. He also had Class 1 medical certificates from Aviation Medical Examiner, valid till 11.01.2015 (without any restrictive endorsements).

The pilot did the following civilian air training events:

- a) 2.04.2005 – „*Kurs współpracy w załodze wieloosobowej MCC*” (A Course in Multi Crew Co-operation) at LOT Polish Airlines;

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- b) 4.04.2005 - „*Pomostowe szkolenie pilotów dla uzyskania licencji JAR-FCL*” – at LOT Polish Airlines (Bridging training for pilots seeking JAR-FCL Licences);
  - c) 24.04.2005 – „*Modułowe szkolenie teoretyczne ATPL(A) dla posiadaczy CPL(A)/IR* – at LOT Polish Airlines (A module knowledge course for holders of CPL(A)/IR licences wishing to upgrade to ATPL(A);
  - d) 16.02.2008 – „*Szkolenie teoretyczne wg programu szkolenia do uzyskania uprawnienia do wykonywania lotów na samolotach wielosilnikowych*” – Ośrodek Szkolenia Lotniczego (OSzL) ADRIANA (Theoretical training according to a programme for multi- engine aircraft piloting rating);
  - e) 8.04.2008 – pilot training for revalidation of a professional pilot licence CPL(A) along with SEP(L) according to the procedure of validation and revalidation of competencies and ratings: „*Procedury przedłużania i wznowiania uprawnień i upoważnień lotniczych*” – in the training centre OSzL ADRIANA;
  - f) 29.04.2008 – a revalidation training, 11 hours 45 min flying, of which 8 hours 5 min on a PA-34 aircraft and 3 hours 40 min on C-150 – OSzL ADRIANA training centre;
  - g) 30.04.2008 – a practical test for a commercial pilot licence CPL(A) – OSzL ADRIANA;
  - h) 30.04.2008 – a practical test for or a check ride for a one-pilot type/class rating for MEP (Multi Engine Piston) – OSzL ADRIANA.

From 13.07. to 19.08.2009, the pilot took a course in ground and flight simulator training „*Szkolenie naziemne oraz symulatorowe w celu uzyskania uprawnień na typ samolotu Embraer 170/190 (Type Rating)*” at the Swiss Aviation Training centre. The training was conducted by a certified centre of aeronautical training according to international requirements with respect to modern training (TR – Type Rating).

At each stage, modern training programmes contain questions relating to CRM (Crew Resource Management). This particular training course was for a two-pilot crew where specificity of two-pilot crew co-operation and management is different from co-operation and management in a four-person crew (Tu-154M).

The Committee assumed that the training course was supposed to improve pilots' skills, broaden knowledge and experience in air operations on modern airlines as well as in emergency situations. It also allowed to apply the knowledge of procedures of IFR flights, try all appliances and systems that are part and parcel of an aircraft, which ensure its safety, e.g.

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TCAS - a traffic collision avoidance system and EGPWS - a ground proximity warning system (an equivalent of TAWS - a terrain awareness and warning system).

In the Committee's opinion, comparisons and generalisation can not be made in relation to training methods in aircraft that differ from each other in terms of:

- a) piloting;
- b) co-operation in the crew and its management (CRM);
- c) piloting habits of crews;
- d) procedures related to handling emergency situations.

### **2.2.2. Co-pilot**

Directly after graduation from WSOSP in Dęblin, in 1997, the pilot began active service in the 36 Regiment and took training for a co-pilot rating on Yak-40, which he finished on 5.03.1999 with a check ride according to exercise no. 270 PSzLT-73.

On 29.08.2005, he began training for a co-pilot rating on M-28 aircraft, which he finished with a check ride on 28.09.2005 conducted according to exercise 101 PSzLT-95. At this stage<sup>72</sup> he finished training for M-28 aircraft.

#### **2.2.2.1. Training for PIC on Yak-40 aircraft**

On 22.08.2006, the pilot began PIC training on Yak-40 in **DVMC**, which he finished on 07.03.2007 with a check ride according to exercises 40 and 60 PSzLT-73.

On 04.10.2006, he began PIC training in DIMC, which he finished on 24.06.2008 with a check ride according to exercises 100 and 114 PSzLT-73. According to an entry in „*Osobisty dziennik lotów*” (Pilot's Logbook), parts 5 and 6, and in the Squadron's records of flights, the flights were performed in the atmospheric conditions: cloud cover 8/8, base 300 m, visibility 3 km. The examiner's endorsement Motion stood for more rigorous atmospheric conditions ratings:

- a) with lighting secured under the USL system - 8/8 150/1,5;
- b) the radio locator system (RSL, Polish name RSP) with lighting secured under USL :  
- 8/8 100/1;
- c) ILS: - 8/8 100/1.

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<sup>72</sup> The Pilot's Logbook („*Osobisty dziennik lotów*”) in part 4, misses a relevant endorsement of meteorological conditions rating for M-28 aircraft.

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In reality, atmospheric conditions that day in BYDGOSZCZ (EPBY) (takeoff 16:45 LMT, landing and takeoff 17:00 LMT) and in WARSZAWA (EPWA) (landing 18:00 LMT) were very good – visibility above 10 km, no clouds.

In the Pilot's Logbook „*Osobisty dziennik lotów*” and in the Squadron's register of flights there is no endorsement about how long the flight was conducted with view limiting devices, therefore in the Committee's opinion, the pilot could not be rated for more rigorous minimum conditions than those of the flight test.

On 21.02.2007, the pilot began training in NVMC, which he finished with a check ride according to exercises 170 and 155 on 3.04.2007;

He began PIC training in NIMC on 24.09.2008 and, like in the DIMC the real atmospheric conditions during the check ride on 30.09.2008, conducted according to exercises 217 and 203 PSzLT-73, were other than entered in Pilot's Logbook and the Squadron's register of flights. A NIMC rating was conferred upon the pilot notwithstanding doing the flights in very good atmospheric conditions. The use of cockpit view limiting devices was not annotated, either. Under the circumstances, **the pilot should not be rated for more rigorous conditions than those of the check ride.**

The PIC training on Yak-40 aircraft in DVMC, DIMC and NVMC was progressing with intervals longer than permitted by methodological directives: „*wznawianie nawyków z pilotami wykonującymi loty na samolotach transportowych*” (**transport aircraft pilots' habit refreshing**). Well, in order to sustain continuance of training it was necessary to perform programme-prescribed additional flights, when in reality, the training was conducted **without programme-recommended revalidation**<sup>73</sup>.

In the course of PIC training on Yak-40, the pilot was executing the statutory piloting techniques checks and navigational checks in compliance with requirements for a co-pilot rating.

On 6.02.2009, the pilot performed a flight according to exercise 203/217 in order to obtain a more rigorous minimum conditions night rating. This is evidenced by an entry in part 5 of the Pilot's Logbook „*Osobisty dziennik lotów*” and in the Squadron's register. However, in parts 6 and 4 of the Pilot's Logbook there is neither any annotation of awarding such rating nor any 36 Regiment Cmd. Order of the Day to confirm such rating. What is important – any

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<sup>73</sup> „*Metodyka wznawiania nawyków z pilotami wykonującymi loty na samolotach transportowych*” (Methodology of transport aircraft pilots' habits refreshment) is an enclosure to the training programme PSzLT-73 implemented on 16.04.1977.



night rating calls for obtaining a daylight rating beforehand (in keeping with the documentation, the pilot did not earn a daylight rating). According to the Squadron's files, the training flight which was meant to earn him more rigorous minimum conditions was concurrently a flight with HEAD (of State) status, which it is not allowed to combine.

#### **2.2.2.2. Training for a navigational rating on Tu-154M aircraft**

On 13.06.2008, the pilot began navigational training on Tu-154M, performing four flights in **2 hours and 33 min**. In the Pilot's Logbook „*Osobisty dziennik lotów*” there are no entries related to ground training completion or to aerial training, no sign-offs from instructors or endorsement of a crew member rating. On 18.06.2008, (after a few tutored flights) he performed as a flight navigator during a HEAD coded flight. According to training requirements and the rules of rating flight personnel who conduct HEAD coded flights, compiled in the 36 Regiment, such ratings are awarded to: ... ~~n~~avigators of Tu-154M after at least **50 flight hours on the type.**” (... *Zgodnie z wymaganiami dotyczącymi szkolenia i zasad nadawania uprawnień personelowi latającemu wykonującemu loty o statusie HEAD opracowanymi w 36 splt uprawnienie takie otrzymują*), ...*n*awigatorzy na Tu-154M – po wykonaniu **minimum 50 godzin nalotu na typie**”).

The demands which flight personnel in HEAD coded flights must meet were determined and explained by the Command of the 36 Regiment in the answer quoted below.

W 36 spłt przyjęto jako **minimalne wymagania do lotów z HEAD**, zgodnie z „Instrukcją organizacji lotów sp o statusie HEAD” sygn. WLOP 408/2009: zgodnie z Rozdziałem 4 paragraf 8 pkt 9, ppkt 1) 2) oraz 3) oraz dodatkowo

**na JAK-40**

- **dowódcy załóg**
  - 1 klasa pilota
  - z nalotem na typie min. 500 godzin,
  - nalot ogólny powyżej 1000 godzin
  - pozytywna decyzja dowódcy pulku podjeta w porozumieniu z dowódcą eskadry oraz szefem szkolenia.
- **drugi pilot**
  - 2 klasa na typie
  - po osiągnięciu nalotu od 100 do 300 godzin na typie
  - po pozytywnej decyzji d-cy pulku podjętej w porozumieniu z dowódcą eskadry oraz szefem szkolenia – z zasadą indywidualnego podejścia, w zależności od doświadczenia lotniczego.

**na TU-154M**

- **dowódcy załóg**
  - 1 klasa pilota
  - po wykonaniu min. 10 odcinków z innymi pasażerami lub lotów innego typu (min. 10 godzin)
  - po decyzji dowódcy pulku, podjętej w uzgodnieniu z dowódcą eskadry oraz szefem zespołu lotniczego – indywidualnie / w związku z trudną sytuacją kadrową/.
- **Drudzy piloci** – po ok. 200 godzinach nalotu jako drugi pilot – lecz z zasadą indywidualnego podejścia – co aktualnie wiąże się ze zmniejszeniem powyższego progu, z powodu trudnej sytuacji kadrowej personelu latającego.
- **Nawigatorzy na Tu-154M** – po wykonaniu minimum 50 godzin nalotu na typie

W związku z sytuacją, że piloci wykonujący loty na TU-154M są wcześniej wyszkolonymi pilotami – dowódcami załóg na samolocie Jak-40 (lub co najmniej jako drugi pilot), a także łączą intensywnością lotów na tym typie sp, w ostatnim okresie, po odejściu dwóch znaczących grup pilotów w latach 2006 oraz 2008, dopuszczenie do lotów o statusie HEAD na Tu-154 M uzyskują piloci z obniżonymi w stosunku do wcześniej określonych wymagań.

IN THE 36 REGIMENT, **MINIMUM REQUIREMENTS FOR HEAD CODED FLIGHTS** HAVE BEEN ADOPTED AS PER INSTRUCTION NO. WLOP 408/2009 Instruction on HEAD Flight Operations IN COMPLIANCE WITH PARA 4 ITEM 9 POINTS 1), 2), AND 3), AND ADDITIONALLY

**FOR YAK-40**

- **AIRCRAFT COMMANDER**
  - CLASS 1 PILOT
  - WITH MINIMUM 500 HOURS ON THE TYPE
  - WITH TOTAL FLIGHT HOURS OVER 1000 HOURS
  - RECOMMENDATION BY THE REGIMENT CMD. IN CONSULTATION WITH SQUADRON LEADER AND CHIEF OF TRAINING
- **CO-PILOT**
  - CLASS 2 TYPE-RATED PILOT
  - AFTER LOGGING FROM 100 TO 300 HOURS ON THE TYPE
  - RECOMMENDATION BY REGIMENT CMD. IN CONSULTATION WITH SQUADRON LEADER AND FLIGHT LEADER – INDIVIDUALLY /DUE TO A DIFFICULT CADRE SITUATION/.
- **CO-PILOTS** – AFTER ABOUT 200 FLIGHT HOURS AS A CO-PILOT – CONSIDERED INDIVIDUALLY IN VIEW OF LOWERING THIS REQUIREMENT AS FLIGHT PERSONNEL ARE IN SHORT DEMAND.
- **NAVIGATORS FOR Tu-154M** – AFTER LOGGING AT LEAST 50 HOURS ON THE TYPE

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BECAUSE THE TU-154M PILOTS HAVE EARLIER PILOT RATINGS – LIKE YAK-40 PIC RATING (OR AT LEAST A CO-PILOT RATING), ALSO, DUE TO INTENSIVE FLYING ON THIS TYPE ESPECIALLY RECENTLY AFTER TWO GROUPS OF PILOTS LEFT THE REGIMENT DURING 2006-2008, PILOTS WITH LOWER THAN REQUIRED QUALIFICATIONS ARE ADMITTED TO PERFORM HEAD FLIGHTS ON TU-154M

A copy of a document from the 36 Regiment, answering the problem of manning the cockpit for the HEAD flight.

The final part of the document contradicts earlier provisions and, the aforesaid flight hours requirement was not complied with in this case.

### **2.2.2.3. Tu-154M Co-pilot training**

The pilot began his practical training in DVMC on 11.12.2008 and performed 11 training flights crowned with two check rides according to exercise no.255 PSzLT-73, as evidenced in the 36 Regiment Cdr. Order of the Day of 18.12.2008. In the Pilot's Logbook, in part 5, is an endorsement of landing approaches made under the ILS system. In reality, the first check ride was conducted in DEBLIN (where the runway was not equipped with ILS), the other was conducted en route from DEBLIN to WARSZAWA.

The training flights began at 9:20 LMT, finished at **12:40** LMT with engine shutdown, and around **12:50** the aircraft taxied out for a flight to GDAŃSK. According to the Squadron's files, during a 10-minute break one crewmember was replaced and two flight attendants were taken on. The Committee noticed inconsistency of timing as it is impossible to prepare an aircraft properly for a next flight and exchange part of crew during 10 minutes (unless it is not inspected before a next flight, not refueled and not re-manned even partly with engines running, which is forbidden). In the GDAŃSK-bound flight the pilot was the Pilot Flying in the right side seat, whereas in the return flight (takeoff at 20:47, engine shutdown at 21:47) the pilot was performing as a navigator. Since the pre-flight briefing for the training flights until finishing pilot duties, the three airmen (Commander, Co-pilot, Navigator, and Flight Engineer) exceeded the flight time by **2 hours and 37 minutes**.

The pilot began his practical training in DIMC on 22.12.2008 and finished on 23.12.2008 with two flight tests at WARSZAWA-OKECIE airport according to exercise no.260 PSzLT-73 in very good atmospheric conditions. The Pilot's Logbook and the Squadron's files lack entries on how long the cockpit was „blinded”. Based on the

endorsement in part 6 of the Pilot's Logbook (exercise 260 ~~–the flight test under NDB, PAR (RSL), ILS~~ systems) the Committee surmised that the rides could be performed solely under ILS or VOR DME systems, because the other systems did not exist at WARSZAWA-OKECIE airport.

The pilot began his practical training in NVMC on 29.12.2008. After 30.12., the pilot had a break in training, which he resumed on 19.05.2009. The next day, i.e. on 20.05.2009, the pilot performed 10 training flights, among them two were flight tests according to exercise no.265, and afterwards, on 21.05.2009, the rating was named in 36 Regiment Cdr. Order of the Day.

On 20.05.2009, he also began training in NIMC (performed two rides according to exercise no.267). He continued the training on the following day, accomplishing check rides according to exercise no.270.

His completing all the training as a co-pilot of Tu-154M was endorsed in the 36 Regiment Cdr. Order of the Day of 22.05.2009.

*„Po zakończeniu szkolenia w powietrzu i zdaniu w dniu 21.05.2009 r. egzaminu praktycznego na samolocie Tu-154M wg ćw. 270 PSzLT-73 na ocenę „bardzo dobry” zezwalam (stopień, imię nazwisko) na wykonywanie lotów w składzie załogi w nocy IMC w charakterze drugiego pilota z prawego fotela:*

- na samolocie Tu-154M;
- zgodnie z przepisami dla lotów z widocznością (VFR);
- zgodnie z przepisami dla lotów według wskazań przyrządów (IFR)”.

After the pilot's finishing air training and passing flight tests in a Tu-154M according to exercise no.270 PSzLT-73 for ~~–~~Very good” on 21.05.2009, I permit Mr.(rank, full name) to fly in crew composition at night in IMC conditions as a Co-pilot in the right side seat:

- in Tu-154M aircraft;
- according to the rules of flights with visibility (VFR);
- according to the rules for flights with the use of instruments (IFR).

The Committee has found inconsistencies of entries between the Squadron's register of flights (time of takeoffs, landings, cruises between individual airports) and the entries in the Pilot's Logbook as well as non-compliance with methodology of training and directives in respect of exercises contained in PSzLT-73.

On 21.05.2009, the pilot performed one more (third) check ride according to exercise no. 265. The PSzLT-73 programme, in its guidelines on organization and methodology recommends conducting 2-3 rides according to this exercise. If the training programme is realised through fewest exercises allowable (the variant accepted in the Regiment), than, performing a third check ride is futile, the more so as the exam was endorsed on 20.05.2009 and became the basis for issuance of a relevant qualification. However, if for any reason, the examiner should ordain an extra check ride, than, the pilot should not be awarded a co-pilot's NVMC rating and begin training in NIMC.

The PSzLT-73 exercise, in the part relating to co-pilot training, had in the atmospheric conditions/flight regulations, for the end of each training stage (save NIMC), the following provisions:

Oceny z wykonywanych elementów lotu wpisać do osobistego dziennika lotów pilota i nadać uprawnienia do wykonywania lotów w DZWA w składzie załogi oraz na rozpoczęcie szkolenia w DTWA.

Oceny z wykonanych lotów wpisać do osobistego dziennika pilota oraz nadać mu uprawnienia do wykonywania lotów w DTWA w składzie załogi oraz na rozpoczęcie szkolenia w NZWA.

Oceny z wykonanych elementów lotu wpisać do osobistego dziennika lotów pilota i nadać mu uprawnienia do wykonywania lotów w składzie załogi oraz zezwolenie na rozpoczęcie szkolenia w NTWA.

A copy of page from the PSzLT-73 exercise

**MARKS, GIVEN FOR FLIGHT ELEMENTS PERFORMED MUST BE ENDORSED IN PILOT'S LOGBOOK AND A RATING MUST BE AWARDED FOR FLIGHTS IN DVMC IN A CREW COMPOSITION AS WELL AS SIGN-OFFS THAT ALLOW BEGINNING TRAINING IN NVMC.**

**MARKS, GIVEN FOR FLIGHT PERFORMED MUST BE ENDORSED IN PILOT'S LOGBOOK AND A RATING MUST BE AWARDED FOR FLIGHTS IN DVMC IN A CREW COMPOSITION AS WELL AS SIGN-OFFS THAT ALLOW BEGINNING TRAINING IN NVMC.**

**MARKS, GIVEN FOR FLIGHT ELEMENTS PERFORMED MUST BE ENDORSED IN PILOT'S LOGBOOK AND A RATING MUST BE AWARDED FOR FLIGHTS IN A CREW COMPOSITION AS WELL AS SIGN-OFFS THAT ALLOW BEGINNING TRAINING IN NVMC.**

The above provisions show that a new stage of training could begin only after completion of entire training on a preceding stage because when two pilots are trained the progress of exercises is not parallel.

The training process should progress in such sequence: DVMC, DIMC, NVMC, NIMC.

Training in NIMC ends with such provision:

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Oceny z wykonanych lotów wpisać do osobistego dziennika lotów pilota oraz nadać mu uprawnienia do wykonywania lotów w NTWA w składzie załogi.

A copy of a page from exercise PSzLT-73

**MARKS, GIVEN FOR FLIGHTS PERFORMED MUST BE ENDORSED IN PILOT'S LOGBOOK AND A RATING MUST BE AWARDED FOR FLIGHTS IN A CREW COMPOSITION IN NVMC.**

At the end of training, the pilot earned also the aircraft **Commander** rating for HEAD-coded flights and not the **Co-pilot** rating, which was illegal. The 36 Regiment Cmd. Order of the Day of 22.05.2009, quote:

*„Na podstawie osiągniętego poziomu wyszkolenia zezwalam (stopień, imię nazwisko) na wykonywanie lotów oznaczonych symbolem WAŻNY na samolocie Tu-154M w charakterze dowódcy załogi”.* (Based on the accomplished airmanship skills, I permit Mr. {rank, full name} to perform flights marked –WAŻNY” (Important) on Tu-154M aircraft as **Aircraft Commander**”).

**Summing up the pilot's training process on Yak-40 and Tu-154M aircraft, the Committee states that:**

- a) the flights were conducted in disagreement with the directives contained in PSzLT-73;
- b) the contents of the exercises contained in PSzLT-73 were outdated in relation to the standing procedures and navigation aids at the airports;
- c) the atmospheric conditions that were entered into flight documentation did not reflect real conditions in which the flights were conducted;
- d) entries into the Pilot's Logbook were made inconsistently.

#### **2.2.2.4. Currency of the pilot's training, ratings and proficiency in piloting**

##### 1) Training flights

Since the end of training in Yak-40 for PIC rating, i.e. since 30.09.2008, the **pilot performed training flights only on 8.09.2009:**

- a) Exercise no.133 – a circling flight at night to make approach landing with one engine inoperative;
- b) Exercise no.94 – a flight in clouds **by day** to hone lighting secured landing approach (USL)<sup>74</sup>;

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<sup>74</sup> As it appears from the pilot's personal documentation and the Squadron's register of flights, the flight was performed at night, that is, contrary to the training programme guidelines as to the time of day for the flight.

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- c) Exercise no.154 – a training flight at night to hone landing approach in the radio locator system RSL (Polish name RSP) In the NAME OF SYSTEM box in the Pilot's Logbook, there is no name of the system with which the flight was executed.

The last flight in a Yak-40 with a landing approach under a system **other than ILS** took place on 11.03.2009 during a sortie flight, when the pilot landed under the **RSL** radio-locator system, exercise no.266/269 (zone/descent under the radio locator system RSL (Polish name RSP) – the right side seat) on 16.02.2008.

Since the end of training as a co-pilot in Tu-154M, i.e. from 21.05.2009 to the day of crash, **the pilot performed three training flights: two on 18.11.2009 according to exercise 58/253 (cross-country/ approach under ILS, in a blinded cockpit) and on 11.01.2010, a training flight (cross-country).**

The last flight in a Tu-154M under a system **other than ILS** took place on 19.05.2009. According to documentation, the approach was performed at night with the use of NDB (exercise no.262). **Under PSzLT-73, a flight executed according to exercise no.262 does not stand for approach under any landing systems** (as it is a circling training flight).

In 2010, he performed one training flight according to exercise no.110 (cross-country) in a Tu-154M, and in a Yak-40 aircraft he performed only sorties.

The foregoing analysis indicates that also in the case of this pilot, the military unit did not abide recommendations contained in training programmes in respect of training flights with one engine inoperative (not fewer than one in six months) as well as training flights under ILS and RSL (Polish name RSP) systems (not fewer than one in a quarter). It refers to both aircraft types which the pilot flew.

## 2) Recency of piloting proficiency check

On the basis of an analysis of entries in the Pilot's Logbook and the Squadron's register of flights, the Committee states that since the beginning of training on Tu-154M aircraft until the day of crash, **the pilot was not submitted to any check in a flight to a zone. Failure to carry out such check brings about incapacity to fly a given aircraft type in compliance with RL-2006, § 15 item 9. In this connection, the pilot did not have recency to perform as a co-pilot in the Tu-154M on 10.04.2010.**

The last check of his techniques of piloting a Yak-40 in a zone was carried out on 14.05.2008.

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The box „nazwa systemu” (Name of system) in „Osobisty dziennik lotów” (Pilot's Logbook) carries no name of the system in which the flight was performed.

### **2.2.2.5. Additional training sessions**

The pilot finished civilian „Ground and Flight Simulation training course for Embraer 170/190 type rating” held in the Swiss Aviation Training Centre between 29.06.-15.08.2009.

### **2.2.3. Flight engineer**

#### **2.2.3.1. Education and experience**

The flight engineer finished the school of aircraft mechanics (*Centrum Szkolenia Techników Lotniczych*) in Oleśnica in 1996 and since 1998 he was in service in the 36 Regiment.

In 1998, he did training in the structure, use and technical maintenance (fuselage and engines) of Yak-40 aircraft at the 36 Regiment. After passing exams at the 36 Regiment on 29.10.1998 he was awarded a one-person aircraft servicing rating in his specializations.

In 2002, he did training in the structure, use and technical maintenance (fuselage and engines) of Mi-8 helicopter at the 36 Regiment and, on passing exams on 26.04.2002 he was awarded a one-person helicopter servicing rating in his specializations.

On 2003, he graduated from the higher technical school (WSZ-SW) in Warszawa and, on 10.07.2003 he passed the English language exam at an elementary level.

In the 2<sup>nd</sup> half of 2003, he did training in the structure, use and technical maintenance (fuselage and engines) of Tu-154M aircraft at the 36 Regiment. After passing exams at the 36 Regiment on 24.12.2003 he was awarded a one-man aircraft servicing rating in his specializations.

Since 22.07.2008, he has been a senior flight engineer. He had all weather and day and night flight engineer ratings for Tu-154M. The last but one flight in his life was on 29.03.2010.

#### **2.2.3.2. Tu-154M flight engineer rating**

Before he began training for a flight engineer of Tu-154M he had received dedicated documentation for on-the-ground preparation of flight personnel preceding in-flight training in Tu-154M „*Dokumentacja naziemnego przygotowania personelu latającego przed rozpoczęciem szkolenia w powietrzu na Tu-154M*”.

On 29.05.2008, an Order of the Day was given by the 36 Regiment Cdr. commanding to conduct ground training before beginning aerial training.



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During 25.05.-01.07.2008, such ground preparation was conducted before in-flight preparations, evidenced by an Order of the Day of 7.07.2008 and a relevant entry in the Flight Crewmember's Logbook „*Osobisty dziennik lotów członka załogi statku powietrznego*”.

The flight engineer began his in-flight training on 22.07.2008, evidenced in the aforesaid Flight Crewmember's Logbook and in an Order of the Day of 22.07.2008.

He took a next step to earn a qualification and test Tu-154M mounted TA-6A and D30KU-II's engines on the ground, individually, which was confirmed in a day's order of 30.09.2008.

On 15.12.2008, in-flight exams were carried out to finalise the training for a daylight rating and, on 30.12.2008 - for a night rating. Based on these exams, he obtained ratings of a flight engineer of Tu-154M, for flights in all atmospheric conditions, day and night, evidenced in the Flight Crewmember's Logbook and in the Orders of the Day of 16 and 31.12.2008.

Based on the exams of 23.03-24.04.2009, under § 15 item 13 RL-2006 he obtained consent for the maintenance of Tu-154M and performance of flights in keeping with his qualifications and ratings.

On 07.05.2009, by the letter of the Order of the Day of the 36 Regiment Cdr., he was put on the flight crew list for HEAD coded Tu-154M flights, as a flight engineer in all atmospheric conditions.

### **2.2.3.3. Summary of the Flight Engineer's training**

- 1) on the grounds of an analysis of documents it can be stated that the flight engineer had professional education which he acquired in a military technical school, also a lot of experience in ground servicing of aircraft, and he catered for furthering his education (college, the English language, transition for next aircraft types);
- 2) this technician fulfilled the requirements of RL-2006, § 13 item 1 as well as those contained in the rules of training and checking aeronautical engineering personnel's aptitude for manning cockpits of aircraft, item 1.2: (*–Zasady szkolenia i kontroli technicznego personelu latającego i dopuszczania specjalistów służby inżyniersko-lotniczej do wykonywania lotów w składzie załogi na statkach powietrznych*”);
- 3) the training events as well as the exams conditioning this in-flight training did not include the matters contained in Item 2.1 of the document recalled under 2) above. From an analysis of the above-named document one may surmise that digesting such vast material

by way of consultation and self-teaching is unlikely in such a short time. In addition, the 36 Regiment was short of training facilities and a body of instructors able to provide a proper standard of training ground personnel and flying maintenance personnel;

- 4) on 18.12.2009, maintenance skills and in-flight practical testing of this flight engineer, with emphasis on possible events in flight, were checked by the Tu-154M commander. It was in line with provisions of RL-2006, § 12 item 25, yet, contrary to the provisions of the aforesaid „*Zasady szkolenia i kontroli technicznego personelu latającego...*”. Because of the layout of seats in Tu-154M cockpits (Flight Engineer is in tandem with Commander) such checking is difficult to carry out.

#### **2.2.3.4. Recency of the flight engineer’s Practical Exams**

Practical exams in in-flight duties were taken on such dates:

- a) 15.12.2008 – exam in the engineer’s daylight competence in respect of Tu-154M servicing, including special cases in the air. Signed: Instructor-Flight Engineer; Flight Leader;
- b) 30.12.2008 – exam in the engineer’s daylight competence in respect of Tu-154M servicing, including special in the air. Signed: Instructor-Flight Engineer; Flight Leader;
- c) 08.12.2009, – a check of the flight engineer’s competencies for Tu-154M, including special in the air. Signed: Squadron Leader.

All the duties under verification were rated –“Very good”.

On the day of crash, he **had flight engineer recency for Tu-154M aircraft**.

#### **2.2.4. Aircraft Navigator**

This pilot served in this Unit for over two years. He took First Officer transition training for Yak-40 on 12.03.2008. On 23.07.2008, he took two check rides according to exercise 260 PSzLT-73 which was the last exercise in the training stage in DIMC. These flights departed from POWIDZ airfield, the cockpit was blinded and the weather was very good. In the Pilot’s Logbook, in the SYSTEM NAME box the only annotation says „ILS”, which is inconsistent with the contents of exercise PSzLT-73. In part 6 of the Pilot’s Logbook are other names of systems which were to be subject matter of the exam. Although the names of systems were inconsistent with the exercise, they were accepted by the examiner. **After performing the**

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**flights under ILS, the pilot got a recency for flights under NDB, PAR (RSL) and ILS landing systems.**

On 23.12.2008, at WROCLAW airport two practical tests were carried out according to ex.270, closing down NIMC training on Yak-40. According to the pilot's personal documentation as well as the Squadron's evidence, the flights were performed in such atmospheric conditions: overall cloud cover 5/8, cloud base 300 m and visibility 3 km.

In reality, the atmospheric conditions on that day at that airport (at takeoff and landing at 18:42 and 18:52, respectively, and at 18:52 and 19:00 LMT) were very good, viz. visibility was over 10 km in a clear sky. In part 5 of the Pilot's Logbook, there are no entries as to possible execution of the above named flights with the windshield blinded. These flights, like the check rides in DIMC, were performed under the ILS system.

Also in this case, the pilot got a rating for landing under various systems though the check ride was conducted according to ILS.

After completion of the training, the pilot executed flights on Yak-40 as First Officer.

#### **2.2.4.1. Aircraft Navigator training on Tu-154M**

Because this pilot was designated as Aircraft Navigator, the 36 Regiment Cdr. Order of the Day of 31.03.2009 read:

*„W związku z rozpoczęciem szkolenia w charakterze nawigatora (stopień, imię i nazwisko) na samolocie Tu-154M, polecam przeprowadzić naziemne przygotowanie do lotów i zakończyć je egzaminami zgodnie z § 15 pkt 13 RL 2006.”*: Following commencement of training by Mr. (rank, full name) for a navigator rating on Tu-154, I command to conduct ground preparation for flights and top it up with the tests according to § 15 item 13 RL 2006. In the process of preparation, give special attention to proper handling of aircraft equipment, use of the cockpit and its fixtures, also, whether his execution of pilot duties in extraordinary cases is masterly. I make the officers named in the Organizational Order responsible for tutoring individual subjects and signs-off. I designate Mr. (rank, full name) as leading instructor. The preparations will be supervised by Second Commander of Unit 2139.

The next element of this process, which testifies the pilot's readiness for air training, is an entry in part 7 of the Pilot's Logbook.

On 3.10.2009, the pilot began training, commencing a test flight (to check aircraft's airworthiness before a HEAD coded flight), **and soon after he performed two flights as a full-fledged navigator.**

|            |        |   |                  |         |   |   |    |      |      |
|------------|--------|---|------------------|---------|---|---|----|------|------|
| 03.10.2009 | TU-154 | N | OBLOT KOMISYONNY | 3 32 10 | 1 | 0 | 30 | 0,10 | 0,20 |
| 03.10.2009 | TU-154 | N | OKECIE BERLIN    | 3 32 10 | 1 | 1 | 13 | 0,20 | 0,53 |
| 03.10.2009 | TU-154 | N | BERLIN GDANSK    | 4 32 10 |   |   |    |      |      |
| 04.10.2009 | TU-154 | N | GDANSK OKECIE    | 2CH-10  |   |   |    |      |      |

A copy of a page from part 5 of the Pilot's Logbook.

Part 4 of the Pilot's Logbook „*Osobisty dziennik lotów*” as well as the Regiment's documentation (Orders of the Day) lack confirmation of the pilot's ratings. Likewise, they lack proof that he was rated for HEAD coded flights.

Regulations were violated in the aspect of training for aircraft navigator rating as well as criteria of designating airmen for HEAD coded flights. **Although however, the Order of the Day of 14.01.2010 carries an item sanctioning the pilot's ratings which, in reality, were never awarded:**

**I confirm** that Mr. (rank, full name) has a navigator rating for Tu-154M. Concurrently, I give my consent to his navigating Tu-154M aircraft with **VIP's on board**).

Because the Regiment's documentation and the pilot's Pilot/Navigator Logbook are short of an entry that he passed the check ride (oral exam and a flight test) on Tu-154M, it is evident that **under RL-2006 § 13 item 6, on 10.04.2010 the pilot had no recencies to navigate the Tu-154M aircraft.**

#### **2.2.4.2. Currency of the pilot's training, ratings and proficiency in piloting**

Performing as Pilot, the Navigator had all piloting and navigational proficiency checks valid for Yak-40. He practiced one-engine inoperative flights with simulated landing operations, not infringing the intervals (set up in PSzLT-73). He regularly practiced descent for landing under NDB and also under ILS.

As it appears from the Pilot's Logbook, he did his last flights in radio-locator RSL system on 28.05.2008.

**The navigator had not his navigational skills checked on Tu-154M aircraft.**

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### 2.2.5. Summary of competence of the crew of Tu-154M flight on 10.04.2010.

Aircraft Commander, Co-pilot, and Navigator were trained hastily, not methodically, careless about documenting the process.

Although awarded formal ratings, confirmed in Unit Cdr. Orders, the flight crew did not comply with criteria of **properly trained and prepared for flight duties**. The flight crew had little experience in flying this aircraft in difficult atmospheric conditions and with the use not precise landing systems, like RSL, 2 x NDB or USL + RSL. During training periods they did most flights in very good atmospheric conditions and with the use of ILS which fact, in the Committee's opinion, had some impact on their knowledge of building elements of approach with the use of non-precision systems. The flight engineer had little experience in regular duties on Tu-154M aircraft.

The Committee has also stated that the speedy plan to train a group of pilots and transport aircraft commanders for transition for airlines: „*Plan przyspieszonego szkolenia grupy pilotów /dowódców załóg/ lotnictwa transportowego na samolotach pasażerskich*” skipped some exercises that are contained in methodological guidelines PSzLT-73 in respect of stages of aerial practice:

- ex.40 (day) and ex.155 (night) – a check ride in a blinded cockpit, and landing from a glide path under ILS and a radio-locator RSL systems: „*lot egzaminacyjny w zasłoniętej kabinie z zejściem i obliczeniem do lądowania wg systemów kursowo-ślizgowego ILS i RSL...*”;
- ex.60 (day) and ex.170 (night) – cross-country flight tests **conditioning** pilot rating for mission flights in DVMS and NVMC (as per methodological guidelines incorporated in the contents of these exercises): „*loty egzaminacyjne po trasie*”, **warunkujące** uzyskanie przez pilota uprawnień do wykonywania lotów operacyjno-usługowych w DVMC oraz NVMC (zgodnie ze wskazówkami metodycznymi do szkolenia zawartymi w treści tych ćwiczeń).

According to the training plan (on Yak-40 and Tu-154M), implemented in the Unit, it was habitual to conduct flights according to Standards 100 (DIMC) and 203 (NIMC) under ILS, but, ratings were awarded for flights under RSL, USL and PAR. The RSL and PAR systems are separate landing systems, whose landing approach procedures are different from those of ILS.

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Doing two different exam exercises in a single flight was contrary to the PSzLT-73 standard, which allowed for joining exercises, however, only in training flights and not in **check rides**.

Analysing the Squadron's files the Committee surmised that entries of atmospheric conditions in which training flights were conducted were made so that they might fit training needs, and did not reflect real conditions. Example: 24.06.2008, BYDGOSZCZ (EPBY) and WARSZAWA-OKECIE (EPWA) airports. For the course of conducting training flights and, afterwards, during check rides, (the pilot under test was First Officer on the fatal flight), the atmospheric conditions entry reads: cloud cover 8/8, ceiling 300 m, visibility 3 km (**8/300 m/3 km**), whereas another crew was training from WARSZAWA airport in very good atmospheric conditions, i.e. cloudless, visibility 10 km (**no clouds/10**).

The annotation of atmospheric conditions in individual Logbooks, that were inadequate from the point of view of recommendations in individual exercises of the PSzLT-73 standard, might stem from implementation of a new RL-2006. The first version of that document was absolutely contrary to directives for particular exercises of the programme of training in DIMC and NIMC:

- 1) § 23 item 15 in the 1<sup>st</sup> edition of RL-2006 (in force during the period under analysis) had a stipulation: *„W procesie szkolenia lotniczego określonego przez program szkolenia lotniczego podczas uzyskiwania dopuszczeń do kolejnych, niższych WM pilota zezwala się realizować to szkolenie w pozorowanych warunkach braku widoczności, w sposób określony w § 14, ust. 10”.* (In the process of air training aimed at earning more restrictive weather minima, stipulated in an air training programme, it is allowed to conduct such training in simulated poor visibility conditions, in a manner determined in Para 14 item 10.).
- 2) § 14 item 10 states that when extending validity of ratings for simulated poor visibility, the change to visual approaching must be done at a height or distance, which are the pilot's minima. Decisive is the value which allows changing to visual when closer to runway threshold: *„Przy przedłużaniu ważności dopuszczeń w pozorowanych warunkach braku widoczności przejście do lotu z widocznością podczas podejścia do lądowania musi nastąpić na wysokości lub w odległości odpowiadającej warunkom minimalnym pilota. Wybiera się przy tym parametr, przy którym przejście do warunków lotu z widocznością nastąpi bliżej progu drogi startowej”.* These provisions, contained in

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RL-2006 „(...) which is the staple codifying document for Polish military aviation led to a situation in which the 36 Regiment prepared „Provisions related to rules of practicing IFR in IMC or with blinded cockpit. Under these documents and contrary to good practice’, the training process was continued practically without paying attention to the atmospheric conditions which PSzLT-73 recommended for particular stages of air training. The Committee has found that the word „**zezwala**” (**permits**), which comes in § 23 item 15 RL-2006 was taken to mean „**nakazuje**” (**commands**) in the 36 Regiment and used in the latter meaning with reference to training (flight simulators were not used).

In 2008, three pilots with PIC rating for Tu-154M left the service (**including two instructors**), which situation imposed „speedy training” of replacements. Another factor which might influence such conduct was direct supervision of such training by Air Force Commander<sup>75</sup>. Presumably, such non-standard rate of training and acceptance of arbitrary entries of atmospheric conditions was justified as a higher imperative’.

Endorsements of ratings in Pilot Logbooks were not uniform or verifiable. As of 18.09.2008, a by-law was put in force: *„Zasady dokumentowania oraz wzory wpisów dotyczących nabywanych uprawnień i dopuszczeń w Jednostce Wojskowej 2139 (zgodnie z RL-2006)”*: Rules of keeping documentation and specimens of signatures applicable to unification of endorsements of ratings in Logbooks *„Osobisty dziennik lotów”*, earned in Military Unit 2139 according to RL-2006. Unfortunately, the very form contained inconsistencies. Example: a possibility to award ratings for flights with the use of PAR or VOR-DME although the training programme did not include any feasible exercise, standard at many airports, hence, no grounds for awarding such ratings.

#### **2.2.6. Assessment of Tu-154M training methods at the 36 Regiment**

An analysis of Tu-154M crew skills show that training on this aircraft type was conducted incorrectly: sequence of exercises was not observed, training was not rhythmical, certain elements of training were skipped, recencies were overdue.

The conduct of training ran along the outdated PSzLT-73 standard, which:

- 1) did not match contemporary procedures and airport facilities;
- 2) did not include refreshment and flight simulation recommendations;

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<sup>75</sup> Training replacements for service leaving pilots and a possibility of doing tasks with the use of Tu-154M aircraft also remained in direct interest of the Minister of National Defence.

- 3) did not include any exercises in TAWS and TCAS which, combined with non existence of flight simulation might create loopholes in training with the use of such systems (especially complacency regarding warning signals);
- 4) did not contain any recommendations regarding training in crew co-operation (CRM).

The Tu-154M aircraft was equipped with facilities whose proper operations called for a new model of training and practicing, and their understanding and use were decisive about safety of that aircraft's operation. Without systemic solutions regarding the use of the set of altimeters, the autopilot, TAWS, TCAS, FMS, flying in reduced vertical separation minimum (RVSM) and abiding noise abatement procedures, the level of familiarization with these aids was uneven in flight personnel. In combination with ineffective supervision of aerial training it constituted threat to the safety of air operations.

The PSzLT-73 standard did not require a cyclic, recurrent training in a flight simulator or with the use of other training devices, thereby it seems indispensable to compile a training programme, adequate for contemporary requirements of safe transportation of passengers, and for the level of crew airmanship (taking into account co-operation in multi person crews) as well as maintaining requirements on which ratings are awarded.

Failure to perform training flights and check rides, and the outdated PSzLT-73 standard affected Tu-154M crews' airmanship and allowed for obtaining ratings incompatible with RL-2006.

### **2.3. Competencies of aeronautical engineering personnel of the 36 Regiment**

Having analysed documents which regulate activities of the engineering staff in terms of coherence and update of their provisions the Committee has found that:

- 1) the instructions for the engineering personnel in the Aviation of the Polish Armed Forces (*„Instrukcja służby inżynieryjno-lotniczej lotnictwa Sił Zbrojnych Rzeczypospolitej Polskiej. Part I”*) – published in 1991, has not been updated since 2000. The Instruction does not reflect the changes implemented in the Polish Air Force's structures and in technological staff training, which brought about substantial incoherence of the Instruction with the overriding documents RL-2006 and IOL-2008;
- 2) the rules of training ground support personnel in the Air Force and authorising engineering specialists to work on aviation equipment: (*„Zasady szkolenia personelu technicznego w jednostkach lotniczych oraz dopuszczania specjalistów służby*



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*inżynieryjno-lotniczej do pracy na sprzęcie lotniczym*”), ref.no. Lot. 1779/77 – issued in 1977, have not been updated, either, notwithstanding implementation of a number of changes in the aviation of the Polish Armed Forces, in aerial training and in many normative documents;

- 3) the rules of training and verifying flight engineers as well as assigning ground engineering personnel to crew complement: (*„Zasady szkolenia i kontroli technicznego personelu latającego oraz dopuszczenia specjalistów służby inżynieryjno-lotniczej do wykonywania lotów w składzie załogi na statkach powietrznych*”), publication of the Air Force Command, Poznań 1979 – notwithstanding the many changes in the aviation of the Polish Armed Forces since publication of the document, have not been modified; they are outdated in quite a degree and in many places they are in contradiction with more recent normative documents.

The training process of engineering personnel (SIL) for them to obtain ratings for one person maintenance of Tu-154M aircraft in the 36 Regiment:

- was triggered for a specific soldier with an Order of the Day of Unit 2139 Cdr. who referred to the instruction: (*„Zasady szkolenia personelu technicznego w jednostkach lotniczych oraz dopuszczania specjalistów służby inżynieryjno-lotniczej do pracy na sprzęcie lotniczym*”, ref.no.Lot. 1779/77 on training engineering personnel in military units and permitting them to work on aircraft and ancillary equipment);
- was conducted according to the programme of training engineering personnel (SIL) in fuselage, avionics, and radio electronic specializations on Tu-154M: (*„Program przeszkolenia technicznego personelu SIL w specjalności płatowiec i silnik, osprzęt, URE na samolot Tu-154M*”), Warszawa 2004, compiled by the Chief of Aircraft Technology in the 36 Regiment and approved by Deputy Chief of Logistics of WLOP;
- was documented in the programme *„Program (Dokumentacji) szkolenia personelu technicznego na samolot Tu-154M w specjalności – »nazwa specjalności«*”) dedicated to documenting Tu-154M ground support personnel training in the specialisation {to fill in}
- was crowned with exams, marks being tapped in into the *„Program (Dokumentacji)...”*, and an award mentioned in an Order of the Day of Unit 2139 Cdr. of respective specialization ratings for one-person maintenance of Tu-154M aircraft.

The 36 Regiment did not employ professional instructors for training in aircraft maintenance. Responsibility for such training was vested in the engineering managing staff who did not consider personnel training a priority, rather it was supervising aircraft

preparation for flights, line maintenance, periodical and extraordinary, and analyzing failures of aerial equipment.

Before the first Tu-154M was commissioned (in 1990), the training process had been conducted properly. All the engineering personnel received training at the manufacturer accepted training centre in Uljanowsk according to standing programmes for each specialization. The engineering personnel knew Russian well enough to make use of original maintenance manuals. However, knowledge of Russian was never verified. Experienced engineering personnel passed their knowledge to their subordinates, ergo, played the role of instructors and examiners (albeit without such ratings). The training base of the 36 Regiment had teaching aids in the form of detailed schematics of all aircraft systems and installations. Such situation continued to the end of the nineties.

Exchange of generations resulted in the necessity to train new personnel who did not know the Russian language. Restructuring in the late nineties and continuing do this day in the Air Force drastically cut finances indispensable for proper functioning of the 36 Regiment. Initiatives of the 36 Regiment Command, aimed at improvement of aircraft operational safety level (forms of training, translating operations and maintenance manuals into Polish, verification of maintenance certification process in line with civilian regulations JAR 145 {Joint Airworthiness Regulations}) did not find acceptance of the Air Force Command and the Ministry of National Defence.

In order to verify competencies of Tu-154M mechanics, the Committee reviewed thoroughly their documentation (one set in each job specialisation) and has found that:

- Part of the training programme „*Program przeszkolenia...*”, for a given specialisation was conducted contrary to its scope (subject matters, time devoted to theory and practice, use of teaching aids);
- „*Program przeszkolenia...*” has never been updated so as to match it with its substance related to the needs arising from operational practice, changing configuration, or the status of aircraft after modernisation;
- „*Program przeszkolenia...*” does not fulfill some requirements specified in „*Zasady szkolenia personelu technicznego w jednostkach lotniczych...*” (Rules of training maintenance personnel at their Air Force Units...) , e.g. an imperative to devote 168 hours to practical training at one own Unit;
- both „*Zasady szkolenia...*” and „*Program przeszkolenia...*” command that, for groups consisting of fewer than seven coursees, self-teaching is the only and fundamental method

of training maintenance personnel, i.e. a trainee or a self-trainer should use scientific aids published in Russian (aircraft operations manuals, albums of electrical schematics, technical descriptions and instructions of use of devices and assemblies).

The documentation has not been translated into Polish though the 36 Regiment asked their superiors (technical sub-commission was shown respective cables) many times to have it translated. There were not any courses of Russian held or knowledge of the language checked in technical personnel though superiors knew of such shortcomings. So, –self-teaching”, without sufficient knowledge of the Russian language, did not guarantee any proper level of competencies of technical personnel (SIL);

- On 26.06.2009, the Chief of Logistics of Unit 2139 sent the Director of Supplies Dept. of Military Forces a letter, no.1581/09/FAX on the subject of purchasing a set of operational and technical documentation of the Tu-154M no. 90A837 (101), explaining that purchasing this documentation would enable proper use of the aircraft, quote: *–Zakup dokumentacji technicznej umożliwi właściwe użytkowanie i eksploataowanie samolotu. Należy rozważyć po zakupie dokumentacji konieczność tłumaczenia na język polski, ponieważ personel lotniczy i techniczny w niewystarczającym stopniu zna język rosyjski i wpłynie to w bardzo dużym stopniu na bezpieczeństwo wykonywania lotów i obsług”*. (Following the purchase it is worth considering **translating the documentation into Polish because maintenance personnel do not know Russian well enough and safety of flights and maintenance are at stake.**) Copies of the letter were sent to:
  - Military Forces Aeronautical Technologies Support Inspectorate Chief;
  - Military Forces Air Force Aeronautical Technologies Chief.

Until the day of crash, the translation motion was not materialised.

On the basis of an analysis of training maintenance personnel (SIL) and aware of possibilities of the 36 Regiment in this aspect, the Committee states that it was **not possible** to ensure any proper standard of training engineering personnel in the 36 Regiment.

## **2.4. An analysis of the 36 Regiment’s operations**

### **2.4.1. An analysis of takeoff times, flight-time and crew rest periods at the 36 Regiment**

Seen from the aspect of safety of air transportation of passengers it is especially important, let alone crew skills, training and rating currency, not to exceed flight duty time. It is especially true about HEAD coded flights.

This aspect in the aviation of the Polish Armed Forces is described in detail in RL-2006 § 17 „Czas startowy, nalot, odpoczynek” (Takeoff time, flight-time, rest periods).

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- 1. Flight personnel's duty period runs individually from commencement of direct preparation for a flight to finishing last regular duties after a last flight.**
  - 2. The maximum duty period of flight personnel is 12 hours, subject to clauses 5, 6, 10, 12 and 14.**
  3. Subject to clauses 5, 6 and 14, within takeoff times, the maximum duty period of flight personnel is:
    - 1) 10 hours – in multi person crews of aircraft equipped with an autopilot,**
  - 5. In justified cases, it is allowed to extend duty period and maximum flight-time by 20%. The decision is with commanders of branches of Forces related to the flight personnel subordinated to them.**
  6. It is allowed for the flight crew to extend their duty time and maximum flight-time by 10% due to atmospheric conditions existing in the flight or due to air traffic.
  7. In the case of flight personnel, the break (rest period) between consecutive duty periods should be not shorter than 8 hours.
  10. It is allowed to knock off from duty period breaks between flight-times, provided they are for resting.
  11. Rest periods should be understood as the time enabling uninterrupted sleep in domestic or hotel conditions and, when aboard a vessel, in a separate cabin.
  14. In multi person crews, in long-haul flights, when the crew is augmented with another crew complement, the duty period may be extended to 18 hours, and the uninterrupted flight-time may be 15 hours. In such a situation crew swapping is allowed in the air, and PIC assigns flight-times in pilot's seat to both crews (Navigator, Flight Engineer) according to their ratings, except takeoff and landing operations which PIC performs himself. Each member of augmented crew enters total flight-time into one's Logbook.

In line with the information received from the 36 Regiment, letter no. 132/11 of 2.02.2011, for the purpose of an analysis aimed at determining duty periods, the Committee assumed for flights originating abroad that duty period began 2 hours before taxiing, and 1 and a half hours for domestic take-offs. In every case, duty period finished 10 minutes after engine shutdown.

Based on airmen's Logbooks and the evidence in the Squadron, the Committee has analysed the cases where time of take-off, flight-time and rest periods of pilots and crews were abused. Time in the tables is the local time of Warszawa.

Cases of infringement of take-off time, flight-time and rest periods are shown for each crewmember of the Tu-154M on a sortie on 10.04.2010.

#### 2.4.1.1. Commander of the Tu-154M aircraft

On 7.06.2006, the pilot was a crew member, as First Officer and Navigator.

| Flight date | aircraft type | Crew (position) | Taxiing (pushback) | Takeoff | Landing | Engine shutdown | Total | Route               |
|-------------|---------------|-----------------|--------------------|---------|---------|-----------------|-------|---------------------|
| 07.06.06    | Tu-154        | F/O             | 01:55              | 02:10   | 07:10   | 07:20           | 05,25 | Djakarta - Calcuta  |
| 07.06.06    | Tu-154        | Deadhead        | 08:05              | 08:20   | 13:40   | 13:50           | 05,45 | Calcuta - Baku      |
| 07.06.06    | Tu-154        | Navigator       | 14:39              | 14:49   | 19:35   | 19:45           | 05,06 | Baku - Brussels     |
| 07.06.06    | Tu-154        | F/O             | 21:00              | 21:10   | 22:50   | 23:00           | 02,00 | Brussels – (Okęcie) |

Tab. 1. Data compiled on the basis of flights evidence in the 36 Regiment

The pilot did his duties during three legs, with a roughly seven-hour break in the second leg. In the case the takeoff was from a foreign airport, duty period began at 23:55 and ended at 23:10.

Accordingly, the duty period was **23 hours 15 minutes**, total flight-time was **18 hours 21 minutes**, and the pilot's flight-time was **12 hours 36 minutes**.

**The maximum duty period was extended by 11 hours 15 minutes, and the maximum flight-time - by 2 hours 36 minutes.**

These flights were performed by the crew made up of one **PIC**, two First Officers (interchangeably doing also as Navigator), one Navigator and two Flight Engineers, so it was **one-crew flights**. **In these flights all limitations (specified in RL-2006) were abused what concerns duty periods, flight-time and rest periods.**

On 18-19.07.2006, the pilot performed four flights with the total **flight-time of 11 hours 4 minutes**, where **duty period was 16 hours 46 minutes**. Also, in this case the aforesaid limitations were infringed.

**The maximum duty period was extended by 4 hours 46 minutes, and the max. flight-time - by 2 hours 36 minutes.**

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TO time | Landing time | Engine shutdown | Total | Route            |
|----------------|---------------|-----------------|---------------|---------|--------------|-----------------|-------|------------------|
| 18.07.06       | Tu-154        | F/O             | 09:26         | 09:36   | 11:21        | 11:31           | 02,05 | Okęcie - Warna   |
| 18.07.06       | Tu-154        | F/O             | 11:55         | 12:05   | 13:50        | 14:00           | 02,05 | Warna - Okęcie   |
| 18.07.06       | Tu-154        | F/O             | 15:03         | 15:13   | 18:25        | 18:35           | 03,32 | Okęcie - Latakia |
| 19.07.06       | Tu-154        | F/O             | 21:20         | 21:30   | 00:32        | 00:42           | 03,22 | Latakia - Okęcie |

Tab. 2. Data compiled on the basis of flights evidence in the 36 Regiment

During 19-21.04.2007 the pilot did such flights:

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TO time | Landing time | Engine shutdown | Total | Route            |
|----------------|---------------|-----------------|---------------|---------|--------------|-----------------|-------|------------------|
| 19.04.07       | Tu-154        | F/O             | 08:08         | 08:18   | 13:35        | 13:45           | 05,37 | Okęcie - Kabul   |
| 19.04.07       | Tu-154        | F/O             | 16:05         | 16:20   | 21:54        | 22:04           | 05,59 | Kabul - Okęcie   |
| 20.04.07       | Tu-154        | F/O             | <b>09:26</b>  | 09:36   | 13:09        | <b>13:19</b>    | 03,53 | Okęcie - Lizbona |
| 20.04.07       | Tu-154        | F/O             | <b>18:50</b>  | 19:00   | 22:23        | 22:33           | 03,43 | Lizbona - Okęcie |
| 20.04.07       | Tu-154        | F/O             | 23:14         | 23:24   | 00:03        | 00:13           | 00,59 | Okęcie - Gdańsk  |
| 21.04.07       | Tu-154        | F/O             | 00:18         | 00:28   | 01:00        | <b>01:10</b>    | 00,52 | Gdańsk - Okęcie  |
| 21.04.07       | Tu-154        | F/O             | <b>08:50</b>  | 09:00   | 10:30        | 10:40           | 01,50 | Okęcie - Warna   |
| 21.04.07       | Tu-154        | F/O             | 10:55         | 11:05   | 12:50        | 13:00           | 02,05 | Warna - Okęcie   |

Tab. 3. Data compiled on the basis of flights evidence in the 36 Regiment

The tables give rise to the following conclusions:

- On 19.04., the crew exceeded both the duty period, working 15 hours 36 minutes and the max. flight-time, working 11 hours and 36 minutes;
- the rest period between the end of flight duties on 19.04. and the beginning of direct preparation for flights on 20.04. could not provide the minimum eight hours of rest;
- on 20.04., the pilot began pilot duties probably not quite rested, and in the air the crew did not have possibilities to rest properly, either, (the stopover in Lisbon too short). The crew exceeded the, 17'21" duty period by 5 hours 26 minutes, doing on that day two flights with most important persons in the State;
- on 21.04., the crew began their duty period as early as at 7:20, and taking into account the time of finishing previous duties, i.e. 01:20 (that same day), things related to debriefing, getting home, etc., the real rest time could not be longer than 4-5 hours.

The above conclusions show that the crews worked without a proper rest what, in the Committee's opinion, was intolerable. At the same time, the other crew was performing flights abroad on the other Tu-154M aircraft.

On 26.04.2007, the pilot performed a flight to Afganistan and again duty period and flight-time limits were abused.

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TO time | Landing time | Engine shutdown | Total | Route          |
|----------------|---------------|-----------------|---------------|---------|--------------|-----------------|-------|----------------|
| 26.04.07       | Tu-154        | F/O             | 05:40         | 05:50   | 11:05        | 11:25           | 05,40 | Okęcie - Kabul |
| 26.04.07       | Tu-154        | F/O             | 13:50         | 14:00   | 19:21        | 19:31           | 05,41 | Kabul - Okęcie |

Tab. 4. Data compiled on the basis of flights evidence in the 36 Regiment

**The max. duty period was exceeded by 1' 31", and the max. flight-time by 1' 21".**

In the 2-3.06.2007 flights under this pilot's command, the crew did not have ample rest, either. The longest break between takeoff operations, which the crew could have, was the time between 01:15 (engine shutdown) and 09:00 (pushback) in BAKU, i.e. 7 hours and 45 minutes, not considering the time of aircraft preparation for night parking, transfer to hotel an back to A/P and aircraft preparation for a flight.

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TO time | Landing time | Engine shutdown | Total | Route         |
|----------------|---------------|-----------------|---------------|---------|--------------|-----------------|-------|---------------|
| 02.06.07       | Tu-154        | F/O             | 18:10         | 08:20   | 20:10        | 20:20           | 02,10 | Okęcie - Rome |
| 02.06.07       | Tu-154        | F/O             | 20:55         | 21:05   | 01:05        | <b>01:15</b>    | 04,20 | Rome - Baku   |
| 03.06.07       | Tu-154        | F/O             | <b>09:00</b>  | 09:10   | 10:10        | 10:20           | 01,20 | Baku - Erewań |
| 03.06.07       | Tu-154        | F/O             | 10:43         | 10:53   | 11:45        | 11:55           | 01,12 | Erewań - Baku |
| 03.06.07       | Tu-154        | F/O             | 12:29         | 12:39   | 16:45        | 16:55           | 04,26 | Baku - Rome   |
| 03.06.07       | Tu-154        | F/O             | 17:30         | 17:40   | 19:29        | 19:39           | 02,09 | Rome - Okęcie |

Tab. 5. Data compiled on the basis of flights evidence in the 36 Regiment

**The max. duty period was exceeded by 49 minutes.**

**29-30.10.2007**

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TO time | Landing time | Engine shutdown | Total | Route           |
|----------------|---------------|-----------------|---------------|---------|--------------|-----------------|-------|-----------------|
| 29.10.07       | Tu-154        | F/O             | 23:50         | 00:00   | 05:30        | 05:40           | 05,50 | Okęcie - Bagram |
| 30.10.07       | Tu-154        | F/O             | 10:54         | 11:04   | 16:38        | 16:48           | 05,41 | Bagram - Okęcie |

Tab. 6. Data compiled on the basis of flights evidence in the 36 Regiment

**Duty period: 18 hours 38 minutes, flight-time 11 hours 31 minutes.** The break between departures after engine shutdown time to engine start-up for another flight was **5'4"**.

**The max. duty period was exceeded by 6 hours 38 minutes, and max. flight-time by 1'31".**

**20.12.2007**

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TO time | Landing time | Engine shutdown | Total | Route             |
|----------------|---------------|-----------------|---------------|---------|--------------|-----------------|-------|-------------------|
| 20.12.07       | Tu-154        | F/O             | 02:28         | 02:38   | 06:10        | 06:20           | 03,52 | Okęcie - Bagdad   |
| 20.12.07       | Tu-154        | F/O             | 07:36         | 07:56   | 10:30        | 10:40           | 03,04 | Bagdad - Kandahar |
| 20.12.07       | Tu-154        | F/O             | 11:56         | 12:16   | 13:14        | 13:24           | 01,28 | Kandahar – Kabul  |

Tab. 7. Data compiled on the basis of flights evidence in the 36 Regiment

**The maximum duty period was exceeded by 36 minutes.**

**21.12.2007**

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TKOF time | Landing time | Engine shutdown | Total | Route           |
|----------------|---------------|-----------------|---------------|-----------|--------------|-----------------|-------|-----------------|
| 21.12.07       | Tu-154        | F/O             | 06:29         | 06:39     | 07:04        | 07:14           | 00,45 | Kabul - Bagram  |
| 21.12.07       | Tu-154        | F/O             | 12:28         | 12:38     | 18:38        | 18:48           | 06,20 | Bagram - Kraków |
| 21.12.07       | Tu-154        | F/O             | 19:10         | 19:20     | 19:50        | 20:00           | 00,50 | Kraków - Okęcie |

Tab. 8. Data compiled on the basis of flights evidence in the 36 Regiment

**Duty period: 15 hours 41 minutes.**

**The maximum duty period was exceeded by 3 hours 41 minutes.**

**20.04.2008**

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TKOF time | Landing time | Engine shutdown | Total | Route           |
|----------------|---------------|-----------------|---------------|-----------|--------------|-----------------|-------|-----------------|
| 20.04.08       | Tu-154        | F/O             | 06:00         | 06:10     | 06:30        | 06:40           | 00,40 | Kabul - Bagram  |
| 20.04.08       | Tu-154        | F/O             | 07:15         | 07:25     | 07:40        | 08:20           | 01,05 | Bagram - Kabul  |
| 20.04.08       | Tu-154        | F/O             | 13:50         | 14:20     | 19:54        | 20:04           | 06,14 | Kabul - Kraków  |
| 20.04.08       | Tu-154        | F/O             | 20:57         | 21:07     | 21:37        | 21:47           | 00,50 | Kraków - Okęcie |

Tab. 9. Data compiled on the basis of flights evidence in the 36 Regiment

**Duty period: 17 hours 57 minutes.** The break between departures, from engine shutdown to next startup for a next flight was **5 hours 30 minutes**.

**The maximum duty period was exceeded by 5 hours 57 minutes.**



### 11-12.08.2008

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TKOF time | Landing time | Engine shutdown | Total | Route               |
|----------------|---------------|-----------------|---------------|-----------|--------------|-----------------|-------|---------------------|
| 11.08.08       | Tu-154        | F/O             | <b>02:50</b>  | 03:00     | 06:12        | <b>06:22</b>    | 03,32 | Erewań - Okęcie     |
| 11.08.08       | Tu-154        | F/O             | <b>15:37</b>  | 15:47     | 18:37        | <b>18:47</b>    | 03,10 | Okęcie - Erewań     |
| 11.08.08       | Tu-154        | F/O             | <b>19:40</b>  | 19:50     | 23:00        | <b>23:10</b>    | 03,30 | Erewań - Okęcie     |
| 12.08.08       | Tu-154        | F/O             | 07:10         | 07:20     | 08:35        | 08:45           | 01,35 | Okęcie - Tllin      |
| 12.08.08       | Tu-154        | F/O             | 08:57         | 09:02     | 10:07        | 10:12           | 01,15 | Tallin - Okęcie     |
| 12.08.08       | Tu-154        | F/O             | 12:12         | 12:22     | 14:10        | 14:30           | 02,18 | Okęcie - Simferopol |
| 12.08.08       | Tu-154        | F/O             | 16:10         | 16:30     | 18:10        | 18:20           | 02,10 | Symferopol - Ganja  |

Tab. 10. Data compiled on the basis of flights evidence in the 36 Regiment

On 11.08., the crew began their direct preparation for a flight at 00:50 and finished flight duties around 06:32. It looks they worked nearly all the night. Yet, that same day, around 14:07 they began direct preparation for flights which finished late, at 23:20. The crew did not have ample **rest time**, provided by RL-2006.

The next day, i.e. on 12.08., the same crew began their direct preparation around 5:40. **This situation also shows that the crew did not have properly planned and secured rest periods. Besides, on 12.08. the crew performed four flights, too, and exceeded the duty period by 50 minutes.**

### 21.10.2008

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TKOF time | Landing time | Engine shutdown | Total | Route                  |
|----------------|---------------|-----------------|---------------|-----------|--------------|-----------------|-------|------------------------|
| 21.10.08       | Tu-154        | F/O             | 00:50         | 01:00     | 05:55        | 06:05           | 05,15 | Okęcie - Nowosybirsk   |
| 21.10.08       | Tu-154        | F/O             | 06:50         | 07:00     | 12:15        | 12:25           | 05,35 | Nowosybirsk - Szanghaj |

Tab. 11. Data compiled on the basis of flights evidence in the 36 Regiment

**Duty period: 13 hours 45 minutes, flight-time 10 hours 50 minutes.**

**The max. duty period was exceeded by 1 hour 45 minutes, and the max. flight-time - by 50 minutes.**

**25.10.2007**

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TO time | Landing time | Engine shutdown | Total | Route           |
|----------------|---------------|-----------------|---------------|---------|--------------|-----------------|-------|-----------------|
| 25.10.08       | Tu-154        | PIC             | 10:45         | 11:00   | 15:55        | 16:05           | 05,20 | Pekin - Astana  |
| 25.10.08       | Tu-154        | PIC             | 17:00         | 17:10   | 21:45        | 21:50           | 04,50 | Astana - Gdańsk |
| 25.10.08       | Tu-154        | PIC             | 22:10         | 22:15   | 22:50        | 22:55           | 00,45 | Gdańsk - Okęcie |

Tab. 12. Data compiled on the basis of flights evidence in the Squadron

**Duty period: 14 hours 20 minutes, flight-time 10 hours 55 minutes.**

**The max. duty period was exceeded by 2 hours 20 minutes, and the max. flight-time – by 55 minutes.**

**5-6.11.2008**

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TO time | Landing time | Engine shutdown | Total | Route            |
|----------------|---------------|-----------------|---------------|---------|--------------|-----------------|-------|------------------|
| 05.11.08       | Tu-154        | PIC             | 14:45         | 14:55   | 15:10        | 15:15           | 00,30 | Okęcie - Okęcie  |
| 05.11.08       | Tu-154        | PIC             | 19:35         | 19:45   | 21:00        | 21:10           | 01,35 | Okęcie - Lublana |
| 05.11.08       | Tu-154        | PIC             | 21:40         | 21:50   | 23:50        | 23:55           | 02,15 | Lublana - Algier |
| 06.11.08       | Tu-154        | PIC             | 00:50         | 01:00   | 03:40        | 03:45           | 02,55 | Algier - Okęcie  |

Tab. 13. Data compiled on the basis of flights evidence in the Squadron

**Duty period: 14 hours 40 minutes.**

**The max. duty period was exceeded by 2 hours 40 minutes.**

**24.11.2008**

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TO time | Landing time | Engine shutdown | Total | Route           |
|----------------|---------------|-----------------|---------------|---------|--------------|-----------------|-------|-----------------|
| 24.11.08       | Tu-154        | PIC             | 08:03         | 08:13   | 08:53        | 09:03           | 01,00 | Okęcie - Gdańsk |
| 24.11.08       | Tu-154        | PIC             | 09:50         | 10:00   | 12:00        | 12:10           | 02,20 | Gdańsk - Londyn |
| 24.11.08       | Tu-154        | PIC             | 17:38         | 17:48   | 19:38        | 19:48           | 02,10 | Londyn - Gdańsk |
| 24.11.08       | Tu-154        | PIC             | 19:52         | 20:02   | 20:42        | 20:52           | 01,00 | Gdańsk - Okęcie |

Tab. 14. Data compiled on the basis of flights evidence in the Squadron

**Duty period: 14 hours 29 minutes.**

**The max. duty period was exceeded by 2 hours 29 minutes.**

## 2.4.1.2. First Officer

### 12.08.2008

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TO time | Landing time | Engine shutdown | Total | Route               |
|----------------|---------------|-----------------|---------------|---------|--------------|-----------------|-------|---------------------|
| 12.08.08       | Tu-154        | Nav             | 07:10         | 07:20   | 08:35        | 08:45           | 01,35 | Okęcie - Tallin     |
| 12.08.08       | Tu-154        | Nav             | 08:57         | 09:02   | 10:07        | 10:12           | 01,15 | Tallin - Okęcie     |
| 12.08.08       | Tu-154        | Nav             | 12:12         | 12:22   | 14:10        | 14:30           | 02,18 | Okęcie - Simferopol |
| 12.08.08       | Tu-154        | Nav             | 16:10         | 16:30   | 18:10        | 18:20           | 02,10 | Symferopol - Ganja  |

Tab. 15. Data compiled on the basis of flights evidence in the Squadron

**On 12<sup>th</sup> August the pilot performed four flights, exceeding allowable duty period (12'55").**

**The maximum duty period was exceeded by 55 minutes.**

### 25.08.2008

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TO Time | Landing time | Engine shutdown | Total | Route           |
|----------------|---------------|-----------------|---------------|---------|--------------|-----------------|-------|-----------------|
| 25.08.08       | Tu-154        | Navigator       | 04:29         | 04:49   | 09:50        | 10:00           | 05,30 | Pekin – Astana  |
| 25.08.08       | Tu-154        | Navigator       | 10:50         | 11:00   | 15:31        | 15:41           | 04,51 | Astana – Okęcie |

Tab. 16. Data compiled on the basis of flights evidence in the Squadron

**Duty period: 13 hours 32 minutes, flight-time 10 hours 22 minutes.**

**The max. duty period was exceeded by 1 hour 32 minutes, and flight-time-by 22 minutes.**

### 28-29.08.2008

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TO time | Landing time | Engine shutdown | Total | Route           |
|----------------|---------------|-----------------|---------------|---------|--------------|-----------------|-------|-----------------|
| 28.08.08       | Tu-154        | Navigator       | 11:59         | 12:09   | 12:29        | 12:39           | 00,40 | Okęcie – Okęcie |
| 28.08.08       | Tu-154        | Navigator       | 14:28         | 14:38   | 15:23        | 15:28           | 01,00 | Okęcie – Wilno  |
| 28.08.08       | Tu-154        | Navigator       | 15:38         | 15:43   | 16:53        | 17:08           | 01,30 | Wilno – Tallin  |
| 28.08.08       | Tu-154        | Navigator       | 19:50         | 20:00   | 21:00        | 21:05           | 01,15 | Tallin – Wilno  |
| 28.08.08       | Tu-154        | Navigator       | 21:20         | 21:25   | 22:12        | 22:22           | 01,02 | Wilno – Okęcie  |
| 29.08.08       | Tu-154        | Navigator       | 01:20         | 01:30   | 06:10        | 06:20           | 05,00 | Okęcie – Astana |

Tab. 17. Data compiled on the basis of flights evidence in the Squadron

**Duty period: 20 hours 1 minute, flight-time 10 hours 27 minutes.**

**The max. duty period was exceeded by 8 hours 1 minute, and flight-time by 27 minutes.**

**6-7.12.2008**

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TO time | Landing time | Engine shutdown | Total | Route               |
|----------------|---------------|-----------------|---------------|---------|--------------|-----------------|-------|---------------------|
| 06.12.08       | Tu-154        | Navigator       | 09:14         | 09:24   | 13:04        | 13:14           | 04,00 | Seul – Ułan Bator   |
| 06.12.08       | Tu-154        | Navigator       | 13:50         | 14:00   | 18:05        | 18:15           | 04,25 | Ułan Bator – Astana |
| 07.12.08       | Tu-154        | Navigator       | 19:20         | 19:30   | 00:18        | 00:28           | 05,08 | Astana – Okęcie     |

Tab. 18. Data compiled on the basis of flights evidence in the Squadron

**Duty period: 17 hours 24 minutes, flight-time 13 hours 33 minutes.**

**The max. duty period was exceeded by 5 hours 24 minutes, the flight-time – by 3'33".**

**27.09.2009**

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TO time | Landing time | Engine shutdown | Total | Route           |
|----------------|---------------|-----------------|---------------|---------|--------------|-----------------|-------|-----------------|
| 27.09.09       | Tu-154        | Navigator       | 09:14         | 10:00   | 10:35        | 10:45           | 00,55 | Okęcie – Kraków |
| 27.09.09       | Tu-154        | Navigator       | 11:30         | 11:40   | 14:55        | 15:05           | 03,35 | Kraków – Kair   |
| 27.09.09       | Tu-154        | Navigator       | 16:30         | 16:45   | 21:10        | 21:20           | 04,50 | Kair – Kigali   |

Tab. 19. Data compiled on the basis of flights evidence in the Squadron

**Duty period: 13 hours 46 minutes.**

**The max. duty period was exceeded by 1 hour 46 minutes.**

**2.4.1.3. PIC, F/O, Flight Engineer, and Navigator (flights performed in the same composition as on 10.04.2010)**

**23-24.01.2010**

| Date of flight | aircraft type | Crew (position) | Taxi pushback | TO time | Landing time | Engine shutdown | Total | Route                     |
|----------------|---------------|-----------------|---------------|---------|--------------|-----------------|-------|---------------------------|
| 23.01.10       | Tu-154        | crewmember      | 21:45         | 22:15   | 23:40        | 23:50           | 02,05 | San Juan – Port-Au-Prince |
| 24.01.10       | Tu-154        | crewmember      | 01:47         | 01:57   | 02:45        | 02:55           | 01,08 | Port-Au-Prince – La Roma  |
| 24.01.10       | Tu-154        | crewmember      | 05:10         | 05:40   | 10:05        | 10:15           | 05,05 | La Roma – Bangor          |

Tab. 20. Data compiled on the basis of flights evidence in the Squadron

**Duty period: 14 hours 40 minutes.**

**The max. duty period was exceeded by 2 hours 40 minutes.**

**2.4.1.4. Summary**

To the question in letter **nr 132/2011 of 2.02.2011**, to the 36 Regiment whether there were cases in the Unit, that duty periods and flight hours had been exceeded, according to § 17 item 5 RL-2006, the Commission got an answer that such cases were not known to the Command of the 36 Regiment.

To the question directed to the Air Force Command, the answering letter, nr 2747/11 of 16.02.2011 confirmed that the 36 Regiment submitted three pleas for extending duty periods and maximum flight-time:

- 1) departure from the USA on 23-25.09.2008. Owing to receiving acceptance of longer flight-time from Air Force Commander, the crew remained within standards of duty periods and maximum flight-time;
- 2) departure from Afghanistan on 8.04.2009. In this case, also, the crew exceeded working time standards. However, the crew received a break between departures, over ten hours for resting;
- 3) departure from Afghanistan on 7-9.01.2010. From the Squadron's file it comes out that the flight did not take place.

Summary of duty period transgressions, flight hours and periods of rest point out to incorrect conduct of analyses by the 36 Regiment and the Air Force Command (DSP) of possibilities to execute assigned tasks.

Non-existence of monitoring and reacting by the Command of the 36 Regiment to infringing duty periods, as well as to the abuse of flight hours and rest periods (while accepting all requests for transportation) and inefficiency of supervision by Air Force Command (DSP) in this aspect, points out to ignoring the problem of crew fatigue, meaning conscious violation of the rules contained in RL-2006. **Such conduct had bearing on the safety of air operations performed by Tu-154M crews.**

#### **2.4.2. An analysis of execution of the CASA C-295M post-crash prophylactic recommendations at the 36 Regiment**

Within the prophylactic framework in the aftermath of the crash of CASA C-295M aircraft, a schedule of operations for Military Unit 2139 was prepared at the 36 Regiment: „*Harmonogram działań w Jednostce Wojskowej 2139 po katastrofie samolotu CASA C-295 zaistniałej w dniu 23.01.2008 r.*”, approved by the Unit 2139 Commander on **18.04.2008**, which comprised 18 staple undertakings. The Committee considers as most important:

- A plea for subsidies to finance in-depth training of transport aircraft flight personnel in matters of airline pilots, including:
  - CRM (Crew Resource Management);
  - MCC (Multi Crew Coordination);
- Approaching the Air Force Command (DSP) about updated Aircraft Flight Manuals for particular aircraft types, in Polish, wherein duties of flight crewmembers would be considered;
- Hold classes with flight personnel on:
  - Types of approach with their instruments, procedures of setting minimum decision height/altitude;
  - Rules of scanning instruments during final approach;
  - Architecture and rules of use of ground proximity warning systems;
  - Flight preparations – documents and rules;
  - Rules of use of altimeters;
- Checking and analysing adherence to:
  - Methodology, rhythm of air training, licencing and rating policy, checking habits of flight personnel;
- Supervising selection of crews for missions, assigning flight personnel adequately trained for anticipated atmospheric conditions and for specificity of a given task. Preparing an algorithm for crew planning;

- Designing a system of crew selection for sorties with due consideration of specificity and difficulties, and its implementation;
- Verification of the 36 Regiment flight personnel in terms of qualifications for mission flights;
- Participating in preparation of corrections to air training programmes in respect of Tu-154 and Yak-40 aircraft in application of newly introduced approach procedures with determined minimum atmospheric conditions.

In line with the 36 Regiment Cmd. Report no.2519/08/Fax of **14.10.2008**, to the Chief of Staff-Air Force Deputy Commander, **all enterprises of said schedule were executed on time**. Beside, owing to allotment of extra funds, the in-depth training of flight personnel materialised in the subject of MCC and in performing flights under IFR IR(A) and IR(H) rules.

In the course of the analysis of the schedule, the Committee noticed relatively short dates of particular enterprises. Taking into account high workload in the Unit caused by numerous transportation flights, it was not feasible to hold classes with the entire flight personnel without allotting extra dates, the more so that the Unit was not freed of any current tasks. Therefore one may surmise that not all flight personnel received such training, or it was conducted cursorily.

The findings of the Committee show that the prophylactic measures undertaken in the 36 Regiment in the aftermath of CASA crash were futile.

#### **2.4.3. An analysis and assessment of prophylactic enterprises related to flight safety**

In the structures of the 36 Regiment was a two-person section of flight safety, made up of a flight safety senior inspector and inspector. The former had also in his charge the objective assessments laboratory (OKL). According to the instruction of flight safety in aviation of the Polish Armed Forces: „*Instrukcją bezpieczeństwa lotów lotnictwa Sił Zbrojnych RP*” folio no. *WLOP 346/2004, part 2. „Zasady, organizacja i zakres działania służby bezpieczeństwa lotów” § 8, (Rules, organisation and scope of responsibilities of flight safety services)* among other responsibilities of the flight safety inspector in an Air Force unit is:

- item 3 uncovering and anticipating endangerments related to air transport tasks, assessment of risks and preparing prophylactic measures;

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- item 6 preparing prophylactic measures based on effects of air incidents and making motions and presenting them to Unit Commander;
  - item 7 analysing air transportation tasks in the aspect of their complexity and possibilities that threat may crop up in the course of executing tasks;
  - item 10 supervising execution of prophylactic recommendations related to flight safety;
  - item 16 Arrangement of investigations into air incidents.

From these tasks it appears that activities of the Section should be considered essential in the process of uncovering threats and carrying out effective prophylactic activity, which require creation of mechanisms and procedures enabling discovery of a biggest number of air incidents. For execution of such goals, engineering means (flight data recorders) as well as reports from flight crews, maintenance personnel and air traffic service should be used.

The Air Forces flight safety instruction The Republic of Poland Air Force Flight Safety Instruction „*Instrukcja bezpieczeństwa lotów lotnictwa Sił Zbrojnych RP*” does not point out to sources of information of air incidents. There are no procedures governing the analysis of flight data from flight recorders. The same with recommendations as to implementation of a system of reporting air incidents. The analysis of flights, based solely on flight recorders is not enough in a situation when not all aircraft of the Regiment have them on board. Identification of threats calls for activation of flight crews (and creation of a voluntary, confidential aviation safety reporting system), whose reporting of problems encountered during flight operations would contribute to finding irregularities and making improvements.

At the 36 Regiment, activities of the flight safety section were directed on uncovering excessive use of aircraft equipment. No analysis of flying standards was carried out mainly because senior air safety inspector, his deputy, Unit Cmdr., his deputy, and training chief did not fly Tu-154M, ergo, lacked knowledge of specificity of flying especially this aircraft type. The senior air safety inspector did not use the knowledge of other members of the Area Safety Team to analyze materials of the objective assessments laboratory (OKL), which meant that analysis of data from Tu-154M recorders was very cursory.

Just for illustration of improper analysis of OKL materials, very frequent activation of TAWS warnings (of a bad landing profile and a deviation off course after take-off) which was the reason why prophylactic recommendations, assessment of piloting skills and arrangement of in-depth knowledge courses were not formulated for training flights. On getting acquainted with „*Dziennik rejestracji danych z odczytu i analizy materiałów OKL Tu-154*” (the transcript



of the record) found that from 2008 to the day of crash there were 125 cases of TAWS warnings sounding, mostly during precision approaches at well equipped airports. When materials of OKL Laboratory were being analysed, causes of the TAWS warnings activation were not written down. Only in fewer than twenty cases, notes were written down that TAWS warnings had been activated on approach at airfields without radionavs (e.g. in Chad on 06.09.2008) or performing approach with ground visibility, ergo, without using the ILS system (landing in Gdańsk on 17.12.2008).

It may mean that **crews did not know the principle of operation of the TAWS system**. In consequence, crews developed a habit of **disregarding TAWS warnings**. The Committee found that only one case of TAWS warning of ground proximity was classified by the senior safety inspector as an air incident – two such signals sounded in climb and one when descending to Kabul airport on 20.04.2008.

Monitoring flights of Yak-40, which have only crash activated recorders, is practically impossible because they were disassembled only after flights with HEAD status, after commissary inspection flights, to analyse technical and piloting data. Such a situation, in the absence of necessity of reporting incidents by the crew affected discovery of infringements of flight standards of this type of aircraft.

There was no possibility to monitor Bell helicopter flights, either, as it did not have any flight recorder. Albeit, contrary to § 11 item 19 „*Instrukcja HEAD*”, this copter was used for flights with HEAD status. The finding of the Committee is that the senior air safety inspector repeatedly reported a necessity to install a flight data recorder on this copter, in vain.

In the Committee's opinion, it is necessary to install flight data recorders on the 36 Regiment's aircraft, where possible. Additionally, it is indispensable to launch the commonly used voluntary, confidential aviation safety reporting system (ASRS), whereby ground personnel, flight and cabin personnel may report one's own<sup>76</sup>, and colleagues' faults and infringements from standards. Launching such a system aims at proper, early identification of threats which contributes to raising safety standards of air operations, the caller remaining anonymous.

#### **2.4.4. Assessment of air training supervision**

Responsibility for theoretical and practical training in the 36 Regiment rested, by assignment of detailed duties, with these officers: chief of training, squadron leader, and the

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<sup>76</sup> None of normative docs in use with the Polish Air Force imposes implementation of such system.

leader of a group of airmen. In addition, the 36 Regiment Cmdr. called up a team for methodological and rhythmical conduct of pilot training.

In line with the scope of responsibilities, aerial training was in the hands of squadron leaders and the leader of a group of airmen, whereas the chief of training was responsible for theoretical training and execution of a pilot training plan.

The 36 Regiment Cmdr. called up a 9-person team<sup>77</sup> for supervision of methodological and rhythmical conduct of pilot training. The team, under Deputy Cmdr. of the Regiment comprised, among others: the chief of training, squadron leaders and the senior air safety inspector. On closing down each quarter year, the team was supposed to carry out an analysis of pilot training and present conclusions to the Unit Cmdr. The findings of the Committee are such that the team was in session irregularly. In 2009, there was only one meeting and the conclusions were laconic and did not bring much to modification of the training process. In 2010, to the day of crash, the team had not gathered.

In June 2009, a team of airmen was called up for Tu-154M in the 36 Regiment. The aim was a financial betterment for members of the team; it did not improve the processes of organisation, supervision or training of Tu-15M crews. The team's tasks were just a carbon copy of a squadron leader's tasks, which limited the squadron leader's responsibility<sup>78</sup> for supervision of air training on Tu-154M.

Specificity of the Unit's operations and its location (at the biggest civilian airport in Poland<sup>79</sup>) lay at the "fly-to-order" model of pilot training (without any schedule tables). Training flights were performed at airfields hired earlier where the instructing pilot was at the same time the flying control officer, and control and support of flights was vested in airfield services on duty. With such a model of conduct, the training tier gave up keeping a book for summing up results from the organisational and specialisation angles<sup>80</sup>. According to recommendations from the Unit Cmdr., it was decided that results of training would be discussed in cycles:

- month – on the regimental level and each time as need be;
- week – on the squadron level, and remarks will be placed in the file of current events).

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<sup>77</sup> Called in annually, in 2010 – according to a training order from Unit Cmdr., no.2, of 04.01.2010.

<sup>78</sup> The Commission found that training chiefs knew that Tu-154M pilots were not performing PTS check rides in a zone, contrary to RL-2006,) and navigators – their navigational handling of this a/c type. The excuse was that such had been the routine before they took positions of training chiefs.

<sup>79</sup> The administrator of EPWA airport does not allow for training flights.

<sup>80</sup> The requirement to keep such book was contained in IOL-2008 r., part 4. *Dokumentacja* § 34, Documentation of flight organisation and pilot training, item 1 p. 11.

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The directives<sup>81</sup> of the 36 Regiment Cmdr., dated 15.01.2008, on organisation of sorties, training and practicing at the 36 Regiment „*W sprawie organizacji lotów dyspozycyjnych, szkolnych i treningowych w 36 splt*”, part III. entitled: „*Podsumowanie organizacji lotów i szkolenia lotniczego*” (summing up flight and pilot training organization), in item 5 we read:

For summing up, prepare indispensable information and documentation from flights, in it:

- documentation of flights performed – a day tasks book and a flight log (responsibility of the chief of training);
- task assessment cards (responsibility of the tutoring pilot);
- OKL materials from the objective assessments laboratory (OKL) (responsibility of the senior air safety inspector (BL));
- observations and remarks of the flight personnel, and others, taking part in summing up, relating to the conduct of flights and their organisation;
- item 6. Conclusions from summing up, relating to the arrangement of flights and training, in the form of guidelines and directives; place them in the file of current events.

The Committee has found that materials of the objective assessments laboratory (OKL) were marginally used during summing up because the normative materials did not carry detailed guidelines, while the training tier did not implement any additional recommendations to make the matters more precise.

After modernisation operations on Tu-154M, the 36 Regiment did not put into the training programme any improvements which would cover newly installed assemblies. Because training and practicing flights on Tu-154M, supposed to unify newly installed assemblies, were not conducted, each flight adhered to standards worked out individually by crew members. This brought about mediocre knowledge of these assemblies in the air among flight personnel and non-existence of uniform procedures of their use. Such situation also made it difficult for the objective assessments laboratory (OKL) to assess transcripts of flight data recorders from the angle of identification of discrepancies from flight standards.

On the basis of an analysis of the processes of training and practising and of the method of conducting prophylactic action, it can be said that on the part of managerial staff of the Unit and supervisors of training on Tu-154M, inclusive of methods of training and upkeep of

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<sup>81</sup> The directives, prepared by the training tier and approved by Unit Cmdr. followed the rules contained in IOL-2008.

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piloting habits and verification of instructor ratings, their control was insufficient<sup>82</sup>. In the Committee's opinion, it was an aftermath of personnel shuffling in 2008 after many experiences pilots and instructors had left. The big number of orders for transportation, the prestige of flying Tu-154M with VIPs and the perks created a situation, where the squadron leaders were interested solely in clocking in flight time in foreign sorties, neglecting recurrent training. Besides, in the Unit one could feel pressure exerted by Air Forces Command<sup>83</sup> for expedient training of crews for Tu-154M, noticeably going beyond the documentary supervision over the Regiment. It was why Air Force Cmdr., personally, supervised training on this aircraft type, hence, persons actually responsible for the training process in the Regiment felt somewhat released from such responsibility.

Additional factors which hampered proper supervision of the training process at the 36 Regiment:

- due to work characteristics in the Unit (working shifts and most ground and air personnel on an „on call” duty), it was not possible to hold integrated training for flight and ground personnel;
- the structure of the Regiment was not adapted to parallel training of pilots and their flying missions. The same persons were instructors, pilots, and managing staff in squadrons. It became especially inconvenient since 2008 when experiences pilots and instructors had left;
- the Regiment had problems with manning key positions in the squadron due to shortage of candidates for consecutive, higher, command and specialist positions. They were mostly entrants from the officers' school in Dęblin, let alone short term aircraft type transition training or language courses. Piloting experience without education in management meant shortage of managerial skills;
- disbandment of the navigation section in the Unit brought about shortage of experienced navigators (mainly in the training tier) and ricocheted supervision of navigator training.

According to the findings of the Committee, the 36 Regiment appealed several times to superiors to change the training methods:

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<sup>82</sup> Example: Appointment of a PIC without an instructor's rating to tutor an F/O for a Tu-154M rating (PIC and F/O on Tu-154M on 10.04.2010). This mistake in training was luckily noticed by superiors and the tutelage was stopped.

<sup>83</sup> This assumption was confirmed by personal supervision of pilots' training rosters by Air Forces Cmdr.

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- a plea to the Air Force Command, concerning the Regiment Cmdr's training intention to send Tu-154M pilots for training in a flight simulator in 2009;
  - a plea to the Air Force Command in mid-2009 with a proposal of changes in pilot training;
  - a plea to the Szefa Oddziału Lotnictwa Transportowego Air Force Command Chief of Transport Section, in 2009, to create a mixed group of officers (regimental and the Command's) for preparation of a new programme to replace PszLT-73.

The pleas were left unanswered.

In the Committee's opinion, the above analysis and the analysis of Tu-154M crew's training show that supervision of pilot training at the 36 Regiment, to be realized by duly appointed sections inside the Regiment and in the Command, did not in fact exist. This led to ignoring methodological guidelines at each stage of training and it drastically lowered the standard of skills of these crews.

## 2.5. Supervision over the 36 Regiment

The period under scrutiny extends from 2004 to the day of crash. During this period four inspections were made for problems, also, there were routine inspections.

The inspection, made by the Ministry of National Defence Department of Inspections during 29.01.-18.02.2004 showed that the Unit, while fulfilling its core task – air transportation of VIP's and top governmental officials – is obliged to operate round the clock, which made day-to-day organization of work difficult. It called for a change of most training tasks from lecturing to self-education, provoked fictitious planning and execution of most enterprises as well as training events contrary to standing regulations<sup>84</sup>. The inspection also revealed irregularities at the stage of summarizing training results. One of **recommendations was that steps should be taken to enable the use of mockups and flight simulators of aircraft used**. It was also raised that the Headquarters of Air Forces and Aerial Protection of the Country (WLOP) allotted too little flight-time<sup>85</sup> for training and practising, which lay at

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<sup>84</sup> Imputation of lack of direct supervision over pilot training on the part of flight organizer (current verification of regimental staff officers) stemmed from the fact that the accepted model of pilot training was contradictory to standing. It consisted in practicing training flights at foreign airports, where an instructor-pilot was the organizer of flights and the flights were under the airports' ATC services. The then model of pilot training (the only feasible because the Unit operated from a civilian airport) was in force to the day of crash. In connection with introduction, in January 2008, a new normative document - IOL-2008, the then model of the 36 Regiment pilot training was not in contradiction with the rules described therein.

<sup>85</sup> Only 15 hours for a single pilot on all a/c types.

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the Regiment Commander's decision to **exploit some transportation flights for continual training and practicing flight elements** (except flights coded as „Ważny” {Important}).

During 21-25.03.2005, aircraft were checked for airworthiness, and ground equipment for serviceability, by the aeronautical laboratory LKSL. Main remarks referred to:

- Discrepancies in records of incidents as taken down by the air safety section and the engineering section (SIL);
- failure to prepare for pilots and the group of maintenance personnel (GOT) any schedule of in-depth training in piloting techniques, on the regimental level, which ended up in random selection of subjects and a not systematic conduct of classes;
- very low attendance (around 40%) in prophylactic classes, commanded in cable messages from higher superiors;
- failure to make checks of aircraft before and after annual checks;
- bad circulation of information about air incidents.

Biggest irregularities were found in the process of in-depth training of flight and maintenance personnel (SIL), causing a drop of level of knowledge and practice. The inspection rated high the solidity and credibility of the laboratory of objective assessments of the handling qualities of aircraft (OKL).

Subsequent two inspections in the line of flight safety matters were made by the Air Force Command Flight Safety Section,. The first of them was on 15-16.12.2005, the second was on 13-14.12.2007. Main post-inspection remarks referred to:

- failure to fulfill all post-inspection recommendations;
- arbitrary interpretation by the Incidents Investigation Committee of air incidents;
- wrong interpretation of the influence of failures on flight safety;
- ground training classes inconsistent with reality (subjects and dates entered OK, attendance blank);
- no remarks in the summary book about results of pilot training, and its bad keeping;
- out-of-date aircraft ops manuals and other documentation;
- no analysis of safety in a given quarter year;
- improper keeping and archive with materials from the Objective Assessment Section (OKL).

After the inspections there were no conclusions on pilot training in Tu-154M aircraft.

During 31.03.-04.04.2008, the Ministry of Defence Flight Safety Inspectorate in the made an inspection in respect of flight safety matters. One of the scrutinized matters was observing the methodological setting of flight personnel training at the stages of training and continual practising, sustaining habits, awarding ratings and their substantiality. Subjected to the inspection was the training on the M-28 helicopter. Shortcomings were uncovered in the working of the flight safety section in such subjects:

- compiling own prophylactics and its implementation;
- keeping records of safety related air incidents (cable messages, orders, regulations);
- execution of enterprises contained in annual work plans of Aerial Safety Team;
- punctuality of meetings of Aerial Safety Team, their agenda, prophylactic and inspection related activities of the members of the section;
- keeping records of air incidents;
- meteorology in support of flights.

Uncovered were also cases of not engaging in investigating air occurrences which should be classified as incidents and inexistence of a flow of information between SIL, OKL lab and the senior air safety inspector. An inspection from the Ministry of Defence Flight Safety Inspectorate did not find incidents where a pilot's failure to fly the airplane or handle its systems could be blamed. The Objective Assessment team (OKL) was rated high by the Committee for the use of their resources for assessment of pilot training and for conclusions and enterprises stemming from the analysis carried out by them. In final conclusions, the inspection team advised the Unit Cmdr., among other things, to approach superiors about changes in and update of the instructions in use as well as about a broader use of flight recorders for an analysis of pilot tasks.

Following a next, routine inspection of the use of aircraft and condition of assemblies, on 07-08.04.2008, the Szefostwo Techniki Lotniczej IWsp. SZ Chief of Aircraft Technologies and Armed Forces Support inspection recommended, among other things to:

- intensify the Tu-154M flight engineers' training so that not fewer than four engineers may reach the one-person level in flight duties;
- limit the number of flights of the Szefa Sekcji Techniki Lotniczej Chief of Aircraft Technologies Section to a minimum ascribed to his responsibilities;
- carry out classes with subordinate engineering personnel on the rules of keeping in-flight logs of aircraft: *–Zasady prowadzenia dokumentacji pokładowej statków powietrznych*".

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On 07.01.2009, the inspection from Szefostwa Wojsk Lotniczych DSP the Chief of Air Force Command, under the command of Szefa Wojsk Lotniczych – Zastępcy Szefa Szkolenia the Air Force Chief/Deputy Chief of Training was to inspect:

- pilot training documentation;
- individual documentation of the commanding staff of the 36 Regiment;
- individual, annual plans of knowledge received, training in the air and in Flight Simulation Training Device (FSTD).

In the book of inspections of the Unit, in the box for recommendations and remarks, the Chief of Air Forces wrote: „**Zalecenia i uwagi przekazano na bieżąco**”. (**Recommendations and remarks given currently**).

On 15.10.2009, the problem solving inspection in the safety of flying was carried out by the Chief of Flight Safety Section in the Air Forces Headquarters. The inspection's aims were:

- to inspect execution of prophylactic recommendations;
- to assess pilot training schedule, rosters, planning;
- to assess condition of documentation at the senior air safety inspector;
- to assess activities of the senior air safety inspector.

There were not any major shortcomings, the view being supported by an entry in the inspection register of the Unit, which runs: „**Drobne uwagi przekazano podczas omówienia wyników kontroli z kierowniczą kadrą pułku**” (**Minor remarks forwarded to the Commanding Staff of the Regiment**).

On 06.01.2010, the inspection within the framework of routine supervision was carried out by the Chiefs of Air Forces Command led by the Chief of Air Procedures Programming Command. Within the framework of supervision, the 2010 documentation of training events was inspected. **No major shortcomings were found**. The team leader made such entry in the log of inspections of the Unit: „**zalecenia i uwagi zostały zrealizowane na bieżąco**” (**Recommendations and remarks executed currently**).

The inspections, carried out in the Unit, give rise to such conclusions:

- 1) the inspections in the period under investigation did not have the Tu-154M type aircraft as its target;



- 2) in the course of the inspections, carried out within the framework of vested supervision, since 2009 till the day of crash, no major irregularities were discovered in air training and in registration of flights;
- 3) recurrent, similar prophylactic recommendations are evidential that implementation of prophylactics was on a low level (mostly in the training process and flight safety);
- 4) if right conclusions had been drawn from inspections carried out by the Ministry of Defence in 2004, operations of the Unit might improve in the years that followed. The inspection showed that specificity of tasks executed by this Unit calls for special supervision over pilot training;
- 5) in the period under analysis there were not any inspections carried out which would be dedicated to training pilots, arranging flights or awarding ratings for all aircraft types in the fleet of the 36 Regiment.

## **2.6. An analysis of arrangement of the flights on 7<sup>th</sup> and 10.04.2010 and their compliance with provisions of normative documents**

### **2.6.1. The regulations underlying fulfillment of orders for special air transportation**

On 10.04.2010, the fundamental document which set up rules of flights with the HEAD status was an instruction to this effect (Instruction of organization of HEAD-coded flights): „Instrukcja organizacji lotów statków powietrznych o statusie HEAD”, Warszawa 2009, WLOP 408/2009<sup>86</sup>, prepared in 2009 by the Ministry of Defence in consultation with the Chief of Presidential Office, the Chiefs of Parliamentary Offices of lower and higher chambers, the Chief of the Office of the Prime Minister and the Chief of Government Security Service.

The document was put in force in military aviation by the Minister's of National Defence decision no.184/MON of 09.06.2009, superseding the temporary instruction securing WAŻNY flights over the territory:OF THE Republic of Poland („Tymczasowa instrukcja zabezpieczenia i wykonywania lotów statków powietrznych oznaczonych symbolem WAŻNY nad terytorium RP (2004)” and the rules on securing and executing aircraft WAŻNY-coded flights in the territory of the [the then] People's Republic of Poland: („Przepisy zabezpieczenia i wykonywania lotów statków powietrznych oznaczonych symbolem WAŻNY nad terytorium PRL (1976))”.

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<sup>86</sup> Henceforth „Instrukcja HEAD”.

Provisions of „Instrukcja HEAD” was obligatory for aviation of the Polish Armed Forces personnel and all other persons using HEAD flights or having in their disposal aircraft with such status.

The aircraft has a HEAD status when on an official mission, carrying:

- 1) The President of the Republic of Poland;
- 2) The Chairman of the Council of Ministers;
- 3) The Speaker of Sejm (the lower chamber of the Polish Parliament);
- 4) The Speaker of Senat (the higher chamber of the Polish Parliament);
- 5) Persons, counterparts of those of items 1-4, reported through diplomatic channels.

According to the documents forwarded to the Committee and the statements from the Offices of the President, PM, Foreign Minister, Speakers, Air Forces HQ, and Gov. Security on the scope of preparations for Polish delegations' visits (on 07 and 10.04.2010), beside the „Instrukcja HEAD”, there were in force also the documents named in Part 1.17.3 of this Final Report.

The Committee did not receive any documents which would outdate the documents named in Part 1.17.3 items 4, 5 and 7. Formally, all the documents were in force, which fact created problems because of their contradictory provisions, the more so that persons from said Offices, eligible for special air transportation, often cited these documents, e.g. Prime Minister's Ordinance On Special Transport, no.2, of 20 January 1997 provided the possibility of such transport for Deputy Ministers and the Minister of National Defence, which consecutive documents did not. The mode and format of placing orders for special air transportation was in all the documents similar, although however, the agreement in respect of special military air transport: „*Porozumienie w sprawie wojskowego specjalnego transportu lotniczego*” of 15.12.2004 and the „Instrukcja HEAD” stipulated different forms of ordering air transportation. No other aspects of arrangement of HEAD flights are depicted in the documents named in items 1-7 part 1.17.3. In „Instrukcja HEAD”, in § 2, there is only such statement: „*Dysponent statku powietrznego realizuje swoje obowiązki zgodnie z postanowieniami RL-2006*” (Aircraft host fulfills his duties according to provisions of RL-2006).

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## **2.6.2. The process of placing orders for special transportation**

„Instrukcja HEAD” does not put any extra requirements on the eligible Offices to fulfill prior to flights. Authorised to make orders for HEAD flights are Chiefs (and persons of their appointment<sup>87</sup>) of the Offices of:

- The President of the Republic of Poland;
- Sejm (Lower chamber);
- Senat (Upper chamber);
- the Chairman of the Council of Ministers.

Orders are made in a written form, addressed to the Chief, Prime Minister’s Secretariat, called a Coordinator.

According to provisions of „Instrukcja HEAD”, on receiving an order, the Coordinator passes it to:

- The Air Force Cmdr., with copies to the Cmdr. of Unit which provides aircraft for HEAD flights;
- The Chief of governmental security service (BOR).

Any order for a HEAD flight should give:

- 1) type of aircraft;
- 2) airport, airfield, other points of origin and destination;
- 3) dates, time of departure and landing;
- 4) name of aircraft provider;
- 5) number of passengers;
- 6) number of pieces of luggage and kind of cargo.

Orders for special air transportation (one Tu-154M and three Yak-40) for 7.04.2010 came from the Prime Minister’s Office directly to the 36 Regiment on 15 and 30.03.2010. Copies of the second order were forwarded to Air Force HQ and to Governmental Security Service (BOR). The Prime Minister’s Office applied to Air Force HQ for, if possible, three CASA C-295M<sup>88</sup> for 7.04.2010. The „Instrukcja HEAD” determines

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<sup>87</sup> According to § 6, PM’s Ordinance nr 139 of 19 Dec. 2007, PM’s Chief of Office may authorise certain persons to conduct in his name matter in his capacity. On the basis of this provision, Deputy Director in the Office of the Prime Minister received such authorization with the scope, among other things: to decide – together with orderers – on the type of a/c, point of departure and landing, flight hours, no. of PAX’es and cabin crew, placing orders for supplies, etc.

<sup>88</sup> In the process of making decisions on the use of particular a/c for the 7.04.2010 flights, the number of a/c and types which to designate, were changed several times. The changes of decision induced Polish Embassy to send a letter on 2.04.2010, asking urgent info from 36 Wing which a/c, out of 7 nominated, would actually

strictly what particulars should be given and who the order for a HEAD flight should be directed to. The orders for 7.04.2010 did not comply formally as they did not quote the number of passengers, luggage and cargo.

On 3<sup>rd</sup> and 9.03.2010, the President of the Republic of Poland Organisational Support Team turned to the Office of the Prime Minister with an order for air transportation for 10.04.2010. Habitually, copies of the letter were sent to the 36 Regiment and to BOR, though there was no such requirement. In this case, too, the number of passengers was not given, nor luggage or cargo. The Committee did not obtain a copy of the order directed by the Coordinator (which should be delivered as „Instrukcja HEAD” requires) to AF HQ, to 36 Regiment Cmdr. and to the Chief of governmental security service (BOR). From the information obtained from employees of the Prime Minister’s Office it appears that the Coordinator considered the President of the Republic of Poland Organisational Support Team’s sending copies of the order to AF HQ, to 36 Regiment Cmdr. and to Chief of BOR a mere formality and contrary to § 2 item 3 pts 1 and 2 of „Instrukcja HEAD”: (*“Z uzyskanych od pracowników Kancelarii Prezesa RM wyjaśnień wynika, że przesłanie przez Kancelarię Prezydenta RP kopii zapotrzebowania do 36 spłt, DSP i BOR było traktowane przez Koordynatora jako formalne powiadomienie tych instytucji, pomimo iż było to niezgodne z § 2 ust. 3 pkt 1 i 2 „Instrukcji HEAD”.*

From employees of the Prime Minister’s Office the Committee obtained information that the role of the Coordinator recalled in „Instrukcja HEAD” was limited to merely checking possibilities of order execution within the flight limits allotted to particular eligible Offices, also, solving conflicts over colliding dates on order. There are no instructions, procedures or bylaws which would direct activities of the Office in this respect. All other information which „Instrukcja HEAD” requires were delivered directly by transportation ordering Offices. The Coordinator did not check adherence of particular Offices to the provisions of „Instrukcja HEAD”. The Offices’ activities in respect of air transportation had oral form.

The other institutions, viz. BOR, SF HQ, and the Polish Embassy in the Russian Federation, collaborating with individual Offices in the arrangement of special air

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arrive, because Russian side mulls over a clearance for landing. Information of specific a/c was sent to Embassy as late as on 6.04.2010. And 8.04., Russian side reproached that crews of two CASA a/c had not have Russian visas (on 7.04.), and hoped that Yak-40 and Tu-154M crews (designated for the 10.04. flight) would have.

transportation did not produce to the Committee any documents that regulate such collaboration<sup>89</sup>. Only from the Ministry of Foreign Affairs a declaration was obtained that there were no bylaws concerning the subject.

According to „Instrukcja HEAD” § 2 – orders for air transportation with HEAD status should be placed:

- 1) at least two days ahead of the contemplated domestic flight;
- 2) in such advancement as stipulated in transit and destination countries. It is welcome that the advancement be not shorter than ten working days (enclosure 1);
- 3) in urgent cases, in respect of outbound flights abroad, within ample time to ensure flight safety, i.e. stipulated in domestic, transit countries’ and destination countries’ regulations contained in Jeppesen publications, or arising from diplomatic arrangements.

The orders for air transportation for 10.04.2010 was placed in keeping with the aforesaid requirements, whereas the order for 7.04.2010 was placed too late, on 30.03.2010, i.e. 5 working days before the planned visit, rather than required 14 days as „Instrukcja HEAD”<sup>90</sup> requires. In talks with members of the Committee, workers of institutions engaged in arrangement of special air transportation complained that it was notorious to place orders too late<sup>91</sup> related to the requirements of „Instrukcja HEAD” (and regulations of destination and transit countries). All attempts to eliminate delays fired on the pan. It is also worth emphasizing that Enclosure 1 which raises the question of placing orders in relation to diplomatic consent to landing in individual countries in 2009, which underpins „Instrukcja HEAD”, was not regularly updated notwithstanding such provision:

*„Uwaga: Za bieżącą aktualizację powyższych danych odpowiada Szef Oddziału Zarządzania Przestrzenią Powietrzną Szefostwa Służby Ruchu Lotniczego Sił Zbrojnych RP. Aktualizacja danych odbywa się w cyklu sześciomiesięcznym”.* (N.B. Updating of the above data is the responsibility of the tRepublic of Poland Armed Forces Chief of Airspace Control Division. Updating must be done in a six-month cycle).

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<sup>89</sup> The Commission sent a plea to the Offices of the President, PM, Parliamentary Speakers, Foreign Affairs Ministry, BOR security, FA HQ, and Polish Embassy in Russia to produce to the Commission documents (procedures), if existing, that regulate collaboration in the scope of special air carriage, or state definitely inexistence of such documents (procedures).

<sup>90</sup> Time needed for flights to Russian Federation, encl. 1, „Instrukcja HEAD”;

<sup>91</sup> On 8.04., Head of Dept. for Russia, in the Polish Min. of Foreign Affairs asked for a.s.a.p. no. of clearance for cruise and landing because at Smoleńsk North aerodrome nobody heard of any consent to Presidential arrival. Actually, no such clearance had been given by the Russian side.

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### **2.6.3. Risk assessment of contemplated flight operations**

In the course of preparing aircraft for special flights on 7<sup>th</sup> and 10.04 the risks were not assessed of flying to SMOLEŃSK NORTH which aerodrome was phased out since autumn 2009. The aerodrome was to be temporarily opened on 7 and 10.04. The 36 Regiment and AFHQ did not make assessment of usefulness of SMOLEŃSK NORTH aerodrome for HEAD flights.

Risks were not assessed because there was no procedure which would enable such analysis and acceptance of a Russian declaration that the aerodrome would be ready to receive special flights.

In the Committee's opinion, this problem can be solved by making a list of airports (airstrips) by categories (domestic, foreign) which can receive such flights.

The lists should comprise the aircraft types which can be used for particular operations to categorised airports:

- 1) with international status, equipped with all indispensable facilities and services for safe operation (navaid, support services, search-and rescue teams of suitable category);
- 2) meeting aforesaid needs, though likely to hamper navigation and execution of procedures without additional practice of the crew due to their elevation (e.g. Salzburg - SZG). In such a case, within the framework of crew preparation, implement some special training inclusive of a session in a Part-Task Trainer (PTT) or a Full Flight Simulators (FFS) (Od tłumacza: Nigdzie nie ma FFS dla Tu-154M), if necessary;
- 3) not falling into either category, let alone military airfields, whose characteristics have not been published in generally accessible material, like AIP;
- 4) airfields which should undergo special assessment prior to decision on use.

At the stage of planning composition of the delegation for 10.04., the risk of flying all commanders of branches of services in one aircraft was not taken into account, either. In the aftermath of the CASA C-295M crash, the Chief of General Staff issued Order no.135 on 5.02.2008 r. (item 3 Para 1) requiring obtaining his acceptance to fly two or more commanders of branches in one aircraft. The Order did not extend to aircraft which were outside military structures (e.g. Office of the President of the Republic of Poland). Additionally, as per item VII of this Order, it was in force until the time of amendments in RL-2006, i.e. to 11.07.2008.<sup>92</sup> It is worth emphasizing that the amendments to RL-2006 did not raise the questions depicted in the Order. Although said Order on the use of military

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<sup>92</sup> Decision nr 264/MON by The Minister of National Defence , dated 28.05.2008.

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aircraft to fly top ranking officers („w sprawie wykorzystania wojskowego transportu powietrznego do przemieszczania kierowniczej kadry jednostek wojskowych Sił Zbrojnych RP”) was not in force in the period when the decision related to arrangement of Smoleńsk-bound flight was taken, in the Committee’s opinion, having in memory the CASA C-295M crash, putting all commanders of military branches into one aircraft should be analysed by the General Staff or the Ministry of Defence.

#### **2.6.4. Assessment of the process of obtaining permit for a flight and a landing operation**

The 36 Regiment used to obtain consent for flights and landing outside the Republic of Poland via the Ministry of Foreign Affairs, skipping<sup>93</sup> the Co-ordination Dep. of Airspace Control of the Republic of Poland Armed Forces ATC Chief through sending standard notes, so called *clarises*. Embassies in target countries directed pleas for diplomatic consents to competent state authorities where landing or overflight was contemplated.

*Clarises* for flights on 7.04.2010 were sent from the 36 Regiment to the Ministry of Foreign Affairs on 30.03. and on 1.04. Beside standard information the *clarises* asked for „current airport charts and procedures”, while not asking for providing leader-navigators, what is contrary to the rules laid down in the Aeronautical Information Publication of the Russian Federation and Countries of the Commonwealth of Independent States”. Para 3.10 GEN 1.2-9 contains a clause conditioning consent for flying outside international air space and landing at an airport/aerodrome closed to international traffic, on hiring a leader-navigator. It also says that the applicant would receive special and agreed conditions on which such flight might be performed.

*Clarises* for the flights on 10.04. were sent by the 36 Regiment to the Ministry of Foreign Affairs on 18.03. Beside standard information, they contained a plea for „current landing patterns and aerodrome procedures” as well as „the presence of a leader-navigator in Warszawa prior to departure”.

All the notes (*clarises*) were translated into Russian and referred to the Director of the 3<sup>rd</sup> European Department in the Russian Federation’s Ministry of Foreign Affairs. The notes, concerning flights on 7.04., were sent on 30.03., and on 10.04. notes were sent for the 22.03. flights. In talks with workers of Polish Embassy in Moscow, the Committee learnt that the process of translation and sending the flight consent notes was routine, without using any special or in-house instructions. Embassy workers were not obliged or qualified to check substance of letters edited in the 36 Regiment. Nevertheless, they were conscious that pleas

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<sup>93</sup> Based on a decision of Polish Air Force Commander.

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for consent from the Russian Federation had to be placed 14 working days in advance of dates of aircraft departures, so they kept on intervening, in vain.

Towards the end of March, (the Committee was not able to discover any exact date) an employee of the 3<sup>rd</sup> European Department in the Russian Federation's Ministry of Foreign Affairs, in a phone call asked the Polish Embassy whether the Polish side was sustaining the order for Russian leader-navigators. The Embassy immediately notified the Chief of Polish ATC Services (SSRL) that detailed arrangements should be made concerning reception of leader-pilots (remain over night, per diem, etc.) if they were still on order. On 31.03., the 36 Regiment sent a letter to the Polish Embassy in Moscow asking them to give up leader-navigators, explaining that the flights in question would have Russian speaking crews. This stance was forwarded (by phone) to the Russian side and met no reservations<sup>94</sup>, except that Russians asked a confirmation (on 3.04.) if a leader-navigator(s) should be needed for any other special flight(s) or, like in the case of the Tu-154M, they would have Russian speaking pilots. This Russian query<sup>95</sup> was sent from the Polish Embassy in Moscow to the Office of the Chairman of the Council of Ministers on 3.04. in the evening without delay. The decision to forward the Russian query from the Office of the Chairman of the Council of Ministers to the aviation of the Polish Armed Forces HQ, the 36 Regiment and to 13 eltr was taken on 6.04., albeit it is not certain if it reached all recipients<sup>96</sup>. The Committee was not shown any documents evidencing that the Russian side got an answer to their query. Resignation by the Polish side of leader-navigators for the flights on 7 and on 10.04. is even less clear because as the Committee learnt, crews of CASA C-295M from the 13 eltr, assigned to the 7.04. flights, did not speak Russian, alike the Yak-40 crew of the 10.04. flight.

According to the findings of the Committee, the 36 Regiment did 212 flights to civilian airports in the Russian Federation from 2000 to 2010 and 25 flights to military aerodromes. Only four flights<sup>97</sup> (inclusive of two to SMOLEŃSK NORTH in 2007), had leader-navigators on board. It was also found that the 36 Regiment as well as other air force units did not keep

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<sup>94</sup> Issuance by the Ministry of Foreign Affairs, Russian Federation, of consent for flights without Russian leader navigators on board Polish aircraft was in violation of their own by-laws, published in their AIP (part GEN 1.2-9 items 3.10 and 3.12). Without fulfillment of this condition, there should be no consent to such flights, what is more, if no leader navigator found on board, such aircraft should be directed to some tolerant airport or diverted to the Polish air space.

<sup>95</sup> The question from the Russian side was about crews for the flights planned for 7 and 10.04.

<sup>96</sup> According to information received by the Commission, the question did not reach the Air Force Command.

<sup>97</sup> „A flight” should be understood as „to-and-fro”.



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documentation which would regulate leader-navigator's functions, tasks and qualifications<sup>98</sup> when on board a Polish state-owned aircraft.

During one working meeting devoted to arrangements of the flights on 7 and 10.04.2010, the Russian side assured that the needed parameters of SMOLEŃSK NORTH military aerodrome would be sent in a note to the Polish Ministry of Foreign Affairs. However, though changes were made at SMOLEŃSK NORTH in approach procedures and notwithstanding a special flight over radionavs: („*Akt przeglądu technicznego lotniska SMOLEŃSK PÓŁNOCNY w celu przyjęcia lotów specjalnych*” dated 5.04.2010), such data were never handed over to the Polish side. The Russian side made only a laconic statement that the approach procedures had not changed since 2009. The crews of the flights on 7 and 10.04. used approach charts<sup>99</sup> which the Polish Embassy in Moscow had handed over to the ATC Command in 2009 and they did not reflect realities of 7 and 10.04.2010.

On 6.04.2010, the Polish Embassy in Moscow received consent for operations to be carried out on 7.04.2010 by PLF 102 (nr 101), PLF 035 (nr 045), PLF 050 (nr 020), and PLF 012 (nr 022). The consent for flights on 10.04.2010 arrived on 9.04.2010 for PLF 101 (nr 101) and PLF 031 (nr 044) flights. In both cases, the consent missed any special and agreed conditions of the flights. According to the findings of the Committee, the consent for flights on 7 and 10.04.2010 did not differ from that for previous flights of 36 Regiment's aircraft to military aerodromes in the Russian Federation.

#### **2.6.5. Alternate airport planning and other reserves**

In „Instrukcja HEAD”, in § 6 entitled („*Zabezpieczenie łączności i UL*” (Securing communications and UL) is an annotation:

„1. Communications and UL during HEAD flights are secured:

- 2) in foreign flights – according to a military civilian set of information of a given country”.

Due to assigning WITEBSK as an alternate airport, one can surmise that AIP of Russian Federation and the Commonwealth of Independent States was not used in the arrangement phase for the 10.04.2010 SMOLEŃSK-bound flight because the information therein says that the WITEBSK airport is open only by daylight on working days.

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<sup>98</sup> It is worth noting that also in documents of Russian Federation, available to the Commission, they are not specified.

<sup>99</sup> These charts had identification features removed, like date of publication and page number.

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In § 1 of the general rules of organization of HEAD-coded flights („Ogólne zasady organizacji lotów statków powietrznych o statusie HEAD”) is an annotation in item 11 to the effect that a HEAD flight must not be done below the takeoff and landing minima of the pilot, aircraft, and airport.

According to the findings of the Committee, in the process of arrangement of HEAD flights, landing at any alternate airport is not taken into account, therefore, institutions and services engaged in arranging and securing flights with most important persons in the State never consulted the 36 Regiment about choosing alternate airports and other variations of executing the task planned. Changes of destination airports happened only in situations which would be confirmed before departure that due to weather at a given destination airport could not be used. Such a change would be consulted directly with representatives of the host of flight and with the Governmental Security Service (BOR). and would concern primarily all domestic flights. Every fly-out with landing at an airport other than stipulated in an order would be executed only after approval from the main host.

#### **2.6.6. Communication within supervision of HEAD flights**

Item 3 § 6 of „Instrukcja HEAD” says that during fly-outs from Poland it is allowed to use a HF radio station for RTF in keeping with the rules of flights outside Poland.

In the document „Zasady prowadzenia korespondencji radiowej w sieciach powietrznych lotnictwa Sił Zbrojnych RP” (Rules of RTF in Aviation of Armed Forces’ Networks), temporary edition, Poznań 1999 WLOP 291/99 part 2., „Przepisy ogólne” (General Rules) is an annotation that during an international flight in controlled air space, when the aircraft is out of reach of Polish AREA CONTROL on VHF/UHF frequencies, it is required for the crew to use SW to communicate with their Unit.

The progress of the flight on 10.04.2010 does not indicate to any attempt to make such communication. Short Waves were used very seldom although their range enables keeping track of entire flight outside Poland as well as transmitting to the crew any safety sensitive information.

#### **2.6.7. Securing an replacement aircraft for a HEAD flight**

„Instrukcja HEAD”, § 11, part V. „Przygotowanie statków powietrznych o statusie HEAD” (Preparation of flights with HEAD status) says:

- „8. Two aircraft shall be dedicated from the Permanent Disposition Place to secure a HEAD flight, basic and replacement.

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9. Before a HEAD flight takes off from the Permanent Disposition Place, both the basic and the replacement aircraft must be test flown by a commission.
  26. In case any unserviceability should crop up, or another cause should prohibit performing a HEAD flight, the host of the flight notifies the Chief of Governmental Security Office of the situation.

The notes (*clarises*) that were asking for consent to fly to and land at SMOLEŃSK NORTH on 10.04.2010 named the Tu-154M reg.no.101, and a Yak-40, reg.no.044. The 36 Regiment did not ask for consent for one more Yak-40 (reg.no.045) to fly reporters, although the Cmdr. of Unit 2139 designated this aircraft for such transportation.

According to documents, Yak-40, reg.no.044 was a replacement of the Tu-154M on 10.04. With a difference in either aircraft's capacity, there was no plan how to carry stranded passengers should the much more capacious Tu-154M not fly. Furthermore, because of a fault in Yak-40, no. 045, its commander decided, without consulting his superiors, that the 044 aircraft be used for the planned flight (it was a replacement aircraft for the HEAD mission). The replacement Yak-40 was without a crew as there was no such assignment made in the Order of the Day of 10.04.2010. It is worth emphasizing that if not for the defect of Yak-40. no.045, reporters would be flown to SMOLEŃSK in an aircraft lacking diplomatic consent of the Russian Federation.

From diplomatic consent of the Ministry of Foreign Affairs of the Russian Federation, directed to the Polish Embassy in Moscow, it appears that the Tu-154M (Flight PLF 102) had a Yak-40 (no.047) as its replacement. And yet, from documents (chronometric dates), obtained from 36 Regiment it appears that the only aircraft which could be a replacement was Yak-40, no.044, because only this aircraft did a test flight required before a HEAD flight.

#### **2.6.8. Aircraft configuration**

During last overhaul, the Tu-154M, no.101 was adapted to accommodate 90 passengers. In an order for special air transportation, sent on 1.04.2010 to 36 Regiment, the Office of the Prime Minister gave 94 as the number of passengers. Indeed, such is the number in Order nr 66/07/103 by 36 Regiment Cmdr., dated 7.04.2010. To fulfill the order, the cabin was reconfigured for 100 passengers (the flights of 7, 8 and 10.04 had such configuration), which was contrary to documentation in force and the aircraft's release to service. In the 36 Regiment's Order no.69/10/101 of 10.04.2010, the Tu-154M was supposed to carry 91 passengers, which was also contrary to the aircraft's release to service.

## 2.7. An analysis of the aerodrome's facilities

### 2.7.1. The condition of navigation aids

#### Radio beacons

On the chart for the 259° landing direction, the beacon is 1100 m before RWY 26, and Outer NDB is 6260 m before RWY 26. According to the measurements taken, the distance between the beacon and runway threshold was:

| Measurement:  | Distance to RWY 26 |          |          |
|---|--------------------|----------|----------|
|   | KBWL LP            | MAK      | Chart    |
| Inner NDB   | 1065 m             | 1050 m   | 1100 m   |
| Outer NDB   | 6270 m             | 6280 m   | 6260 m   |
| Measured gradient of descent between OM and IM              | 2°31'49"           | 2°31'05" | 2°33'08" |
| Theoretical gradient of descent, depicted on descent plate: | 2°40'00"           |          |          |

In the opinion of the Committee, the differences between the data on the approach chart and the measurement figures are insignificant and without any bearing on the procedure of non-precision approach.

As a standard in military aviation, Outer NDB is situated 4000 m ±200 m before RWY THR. Such standard is in force both in Polish and in Russian military aviation. At SMOLEŃSK NORTH aerodrome, due to terrain relief, the OM Beacon is at 6260 m (according to the approach chart). Apart from giving the distances of IM beacon's and OM beacon's distances to RWY THR, the publisher of the approach chart quoted geographic coordinates of their location. The crew of the Tu-154M had possibilities to tap in these coordinates in the navigational system of their aircraft. In the opinion of the Committee, the non-standard location of the OM beacon had no bearing on safety of approach as it was extending the final approach segment of the flight. For aircraft with a higher approach speed it is beneficial as it provides more time to fly from OM to IM, hence, more time for correcting a possible deflection from preset trajectory of the flight. In the case of extended final approach segment the pilot should take into account a somewhat smaller gradient of descent, 4.45% (rather than 5%), which is equivalent to the 3.4 m/s rate of descent relative to 3.8 m/s.

According to a statement of the Cmdr. of Yak-40 PLF 031, after flying over OM and switching the radio direction finder (RDF) to IM, the RDF needles became unstable and swung within ±10°. Therefore, the pilot switched RDF back to OM and continued on back course approach.

The Committee surmises that the unstable indications of RDF might be distorted by characteristics of the beacon's signals, caused by:

- the overhead power line close to IM,
- the trees in the antenna field, much higher than the post of antenna,
- the depression with a water-course near IM.

The pictures show surroundings of IM on 29.04.2010 and on 8.08.2010.



Photo 17. Location of power lines and low-voltage lines relative to Inner NDB

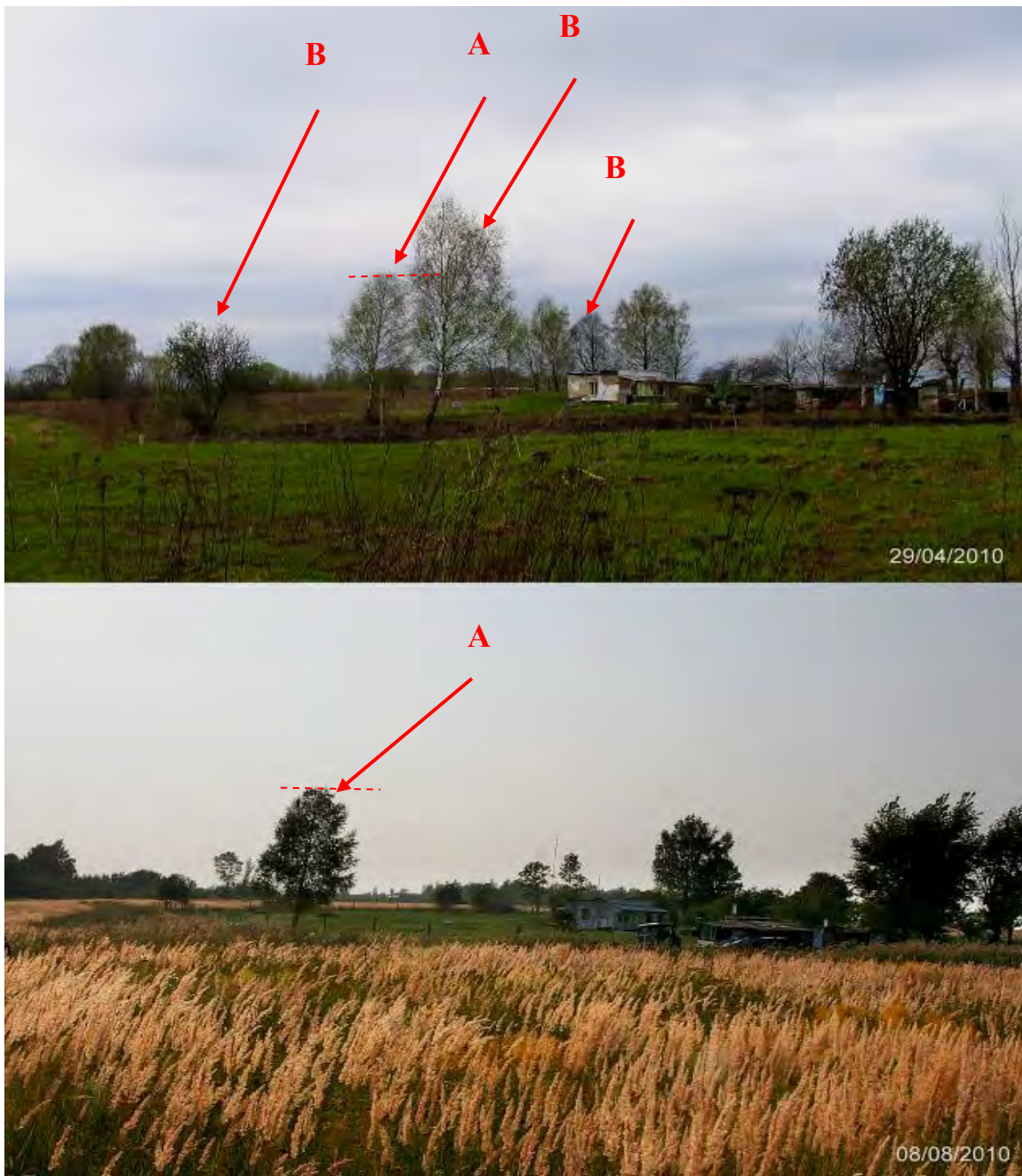


Photo 18. Surroundings of Inner NDB – Pictures taken in April and August 2010 r.  
(differences in the tree stand)  
A – the tree, trimmed by Tu-154M,  
B – trees, cut down after 10.04.2010.



Photo 19. IM positioning and terrain relief in the area of descent to RWY 26 at SMOLENSK NORTH (visible terrain depression and a ravine with a watercourse in the area of IM)

Assessment of operation of the Inner and the Outer NDB radio beacon was carried out on the basis of cockpit voice recorders in Yak-40 and Tu-154M aircraft. The Markers worked correctly.

### **The radiolocation landing system RSP-6M2**

In the opinion of the Committee, elevation<sup>100</sup> of the surface where RSP-6M2 system is mounted should make aircraft visible to a height of 5-10 m in a  $\pm 15^\circ$  sector of RWY. Terrain obstacles (a group of trees) in the area of approach from  $KM_{ląd}$  259° was responsible for canted position of RSP-6M2. The report of aerial inspection of the RSP-6M2 radiolocation landing system („*Protokół kontroli z powietrza radiolokacyjnego systemu lądowania RSP-6M2*”), written after the overflight on 25.03.2010, intended to verify the working of RSP-6M2 system is incomplete, as it is short of:

- factographic material of a by-the-book landing approach;
- graphic presentation of glide path, course and location of IM and OM;
- a profile with a “dead zone’s” radius delineated and a marked range of portable radio locator DRŁ (all-around looking radar);
- a schematic of „true echoes” and reflections from bounce-off cones;
- information about the direction on which the inspection overflight landed;
- information about minimum distance to RWY THR and its equivalent elevation up to which control of aircraft on glide path is possible;
- an annotation of plotting and/or comparing the course shown by landing locator PRŁ with a previous glide path and course.

### **Ground visual nav aids**

According to the Report from ŁUCZ-2MU lighting system aerial inspection („*Protokół kontroli z powietrza systemu świetlnego ŁUCZ-2MU*”) of 25.03.2010, the system was visible from a distance not smaller than 15 km, and correctness of lamps positioning and regulation of their beams complied with parameters and characteristics of light signal devices depicted in the instruction for inspection flights over communication and radio-technical facilities supporting flights of Russian Air Force.

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<sup>100</sup> The document: „Standardy na środki łączności i radiotechnicznego ubezpieczenia lotów lotnictwa wojskowego państw – stron Układu Warszawskiego”. (Standards of means of communications and radio-technical means for securing military flights of the member States of the Warsaw Pact). Due to the failure of the Russian side to disclose pertinent regulations, the Commission accepted the document named herein as a basis for assessment of how the RSP-6M2 navaid has been mounted at SMOLEŃSK NORTH.



In the report from an inspection flight („*Protokół oblotu kontrolnego*”) performed on 15.04.2010 it is stated that the approach lamps, subject to their location and how high an inbound aircraft is, can be shaded by surrounding trees and shrubs<sup>101</sup> when the aircraft is at a distance of 400, 700 and 800 m from RWY THR26. In the same document it is depicted that the lamps of second and third group (800 and 700 m from RWY THR26) were not there – what was remnants of lamps, and the power cable was broken away. The lamps of the first group (900 m) had their light filters shattered and, of three bulbs, one was O.K. From the reconnaissance which the Committees made on 14.04.2010 to the site of crash, it showed that of the six lamps of code beacon KNS-4U, which was atop Inner NDB, three were O.K. Serviceability of the lighting system is presented in Fig.1.

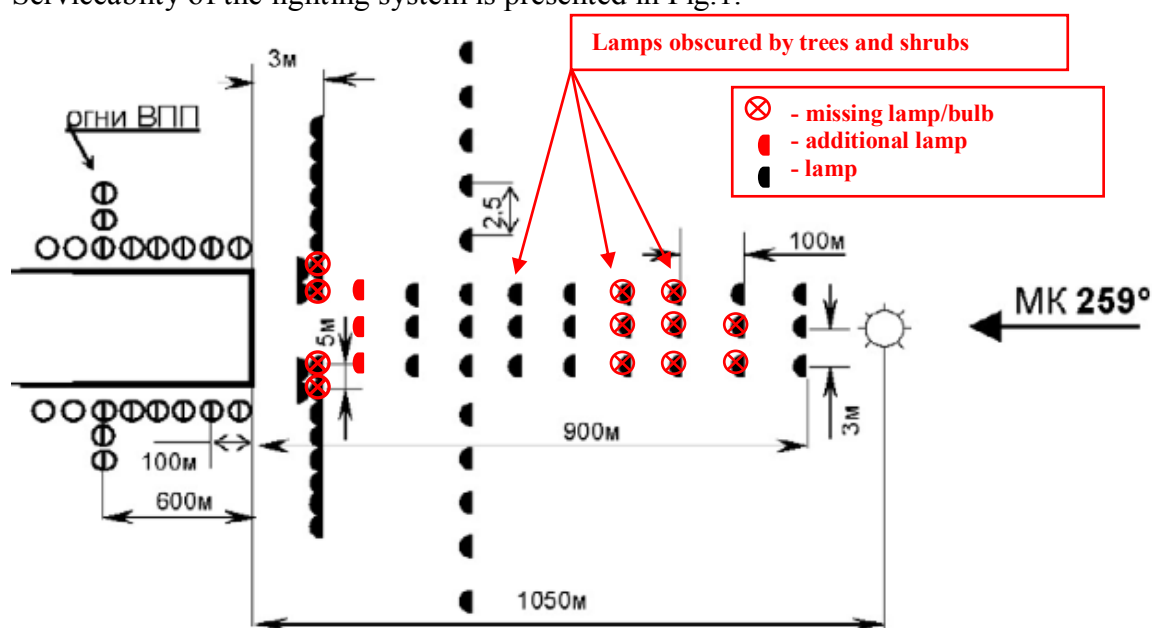


Fig. 15. Serviceability of ŁUCZ-2MU lighting system

From the photographic documentation of the Committee it appears that the origin of components of SMOLEŃSK NORTH lighting system was unknown and could not be traced back to any specific system. Unlike the components of ŁUCZ-2MU navaid, they had not any reflectors and focusing lenses and their beams could not be pivoted vertically or horizontally. Arrangement of lighting points at SMOLEŃSK NORTH is different from the specification of ŁUCZ-2MU (an additional line of lamps).

An annotation in the Report from ŁUCZ-2MU lighting system aerial inspection („*Protokół kontroli z powietrza systemu świetlnego ŁUCZ-2MU*”) of 25.03.2010, stating that

<sup>101</sup> The Polish side (accredited representative and his advisors) was not admitted to the inspection flight, performed on 15.04.2010. Contrary to earlier declarations, the Russian side did not share results of this flight with the Polish side.

the system met requirements of unlimited safety of aircraft was not true to realities on the day of the inspection flight and was not true on the day of crash.



Photo 20. Navigation lamps obscured by trees and shrubs



Photo 20. Approach lamps positioning



Photo 21. The technical state of approach lamps

Consecutive photos depict the lamps of ŁUCZ-2MU lighting system with description of differences between them.



Photo 22. Construction of elements and the environs of ŁUCZ-2MU lighting system at the military aerodrome



Photo 23. Comparison of lamps of the lighting system

On the left– a lamp of the lighting system at SMOLEŃSK NORTH aerodrome on 10.04.2010.

On the right– a lamp of ŁUCZ-2MU lighting system

### 2.7.2.Charts and landing patterns - data

The approach charts, handed over by the Polish Embassy in Moscow to ATC Command in 2009 **did not carry the date of publication** or the name of document which they were taken from, or the number of the page. The date of publication of such document and its ISBN or another number serves correct identification. The Committee found that the charts were

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prepared<sup>102</sup> like that by the Russian side. The content of the charts was incompatible with realities, as it also contained a scheme and description of approach to the 079 direction, together with nav aids which have been decommissioned with a NOTAM, nr M2113/09<sup>103</sup>, since 15.10.2009.

The aerodrome's data, including: co-ordinates of aerodrome reference point, runway thresholds, location of inner and outer beacons (Inner NDB and Outer NDB) (all the coordinates on the approach chart), gathered in a system of references SK-42. The approach chart did not carry information in what system of reference the coordinates of individual fixes were given. Even at the time of handing the charts over to the Polish side such information was not disclosed.

From AIP (air information publication) of the Russian Federation and the Commonwealth of Independent States, part GEN 2.1-2 item 3 *Geodetic Reference Datum* it appears, also from Jeppesen General – Russia-1, sub-section *WGS Implementation Status* it appears that in Russia they used a cartographic system PZ-90 which, in the PZ-90.02 version is identical to WGS-84. However, since the PZ-90 system was implemented in all of Russian territory, newly published charts will inform about the use of this system. Both the Russian AIP and Jeppesen publications lack information (warning) that data in SK-42 system differ from the data described according to PZ-90/WGS-84 system.

The charts lack information which is key to air operations, e.g. altitude restrictions, descent gradient, descent vertical speed, a non-precision approach procedure for aircraft of various categories, and altitude/height to clear obstacles (OCA/H) Obstacle Clearance Altitude/Height).

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<sup>102</sup> With identification features removed.

<sup>103</sup> This NOTAM has not been published in the global network of data exchange (not available in Poland).

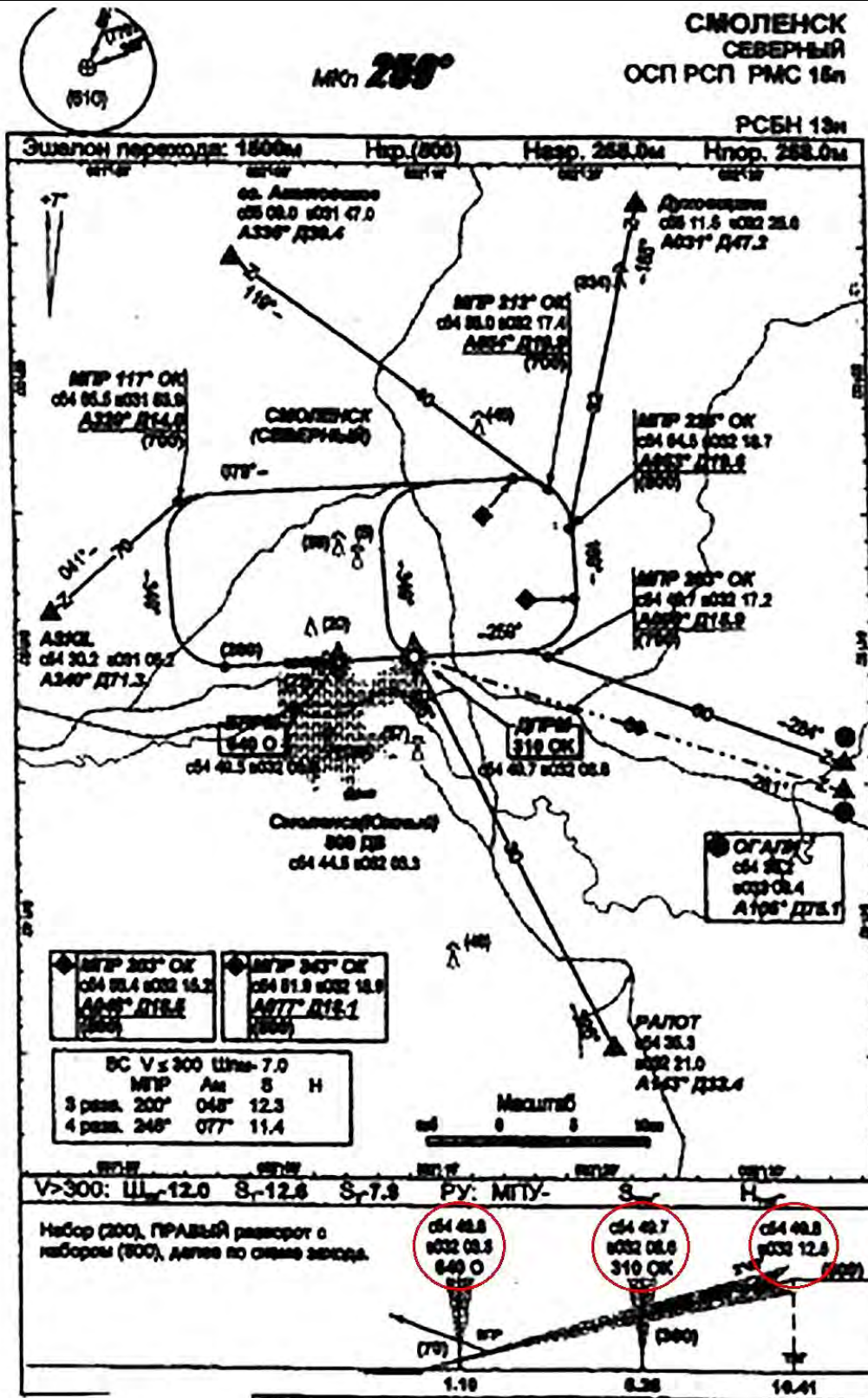


Fig. 16. A copy of the approach chart for the 259° direction

### **2.7.3. Terrain obstacles near the aerodrome**

Safety areas are delineated round each aerodrome to present a situation where aircraft and aerodrome could not operate because of obstacles in its vicinity. Regulations alike, international, Polish, Russian provide such safety areas.

The Committee, while taking into account the general conclusion from the review of technical possibilities of SMOLEŃSK NORTH to receive special flights, carried out on 5.04.2010 and published under the title „*Akt technicznego sprawdzenia lotniska SMOLEŃSK PÓLNOCNY do przyjęcia specjalnych rejsów* (A report from technical inspection of SMOLEŃSK NORTH aerodrome's readiness for special in-bound flights) - states that the aerodrome meets standards of Class I aerodromes and is ready to receive special flights in determined weather minima: „*Lotnisko odpowiada klasie 1-ej, jest gotowe do przyjmowania rejsów specjalnych przy ustalonym minimum pogody*”, nevertheless, reviewed terrain obstacles in RWY 26 safety areas, taking Class I military aerodromes' safety areas as reference.

In terms of technical characteristics of ascent and descent, airports are broken down into classes under such three parameters:

- length of main runway;
- bearing capacity of main runway (load on one wheel of aircraft);
- slant of runway end safety areas

For Class I aerodromes these parameters are:

- 2500 m and more;
- 17 tonnes;
- 1:100 (1%).

Considering that most Polish military instructions followed Soviet documents, the Committee made assumption (as Russian documents are not accessible) that the same or very similar parameters are true in respect of military airports in the Russian Federation.

#### **Particulars of runway end safety areas:**

- a 200 m overrun at the end of runway 26 (RESA)
- width of initial edges (inner) 124;
- widening of side edges 15° (26.8%);
- slant 1 : 100 (1%);
- end of runway vertical datum: 256 m MSL.



Based on these data, a scheme of approach to SMOLEŃSK NORTH aerodrome has been drawn, with RWY 26 safety area delineated (Fig.17). Given are:

- terrain height above sea level;
- height of the runway safety area (above sea level);
- allowable height of obstacles on the runway safety area.

After an analysis of photos which the Committee took on the site of crash, and satellite photos, a map was drawn to show sparse trees on RWY 26 approach (Fig. ). Also, stand density and land relief were measured. After a thorough analysis of terrain, obstacles and the safety area, it was stated that many trees that were growing at RWY 26 strip end (900 m) were higher than allowable. Along the axis of RWY 26, in the area of approach lights three were many. The trees and shrubs stood in the line of vision of descending aircraft and greatly limited observation of aircraft approaching RWY 26.

Fig.19 shows dislocation of the higher than allowable trees. At 400-600 m from RWY THR 26 sparse trees were about 10 m high, i.e. too high by 5-6 m. In the area of an asphalt road (about 600 m from RWY 26) the trees were too high by allowable 7 m. At 700 m from RWY THR 26, the tree stand was too high by 8 m and, at 800 m – 5-6 m higher than allowable. The tree height limit was mostly abused at 640-690 m from RWY THR 26 where 10-11 m high trees were obstructing the safety area. Terrain elevation in that area is around 256-257 m above sea level.

The above analysis shows that SMOLEŃSK NORTH aerodrome was not properly prepared to receive aircraft.

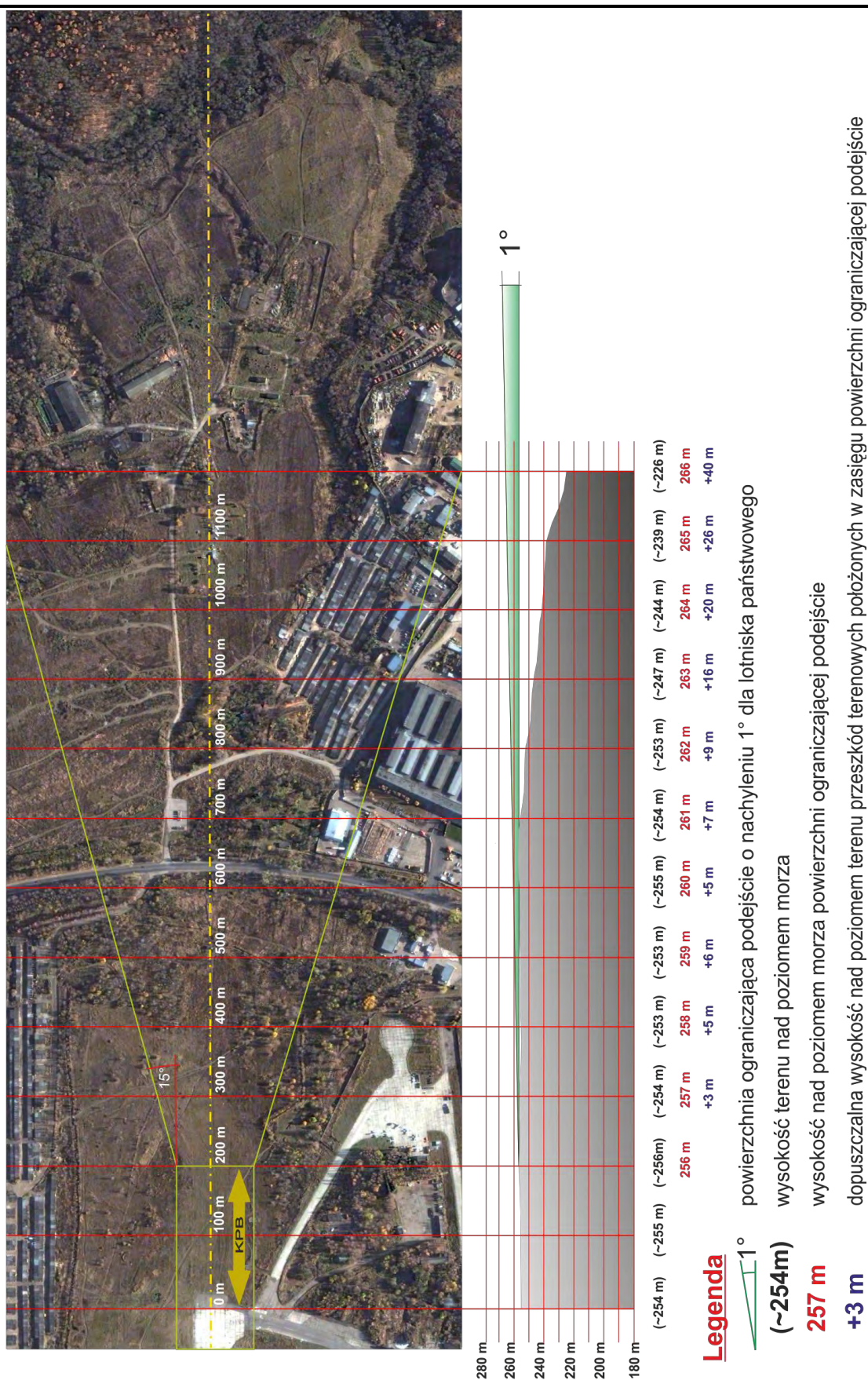


Fig.177. The runway safety area of SMOLEŃSK NORTH  
 (according to Polish regulations for Class I military aerodromes)




 Tree stands and shrubs on the runway safety area

Fig. 18. Tree stands and shrubs in the runway safety area with a 1% slant – according to Polish regulations for military aerodromes

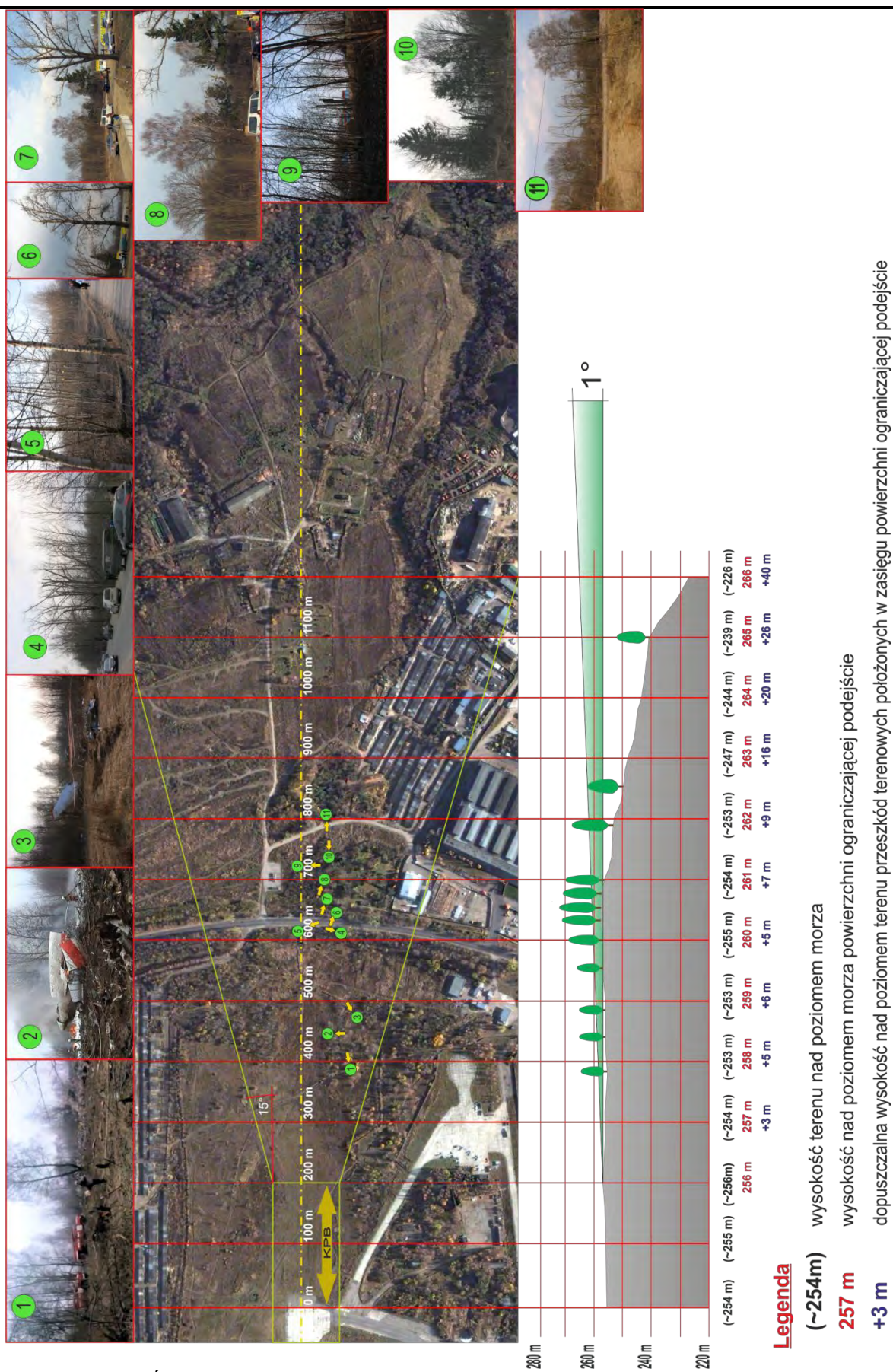


Fig. 19. SMOLEŃSK NORTH aerodrome – location of trees taller than allowable on runway safety area

After 10.04.2010, there was felling of trees around the glide path to SMOLEŃSK NORTH. In Fig.4, place of felling of view-obscuring trees are marked; those were the trees which cluttered the radar screen and obstructed the sight of RWY 26 approach lights. Following drawings depict differences in tree stands between 10.04.2010 r. (Fig.Fig. - Fig.8) and 30.06.2010.

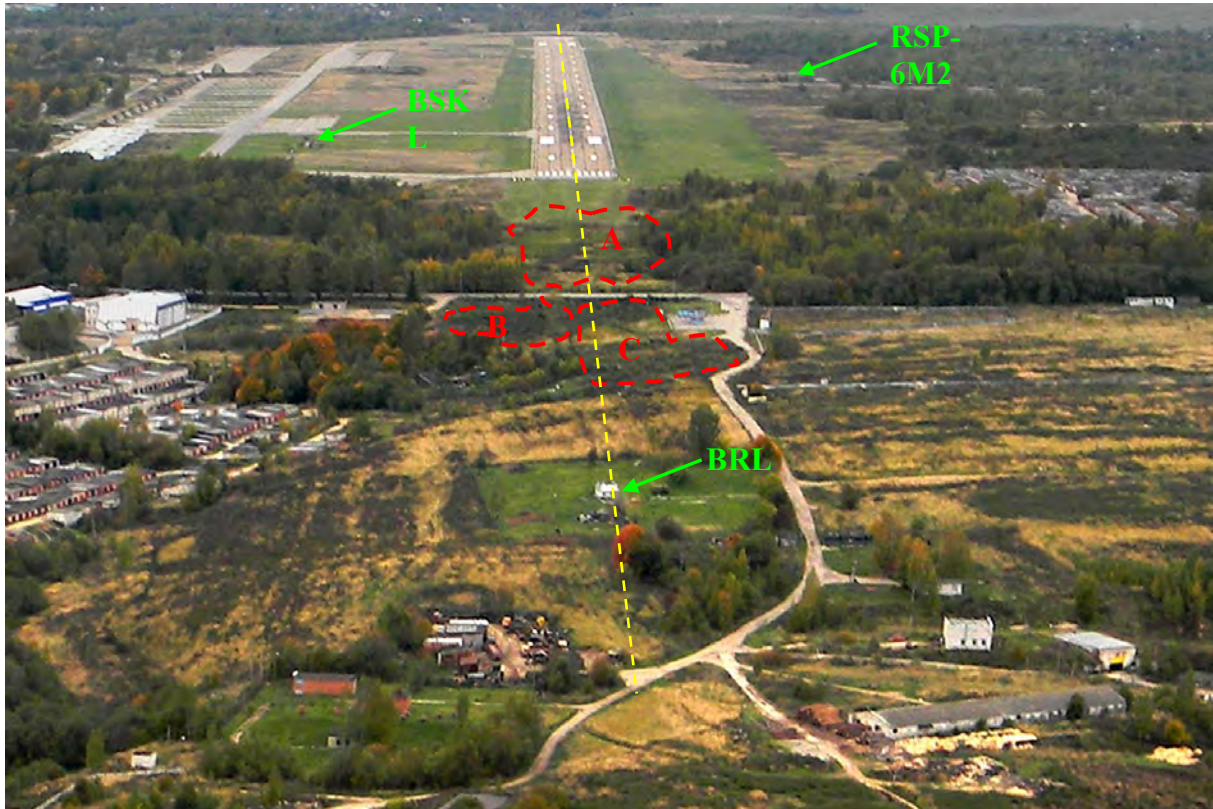


Fig.20. SMOLEŃSK NORTH – areas where trees and shrubs were removed (red) on RWY 26 centerline (yellow) (photographed on 30.06.2010)



Fig. 21. SMOLEŃSK NORTH – difference in tree stands in „A” area – approach path lamps, about 600 m from RWY THR 26



Fig. 22. SMOLEŃSK NORTH – differences in tree stands in the area about 670 m from RWY THR 26



Fig.23. SMOLEŃSK NORTH – difference in tree stands– approach path lamps, about 700 m from RWY THR 26



Fig.24 SMOLEŃSK NORTH – differences in tree stands – approach path lamps, about 600 m from RWY THR 26

## 2.8. Atmospheric analysis

### 2.8.1. Assessment of observation and met measurements at SMOLENSK NORTH

On the basis of an inspection of aerodrome weather station it can be stated that the system of measurements and atmospheric observations did not comply with ICAO and WMO regulations. Location of the aerodrome weather station was restricting observation of

visibility, cloud covering and weather phenomena at the aerodrome. In order to assess visibility, the meteorologist had to go onto the roof of the building, however, because of mounds, buildings and aircraft parked around his station he could only see car sheds on the other side of the runway, which the diagram located mistakenly (at 1000 m instead of 650 m to one corner and 700 m instead of 570 m to the other). In such conditions of observation, he was not able to notice development of fog at the aerodrome (lateral visibility below 1000 m). The closest objects also falsified his measurements of wind, air temperature and humidity.

The cloud base and visibility, measured at the atmospheric station on 10.04.2010 did not reflect real lateral and vertical visibility values that were measured in the Near Control Zone and on the landing direction. According to Russian regulations, measuring should be taken at the Near Control Zone as well as Outer beacon and Inner beacon (Instruction NAMS 86 items 21-23).

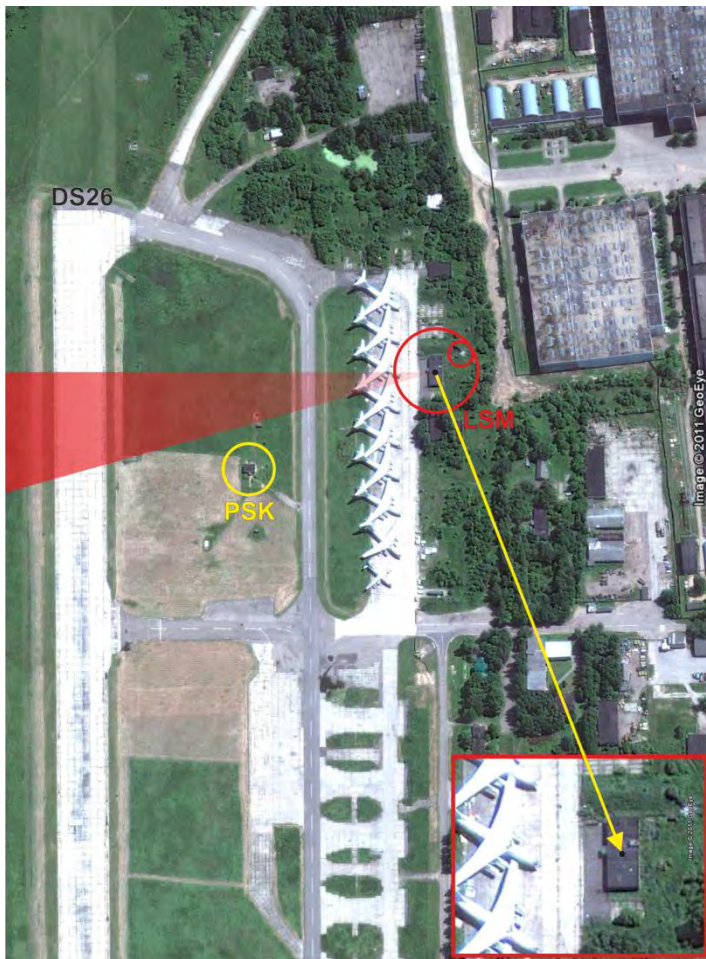


Fig.18 SMOLENSK NORTH aerodrome – location of the atmospheric station  
**LSM** – aerodrome atmospheric station                      **PSK** – ancillary control post

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### 2.8.2. Atmospheric conditions on 10.04.2010.

The Committee established the atmospheric conditions in aerodrome area through an analysis of:

- a) measurements and observations made by aerodrome station meteorologist manager;
- b) voice recording from the Near Control Zone on the subject of visibility observation<sup>104</sup>;
- c) declaration by the Inner beacon's operator who, within his responsibilities, was obliged to take measurement of low clouds base and determine lateral visibility<sup>105</sup>;
- d) SYNOP<sup>106</sup> messages and aerological measurements taken at SMOLEŃSK NORTH, about 10 km distant;
- e) filmed flight of an Il-76 over Inner beacon (05 hours 26 seconds).

1) Atmospheric conditions in SMOLEŃSK NORTH area – between 03:00 and 09:00 were such:

- a) **cloud cover:** from 03:00 1-3/8 high and medium level clouds, expanding to an overcast after 05:00 through low level clouds (St) with the cloud base swiftly lowering from initial 150-120 m to over 60 m (at 05:17). A Yak-40 aircraft, landing at 05:17, was noticed by Terminal Controller near RWY THR 26 at a height of around 40 m, which means that at that time the cloud base (vertical visibility) was already below 60 m. Low, layer stratus clouds were blending with the approaching fog into one continual atmospheric object (stratus clouds and fog have the same character and structure, the difference is only in the height of their occurrence). The fog and clouds extended from the ground to about 500 m above;
- b) **lateral visibility** – between 03:00 and 05:00 was restricted to 6000-4000 m through mist and smoke. Visibility from 05:00 to 05:10 was deteriorating quickly to 1000 m as the mist was thickening, and, additionally, due to smoke from smouldering wasteland in the vicinity of Smoleńsk. The fog occurred together with deteriorating visibility below 1000 m around 05:10. At SMOLEŃSK NORTH aerodrome, the fog which obscured lateral visibility to 500 m at ground level came 20 min earlier, at 04:50 (the time when the STORM message was sent).

When the Yak-40 landed, the Lateral visibility at the aerodrome deteriorated still further and when an Il-76 tried to make two landings before 05:40, the visibility was in the range 500-300 m (in fog). After 06:20 and during the crash, ground visibility (in the

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<sup>104</sup> The observations were made by Terminal Controller and by Deputy Commandant of an aviation base of TWER on the basis of patterns of dislocation of repeaters for lateral visibility observation, at Inner beacon.

<sup>105</sup> Based on patterns of dislocation of repeaters for lateral visibility observation, at Inner beacon.

<sup>106</sup> SYNOP messages carry information about measurements and atmospheric observations.



area of approach – watched from Near Landing Control post changed within 500-150 m. The changes were due to wavy changes in fog intensity, induced by its radiation and advection nature and uneven terrain (numerous, deep gorges and ravines) on the way of the approaching fog;

- c) **weather phenomena**– at Wight and after sunrise until 05:10 it was misty in the area of SMOLENSK NORTH aerodrome and after 05:10 **fog** appeared on the aerodrome. This phenomenon stayed until 08:00. Due to rising temperature, after 08:15, the fog changed to mist. Another phenomenon was occurring for a few days in the area of the aerodrome, viz. **smoke** from smouldering wasteland and dry grassland, once the snow melted away;
- d) **surface wind** – from the direction 110-160° , at 2-4 m/s – and in the gorge before Inner beacon its velocity could be much greater;
- e) **air temperature** at the ground– from +1,0 to +2,0°C;
- f) **relative humidity** of the air at the ground– 92-100%;
- g) **isotherm height 0°C** – 1650 m;
- h) **wind direction and velocity** at a height of 500 m – 170°/7 m/s, at 1000 m – 140°/6 m/s, and at 2000 m – 110°/4 m/s;
- i) **atmospheric pressure (QFE)** (at aerodrome elevation) – was rising very slowly from 744.5 to 744.8 mmHg (from 992.6 to 993.0 hPa);
- j) **atmospheric pressure (QNH)** (reduced to seal level) – was rising very slowly from 767,3 to 767,6 mmHg (from 1024,4 to 1024,8 hPa).

2) Atmospheric conditions at the time and place of the crash:

- a) **Cloud cover**– overcast, through low layer stratus, blending with thick fog at the ground and reaching high to about 500 m;
- b) **ground visibility in approach area to RWY 26THR** – 50-100 m;
- c) **ground visibility on RWY 26 THR**– 100-200 m;
- d) **vertical visibility**– below 20 m;
- e) **Feather phenomena** – fog;
- f) **surface wind** from the direction 110-130°, velocity 2-4 m/s;
- g) **atmospheric pressure (QFE)** at aerodrome level – 744.8 mmHg (993.0 hPa);
- h) **atmospheric pressure (QNH)** (at sea level) – 767.6 mmHg (1024.8 hPa);
- i) **air temperature** at the ground– from +1.0 to +2.0°C;
- j) **relative air humidity** – 100%.

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### **2.8.3. Possibilities of forecasting stratus clouds and fog advection**

On 09 and 10.04.2010, in the Smoleńsk area, advection of a warmer mass of air from the Low which was over Volga Region was in progress. These two different masses were mixing and giving rise to bow-like low stratus clouds and fog drifting from SE to NW. The following analysis gives causes of this phenomenon and answers if it was predictable.

Consecutive aerological radiosondes from the met station at SMOLEŃSK NORTH aerodrome pointed out to ever greater inversion of settling, related to a vast high pressure area. Additionally, radiation gave rise to a clear-cut inversion layer in night hours, with temperatures of about +2°C in its bottom. Near-ground inversions reached heights of around 500 m on 10.04.2010. On sunny days such near-ground inversions would disappear totally and the temperature of air would rise to about 15°C. The speed of advection of air from SE was very small and did not reach 25 km/hour, and at the very ground it was quiet for most of the night.

Due to the direction and speed of advection, the area of Kursk (450 km to the East) was the source of the masses for Smoleńsk in morning hours. The radiosonde of 00.00 hours on 09.04.2010 disclosed a layer of inversion which rose from 530 m to 900 m above terrain elevation. In this layer, steam water saturation was close to 100% and the steam content in the air was up to 4.04 g/kg. It is evidence that big masses of water were condensed in stratus layer clouds near the ground. With average movement of air in the border layer, of about 18 km/hour, this mass of air travelled some 430 km, viz. from Kursk to Smoleńsk.

In the Committee's opinion, at the stage of weather forecast preparation for Smoleńsk for 10.04.2010, the results of sounding the atmosphere helped forecasting advection of stratus lower layer clouds and the mist from SE.

Zones of stratus low clouds/fog were visible from NOAA atmospheric satellites which circle on polar orbits at a height of 800 km. The applied methods of measuring allow determination of temperature of the upper surface of clouds as well as interpretation of their microphysical structure<sup>107</sup>. Most substantial information is contained in photos in the NM array (Night Microphysical RGB composite image)<sup>108</sup>. On 10.04.2010, at 01:12, a willow green layer of stratus clouds/fog was clearly seen against a cloudless, pink tinted background.

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<sup>107</sup> Data of the way of interpreting are contained in pages of European agency Eumetsat and the Czech Institute of Hydrometeorology.

<sup>108</sup> For the purpose of the analysis, a composition of colours is used for the discovery of fog and low stratus clouds (only in the night). It is a synthesis of channels 3, 9, 10, 8 and 12.0 µm – infrared radiation. On these photos, well developed, thick clouds are marker red, scarce cirri – blue, sea surface – navy blue, terrain – pink, medium and low Cloud – Brown, and fog and lowest clouding (stratus) – yellow-green.

The same fragment of the photo on a thermal scale shows, solely through shades of gray, that the area of clouds/fog does not differ from the background. It is even possible to assess that the area is somewhat darker, i.e. warmer.

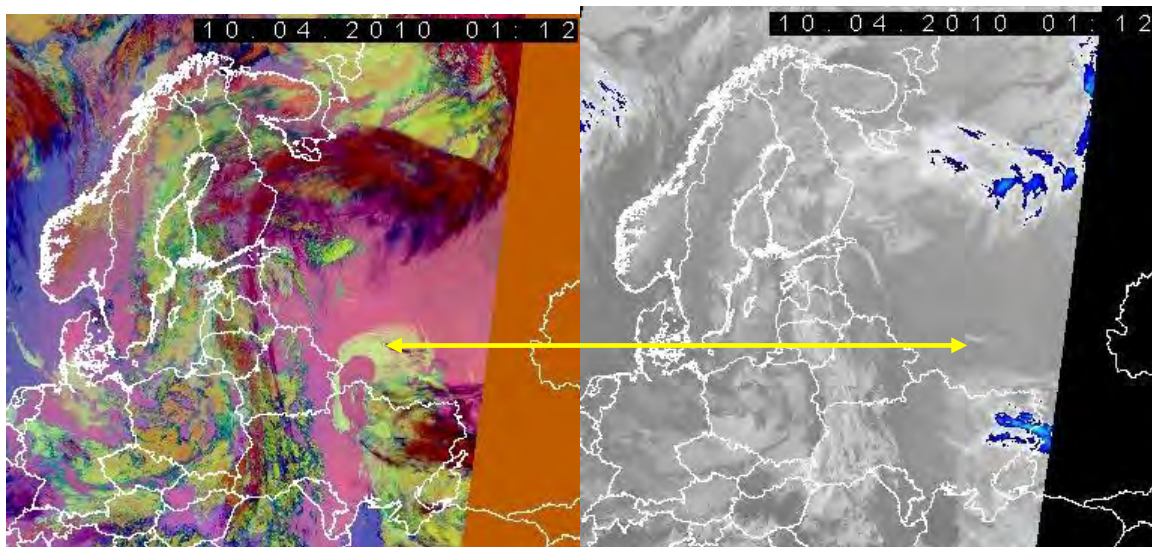


Fig.19. Processed NM photo NOAA-18; 01:12; 10.04.2010 Type b4BT IR photo

Photos from the consecutive orbits of NOAA satellites depicted the area under analysis already after sunrise (there are no NM photos recognizing stratus cloud/fog), however, the photos in the visible spectrum show very clearly the top, smooth surface of stratus/fog zone.



Godz. 04:43 NOAA-15

Godz. 05:55 NOAA-16

Godz. 08:40

NOAA-17

Ever more perfect photo can be obtained from MODIS environment al satellites. The satellites are destined to discover fires and, also, they show clouding in detail. The picture<sup>109</sup>, taken on 9.04.2010 at 08:55 shows that north of Smoleńsk was one zone of clouding and the other was north of the town. The zones were more or less parallel to each other and 350-400 km away from each other which arrangement was responsible for substantial radiation of heat in the night. The numerous red spots were interpreted by the satellite as fire sources<sup>110</sup>

<sup>109</sup> Satellite AQUA, source: [www.rapidfire.nasa.gov](http://www.rapidfire.nasa.gov) Meridians 30° and 40° E and parallels 50° and 60° N.

<sup>110</sup> Typical of local cultivation operation – smouldering of controlled burns of weeds and wasteland vegetation.

which emit to the atmosphere many, additional nuclei of smoke condensation, contributing to generation of fog in small hours.

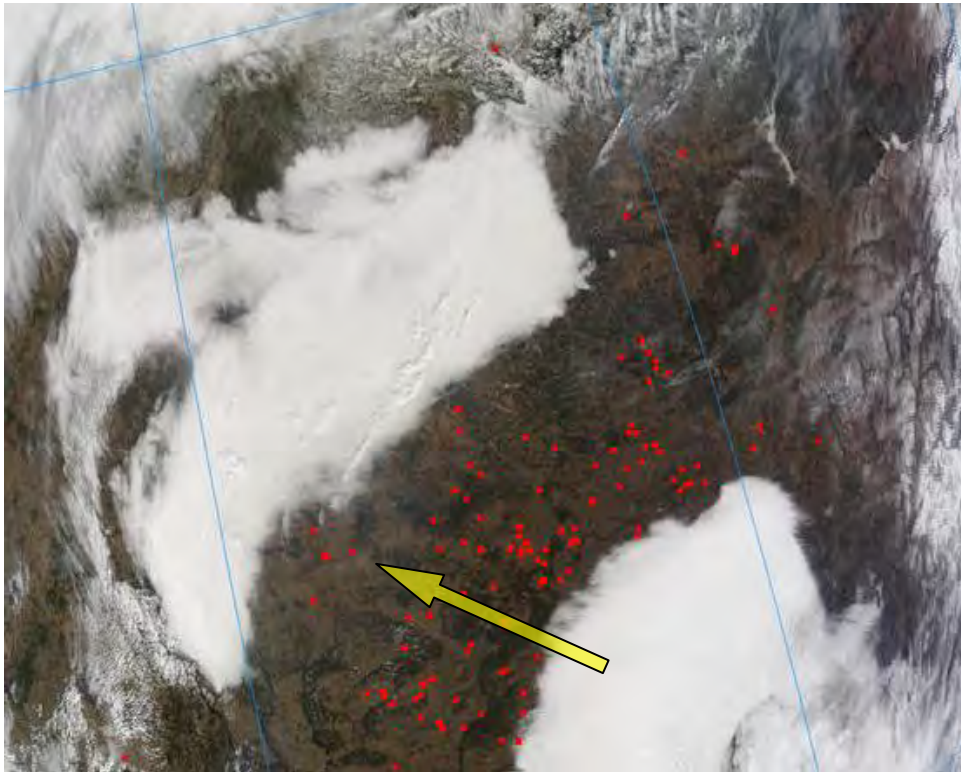


Fig.20. Yellow arrow points to Smoleńsk and shows direction and distance which the zone of stratus low layer clouds travelled with the fog from SE

In the Committee's opinion, generally accessible information from radiosondes let diagnose the cause of stratus clouds zone formation combined with fog, and establish its movement. Satellite photos show precisely its existence south of Smoleńsk even the day before as well as its slow advection during the night to NW. This zone was not clearly visible on satellite pictures in standard infrared region, yet, perfectly visible and with contour in a special array of channels destined to detect low level clouds and fog.

Occurrence of low, sub-inversion layer clouds combined with fog was not induced solely by radiation, but, in a big part by advection of damp air (radiation inversion only intensified this process). Advection of the layer of stratus clouds and fog arrived at Smoleńsk area in the morning, therefore such swift and unexpected change in radiation and advection of weather conditions at the aerodrome. Assuming that only radiation fog will form, one might think that visibility would certainly improve when the aircraft arrives in Smoleńsk and that the fog will go.

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#### **2.8.4. Possibilities of giving a warning against dangerous weather phenomena on the basis of STORM messages (available solely on the territory of the Russian Federation)**

In the atmospheric service of the Russian Federation, exchange of STORM<sup>111</sup> messages that warn against occurrence of dangerous weather phenomena between met offices is mandatory. Fog is such an occurrence, which is deterioration of visibility below 1000 m due to steam water condensation. The synoptic stations, residing NE of Smoleńsk, were sending fog<sup>112</sup> since 00:10. At stations, closer to Smoleńsk, fog was nearing gradually and allowed plotting an isochron which indicated clearly that fog was drawing ever closer to SMOLEŃSKA from SE. This information should suffice for the shift of duty at TWER met office to compile a prognosis and a warning against imminent dangerous weather. Any such activity was not possible in Poland as STORM reports are not let out of the Russian Federation.

#### **2.8.5. Assessment of Polish weather prognosis for the time of Tu-154 M landing at SMOLEŃSK NORTH**

The weather prognosis for the time of landing of Tu-154M at SMOLEŃSK NORTH – planned take-off at 05:00, according to prognosis no.198, prepared on 09.04.2010 at 17:00 by a senior synoptic at the military Centre of Hydrometeorology {(CH) SZ RP} for DSO COP for 9-10.04.2010 and prognosis no.199, prepared on 10.04.2010 at 03:30 for 10-11.04.2010, said: „visibility 1000-3000 m in dense mist, big cloud amount (5-7/8), St base 120-180 m”<sup>113</sup>.

The Committee found that the crew had been briefed on the weather prepared by airport meteorologist-on-duty at 36.Register, which differed greatly from the prognosis prepared by CH SZ RP, both seen in this table.

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<sup>111</sup> STORM warning messages, used in the hydro-meteorological service of the Russian Federation are destined to advise on occurrence of dangerous atmospheric phenomena: 1) gust; 2) strong wind, storm, whirlwind on land or sea; 3) low ceiling; 4) dust storm or snow storm or blizzard with/without precipitation; 5) poor visibility or hoar frost, or; 6) glaze ice; 7) intensive precipitation; 8) ice grains or hail; 9) dangerous condition of the sea; 10) storm with/without rainfall.

<sup>112</sup> As it appears from MAK Final Report (page 52).

<sup>113</sup> Weather prognoses nos.198 and 199 did not give very exact visibility of 1000-3000 m, in strong fog, while it was 150-300 m during the crash in fog, with stratus low layer clouds at 50-60 m while the forecast said 150 m.

|                           |                                       |   |
|---------------------------|---------------------------------------|---|
| <b>UTC time</b>           | Work shift at<br>CH SZ time:<br>03:30 | Meteorologist-<br>on-duty at 36<br>Regiment 03:35<br>Crew briefed at<br>04:10 |
| visibility                | <b>1000-3000 m</b>                    | <b>3000-5000 m</b>  |
| Cloud cover<br>Cloud base | <b>5-7/8 St</b><br><b>120-180 m</b>   | <b>3-5/8 St + mean</b><br><b>200-300 m</b>                                    |
| Weather<br>phenomena      | <b>dense fog</b>                      | <b>fog</b>  |

Closest to encountered at the aerodrome were the prognoses of the work shift on-duty at CH SZ RP, though, it was not forecast that visibility and ceiling would still go down even more.

Not very precise forecasting of appearance of stratus appearance, the ceiling and fog (lateral visibility) stemmed from a routine attitude towards data from scarcely located meteorological measurement stations. For SMOLEŃSK NORTH aerodrome no METAR or TAF were prepared and no information in respect of weather predictions was sent to the international network of atmospheric air data exchange.

The phenomenon of advection and radiation fog which is related to stratus very low clouds, which occurred in the area, albeit the vast area where it occurred to the south and east of Smoleńsk, was a phenomenon difficult to predict by weather forecasters due to short time and small number of synoptic information from observation stations. However, accessible satellite information and results of numerical prognoses were not used.

#### **2.8.6. An analysis of prognoses prepared in the Russian Federation**

Weather forecasts for SMOLEŃSK NORTH aerodrome were prepared by meteorologist-on-duty at the aircraft base in TWER. The forecast of 10.04.2010 at 01:30 predicted that Lateran visibility was going to be less than **3000-4000 m** and the lowest cloud base of **600-1000 m**, cumulus clouds forming during the day. Along with worsening of atmospheric conditions at the aerodrome, at 05:12 the forecast was altered to: low clouds base **150-200 m**, visibility **1500-2000 m** (although lower than aerodrome minima conditions were prevailing at the aerodrome since 05:10).

The manager of the met station at SMOLEŃSK NORTH (the only meteorologist at the aerodrome on that day) prepared at 05:40 (the time stated in the report) – probably – a

**SZTORM**<sup>114</sup> warning for SMOLEŃSK NORTH **from 05:40 to 07:00**, wherein he predicted: cloud cover 7-8/8 through low, layer clouds, base 50-100 m, strong mist at lateral visibility 1000-1500 m and waves of fog at visibility 600-1000 m. From the tape-recorded conversation of the meteorologist at Near Landing Zone post it appears that the Landing Controller knew nothing of the warning at about 06:05 and asked whether it was procured. According to Russian regulations (instruction NAMS 86 items 133 and 134), the Landing Controller was supposed to be addressee no.1. of the warning. In the Committee's opinion, the warning was prepared only after the Landing Controller asked about it. According to the current atmospheric conditions at the aerodrome, the warning was out of date already and the conditions predicted therein were overstated.

The weather forecaster at TWER met office altered his forecast again at 06:00. In it, he foresaw that until 08:00 the cloud cover would be 6-8/8 through layer clouds with 50-100 m base, visibility 400-800 m and wind 120-140°/1-4 m/s, and after 08:00 a noticeable change for better, above aerodrome minima.

In the Committee's opinion, the TWER forecaster had great difficulties in correct predicting of such unfavourable conditions. His prognoses hardly kept pace with ever worsening weather conditions, never were ahead. It was not only due to big distance between Twer and Smoleńsk, but also because the shift-on-duty at the met office did not consider the occurrence of fog on the direction of advection. As has been proved, it was possible to make a map of isochrones of places of fog occurrence, which would clearly show the advance of the zone of fog towards SMOLEŃSK NORTH aerodrome from SE.

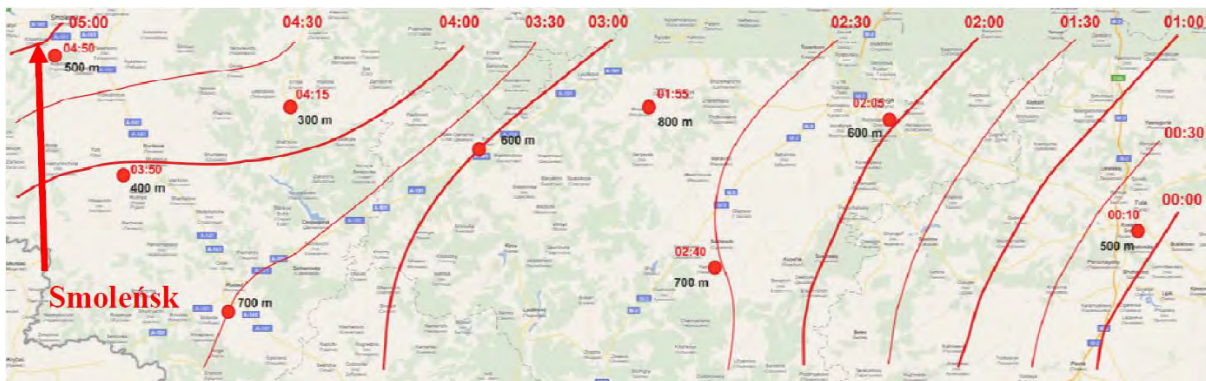


Fig.21. A map of isochrones of fog spots as well as visibilities watched – prepared on the basis of STORM messages from met stations resided to the east and south of Smoleńsk

<sup>114</sup> A.k.a. „Ostrzeżenie sztormowe” (Storm warning) – information about occurrence, or expected occurrence, of a dangerous weather phenomena or below aerodrome minima conditions, stating duration of such phenomena or conditions.

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### **2.8.7. Assessment of meteorological support execution of 36 Regiment to the flight**

„Instrukcja HEAD”, in § 7 items 4, 9, 12 and 13 tells to prepare weather forecast for international flights to facilitate decisions of their execution, also, to compile all flight papers and meteorological documentation in the Polish Force Centre of Hydrometeorology {(CH) SZ RP} and send the be technical means to the air port of origin, in this case to the military airport of the 36 Regiment in Warszawa.

**The military airport of the 36 Regiment was obliged to present to crew of Tu-154M the prognosis of senior meteorologist of the Centre of Hydrometeorology{(CH) SZ RP}.** The senior meteorologist on duty prepared a prognosis for the flight and landing of the Tu-154M and handed it over to the military airport of the 36 Regiment. In spite of it, the military airport prepared their own atmospheric documentation, and in it, their own version of the weather for the Tu-154M aircraft for SMOLEŃSK aerodrome and, at 04:10, handed it to the aircraft’s navigator. The Committee has found that the forecast of the military airport did not make use of all available data and that some data were already outdated. Probably, the military airport did not go through all most up-to-date met reports and overlooked a crucial info about fog and low clouds in the TAF for MOSCOW-VNUKOVO airport. In a talk with the Committee about this change the Centre of Hydrometeorology could not explain his conduct.

### **2.8.8. Assessment of meteorological support of the flight**

Meteorological support was being realised improperly due to:

- 1) the failure of TWER air base met Office to do basic tasks which was atmospheric support of SMOLEŃSK PÓLNOCNY. In particular, they did not predict fog and stratus layer clouds that were drawing near to the aerodrome (although they had access to atmospheric information from the territory of the Russian Federation that fog began to appear on the direction of advection as early as 00:10);
- 2) failure to publish at the specified time a STORM warning for SMOLEŃSK NORTH aerodrome notwithstanding continuous messages from the weatherman of abrupt weather;
- 3) failure of the 36 Regiment military airport to deliver to the crew of Tu-154M and the Regiment’s Deputy Commander the weather forecast for the SMOLEŃSK-bound flight, which was prepared by meteorologist-on-duty at the Air Force Centre of Hydrometeorology.
- 4) failure of SMOLEŃSK NORTH Terminal Controller to pass to the crew of Tu-154M full information of prevailing atmospheric conditions – omitting information on cloud base (vertical visibility).



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### **2.8.9. Assessment of conduct of persons in charge of meteorological support of flights**

- a) Commander of Tu-154M – assessed and analysed correctly the atmospheric conditions prevailing at SMOLEŃSK NORTH. Although the met report from the military airport did not predict minimum atmospheric conditions – for on the aerodrome for the time of landing - he assessed correctly the info (06:14) from the Controller in Mińsk, also from the Terminal Controller and from the crew of Polish Yak-40. Having analysed all this, at 06:26 he told the Diplomatic Protocol Director, who was in the cockpit, that in such atmospheric conditions any landing at SMOLEŃSK NORTH is out of the question and a decision is needed<sup>115</sup> whether to hold in the air or make to an alternate airport;
- b) Commander of Yak-40 made a landing in atmospheric conditions below his and his aircraft's minima but did not tell it a.s.a.p. to the 36 Regiment, which he could phone, about the true atmospheric conditions (below his and his aircraft's) which he just had during landing at SMOLEŃSK NORTH. When the atmospheric conditions at the aerodrome went from bad to worth, he merely said of the atmospheric conditions that at landing the cloud base was 60 m and lateral runway visibility was 2 km. In the radio exchange with Tu-154M the Yak-40 Commander passed his assessment of the atmospheric conditions in a very undecided way. He did not say that clouds were merging with thick fog and there was no possibility to see the runway from the height of 100 m when on final approach. And yet, he suggested a landing though according to him it was not possible;
- c) after the Yak-40 landed at SMOLEŃSK NORTH airport at 05:17, for nearly 30 minutes from its planned landing, the controller at Warsaw Military Airport of the 36 Regiment did not ask its crew their weather observation of SMOLEŃSK NORTH area. When he did, at 05:50, he passed this news to the met-on-duty as late as at 06:32, after intervention of the met-on-duty at the Air Force Centre of Hydrometeorology.

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<sup>115</sup> Aircraft's host– The President of the Republic of Poland.

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## 2.9. Flight Preparation Analysis

### 2.9.1. Designation of Crew

–HEAD Instructions”, § 8 –General Rules” sets forth the principles for designation of crew for performing a flight with a HEAD status:

para. 1. –The flight organizer is responsible for organizing flights with a HEAD status”.

para. 6. –Flight crew authorized to perform aviation activities aboard aircraft with a HEAD status shall be designated by the commander of the air force unit, by virtue of an order regarding organization of aviation training, and by the head of the Government Protection Bureau (BOR – *Biuro Ochrony Rzqdu*) with regard to his or her own officers on the flight crew, in internal documents of BOR”.

para. 7. –The air force unit commander unit shall appoint the flight crew and cabin crew”.

para. 8. –Only crews with full membership shall be approved for the performance of HEAD status aircraft; all crew shall carry valid certifications and approvals”.

para. 9. –The crew designated to perform a flight of a HEAD status aircraft shall meet the following conditions:

- 1) aircraft commander – shall be cleared for VFR and IFR flights, and shall carry valid approval to perform flights of HEAD status aircraft as aircraft commander;
- 2) co-pilot – shall be cleared for VFR and IFR flights, and shall carry valid approval to perform flights of HEAD status aircraft as a co-pilot;
- 3) other crew members – shall be cleared to perform aviation activities onboard aircraft”.

The Committee received the following response to the question –How is training conducted and what are the rules of issuing STS/HEAD flights certifications to flight crew” from the 36 Regiment:

–Pursuant to documentation in force in the aviation of the Polish Armed Forces, there is no formal requirement to award authorization for STS/HEAD flights, there only exists a provision regarding approval to perform such flights. There is no dedicated, additional training for obtaining approval to pilot STS/HEAD flights. Flight experience gained is the only criterion applicable. In the 36 Regiment, approval for STS/HEAD flights, and prior WAŻNY (IMPORTANT) flights, is confirmed by virtue of Daily Orders of the Commander of the 36 Regiment, and in Order no. 2 for the given year (appendix on permissions and licenses). Each pilot is required to make an appropriate entry in the ODL – as an excerpt from the order of the day of the regiment commander – in Section 4”.

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In reference to findings in Section 2.2 –“Training of the Tu-154M Plane Crew”, the Committee has found infringement upon principles stipulated in items 6-9 § 8 of –“General Rules” in the –“HEAD Instructions”. This pertains in particular to:

- failure to adhere to dates of licenses obtained, monitoring of piloting and navigation technique, and regular performance of training flights. The aircraft commander and co-pilot had no current checkrides for flying into zone, and the navigator had undergone no inspection of his navigation in a Tu-154M aircraft. The aircraft commander had made no training flights in 2009 and 2010.
- failure to adhere to internal regulations in respect of minimum requirements for allowing air crew members to perform STS/HEAD flights.

Despite the demand for flight on April 10<sup>th</sup>, 2010 having been submitted in advance, crew assignment for the flight was problematic for the 36 Regiment due to:

- A major burden on dispatched flights on the 36 Regiment, STS/HEAD flights in particular, on Tu-154M and Yak-40 aircraft;
- Insufficient number of crew members for the Tu-154M aircraft;
- Absence of permanently employed onboard navigators (there was only one in the unit). For this reason, in accordance with an internal arrangement by the unit command, the function was entrusted to co-pilots of Yak-40 planes with permission to perform on-board navigator responsibilities as part of Tu-154M crew. In the majority of flight cases, the choice of on-board navigator for the crew was random – the pilot who was not involved in Yak-40 aircraft flights was appointed navigator.

The crew was assigned by virtue Order no. 2 of the commander of the 36 Regiment of January 4<sup>th</sup>, 2010. Lists of authorizations issued to flight personnel of the 36 Regiment contained therein, indicates that the pilot assigned with the navigator role had no license to perform flights as an on-board navigator in the Tu-154M, or to make STS/HEAD flights. Only the Daily Order of the commander of the 36 Regiment of January 14<sup>th</sup>, 2010, contains a clause confirming the authorization of the navigator, which had never been extended to him.

### **2.9.2. Analysis of Initial Preparation of the Crew for Flight**

§ 8 of –“HEAD Instruction”, in Section –“General Rules”, stipulates as follows:

para. 11. –Each member of crew and cabin crew shall be responsible for preparation for flight and for properly performing duties assigned to him/her”.

§ 9, Section –“Rights and Duties of Aircraft Commander” stipulates as follows:

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para. 3. –The aircraft commander shall be responsible for verifying crew members‘ readiness for flight, and for assuring that no duties on board aircraft are performed by unprepared personnel”.

para. 4. –Aircraft commander is required to adhere to total duty time, flight time and rest time of crew members pursuant to RL -2006”.

Pursuant to § 12 IOL-2008:

para. 2. –The duration, validity period and organizational form are not specified with regard to preliminary flight crew preparation for flight”.

para. 3. –As a result of preflight briefing, the flight crew shall:”

2) have information concerning the following available and prepared:

b) navigation and traffic conditions in the area of assignment to be performed (e.g. AIP, AUP, NOTAM, Jeppesen)”.

Findings of the Committee indicate that preflight briefing of the crew for flight took place on April 9<sup>th</sup>, on-site at the unit, and at home in the afternoon/evening hours. On the basis of conversations with flight personnel at the unit and of family interviews, it was found unlikely that the full crew as designated had met for more than one hour. The day before takeoff, the aircraft commander and the flight engineer remained at the unit full time. On April 9<sup>th</sup>, the co-pilot remained at the unit for two hours only, from 0800 (1000 LMT) to 1000 (1200 LMT). In the Committee’s opinion, preparation of the crew for flight to SMOLEŃSK was made on an individual basis.

On April 9<sup>th</sup>, at 1415 (1614 LMT), the aircraft commander telephoned the airfield weather forecaster on duty (AWFD) in order to check the preliminary weather forecast for the flight to SMOLEŃSK. The AWFD forecast VIS 4km-5km, with medium and tall clouds, with cloud base lowering to 200m-300m a possibility. The forecaster did not forecast weather conditions below crew minima for the time of aircraft landing. He only suggested that the worst conditions would be present during morning hours, at time of the scheduled landing of the Yak-40 aircraft with a group of journalists. The Committee noted the behavior of the pilot, who expressed astonishment at the conditions forecasted: „*Rozumiem 3-5 km tylko widac?*” (–I understand one can only see 3-5 km away?”)<sup>116</sup>. This could suggest that the pilot, when assessing weather conditions from the viewpoint of his own experience, found the landing conditions to be difficult for him. The time when he actually became familiar with the preliminary weather forecast may suggest that it had not been reviewed during prior briefings with other crew members in attendance.

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<sup>116</sup> The Committee obtained the information from a transcript of the telephone call to the AWFD.

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Due to the flight to GDAŃSK scheduled for April 9<sup>th</sup>, 1400 (1600 LMT) by Yak-40 aircraft, where he was co-pilot (STS/HEAD flight), he did not arrive at the unit until 0900 (1100 LMT). Prior to that, he was advised on the telephone, that he would be flying to SMOLENSK as onboard navigator on a Tu-154M on April 10<sup>th</sup>. Upon arrival at the unit, he met the full-time navigator at the records and planning section, in order to collect all necessary documentation, and to prepare for flights to SMOLENSK and GDAŃSK. The full-time navigator provided him with photocopies of approach charts of the SMOLENSK NORTH airfield. Then the pilot began individual preparation for both scheduled tasks. In accordance with representations of the full-time navigator, the pilot, as part of preflight briefing, filled flight plans for April 10<sup>th</sup>, 2010, which he sent via Air Traffic Services at 0922 (1122 LMT), entered all data in the computer, calculating the so-called *–wilka*<sup>117</sup>, and entered all data into the Flight Star navigation software. In the opinion of the Committee, the flight plans for April 10<sup>th</sup> were copied over from April 7<sup>th</sup>, as on that day the VITEBSK airfield was open and could have been an alternate airfield, whereas according to AIP of Russian Federation and Commonwealth of Independent States (RF&CIS AIP), it was closed on April 10<sup>th</sup>, 2010 (a holiday). Then, the navigator proceeded to make preparations for flight to GDAŃSK<sup>118</sup> together with the commander of the Yak-40. According to order, takeoff was scheduled for 1400 (1600 LMT), but actually took place at 1525 (1725 LMT). While awaiting departure for GDAŃSK in the cockpit of the Yak-40, the navigator asked the aircraft commander about peculiarities of flying in the Russian Federation’s air space, and browsed a Russian aviation terminology handbook. He was learning commands and phrases, and inquired about their meaning and usage. Statements of the Yak-40 commander indicate that the navigator communicated to the commander of the Tu-154M that he was unable to conduct radio communication in Russian, and was learning it because he wanted to have at least rough orientation in the air situation. Having completed the flight to GDAŃSK (landing in WARSAW at 1720), the navigator went home, where he arrived at 1830 (2030 LMT). At home, he was preparing for next day’s flight. According to the account of his wife, he was *–studying maps*” and reviewing weather conditions forecast for the WARSAW-SMOLENSK flight route. He summarized preparations by stating that he *–expects fog during performance of the task*”, and ended them about 2000 (2200 LMT). The pilot had had an extended intermission in flights on the Tu-154M as onboard navigator (last flight made on January 24<sup>th</sup>, 2010, with same crew members on the day of the accident). In accordance with RL-2006 §

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<sup>117</sup> Calculations of magnetic declination needed for setting the course setting system to the landing meridian.

<sup>118</sup> Detailed description of task components, analysis of current weather conditions, checking information in the *Air Information Procedures*, waiting for passengers’ arrival.

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17.2: ~~In~~ case of a flight crew member, intermission between consecutive times of duty should consist in a resting period no shorter than 8 hours. Within the meaning of RL-2006 § 17.11, a resting period ~~shall~~ be understood as time allowing uninterrupted sleep in home or hotel conditions”. On April 10<sup>th</sup>, the navigator, willing to participate in all parts of the briefing for the SMOLENSK flight, could only rest for six and a half hours, as he got up about 0230 (0430 LMT)<sup>119</sup>. The above analysis indicates that the requirement as per § 17 para. 11 RL-2006 was not fulfilled in the process of flight preparation. In the opinion of the Committee, the shortened resting period may have impacted the mental and physical condition of the navigator during the flight.

The crew did not have access to current documentation of the SMOLENSK NORTH airfield. Data of the airfield was not provided in the RF&CIS AIP. The crew’s main source of knowledge of the airfield’s approach procedures consisted in approach charts sent to the unit in 2009 and information from pilots who had previously made flights to SMOLENSK.

In reviewing the flight briefing of the crew for the flights in the context of IOL-2008 provisions, the Committee stated that the provision in § 12.3.1.b was not discussed or completed by the entire crew, because:

- a) Following departure from WARSAW, the crew did not abide by the noise abatement procedure in force as described in the airfield documentation;
- b) During descent, the ~~Before~~ commencement of descent” checklist card was being read, whereas there is no information about ending it;
- c) The checklist card ~~After~~ reaching transition altitude” was read intermittently, and the reading was interrupted by discussion in the cabin. The time when the card was read was improper – prior to leaving transition altitude;
- d) At landing approach, there was no analysis of aircraft performance with reference to strip length, aircraft mass and current weather conditions, as a result of which the aircraft was configured for landing with flaps at 36°, rather than 45°, as specified in the inflight operation manual.

Also, §12.3.1.d ~~weather~~ conditions status and expected changes, and their impact on flights scheduled” was omitted, because after having receiving information on weather condition at the SMOLENSK NORTH airfield from the MINSK CONTROL controller, the crew failed to discuss the situation precisely. There were only some unfavorable opinions expressed about the work of the meteorologist on duty, who had prepared the forecast.

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<sup>119</sup> According to account of the wife.

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In lieu of a situation where all components of flight preparation consist in the individual preparation of flight personnel flying on multi-seat crews on two aircraft types, there is no assurance that the crew will be properly prepared for flight. In the opinion of the Committee, individual preparation of flight personnel without discussing the flight with all crew members does not guarantee preparation to the required standards.

### **2.9.3. Analysis of the Crew's Immediate Preparation for Flight**

Pursuant to IOL-2008 § 13, "Immediate Preparation":

- para. 1. ~~Immediate~~ flight preparation shall be performed on the day of flight, before its commencement. Its duration depends on the type of tasks performed and the nature of flights scheduled, and it should ensure performance of all necessary preparatory activities of flight and auxiliary personnel for the timely and safe performance of tasks".
- para. 4. ~~The~~ duration of immediate flight preparation for flights other than training flights should be not less than one hour. The decision to extend such time shall be made by commander of the aircraft or group".
- para. 13. ~~Individual~~ flight briefing shall be performed in accordance with Appendix 3. It is recommended that the flight organizer prepare detailed plans of individual pre-flight briefing, depending on the nature of flight assignments performed".

According to findings of the Committee, the unit had no detailed plans of individual pre-flight briefings depending on the nature of flight assignments being performed.

In accordance with provision of IOL-2008 § 13.8, pre-flight briefing should be performed in the crew briefing room of the 36 Regiment. Pre-flight briefing of crew probably took place aboard aircraft, between 0421 (0621 LMT) and 0446 (0646 LMT). Immediate flight preparation should not be performed aboard aircraft, as it could be interfered with by third parties.

The weather forecast received for the flight allowed the flight to be performed; nonetheless, it should not be precluded that had the crew received the forecast prepared by the Hydrometeorology Center of the Polish Armed Forces (CHSZ RP) of 0330 (0530 LMT), which predicted, for the time of landing of the Tu-154M aircraft in SMOLENSK, conditions by far inferior to those of the forecast prepared by the airfield meteorologist on duty (stratus clouds with cloud base of ca. 150m, VIS 1,000m – 3,000m in fog conditions), it could have suggested to the dispatcher a change in departure time from WARSAW, or choice of a different flight route.

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The aircraft commander did not confirm taking over the plane by signing the “Aircraft Operation Log” aboard aircraft. According to findings of the Committee, that was by negligence rather than willful misconduct. A review of the “Aircraft Operation Log” indicates that such negligence occurred often. Missed entries were not filled in, which suggests no appropriate supervision of such documentation by units assigned with such duty.

The analysis of immediate preparation of the crew for flight (including entries in the monitoring system) indicates that the crew did not meet the requirements of IOL-2008 §13 “Immediate Preparation” para. 4 (immediate flight preparation, construed as flight discussion with all crew members present, should last no less than 1 hour, whereas the entire crew had only 25 minutes available for immediate preparation). The “Guidelines of the Commander of the 36 Special Air Transport Regiment of January 15<sup>th</sup>, 2008, regarding organization of dispatched and training flights in the 36 Regiment”, item II.10, were not followed either, albeit stipulating “In case of immediate preparation for foreign flights, immediate preparation time shall be no less than 2 hours”, which goes to confirm that the flight was prepared for in a rushed manner.

## 2.10. Flight

### 2.10.1. Description of the Flight of Tu-154M tail no. 101, from Engine Startup to Ground Impact<sup>120</sup>

Aircraft power supply was turned on at 0252:38, a run-up test was performed on all aircraft engines between 0305 and 0324, and then engines were turned off.

At 0508, last passengers boarded the aircraft. After closing aircraft doors, the crew commenced flight procedures.

At 0511:30, the navigator made contact with the DELIVERY service of the OKECIE airfield on 121.6 MHz frequency. He obtained air traffic clearance [*in English*] as follows: „PLF 101, You are cleared to Smolensk, flight plan route, departure from runway 29,

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<sup>120</sup> Flight altitude, IAS speed, heading and engine operation parameters were adopted in accordance with records on onboard flight parameter recorders. All event time is UTC and established on the basis of an assumption that its determination will be based on an analysis of records of the cockpit voice recorder by the Central Criminal Laboratory (CCL). Time shift of data recorded by the QAR was minus (-) 3s, and of the TAWS database was minus (-) 6s versus the time base adopted by the CCL. Content of radio communication is derived from a readout of the MARS-BM recorder records by the CCL, and an analysis of correspondence recorded by PANSA. Distance from runway edge and reference to flight altitude above the landing strip in SMOLENSK was taken over from an analysis done by the aerial and technical subcommittee. In re-creation of the flight, records from the cockpit voice recorder, records of communications of Air Traffic Service of the OKECIE airfield, SMOLENSK NORTH airfield, and information stored in the TAWS and FMS systems were used.



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**right heading 310, initially 6000 feet altitude, squawk 4540, departure frequency 128.8. For start-up contact GROUND 121,9”.**

At **0513:00**, navigator made contact with GROUND service and was cleared to start engines.

At **0514:20**, engine no. 2 was started, at **0515:04** engine no. 1 was started, and at **0515:47** engine no. 3 was started. Between **0516:17** and **0516:27**, the aircraft crew checked control surface angles in the following sequence: ailerons, elevator, rudder.

At **0516:40**, navigator was cleared to taxi to Runway 29 via Taxiways: Z, A and E.

At **0517:05**, taxiing via taxiways towards the active Runway 29 began. During taxiing, at **0523:06**, after taking taxiway E, flaps were extended to position 28, and then freedom of movement of control surfaces was checked.

At **0523:15**, GROUND controller ordered the crew to await connection with TWR on 118.3 MHz frequency (**PLF 101, monitor TWR 118.3**).

At **0523:40**, TWR controller issued permission to take Runway 29 and to wait there. At the time, aircraft were landing on Runway 33 of the airfield. After obtaining permission, at **0525:30** the plane occupied Runway 29.

At **0526:30**, TWR controller issued clearance for takeoff [*in English*]: **“PLF 101, wind variable 3 knots, runway 29, cleared for takeoff”**.

Aircraft crew commenced takeoff at **0526:37**. Engines reached takeoff parameters at **0520653**, with aircraft speed of 65 km/h. At **0527:13**, at aircraft speed of 250 km/h, a movement of the yoke was initiated, which resulted in the plane parting from the runway after 4 s (**0527:17**), at a speed of 277 km/h. The next action of the crew was to retract landing gear (**0527:19**) at a flight speed of 296 km/h. The plane continued ascent, and at **0527:32**, at radio altitude (RA) of 128 m, with air speed of 327 km/h, the crew commenced retraction of flaps from 28° to 15°, which was achieved at airspeed of 349 km/h. After increase of speed to 365 km/h, the flaps angle was reduced from 15° to 0°, which was achieved at the speed of 389 km/h, RA altitude of 281 m. These actions ended at **0527:48**.

At **0527:33**, the plane initiated a turn to the heading of 310 deg., as per clearance.

At **0527:35**, navigator established communication with APP (APPROACH) service at the frequency of 128.8 MHz, notifying of having passing the altitude of 1,200 ft. Controller issued permission to ascend to flight level FL210, and the navigator confirmed the permission received.

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At the RA altitude of 297 m, at a speed of 393 km/h, at **0527:49**, the crew reduced engine thrust to that required for ascent. The next action was to activate the autopilot in the pitch and roll channels at **0528:11**, at a RA altitude of 512 m, at a speed of 436 km/h.

At **0528:17**, APP controller issued permission to turn right toward waypoint BAMS0. Navigator confirmed permission, and at **0528:24** the plane commenced a right turn.

At the altitude of 2,000 m, at **0529:47**, speed of 464 km/h, the PIC's VBE-SVS altimeter was set to the standard pressure value (1013 hPa).

At **0533:20**, APP controller instructed the crew to establish communication at a new frequency of 134.925 MHz. Navigator confirmed the controller's order.

At **0535:08**, the navigator established communication on the new frequency, calling: **–PLF 101, approaching FL210 inbound BAMS0, request FL 330 as cruising level”**.

The controller responded: **PLF 101 climb FL 330, direct RUDKA”**. The navigator confirmed the permission received.

The aircraft reached FL330 at **0542:16**.

Between **0542:16** and **0609:55**, the aircraft was flying at an altitude of 10,000 m (FL330). Flight along the route was made with autopilot active in the longitudinal and roll channels, without automatic engine thrust deactivated.

At **0544:50**, the area controller instructed the crew to change frequency and to establish communication with MINSK CONTROL at 133.550 MHz. The navigator confirmed the instruction received.

At 0559:00.5 the flight engineer switched the steering and fuel consumption measurement system from automatic to manual.

At **0606:08**, MINSK control issued instructions to change frequency to MINSK CONTROL 118.975 MHz.

At **0606:41**, the navigator established communication on the new frequency and transmitted the information that he was flying at FL330 and was above Minsk.

At **0607:17**, the controller asked the crew about the FL expected above waypoint ASKIL. The navigator answered: 3,900m. The controller confirmed receipt of information and asked for notification of readiness for descent.

At **0609:32**, the navigator notified the MINSK control of readiness for descent. At **0609:37**, the controller issued permission to descend to 3,900m.

At **0609:50**, the aircraft commander gave orders to change powerplant operating range to **–low thrust”**.

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At **0609:53**, engine thrust was reduced, and at **0609:55**, descent commenced. For that purpose, the altitude maintenance mode was deactivated, and descent commenced by pitching the plane downward. At **0614:15**, the controller transmitted the following information to the crew: „**Polish one zero one, for information at zero six one one Smolensk visibility: four zero zero meters, fog**”. The navigator confirmed the message as received. The crew began a discussion, giving an unfavorable opinion on the work of the OKĘCIE airfield meteorologist, who had reported better weather conditions. Disbelief was expressed that fog was still present at 1000 local time. The commander was already aware of bad weather and inaccurate forecast, as he conditionally admitted landing outside SMOLENSK.

At **0610:06**, while reading out the checklist card “Prior to commencement of descent”, the crew stated that the procedure was as yet unknown (aircraft commander), landing data is partly written down, RA controls set to 100 m.

At **0622:15**, the controller notified passing waypoint ASKIL, and instructed the crew to change to 128.8 MHz, MOSCOW CONTROL. At **0622:37**, the navigator established communication and transmitted information that the aircraft was at 3,900 m and the crew requests further descent. At **0622:50**, the controller granted clearance for descent to 3,600 m and he instructed crew to switch to communication with KORSAZH (codename of the SMOLENSK NORTH airfield) at 124.0 MHz.

At **0623:00.5** the Director of Diplomatic Protocol entered the cockpit.

**From that point, communication with the Air Traffic Control (GKL) was conducted by aircraft commander in Russian.**

At **0623:04**, the aircraft turned left, to heading 050°. At **0623:33** the aircraft commander established communication with KORSAZH: „**Корсаж Старт, польский сто один. Добрый день. На дальний привод, снижаем три тысячи шестьсот метров**” (*KORSAZH START Polish 101, good morning. For outer NDB, we are descending to 3,600m*). In response, ATC KORSAZH asked about fuel remaining and alternate airfields. PIC responded that fuel remaining was 11 tons, and alternate airfields were VITEBSK AND MINSK.

At **0624:25**, ATC communicated: „**Рапа Lima Foxtrot one two zero one на Корсаже туман, видимость четыреста метров**” (*PLF 1201, fog on KORSAZH, visibility four hundred meters*).

At **0624:35**, aircraft commander responded: „**Я понял. Дайте, пожалуйста метеоусловия**” (*I copy, please provide weather conditions*).

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At **0624:42** ATC communicated: „**На Корсаже туман. Видимость четыреста метров. Four zero zero meters**” (*Fog on KORSAZH, visibility four hundred metres. Four zero zero meters*).

At **0624:52**, the aircraft commander requested further information: „**Температура, давление пожалуйста**” (*Please provide temperature and pressure*).

At **0624:51**, ATC responded: „**Температура плюс два, давление семь сорок пять. Семь четыре пять. Условий для приёма нет**” (*Temperature plus two, pressure seven forty five. Unsuitable landing conditions*).

At **0625:04**, aircraft commander communicated information to ATC: „**Спасибо. Но если возможно попробуем подход, но если не будет погоды, тогда отойдём на второй круг**” (*Thank you. If possible, we shall attempt approach, and if the weather is too bad, we will go around*).

At **0625:14** ATC asked: „**Один ноль один, после контрольного захода у вас топлива хватит на запасной?**” (*One zero one, have you got enough fuel for getting to alternate airfield after trial approach?*). AC confirmed: „**Хватит**” (*Enough*). At **0625:25** he requested clearance for further descent from ATC: „**Розрешите дальше снижение, пожалуйста**” (*I request clearance for further descent*). At the same time, the co-pilot conducted a conversation with the Yak-40 crew on 123.45MHz (the conversation was initiated by request of Yak-40 pilot to the crew of Tu-154M at **0624:19** on 124.0 MHz). The PIC of the Yak-40 communicated his assessment of weather conditions: widzialność 400 m podstawa poniżej 50 metrów, grubo” (*visibility 400m cloudbase below 50 meters, thick*), said that he had landed, that the crew of Tu-154M could try landing, and that a double APS gate had been set up at the airfield. At **0625:27**, the controller provided clearance for descent: „**Один ноль один с курсом сорок градусов, снижение тысяча пятьсот**” (*One zero one on heading 40 degrees, descent 1500*). At **0625:34** aircraft commander confirmed: „**Тысяча пятьсот с курсом сорок градусов**” (*1,500, on heading forty degrees*). At **0625:39**, the plane commenced descent and changed heading to 034.

At **0626:18.5**, the aircraft commander informed the Director of Diplomatic Protocol, still present in the cockpit: „**Пане dyrektorze – wyszła mgła w tej chwili i w tych warunkach, które są obecnie, nie damy rady usiąść. Spróbujemy podejść – zrobimy jedno zajście – ale prawdopodobnie nic z tego nie będzie. Tak że proszę już myśleć nad decyzją, co będziemy robili**”. (*Director – fog has come out now and under present conditions we will not manage to touch down. So please start thinking about your decision as to what we are going to do*). Director said: „**No to mamy problem**” (*So, we have a problem*). The aircraft commander

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explained: „Możemy pół godziny powiszieć i odchodzimy na zapasowe”. (*We may hang around for half an hour, then we part for alternate airfield*). When asked about alternate airfields, he answered: „MIŃSK albo WITEBSK” (MINSK or VITEBSK). After the conversation, in the opinion of the Committee, the Director left the cockpit.

At **0628:47**, at an altitude of 2,176 m, the aircraft commander’s VBE-SVS altimeter was switched from standard pressure to another setting (judging by the discussion between crew members, to 993 hPa, which was the barometric pressure at airfield level, and from that point barometric altimeters read altitudes in reference to the runway).

At **0630:11** the aircraft commander notified ATC that he was maintaining altitude of 1,500 m.

At **0630:14** ATC gave clearance for descent to 500m at 745 mmHg pressure, and at **0630:27** ordered a heading change to 079. Aircraft commander confirmed both instructions.

At **0630:33** the Director appeared in the cockpit again, saying: „Na razie nie ma decyzji Prezydenta, co dalej robimy” (*No decision as yet from the President as to what we are doing next*), and then left the cockpit.

At **0630:47** the controls and fuel measurement system was switched to automatic mode.

At **0634:23**, at an RA altitude of 494 m, automatic engine thrust was activated.

At **0634:58**, ATC asked: „**На военном аэродроме посадку осуществляли?**” (*Have you performed landings at military airfields?*). Aircraft commander confirmed: „**Да, конечно**” (*Yes, of course*).

At **0634:59**, at an RA altitude of 472 m, at a speed of 378 km/h, landing gear was put down, and between **0635:01-0639:05** flaps were extended (in a 15°-28°-36° sequence).

At **0635:13.5**, the purser called: –Commander! Deck ready for touch-down”.

At **0635:16** ATC issued order to enter base leg.

At **0635:24** ATC communicated to the crew, that from the altitude of 100 m they should be ready for a go-around. Aircraft commander confirmed the information.

In the view of the Committee, at **0636:48.5**, Commander-in-Chief appeared in the cockpit, probably after a discussion with the Director of Protocol. When in cockpit, he did not have radio headphones on.

At **0637:04**, the pilot of the Yak-40 aircraft communicated on 124.00 MHz frequency that current visibility was 200m. The aircraft commander thanked him for the information.

At **0637:26.5**, aircraft commander reported commencement of final approach.

At **0639:11.5** Landing zone control communicated to the crew: „**Сто первый, удаление десять вход в глиссаду**” (*One zero one, distance ten, entry into path*). The

aircraft was then at the RA altitude of 519 m, 502 m above airfield level, at a distance of 10,110 m from threshold of RWY 26). At that time, the crew were reading the landing checklist, checking required parameters and performance of landing approach activities.

At **0639:33** Landing Zone Control transmitted information to the crew: „**Восемь на курсе, глиссаде**” (*eight on course, glide path*) (550 m by RA, 528 m above airfield level, within 8,300 m of RWY 26 threshold, at a position of 130m above glide path and 65 m to the left of runway centerline).

At **0639:40.5** ATC transmitted the message: „**Полоса свободна**” (*Runway free*) (522 m by RA, 445 above airfield level, at distance of 7,664 m of RWY 26 threshold).

At **0639:43.5** ATC transmitted the message: „**Посадка дополнительно**” (*Continue approach*) (525 m by RA, 470 above airfield level, at distance of 7,409 m of RWY 26 threshold).

The aircraft commenced the final leg of approach at **0639:45.5**, at a distance of 1.54 m before the outer beacon.

At **0639:52.5** Landing zone control communicated: „**Подходите к дальнему, на курсе глиссаде, удаление шесть**” (*You are approaching outer NDB, on course and path, distance six*) (450 m by RA, 444 above airfield level, at distance of 6,649 m of RWY 26 threshold, at position of 120 m above gliding path and 115m to the left of runway centerline).

Outer NDB signaling began at **0639:53**. The co-pilot reported passing the outer NDB at **0639:55.5**. He gave no information about flight attitude. The plane was, at that time, at an altitude of 426m above airfield level, distance of 6,395m from RWY 26 threshold.

At **0639:57**, when flying above outer NDB, aircraft commander responded to Landing Zone Control message of 0639:52.5, saying: „**Четыре**” (*Four*) (419 m RA, 420 m above airfield level, 6,270m from RWY threshold 26). The beacon was passed at a speed of 303 km/h. Soon afterwards, between **0639:57-0640:09**, at RA altitude between 418 m and 356 m, at 303 km/h, autothrottle reduced engine thrust to minimum range.

At **0640:00.5**, the navigator reported altitude of 400 m. The aircraft was then at 404 m above airfield level, at a distance of 5,974 m from RWY 26 threshold, and RA indicated 397 m.

At **0640:09** at RA altitude of 356 m (341 m above airfield level, 5,251m from RWY 26 threshold) at a speed of 306 km/h, synchronization of TAWS – TERRAIN AHEAD occurred. At **0640:14.5** at an RA altitude of 366 m (297m above airfield level, at a distance of 4,768 m from RWY 26 threshold), at a speed of 309 km/h, the VBE-SVS altimeter of the aircraft

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commander was switched to standard pressure of 1,013 hPa<sup>121</sup>. Immediately afterwards, at **0640:15** – at RA altitude of 366 m, 295 m above airfield level, at 4,724 m from RWY 26 threshold, TAWS stopped generating the TERRAIN AHEAD message.

At **0640:16.5** Landing Zone Control communicated: „**Четыре на курсе, глиссаде**” (*Four on course and glide path*). (359m by RA, 287 m above airfield level, at a distance of 4,591 m from RWY 26 threshold, 60 m above descent slope and 130 m left of runway centerline).

At **0640:26.5** the Commander-in-Chief of the Air Force said: „Dwieście pięćdziesiąt metrów” (*Two hundred and fifty metres*) (at an altitude of 227m above airfield level, RA 269m), 3,716m from RWY 26 threshold). At **0640:28** the navigator notified: „Dwieście pięćdziesiąt” (*Two hundred fifty*) (at an altitude of 220m above airfield level, RA 259m), 3,585m from RWY 26 threshold).

At **0640:29.5** LZC communicated: „**Три на курсе, глиссаде**” (*Three on course, glide path*). (250 m by RA, 210 m above airfield level, 3,456m from RWY 26 threshold, 35m above glide slope and 100m left of runway centerline).

At **0640:34.5**, at RA altitude of 219 m, 182 m above airfield level, 3,040 m from RWY 26 threshold, at a speed of 288 km/h, TAWS system warnings activated again, which continued until the aircraft rolled to the left after losing a part of left wing, 3.5 s before ground impact.

At **0640:36** the navigator communicated altitude: „Dwieście” (*Two hundred*) (200 m by RA, 168 m above airfield level, 2,926m from RWY 26 threshold). At **0640:40** he communicated altitude: „Sto pięćdziesiąt” (*One hundred and fifty*) (147 m by RA and 128m above airfield level, 2,631m from RWY 26 threshold).

At **0640:41.5** LZC communicated: „**Два на курсе, глиссаде**” (*Two on course, on glide path*). (131 m by RA, 114 m above airfield level, at 2,521 m from RWY 26 threshold, 20m above glide slope and 80m left of runway centerline).

At **0640:44.5** (98 m above airfield, 113 m by RA, 2,291 m from RWY 26 threshold) Air Force Commander-in-Chief said: „100 metrów” (*100 metres*).

At **0640:45.5** (103 m by RA, 90 m above airfield level, 2,212 m from RWY 26 threshold) the navigator communicated: *100*.

At **0640:49**, at RA altitude 103m, at a speed of 280 km/h, automatic control began to increase engine thrust (from low throttle range). This was due to airspeed decreasing below

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<sup>121</sup> This caused the altimeter readings of aircraft flight altitude to increase by 168 m, as reported to TAWS. This fed incorrect information to the system, as a result of which it assumed the aircraft to be at a higher than actual altitude, and failed to generate warnings.

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280 km/h, which was set for automatic engine thrust control (when speed decreases below the setpoint, in this case 280 km/h, the system increases engine thrust).

At **0640:50.5** The Commander-in-Chief of Air Force said: „Nic nie widać” (*Nil visibility*). This occurred 63 m above airfield level, at 109 m RA altitude, 1,815 m from the RWY 26 threshold.

At **0640:51.5** (49 m above airfield level, 100 meters by RW, 1,736 m of RWY 26 threshold), the navigator notified: „sto” (*one hundred*).

Three references to 100 m RA altitude with actual flight altitude decreasing above the airfield resulted from the shape of terrain at approach.

At **0640:52**, when the aircraft reached radio altitude of 91 m RA (39 m above airfield level, 1,696 m from the RWY 26 threshold), the aircraft commander communicated to the crew: „Odchodzimy na drugie (najście?)” (*Going around?*), at **0640:53** the co-pilot confirmed: „Odchodzimy” (*Going around*). At **0640:54**, 66 m RA altitude (23 m above airfield level, 1,538 m from runway threshold) at a speed of 277 km/h, warning of hazardous altitude as set on the radio altimeter occurred.

At **0640:55** LZC transmitted the message: „Горизонт 101” (*Horizon 101*) (50 m by RA, 14 m above airfield level, 1,459 m from RWY 26 threshold, 70 m below glide slope and 70m left of runway centerline).

At **0640:57.5** ATC transmitted the message: „Контроль высоты и горизонт” (*Altitude control and horizon*) (28 m by RW, 2 m above airfield level, 1,265 m from RWY 26 threshold, 75 m below glide slope, 65 m left of runway centerline). At the same time, onboard the aircraft flying at 277 km/h, the autopilot’s pitch channel was deactivated. This resulted from the aircraft commander pulling the control column toward him by more than 50 mm, which is described in the Aircraft Flight Manual as the value above which the ABSU pitch channel is disconnected. Disconnection of autopilot pitch channel was signaled by a chime.

At **0640:58.5**, RA altitude 16m, 5m below airfield level, 1,187m from RWY 26 threshold, at a speed of 274 km/h, marker signaling of the inner beacon became active. At the same time, automatic thrust control system was deactivated by pushing engines control levers forward, increasing their thrust and pulling the control column backwards.

At **0641:02.8**, at 1.1 m above airfield level, at a distance of 855 m of RWY 26 threshold, the aircraft’s left wing hit a birch with a trunk 30cm-40cm in diameter, resulting in loss of 6.1 m of left wing. This caused the aircraft to roll to the left uncontrollably, which the crew tried to counteract by turning the control column in the opposite direction. As a result, the roll channel of the ABSU autopilot was disconnected.



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At **0641:05** ATC issued the command: „Уход на второй круг!” (*Go around!*). The aircraft was at a distance of 698 m from the 26 threshold in uncontrolled rotation, with the crew unable to steer the aircraft.

At **0641:07.5** the aircraft’s ground impact occurred.

## **2.10.2. Analysis of Tu-154M Crew Actions**

### **2.10.2.1. Flight Preparation**

On April 4<sup>th</sup>, the aircraft was modified in the 36 Regiment, contrary to documents issued by the overhaul facility after the overhaul completed. In the third salon compartment, designed for 8 people, 18 passenger seats were mounted. An analysis of change in the location of empty aircraft weight center was not performed.

The crew should not commence flight in an aircraft, the weight center location of which and mass was unspecified following modification. In the absence of appropriate entry documents, such as: weighing report and balancing sheet for the current configuration, the crew was unable to prepare a balancing sheet for current aircraft configuration.

The balancing sheet is missing, as are other documents demonstrating the form and manner of the crew analyzing aircraft mass and balancing.

The Committee assumed that on the date of takeoff the aircraft weighed ca. 84,900 kg, and ca. 78,000 kg<sup>122</sup> before landing. Calculation of weights was necessary in order to perform an analysis of speeds used by the crew during takeoff and landing<sup>123</sup>. Mass values for takeoff and landing did not exceed acceptable values.

The technical report remaining from the accident specifies that 6,000 kg of fuel was filled in tank no. 4. The pre-flight fuel volume onboard aircraft was 18,672 kg total. According to flight plan, the crew specified the possible flight duration as 3 h 30 min. Considering the aircraft fuelling rules, as stipulated in the flight manual of the Tu-154M aircraft, section 9.1.3. *Fuel filling scenarios*, and in the *Tu-154M loading and balancing instructions*, fuel in tank no. 4 (6,000 kg) could not be treated as navigation fuel but as ballast fuel only. 12,762 kg of fuel should have been considered the basis for determining flight duration (in the flight plan, and for acceptance at alternate airfields). Thus, flight duration was about 2 hours 30 min.

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<sup>122</sup> On the basis of an analysis of flight data recorder readings, the following masses have been assumed:

- takeoff: 84 883 kg,
- landing: 77 886 kg,
- fuel at time of accident: 10 600 kg.

<sup>123</sup> Takeoff speeds are set on the basis of tables for the 84-86 tons range.

The crew had approach charts of SMOLENSK NORTH at their disposal, which were copies of material handed over to the Polish Embassy in Moscow by the RF MoFA. The authority handed over materials received from the Russian side to the Headquarters of the Air Traffic Services of the Polish Military, who then forwarded them to the 36 Regiment.

The Committee found that aviation-related content of approach charts was inconsistent with the actual situation, as they comprised an approach diagram and description on heading 079, as well as an incorrect value of magnetic declination.

On the basis of FMS data, the Committee concluded that the crew placed points on the flight plan with datum derived from aforementioned approach charts. Entry of datum appropriate for the SK-42 frame of reference in the FMS system working to the WGS-84 reference caused those points to move 116m south compared to their actual location.

#### **2.10.2.2 Engine Startup**

Actions related to engines startup are described in the Aircraft Flight Manual (AFM) of the Tu-154M aircraft. Engine startup was performed in accordance with principles contained therein. After the startup procedure of engine no. 3 was completed and pressure obtained in all hydraulic systems, movement of all control surfaces was tested.

#### **2.10.2.3. Taxiing**

Taxiing on the WARSAW-OKECIE airfield proceeded properly, flaps displaced to pos. 28 after taxiway "E" was taken. While Aircraft Flight Manual 4.1.2 item 6 prohibits taxiing with wing mechanization extended, taxiway E leads directly to the waiting point before RWY 29, and operational practice on communication airfields requires the crew to configure the aircraft for takeoff before taking the runway. Considering that, the action of the crew was reasonable and did not infringe upon the manual. Prior to taking the runway, angles of all control surfaces were checked. All actions complied with procedures as described (in checklists and aircraft flight manual).

#### **2.10.2.4. Takeoff Roll to the Point of Rotation (lifting the nose gear)**

Actions of the crew concerning takeoff commencement were appropriate. Starting thrust was set. For starting mass between 84-86 tons, respective takeoff speeds were:  $V_1 = 235$  km/h,  $V_R = 245$  km/h<sup>124</sup>. According to recorder readings, at aircraft speed of 250 km/h control column movement was initiated, which ensued with the aircraft lifting from the runway at

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<sup>124</sup> The speed described as  $V_1$  is the speed at which the crew makes the decision to continue or discontinue takeoff after failure occurs in run-up.  $V_R$  indicates the moment of nose gear lifting and commencing climbing.

a speed of 277 km/h. All speeds were appropriate speeds, within delay tolerances necessary to account for when performing takeoff maneuvers.

#### **2.10.2.5. Takeoff from the Moment of Rotation to Reaching Cruising Altitude**

After lift-off, on climbing after takeoff from WARSAW, the crew did not adhere to the noise abatement procedure in force, as described in airfield documentation. This is evidenced by the altitude of flaps retraction (128 m).

The proper procedure was described in AIP Poland, in section EPWA AD 2.21.2, and was entered into use by means of amendment AIRAC no. 093, on January 14<sup>th</sup>, 2010. Information about the procedure in force was also contained on Jeppesen documentation cards for EPWA airfield, page 10-1P5.

In the process of flaps retraction, the crew correctly performed the stage of reduction of flaps displacement from position 28-15. The crew did not maintain speed described in the aircraft flight manual (AFM) in the process of retracting flaps from position 15 to 0. The manual requires the speed at the end of the flaps retraction process to be not less than 410 km/h. During the flight in question, flaps reached 0° at 389 km/h. The aircraft reached the required speed of 410 km/h 5s later.

Crew actions during climbing after takeoff are described in section 4.2.2.2.

The altimeter was switched to standard pressure at the appropriate altitude (2,000 m = 6,570 ft.), after reaching transition altitude. Leaving automatic thrust control off (after autopilot activation) is standard procedure at this stage (due to characteristics of automatic thrust control operation).

In Warsaw TMA, there was a limitation of flight speed to 250 knots below FL100 level. The crew commenced acceleration beyond that speed 2,650 m (FL87). That was a deviation from takeoff procedures.

#### **2.10.2.6. Flight**

Flight at the scheduled flight level proceeded correctly. The flight engineer switched fuel automation from automatic to manual due to a need to work out the fuel in such manner as to allow avoiding of aircraft trimming the airplane using ailerons, thus allowing reduced fuel consumption.

##### **2.10.2.6.1. Descent to Transition Altitude**

Descent from cruising level was initiated after obtaining clearance from ATC. Descent was made to the altitude of 3,900m, then 3,600m, in accordance with ATC clearance.

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At **0610:06**, while reading the checklist card *Before commencing descent*, the crew concluded that the procedure was still unknown (aircraft commander), landing data was partly written down, RA dials set to 100m; at **0610:31** the aircraft commander and co-pilot communicated that their runway heading was set at 259. There is no information, however, that the checklist reading was completed, and the way it was read out indicates that the data necessary for completing it had not yet been prepared or considered. An analysis of recorder readings suggest that despite the aircraft commander stating that RA dials were set to 100m, they were actually set to 65 m. When and how the crew made the decision is unknown. Absence of clear rules for setting the RA for approach in documents other than AFM resulted in the crew setting the RA inconsistently with AFM 4.8.3.6 item 4.

During descent, the crew used the FMS for maintaining and changing the set heading values. From the point of view of crew teamwork and security considerations, there is an absence (in the existing MARS-BM recorder record) of as much as a brief discussion of the manner of approaching landing with the crew by the flying pilot<sup>125</sup>. Some content appears during the reading of checklist cards; it was not, however, a discussion that could afford the crew an opportunity to verify the planned approach scheme. The information about weather conditions provided by MINSK CONTROL controller at **0614:15**, significantly below the aircraft and crew minima, should have resulted in the aircraft commander conducting a thorough discussion of the situation with the entire crew.

During descent, the flight was performed as planned to waypoint ASKIL. According to the submitted flight plan, past ASKIL the flight should be continued to waypoint RALOT. The heading between waypoints ASKIL and RALOT is 076 degrees. After passing waypoint ASKIL, the aircraft changed course to 050 at **0623:10**, and the aircraft commander reported for communication with KORSAZH, as instructed by MOSCOW CONTROL, communicating that he was tracking to outer beacon, and descending to 3,600 meters. An analysis of FMS data stored indicates that the crew had preprogrammed such route (from ASKIL to DRL1<sup>126</sup>), contrary to the flight plan submitted beforehand, and to instructions from air traffic authorities. The beacon was not operational, as it had been decommissioned<sup>127</sup>. ATC had not issued permission for route change, therefore the crew's

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<sup>125</sup> In the case of a crew of two pilots, the one who is piloting the aircraft is referred to as the "flying pilot", and the other as the "monitoring pilot".

<sup>126</sup> The name of the point defined by the crew in the FMS was appropriate for the location of the outer beacon on heading 079 on the SMOLENSK NORTH airfield.

<sup>127</sup> Information about the beacon being decommissioned was sourced in NOTAM M2113/09. The crew was unaware of the document, as it was not distributed outside the RF. On approach charts available to the crew, the beacon is part of the approach to runway 08. The fact that radio communication & navigation

action infringed upon aviation regulations. We need to note that the aircraft did not reach the altitude of 3,600 m (as per clearance). Descent discontinued at 3,706 m, and such altitude was maintained from **0623:49** to **0625:48** (2 min), even though at **0623:42** the aircraft commander communicated to KORSAZH that he was descending to 3,600m and tracking to outer beacon. Failure to reach the altitude as instructed was another departure from air traffic principles and may demonstrate an absence of cooperation among the crew.

Clearance for further descent to 1,500m, on 40° heading, was received by the aircraft commander from ATC at **0625:34**. The maneuver commenced at **0625:48**. The co-pilot was communicating talking with the Yak-40 crew at the same time. The exchange which took place after commencing further descent, when at **0627:04** the co-pilot asked the aircraft commander: „Do ilu schodzimy? Do sześciuset?” (*How far do we descend? Six hundred?*); unidentified voice in the cockpit: „+500, 4900”; aircraft commander at **0627:10**: „~~to~~ 745”. This indicates that, contrary to regulations, the aircraft commander considered descent as descent below transition level. At **0628:47**, at altitude of 2,176 m, the aircraft commander switched the VBE-SVS altimeter from 1,013 hPa to another setting (probably 993 hPa, according to records of the MARS-BM recorder).

At **0629:58**, the co-pilot reported: „Wysokościomierze 993/745” (*Altimeters 993/745*). At **0630:11**, the aircraft commander communicated to ATC: „Korsazh, polski 101, utrzymujemy 1500” (*Korsazh, Polish 101, maintaining 1,500*).

Altimeter setting procedures are described in § 24 of RL-2006 2<sup>nd</sup> issue, as amended on December 28<sup>th</sup>, 2008.

In the opinion of the Committee, the commander commenced descent to 1,500 m according to QFE pressure of 745 mm Hg/993 hPa, contrary to applicable regulations and clearance obtained. In accordance with approach charts to SMOLENSK NORTH, the flight level of 1,500 was the transition level, and until below it, it was necessary to control altitude on the basis of standard pressure of 760 mmHg/1013 hPa. The altitude of 1,500 m reported to ATC by the aircraft commander was actually different than expected by the controller (was 1,332 m). Only the next clearance from ATC, issued at **0630:14**: „Polski 101, według ciśnienia 745, zniżanie 500” (*Polish 101, by pressure 745, descent 500*) allowed the crew to descend using the pressure value of 745 mmHg.

The flight engineer switched the fuel system from manual to automatic mode at **0630:47**. That did not coincide with relevant communication to the commander of the aircraft.

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instruments were deactivated on heading 08, was also unknown to the crew of the IL-76 aircraft, which approached before Tu-154M.

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One can speculate that fuel automation was activated to alleviate the flight engineer's workload in the last stage of flight.

The checklist card *After reaching transition altitude* was read between **0629:58** and **0631:13**. The checklist card was read in an unsystematic way, and reading was interrupted by discussion in the cockpit. Additionally, the card was called out at an inappropriate time, before leaving the altitude of 1,500 m, which was the transition altitude. The first item on the checklist was to check the setting of altimeters, taking pressure on the landing airfield into account. In this case, pressure value QFE 993 hPa/745 mmHg was confirmed without regard to the fact that flight altitude was 1,500 m (as per approach chart), and the crew had not obtained permission for descent below transition level.

While reading it, the navigator reported „ILS niestety nie mamy. Kurs lądowania 259 ustawiony. ARK mamy przygotowane, 310/640, nastrojone. Piątka, szóstka, automat ciągu”. (*Unfortunately no ILS. Landing heading 259 set. ADF prepared, 310/640, tuned. Five, six, automatic thrust control*).

At **0632:58**, the aircraft commander said: „W przypadku nieudanego podejścia, odchodzimy w automacie” (*In case of failed approach, we're going around in automatic*).

Crew work was chaotic, interrupted by third parties appearing in the cockpit, the flying pilot – PIC – was burdened with radio communication duty. Crew cooperation involved only the performance of commander instructions regarding aircraft configuration. The crew did not react to the commander's suggestion to “go around in automatic”. The maneuver of go-around in automatic mode can only be performed in two cases:

- with glide path taken over from the ILS system after pressing the “go-around” button.;
- with glide path taken over from the ILS system, after the pilots move the engine control levers (which cannot be done from the flight engineer position) all the way forward.

A similar effect can be achieved when, despite there being no ILS signals, the ABSU “Glisada” mode is activated, with “Posadka” switch activated on PN-5 panel. Such action, however, results in the pitch control “angazh” channel of the ABSU deactivated, when the aircraft is not steered in the pitch channel. Findings of the Committee indicate that such possibility (undocumented in the AFM) was unknown to pilots of the 36 Regiment.

Presence of third parties at this stage of flight and conversation with them could have distracted the crew and drawn their attention away from core duties.

In general aviation, there is an unwritten but practiced rule of “silent cockpit”. In essence, below FL100, the crew only exchanges flight-related information; presence of third parties in the cockpit and any communication with them is unacceptable. The crew enters the

operation area, requiring concentration on the landing approach maneuver. It is a duty of the aircraft commander to enforce this principle. Such procedures are stipulated in documents referring to the way standard crew activities in the cockpit are performed, and in documents referring to the duties of the carrier's flight personnel.

During the crew's preparation for landing, an analysis was not conducted of the aircraft's performance in reference to runway length, aircraft mass or current weather conditions. The necessity to make such analyses is stipulated in the AFM, section 7.7.3. ~~Maximum allowed landing weight~~".

It must be noted, that for conducting a full analysis on the basis of chart 7.7.5 in the AFM, exact temperature and wind speed and direction information would be necessary. The crew did not attempt to obtain such information during initial approach, and the aircraft commander only asked about weather conditions at **0624:35**. He obtained visibility and temperature data, with information on wind speed and direction missing. ATC only transmitted the information at **0639:45**, as he gave clearance for further approach. Considering weather conditions at the time of landing on RWY 26 in SMOLENSK, the Committee concluded from chart 7.7.5 that acceptable landing mass should not have exceeded 74.5 tons (was 78 tons). In the case of using a 45° flaps angle for landing (determined on the basis of chart 7.7.6), the mass would be 79.5 tons.

According to AFM item 3.1.6, in case of three operational engines and no wind gusts, 45° flaps should be used; 36° flaps in the case of noise restrictions in place. Another argument in favour of using 45° flaps was lower approach speed: 270 km/h in the case of 45° flaps (for a mass of 78 ton) (280 km/h for 36° flaps).

#### **2.10.2.8. Landing Approach**

At **0614:15**, MINSK controller notified the crew of weather conditions at the SMOLENSK NORTH airfield: visibility 400 m, fog.

Regardless of information provided by the crew of the Yak-40 aircraft, the crew was further notified of weather conditions at **0624:25** by ATC KORSZAH: fog on airfield, visibility 400. At **0624:51** ATC added that there were no conditions for acceptance (unsuitable landing conditions). At **0625:04**, aircraft commander communicated the crew's decision to the ATC: *–Jeśli można, spróbujemy podejść, a jeśli nie będzie pogody, to odejdziemy na drugi krąg*" (*If possible, we shall attempt approach, and if the weather is too bad, we will go around.*). Communication thus phrased by the aircraft commander suggests that such plan might not have been approved by ATC. After having been notified by the crew

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that after trial approach, the aircraft will have sufficient fuel to reach the alternate airfield, ATC granted clearance for descent to an altitude of 1,500 m on heading 040°.

At **0626:18**, the aircraft commander informed the Director of Protocol as follows: *–Panie dyrektorze – wyszła mgła w tej chwili i w tych warunkach, które są obecnie, nie damy rady usiąść. Spróbujemy podejść – zrobimy jedno zająście – ale prawdopodobnie nic z tego nie będzie. Tak że proszę już myśleć nad decyzją, co będziemy robili”* ”. (*Director – fog has come out now and under present conditions we will not manage to touch down. So please start thinking about your decision as to what we are going to do*). In the opinion of the Committee, the decision of the aircraft commander, who was aware of unsuitable landing conditions, resulted from the need to convince his superiors that there would be no conditions for touchdowns. Information communicated by the Director at **0630:33**: *„Na razie nie ma decyzji Prezydenta, co dalej robimy”* (*No decision as yet from the President as to what we are doing next*), caused the aircraft commander to continue the adopted plan of performing a landing approach down to the minimum altitude. The fact of such a scenario being adopted is corroborated by an exchange among crew members at **0635:48** *„I musimy to lotnisko wybrać, w końcu na coś...”* (*And we must choose the airfield, after all we must ...*).

The Committee found that the crew had a right to approach for landing down to minimum altitude in accordance with principles in RL-2006 § 23, para. 16. Stipulations of § 48 do not prohibit such action – in para. 3 they require the task to be discontinued in a situation of continued flight being impossible due to safety concerns. According to IFR regulations, flight can be made down to altitude described as DA(DH) or MDA(MDH) only by instruments; fog above that altitude did not in any way reduce the safety level of approach. After passing below the decision altitude, § 19 para. 24 items 4 and 5 RL-2006 apply.

#### **2.10.2.9. Performing an Approach to Minimum Descent Altitude**

Landing approach was performed with the ABSU – automatic stabilisation and pitch and roll channel steering activated. The base leg was performed by entering on FMS-required heading. Final approach was initiated by rolling the aircraft, and ended with taking over the waypoint stored in the FMS. Such operation mode of the UNS-ABSU (according to pilot statements) was practiced in former 36 Regiment flights. That was incompliant with AFM provisions. A supplement to the AFM regarding the use of the UNS-1D stipulates that it is necessary to disconnect the UNS-1D unit from the autopilot during performance of SID and STAR procedures, as well as during approach to land. It also provides for an option of flight with active autopilot in course stabilization mode, and of retrieving flight route information on the CDU screen.



For an aircraft mass of ca. 78 tons, approach speed for flaps at 36° should be 280 km/h.

Aircraft Flight Manual allows for autopilot use during landing approach, and it describes in section 4.6.1.4 how appropriate operation modes can be used.

Crew activities related to manual approach (without autopilot use) are described in item 4.6.3; actions of automatic and directive approach are stipulated in item 8.8.4.

The document does not describe the technique for making non-precision approach with or without autopilot use. Approach by ILS is the only landing approach procedure described. Nonetheless, no restrictions have been introduced to prevent automatic approach with non-precision approaches.

Limitations to the ABSU use are described in section 8.8.1. There is no information here, either, regarding an inability to perform non-precision approaches using the ABSU.

The Committee concluded that the crew's use of autopilot (ABSU) in a non-precision approach was not contrary to principles in the manual (no restriction present), but a failure to develop a procedure describing how the unit should be used and to publish it in training materials may have caused problems with safe approach performance. The use of an FMS system combined with the ABSU was forbidden by the AFM at this stage of flight. In the opinion of the Committee, keeping autopilot in active mode in that stage of flight resulted from the excess workload of the aircraft commander, as by using it he attempted to facilitate piloting.

Recordings of crew members' conversations indicate that they set up data of the airfield's NDBs. Recording of the MARS-BM has a report of the navigator about preparation of the ADF and frequencies of inner and outer NDBs. It is fair to assume, knowing the sequence of data entered in the FM from the report of the TAWS manufacturer, that the system was a source of reference for the crew. It is impossible to declare, however, that the FMS was the sole source of information concerning location on the landing course. The ADF system was operational and available for use by the crew. At **0630:02**, the navigator said: „ILS niestety nie mamy. Kurs lądowania 259 ustawiony. ARK mamy przygotowane, 310/640, nastrojone. Piątka, szóstka, automat ciągu” (*Unfortunately no ILS. Landing heading 259 set. ADF prepared, 310/640, tuned. Five, six, automatic thrust control*). Activation of automatic thrust control is standard procedure, compliant with air practice.

The checklist *After landing gear and wing systems extension* card was read out between **0639:05 and 0639:32**. Beginning of checklist reading coincided with information from ATC: „**101 вход в глиссаду**” (*101, entry into path*), with no response or reaction from the crew. This may suggest that at this stage in flight, the crew were busy reading the landing checklist

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card, which caused delay in commencing final descent. Reading of the checklist is completed before reaching the outer beacon, before commencing final descent.

Passing the outer beacon was reported by the co-pilot, who said: „Dalsza” (*Outer*). He did not communicate altitude information. 5 s later, the navigator communicated altitude information: „Czteryście metrów” (*Four hundred metres*). Altitude above airfield was then 426 m, 397 m according to RA. That was the last altitude readout by the navigator according to the QFE altimeter settings. From that point, the navigator communicated altitude information according to RA. At **0640:36** he communicated altitude: „Dwieście” (*Two hundred*) (200 m by RW and 168 m above airfield level, at a distance of 2,926 m from RWY 26 threshold). At **0640:40**, he communicated altitude: „Sto pięćdziesiąt” (*Hundred and fifty*) (147 m by RA, 128 m above airfield level, 2,631 m from RWY 26 threshold).

The Committee’s analysis of MARS-BM recorder readings suggests that the Commander-in-Chief of the Air Force, present in the cockpit during final approach, expressed his observations three times on the readings of the pressure altimeter, set to QFE 745 mmHg. This is evidenced by his comments on altitude, expressed prior to the navigator’s reaction to the same altitudes:

- „dwieście pięćdziesiąt metrów” (*two hundred and fifty meters*) at the altitude of 227 m above airfield level and 269 m by RA. Navigator said „dwieście pięćdziesiąt” (*two hundred and fifty*) at RA indication of 259 m and 220 m above airfield level;
- „sto metrów” (*one hundred meters*) at an altitude of 98 m above airfield level and 113 m by RA. Navigator said „sto” (*one hundred*) at RA indication of 103 m and 90 m above airfield level;
- „nic nie widać” (*nil visibility*) at the altitude of 63 m above airfield level, 109 m by RA. A moment later, the navigator said „sto” (*one hundred*) again at the altitude of 100 m RA, 49 m above airfield level, even though 6 s before that he had read out 100 m on the RA indicator, at 90 m altitude above airfield level (as indicated by the barometric altimeter according to QFE).

The above confirms that the navigator and other crew members were not using barometric altimeters showing altitude above airfield level<sup>128</sup>.

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<sup>128</sup> Minimum descent altitude is specified with regard to airfield level. It can only be determined using the barometric altimeter, which refers to atmospheric pressure on the aerodrome. Altitude shown by radio altimeter (RA) does not provide information about the aircraft’s position with relations to the airfield, only displaying altitude above the ground over which the aircraft is flying, and is useless from the point of view of the procedure being executed. AFM allows RA readings to be used from an altitude of 60 m, when the crew has visual contact with the airfield, and the precise altitude displayed facilitates precise touch-down.

In the opinion of the Committee, statements of the Commander-in-Chief of the Air Force were limited to flight altitude readings on the barometric altimeter (250 m, 100 m and 60 m). He did not interfere with the decision-making process of the aircraft commander.

Upon passing the outer NDB, the aircraft commander responded *–Cztery” (Four)* at LZC message: *You are approaching outer, on course, on glide path, distance six*. This suggests the belief of the aircraft commander that the outer beacon is at a distance of 4 km from the runway, as is the case at most military airfields in Poland.

Flight above the outer beacon was made at an altitude of 120 m higher than indicated on approach charts. That is a very large difference, forcing the crew (flying pilot) to decide to increase the rate of descent in order to *–catch up”* with the glide slope planned, which resulted in increased airspeed above the speed setpoint of the automatic thrust control. Automatic control reduced engine thrust to minimum value. Flight at minimum thrust continued for 40 s. This is a serious error in terms of approach stabilization, as a result of which, during a possible go-around procedure, engines require much more time to achieve takeoff power (acceleration). Furthermore, according to AFM item 4.6.2.2-2: if, at altitudes above 200 m, the operational range of engines required for flight in the path, at recommended instrument and vertical speed, exceeds nominal value, or high pressure compressor speed is less than 75%, go-around is mandatory.

Even though this provision pertains to approaches in wind shear conditions, application of the principle in all approaches is reasonable and justified.

If high-pressure compressor speed had been ca. 60%, approach should have been discontinued. There was no reaction from other crew members to such action of the aircraft commander.

Switching the aircraft commander’s altimeter back to 1013 hPa during approach resulted, in the opinion of the Committee, from warning signal of the TAWS coming on. The instrument can operate at QFE pressures, but the unit can only be used at airports stored in the instrument’s database, the SMOLENSK NORTH airfield not being one of them. Thus, the altimeter was switched in order to *–fool”* the TAWS. That, however, resulted in a loss of information on the aircraft’s altitude above airfield (QFE), displayed on one of the altimeters available. The way the action was performed may suggest that the aircraft commander knew the way the TAWS instrument worked, and knew how to react in order to silence the alarm. Such hypothesis is corroborated by the use of TAWS on April 7<sup>th</sup> during a flight to SMOLENSK in accordance with the manual in the TERRAIN INHIBIT operation mode. The device is located on the instrument panel on the co-pilot side, and is operated by the co-

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pilot. The co-pilot function on that day was performed by the aircraft commander of April 10<sup>th</sup>. Despite such knowledge, activation of the TAWS system came as a surprise for the crew, as the co-pilot (of April 10<sup>th</sup>) was not very familiar with the operation of the TAWS instrument, and had not prepared TAWS for operation on the airfield.

Moreover, there was no reaction from crew members to the minimum descent altitude, as required by AFM item IUL pkt 4.6.3.

From altitude of 366 m RA, (295 m above airfield level), the aircraft commander was deprived of the ability to read out the reference altitude on one of his altimeters, originally set to the pressure of 993 hPa QFE. The crew did not react to passing the altitudes indicated by the barometric altimeter. This may prove that the crew were only watching radio altimeters, a grave error in the landing procedure. The proposition is confirmed by the exchange between co-pilot and pilot at **0640:12**, when the co-pilot said: „Tam jest obniżenie, Arek” (*There is a dip, Arek*), and the aircraft commander answered: „Wiem, zaraz będzie” (*I know, it is coming soon*).

Airspeed during the entire approach exceeded the value of 280 km/h as set on the automatic thrust control (reported by the co-pilot at **0640:21.5**). The reason was that throughout the final approach, the crew were descending at an excessive vertical rate of descent, which resulted in the aircraft gaining speed, to which the automatic control reacted by reducing thrust to the minimum range. Only at **0640:49**, at RA altitude of 103 m, with flight speed reduced below 280 km/h set for the automatic thrust control, thrust was slightly increased by the system, so as to maintain 280 km/h.

The crew's activities for making a go-around from minimum altitude are described in the AFM, section 4.6.10. The crew did not adhere to the procedures.

In analyzing the moment at which the aircraft commander said, at **0640:52**: „Odchodzimy na drugie” (*Going around*), one needs to recall the sequence of messages and altitude changes. At **0640:45**, the navigator reported „sto” (*one hundred*). Six seconds later, he said „sto” (*one hundred*) again. Information about no altitude change for such an extended period had to be problematic for the flying pilot, causing him to decide to increase the rate of descent. The aircraft commander's decision „odchodzimy na drugie” (*going around*) was made after the words of the Commander-in-Chief of the Air Force „nic nie widać” (*nil visibility*), at the same time as the navigator said „sto” (*one hundred*) again. This happened 1,696 m from the runway threshold, at an altitude of 91 m above ground, 39 meters above airfield level. The go-around procedure was not initiated after that message. The first reaction of the flying pilot was recorded by the flight data recorder at the moment when RA began

signaling alarm altitude. That happened at **0640:54**, at a distance of 1,538 m from the runway threshold, at an altitude of 66 m above ground, 23 m above airfield level. At the same time, the recorder's data shows the pilot's reaction of pulling the control column ~~to~~ "towards him"<sup>129</sup>, with the ABSU pitch channel still active. There was no message given or action taken in relation to the situation. The pilot's reaction to deactivate the ABSU (autopilot) pitch channel by overriding it took place at **0640:57.5** – at altitude of 28 m RA, 1,265 m from the runway threshold, 2 m above airfield level. Communication of the commander to confirm his action, was still missing. One second later, at **0640:58.5**, thrust was increased and the control column was strongly pulled backwards. This took place at a distance of 1,187 m from runway threshold, at an RA altitude of 16 m, 5 m below airfield level. It happened 5 s after the "go-around" command, 3.5 s after RA alarm. Insufficient altitude and tree impact at **0641:02.8** (855 m from runway threshold, 1.1 m above airfield level) rendered the initiated go-around maneuver ineffective, ending in ground impact at **0641:07.5**, at a distance of 534 m from RWY 26 threshold.

In assessing cooperation of the crew on the basis of cockpit voice recording, one must conclude that verification of individual flight aspects was missing between the flying pilot and co-pilot.

In communicating information to each other, which they did not obtain together, pilots commit significant distortions. One example is that of the co-pilot communicating information obtained from the Yak-40 crew „podstawa grubo poniżej 50 metrów” (*cloud base well below 50 meters*) as „podstawa 50 metrów” (*cloud base 50 meters*).

The flying pilot was charged with conducting radio communication, which limited his ability to receive information from other crew members. An example of that is found in the recording of the MARS-BM recorder, where at **0640:34** the ATC issued an order to light landing headlights. At the moment when the aircraft commander said „reflektory włączone” (*landing headlights*), the navigator reported altitude of 200 metres. The overlapping of the two actions in time prevented the information from being received by the commander. On the part of all crew members, a reaction was missing to the deviations from the approach procedure. Engines ran at low thrust for an extended period (40 s), approach speed was higher than planned by almost 30 km/h, descent rate was in excess of 5 m/s, and still no crew

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<sup>129</sup> According to the Committee, the pilot attempted to execute the planned go-around maneuver using the ABSU system, by pressing the "go-around" button, and was surprised by lack of aircraft's reaction to his action. Deactivation of the autopilot (pitch channel) occurred after 3.5 s, by overriding its operation (by pulling the control column backwards), after which the aircraft commander increased thrust and initiated go-around procedure.

member reacted to the aircraft commander's deviations from required parameters, which was in breach of AFM item 4.6.3. stipulations.

The co-pilot confirmed the aircraft commander's "go-around" command, but did not take any clear action despite the commander taking none. Nor did the navigator react to the fact of passing the minimum without commencing a go-around procedure, and he only read altitude until impact on the first terrain obstacle. The tragic ending of the flight was ultimately caused by: failure to report the approach and reaching of minimum altitude, the crew's lack of reaction to a deviation from required flight parameters and TAWS signals, and ignoring alarms generated by the TAWS system (PULL-UP).

## **2.11 Analysis of psychological factors affecting the crew of Tu-154M aircraft**

Factors which could have influenced crew's preparation for the flight planned:

- a) completing the crew one day before take-off and lack of task debriefing with the complete crew at the preliminary stage of the crew preparation for the flight;
- b) late coming of the crew (in relation to the guidelines of the commander of 36 Special Assignment Regiment), due to that the direct preparation of the crew for the flight took place in a very short time onboard, already when first passengers were entering on board;
- c) not transferring by Weatherman-on-Duty less favorable weather forecast for the flight prepared by the senior meteorologist of the Hydrological Centre of the Polish Forces, therefore it did not become a subject of detailed analysis by the crew.

Before the flight, two meetings of the Air Forces Commander-in-Chief with the commander of the Tu-154M Aircraft took place. During the first of them they talked for about half a minute in presence of a few Tu-154M aircraft passengers in front of the main entrance of the Military Airport. The second meeting took place while waiting for the President of the Republic of Poland in front of the aircraft after 0649 hours. The talks could not have concerned weather conditions expected in SMOLENSK, because such information had not been known either to the aircraft commander or to the Air Forces Commander-in-Chief. In the Committee's opinion, during the first conversation, the Air Force Commander informed the aircraft commander of an intention to report readiness to the President of Poland. The report, although not compliant with the tradition, has a symbolic character and only in such a sense any connection with analyzed flight should be seen.

During the flight over Belarus the crew received information that the weather conditions at the SMOLENSK aerodrome are substantially under minimal conditions of the aerodrome,

of the crew and of the aircraft. This information should force the aircraft commander to discuss the situation they found themselves with the remaining crew members, as well as to discuss possible ways of landing approach or alternative solutions. Unfortunately, such actions were not undertaken. Omission of discussing prevented the aircraft commander from the possibility of a joint analysis of a problem and potential reaching the decision on continuing the flight. Behavior of the aircraft commander could have “turned off” crew’s activity – because they did not know the scenario adopted by the commander they could not cooperate in its realization. Behavior of the crew in the analyzed moment proves of a lowered level of situational awareness (including understanding, foretelling pilotage situation and knowledge of possible ways of solving the difficulties) and weakening control mechanisms necessary to undertake rational decisions. Reasons for such weakening originated in three factors playing important role at that stage of developing pilotage situation:

- lack of uniform information on the weather in SMOLEŃSK and reaction of surprise while the crew were informed of real weather conditions (0614:15);
- inadequate level of crew cooperation;
- personality of the aircraft commander – high level of intelligence and complementing it high tendency for improvisation.

The last factor can explain the behavior of the aircraft commander mostly consisting in counting on his own capabilities and skills and also connected with inadequate experience of the crew, of what the commander must have been aware. Upon confirming weather conditions at the aerodrome in SMOLENSK by the Terminal Control Manager, the aircraft commander made a decision on performing control approach (“If possible, we will try to approach, and if the weather is not good enough we will go around”). At the same time the co-pilot learned that the commander of Jak-40 aircraft estimated visibility to be 400 m, and the bottom of clouds to be “way under 50 m”. Despite that, at 0625:12 he suggested possibility undertaking the attempt to land: “However, to be honest, you can still try, by all means”. The co-pilot passed to the aircraft commander at 0626:06: “Well, they managed to do it” and further at 0626:09: “They just said that if at the second time don’t sit, he says – go towards Moscow”.

Confirmed information about very difficult weather conditions, a lot lower than the minimum for the crew and the aerodrome, did not cause change of the decision made by the aircraft commander or proper reaction of the other members of the crew, what can indicate that the pilots made this very important pilotage decision, being guided not by flight premises but by the fact who and why they transport on the board.

During the landing approach the Terminal Control Manager passed command to the crew to be ready to go around at the height of 100 m. The aircraft commander confirmed acceptance of this information what can prove that the height of 100 m was adopted as a minimal height of descend.

Analysis of the correspondence and pilots' conversations in the cockpit indicates commencement of a phenomenon of cognitive tunneling at the aircraft commander, consisting in strong attention selection, focused on the details indispensable for realization of the current task priority. The higher level of stress influences a pilot, the selection is clearer. Main psychological factors that materially influenced increase of the stress level at that stage of flight were high level of situation unpredictability and internal conflict of the aircraft commander – understood not as a dilemma whether to land or not (striving – avoiding), but connected with the attempt of landing approach planned by the aircraft commander (how low to descend and what approach procedure to apply). At this particular moment it must be assumed that there was a high level of stress resulting from concentration on the executed plan of action. During executed attempt of landing approach in cockpit of Tu-154M aircraft TAWS system signalization activated and immediately the barometric altimeter was shifted by the aircraft commander. This action caused the system to cease (for some time) to generate warnings but, simultaneously, left the pilot without direct information from one of the altimeters, indispensable for establishing real altitude of the aircraft over the surface of an aerodrome. It lead to the situation, in which the aircraft commander created a plan of landing approach on the basis of a subjective mental model (imagination of the current aircraft location). One of the features disrupting correct situation assessment was a use of imprecise indications of radio-altimeter instead barometric altimeters during the approach. Additional, but very important, misinforming element was transferring by Landing Zone Manager reassuring information indicating that they are all the time “on glide path and on course”. It was a factor negatively influencing both the aircraft commander and the whole crew, as it was strengthening the conviction that, despite lack of reference, location of the aircraft was under control. Such confirmations took place five times, while actually the aircraft was a lot higher than the glide path and in the final phase of flight a lot under it. At the altitude of 90 m indicated by the radio-altimeter the aircraft commander informed the crew: “Making a go around”, and the co-pilot read back: “Going around”. After this command go around procedure was not immediately initiated. First reaction of the steering pilot was recorded at the moment of activating signals by the radio-altimeter concerning alarm altitude (65 m). There was a clear command missing, as well as and actions referring to this situation.



Unhesitating pilot's reaction consisting in pulling yoke column and causing turning off the longitudinal channel (of autopilot) took place 5 seconds after command "Going around" and 3.5 seconds after radio-altimeter alarm activated. Too low altitude and hitting the tree caused the maneuver of initiated going around to fail.

Reasons for lack of efficiency in execution of the decision to go around are of a complex character. First of all, the command given by the aircraft commander was not firm enough and too late. Other, very important factor, influencing tragic final of the flight was planning and executing landing approach with a use of autopilot at the aerodrome without ILS system. Such a procedure is indeed not prohibited, however, there are no clear regulations and procedures describing its use in similar situations. From the psychological point of view it meant that there was an attempt of landing approach in the way of not fully predictable consequences, in very difficult weather conditions. Choosing the autopilot mode by the aircraft commander in that phase of flight must be understood as an attempt to reduce work overload and to make the pilotage process easier. It is likely that the aircraft commander was surprised by a lack of an immediate response of the aircraft to his actions. In face of the course of flight inconsistent with established plan, the aircraft commander had to simultaneously analyze the situation, make decisions, carry out operating procedures, carry on correspondence in Russian and additionally monitor situation in the cockpit. It was accompanied by the necessity to take increased amount of pilotage information, control over visual search and careful data processing. Those actions, normally automatic in a large scale in the conditions presented were carried out with an increased amount of cognitive control. Automatic processes occur simultaneously (fast) in mind, and controlled ones require serial processing (much slower). Abovementioned factors caused the fact that the aircraft commander's decisive, cognitive and executory processes in the stressful situation run slower and contributed to slowing down of reaction.

Evaluating the abovementioned facts, first of all, it needs to be stressed that level of crew's coordination in the critical phase of flight was very low, to which contributed Terminal Control Manager's lack of decisiveness and passing by Landing Zone Manager information inconsistent with the actual aircraft location. The crew's cooperation mainly based on following the aircraft commander's orders and accepting commands for execution in an almost automatic way (even those which, from the pilotage point of view, were dangerous). Crew members were not able to oppose those decisions, nor intervene in critical situation. What draws attention, is lack of reaction of the co-pilot to the aircraft commander's decision to go around in automatic mode and passive attitude of navigator, who till the end read radio-

altimeter indications without any attempt to change pilots' behavior. What is puzzling is lack of reaction of anyone present in the cockpit to exceeding critical flight parameters during the approach (exceeding minimal height of descend, high vertical speed, warning signals of TAWS). In case of the aircraft commander, above-mentioned phenomenon of cognitive tunneling needs to be recognized. It appears in the event of a necessity to exercise conscious control and verification of pilotage information in stressful conditions, due to that the pilot is excessively concentrates on one aspect of the task, ignoring other, equally important (sometimes even more important from the point of view of safety) elements. Such a situation must have led to weakening of situational awareness-ot, what resulted in omission of directly inaccessible critical information concerning the actual location of the aircraft. Hence, the aircraft commander's cognitive and executory resources were burdened simultaneously by a necessity to pilot in extreme conditions, to maintain correspondence in Russian, to supervise correctness of work of less experienced colleagues and professional responsibility for proper and scheduled course of flight. Such load, multiplied by the stress influencing mental processes must have caused cognitive overload – omitting important data and difficulties in making decisions. If we assume, that the last phase of this critical flight met the criteria of the psychological phenomenon discussed, then the behavior of the aircraft commander must be understood as oriented towards an attempt of landing approach in extremely difficult weather conditions, which, furthermore, had not taken into account mistakes and breaches made earlier. Ignoring or even physical tampering warning devices can be explained by a phenomenon of bolstering. Information suggesting necessity to change the decision and action are somehow eliminated as irrelevant, interfering processes of data perception and analysis indispensable for pilot. This mechanism serves avoiding conflict in a situation of action selection under time pressure in tasks of a very high level of difficulty. It consists in ~~bolstering~~ "once made decision and it takes the form of selective pilotage data processing, eliminating the information contrary or inconsistent with the action plan assumed earlier, and reinforcing information which is consistent and necessary to properly execute the decision made in a rigid way. The crew's behavior can be seen more as a process of avoiding any decisions or interference in the pilotage process than a process of making decisions. If there were no alternative procedures trained as a team (e.g. CRM training or in flight simulator training), the most psychologically likely scenario was continuing the mission as other solutions would require analysis of theoretical capabilities, being something completely new, untaught. Under strong stress theoretical analyses and application of declarative (~~textbook~~) knowledge are not possible, the only possible solution is a selection of an action from

available trained procedures. Those factors can explain crew's passivity. In the situation of uncertainty the crew conformed to the aircraft commander, who performed certain actions, so, as it could have been expected, had a plan, information justifying the action selected and skills sufficient to execute it. Under so high level of stress influencing the crew, thinking out of the box was seriously hindered, if not impossible, and changes of decisions were limited rather to a selection of known, learned patterns. Additional distracter was non-compliance with the unwritten principle of "silent cockpit", which orders complete concentration of the crew at the landing approach in progress. Yet, in this critical moment the Air Forces Commander-in-Chief was present in the cockpit, as the Protocol Director earlier. Analysis of the recordings from the cockpit voice recorder indicates that the Protocol Director appeared in cockpit probably after receiving from the chief cabin crew information that there was a possibility that there would not land in SMOLENSK (0617:47). Because within a scope of his responsibilities was the control of the course of the President's visit he entered cockpit in order to confirm the situation in person (0623). The Air Forces Commander-in-Chief's appearance in the cockpit was a result, in Committee's opinion, of being informed by the Protocol Director about deteriorating weather conditions. It needs to be noted that the aircraft commander at 0626:18 informed the Protocol Director about necessity to make a decision in further plan of action in the event of worsening weather conditions at the aerodrome in SMOLENSK. The Protocol Director, at 0630:33, told: "As for now, no decision from the President about what to do next", so nobody imposed on the crew the necessity to land at the aerodrome SMOLENSK NORTH, but also did not indicate preferred solution (e.g. we fly to aerodrome VNUKOVO). At lack of support for decision process the aircraft commander continued landing approach to the minimal altitude as planned earlier.

Air Forces Commander-in-Chief in no direct way interfered in a process of pilotage. His psychological characteristics, prepared for the purposes of this analysis, stress that, "overtaking initiative in a situation, in which detailed competence of others he regarded as high, is quite unlikely". Thus, he was not oriented on any active intervention, he was rather an observer of the events. In this context it cannot be said that there was any direct Air Forces Commander-in-Chief's pressure upon the aircraft commander, and more widely, upon the crew. What can, however, be confirmed, there was a pressure which influenced the crew in the indirect way, and connected with the rank of the flight, presence of the most important people of the state onboard and importance of the ceremonies in the Forest of Katyn. What must be remembered, the element of indirect pressure was the Air Forces Commander-in-Chief's presence in the cockpit itself, as in the aircraft commander's consciousness there

could have been the anxiety concerning evaluation of the landing approach performance. Still, this factor was merely a complementary to the events in the last phase of flight.

Concluding this part of analysis the mistakes and breaches, which took place during the critical flight, need to be indicated. Crew's improper preparation for the flight, tampering the altimeter in order to "dealm" TAWS, going around in autopilot mode at the aerodrome without ILS system, presence of third parties in the cockpit, lack of the crew's effective cooperation, accepting too many responsibilities by the aircraft commander, insufficient level of the crews training and undecided, and manner of operation of the Air Traffic Control Group which was sometimes chaotic and showing symptoms of a strong stress connected with responsibility and improper organizational preparation, were the factors which were of a key importance in determining the reasons for the accident.

It is obvious that the crew acted on a level which was relevant to their training. They reacted to extremely difficult situations in a way reaching far beyond safety standards, but these standards in the functioning practice of the 36 Special Assignment Regiment were subject to serious lowering. Therefore, they could not be any model being a basis for making proper decisions by the aircraft commander and for active attitude of the other members of the crew reacting to decision mistakes made by him. Safety standards depreciation and incapability of acting in difficult were caused by lowering the level of trainings (or by lack of them), primarily in a scope of CRM (Crew Resource Management), ORM (Operational Risk Management) i MCC (Multi Crew Cooperation). Not less important was discontinuing simulator trainings and lack of defensive system reactions<sup>130</sup>, including higher superiors' reactions, to earlier aviation incidents and accidents. The result of that state of affairs was gradual lowering of training quality of a creeping character what caused getting used to deteriorating safety level. It also effected in accepting lower and lower work and service conditions and a habit of flying at a brink of safety.

## **2.12 Analysis of Action Taken by Air Traffic Services**

### **2.12.1 Analysis of Action Taken by Polish Air Traffic Services to Support the Flight of Tu-154M Aircraft Tail Number 101 on April 10<sup>th</sup> 2010**

In accordance with ICAO requirements, flight plans were sent by facsimile to Aircraft Crew Check-in of the 36 Regiment by the navigation officer of the Tu-154M aircraft on April 9<sup>th</sup>

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<sup>130</sup> It must be clearly stressed that, in recent years, in many aviation incidents in Air Forces various mistakes in use of altimeters have been a major cause of incidents. Absence of effective action in this field demonstrates systemic failures of the training process.

2010 at 0922. The Air Traffic Planner at Aircraft Crew Check-in of the Military Airport dispatched flight plans to Aircraft Crew Check-in of the WARSAW-OKECIE (EPWA) airfield at 0950-0952. EPWA personnel circulated said flight plans in conformity to stipulations of the *HEAD Aircraft Flights Dispatch Manual*.

First radio contact with the Air Traffic Services of the WARSAW-OKECIE airfield (DELIVERY) was established (according to PANSA's communication recorder) at 0511:30. Prior to flight take-off at 0517, the Main Air Traffic Management Center of Russia dispatched a message concerning the departure of flight PLF 101 to EPWA Aircraft Crew Check-in.

```
YCA0163 100517
FF EPWAZPZX
100517 UUUWYWX
DEAR SIRS
WE KINDLY ASK YOU TO INFORM ABOUT DEP/DLA OF FLIGHT
(DEP/DLA-PLF101-EPWA-XUBS) REG/101 STS/HEAD
THANK YOU FOR HELP AND BEST REGARDS
MAIN AIR TRAFFIC MANAGEMENT CENTER OF RUSSIA
```

The take-off of the Tu-154M aircraft (PLF 101) was delayed by 27 minutes against the time planned (i.e. the aircraft took off at 0527).

Following departure, the Air Traffic Planner of the Military Airport's Aircraft Crew Check-in dispatched a flight departure notification message to EPWA Aircraft Crew Check-in at 0529.

```
YCA0174 100529
FF EPWAZPZX
100529 EPWAZPZM
(DEF-PLF101-EPWA0527-ZZZZ)
```

At 0536, EPWA Aircraft Crew Check-in staff notified the Main Air Traffic Management Center of Russia of the departure of flight PLF 101.

```
ZYA0019 100536
FF UUUWYWX
100536 EPWAZPZX
(DEF-PLF101-EPWA0527-XUBS)
```

Addressed to: Main Air Traffic Management Center of Russia

At 0541, the Military Unit Deputy Commander (MUDC) at Inner ATC Post of the SMOLENSK NORTH airfield was notified by the Operations Officer of the Tu-154M aircraft's departure.

The flight plan was correctly distributed. Information concerning the Tu-154M aircraft's departure reached the Air Traffic Control (ATC) Group of the SMOLENSK NORTH airfield 14 minutes after take-off.

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## **2.12.2 Analysis of provisions of the Operations Manual of the WARSAW-OKECIE (EPWA) Military Airport**

Following an analysis of the *Operations Manual of the WARSAW-OKECIE (EPWA) Military Airport* (hereinafter referred to as “OPMA”) it was found that it had introduced for use by the Military Airport personnel with no consideration of the specificity of 36 Regiment’s location at the WARSAW-OKECIE airfield, where civilian airfield air traffic services operate in controlled airspace.

Presented below are those OPMA regulations which are impossible to implement for the WARSAW-OKECIE (EPWA) Military Airport personnel.

Item 1.2. *Basic Normative Documents Regulating Military Airport Operations.*

Item 1.2.4. Rules and Instructions – paragraph 13: ~~“Rules of Air Band Radio Communication in the aviation of the Polish Armed Forces, WLOP 291/99”.~~

Section 2. *Radio Communication – General Provisions:* ~~“Voice radio communication shall be used mainly in circumstances of considerable distances between radio stations, which preclude VHF/UHF voice communication. During international flights in controlled airspace, whenever military aircraft remains out of range of VHF/UHF communication with Polish airspace control services, it shall be required for such aircraft to maintain shortwave communication with the parent air force unit”.~~

The Committee believes the above regulation to be no more than paper law, as on April 10<sup>th</sup> 2010, the Military Airport Air Traffic Controller had no possibility of maintaining shortwave communication due to there being no devices enabling such communication at their posts of duty<sup>131</sup>. Moreover, not all 36 Regiment aircraft performing international flights are equipped with devices enabling shortwave communication.

The WARSAW-OKECIE Military Airport Air Traffic Controller cooperates with the Air Missions Center (AMC) Air Traffic Specialist with regard to notification concerning flight progress of all 36 Regiment aircraft (the AMC is equipped with devices used in shortwave communication with aircraft crews).

Item 3.9. *Supporting STS/HEAD Air Missions.*

Item 3.9.1. ~~“STS/HEAD air missions shall be supported in conformity to stipulations of the following document:~~

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<sup>131</sup> In the course of a conversation on February 4<sup>th</sup> 2011, the Commander-in-Chief and Air Traffic Controllers of the WARSZAWA-OKECIE Military Airport declared that are aware of the content of the *Rules of Air Band Radio Communication in the Polish Air Force, AFAD 291/99*. Nonetheless, after having been presented with the quoted OPMA entry, they declared it had not been known to them.

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paragraph 1. *Support and Performance Manual for Aircraft Flights with the status „Important“ over the Territory of the Republic of Poland (Temporary), AFAD 341/2004”.*

The afore-quoted Manual expired following the approval for use<sup>132</sup> of the *STS/HEAD Aircraft Flights Dispatch Manual, AFAD 408/2009.*

### **2.12.3. Analysis of the ATC TWR duty against provisions of the Operations Manuals of the Warsaw-Okęcie (EPWA) Military Airport**

Pursuant to provisions of OPMA Item 2.9.4 paragraph 6, the Military Airport Air Traffic Controller was obliged to “obtain information on meteorological conditions from aircraft crews, and forward it to the airfield’s meteorologist on duty.”

On April 10<sup>th</sup>, 2010 at approximately 0545, the Military Airport Air Traffic Controller (whose shift that day ended at approximately 0600), was notified by one of the Yak-40 aircraft crew members by telephone about the aircraft’s landing at the SMOLENSK NORTH airfield in meteorological conditions of “60 over 2 kilometers”. At 0632, the Military Airport Air Traffic Controller reporting for duty forwarded that information to the meteorologist on duty of the WARSAW-OKĘCIE Military Airport. Until 0545, the Tu-154M aircraft had remained in the airspace of the Republic of Poland, with Polish Air Traffic Control services being able to establish radio communication with the crew. After 0545, such information could have been forwarded to the aircraft crew via satellite telephone, or in HF communication. If the commander of the Tu-154M aircraft had received information of meteorological conditions at the SMOLENSK NORTH airfield at landing time of the Yak-40 aircraft, he could have decided to turn the aircraft around to the airfield of departure, to continue flight to an alternate airfield, or to continue flight to the original destination as planned upon improvement of meteorological conditions. At 0614:15, the Tu-154M aircraft crew (flying in Belarus Republic airspace) was notified of meteorological conditions at the SMOLENSK NORTH airfield as below the aircraft, crew, and airfield minima. Upon having received said information, the aircraft commander made a decision to continue flight to the original destination as planned.

A delay in the forwarding of information received by the Military Airport Air Traffic Controller from the Yak-40 aircraft crew to the meteorologist on duty caused a delay in actions taken by the Air Missions Center. The Hydrometeorology Center of the Polish Armed

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<sup>132</sup> Decision No. 184/MON of the Minister of National Defense, June 9<sup>th</sup>, 2009.

Forces staff had raised the alarm at the Air Missions Center only after having received at 0620 a SYNOP message with SMOLENSK NORTH SYNOP station readings (fog 500 m, sky nil visibility), i.e. approximately 30 minutes after meteorological conditions notification by the Yak-40 aircraft crew.

#### **2.12.4. Membership and Duties of the ATC Group at the SMOLENSK North Airfield**

According to information contained in Section 1.10.3 of the Final Report, on April 10<sup>th</sup>, 2010, the ATC Group at the SMOLENSK NORTH airfield included, among others:

- 1) Air Traffic Controller (ATC),
- 2) Assistant Air Traffic Controller (AATC),
- 3) Landing Zone Controller (LZC).

Furthermore, the Military Unit Deputy Commander (of the Tver airbase) (MUDC), who was acting as coordinator, and person responsible for flight preparation and support on April 10<sup>th</sup>, 2010, was present at the Inner ATC Post. As such, he was ATC's superior and had the power of decision with regard to actions concerning flight clearance.

According to Item 555 of the Federal Aviation Principles for State Aviation in the Russian Federation (hereinafter referred to as *FAF PP GosA*"), the following zones of jurisdiction shall be designated for air traffic control purposes:

- Visual control zone – within a radius of 5 km from airfield center,
- Inner zone – within a radius of 75 km from airfield center,
- Landing zone – within an area of  $\pm 25^\circ$  with regard to the landing course, and at a distance of up to 60 km from RWY threshold.

According to the *Layout of Zones of Jurisdiction of Air Traffic Control Services at the SMOLENSK NORTH Airfield*, dimensions of the zones of jurisdiction have been designated as follows, respectively:

- Visual control zone – within a radius of 5 km from airfield center,
- Inner zone – within a radius of 60 km from airfield center,
- Landing zone – within an area of  $\pm 25^\circ$ , at a distance of up to 20 km from RWY threshold.

On April 10<sup>th</sup>, 2010, ATC was on duty in the inner and the visual control zones.

#### **2.12.5. Rules and Procedures Followed by ATC Group Personnel**

Information contained in Sections 1.8.1-1.8.2, and 1.10-1.10.3 of the Final Report proves that landings of Yak-40, IL-76, and Tu-154M aircraft on April 10<sup>th</sup>, 2010 were supported by



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ATC Group Personnel in accordance with regulations<sup>133</sup> of the Russian Federation's military aviation:

- 1) *FAP PP GosA*, Ordinance No. 275 of the Minister of Defense of the Russian Federation of September 24<sup>th</sup>, 2004 r,
- 2) *Flight Control Manual*,
- 3) *Air Operations Manual for the SMOLENSK NORTH Airfield Area*.

This may be supported by ATC's question at the time of the Tu-154M aircraft approaching the base leg: „А, пятьсот метров, а, на военном аэродроме посадку осуществляли?” (*Aaah, five hundred meters, aaah, have you performed military airfield landings before?*), which determined the airfield status and airfield procedures.

Moreover, as per telegram No. 134/3/11/102 of March 13<sup>th</sup>, 2010 with regard to the preparation and support of special Yak-40 and Tu-154M aircraft flights in April 2010, the ATC Group was ordered to conform with provisions of Item c, Section AD, Part III, Volume II of the *Aeronautical Information Publication for the Russian Federation and the Commonwealth of Independent States* when supporting special status Polish flights. According to aforementioned *AIP* items, ~~the~~ commander of a foreign aircraft shall assume full responsibility for deciding to depart from an airfield, and/or to land at the destination airfield”.

An extract from *FAP PP GosA* regulations recognized as pending for flight-supporting ATC Groups follows:

Item 20. ~~Whenever~~ flights are performed, the principle of their safety is of highest priority, and all personnel efforts shall be aimed at adherence to that principle”.

Item 96. ~~During~~ a flight, the airfield Air Traffic Controller shall:

- In case of a rapid deterioration of weather conditions in the airfield area, organize aircraft landing at his airfield in conformity with the aircraft crew minima, or direct such aircraft to an alternate airfield,
- In case of any uncertainty as to the success of a landing, order the aircraft crew to go around (...),
- Regularly check the preparedness of alternate airfields, such checks to be performed by ATC, air commissioning institutions, and/or by aircraft crews in flight,

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<sup>133</sup> Instructions listed under Item 2 and 3 had not been disclosed to the Polish party.

- Be diligent in listening to and engaging in radio communication; order all aircraft crews and ATC Group personnel to conform to radio communication rules,
  - In case of receiving a storm warning, assess meteorological conditions jointly with the meteorologist on duty, and duly notify the air base commander (or the acting air base commander); upon the commander's order, suspend (or restrict) flights until touchdown guidance decisions are made".
- Item 98. –The airfield Air Traffic Controller shall have the right to:
- Decide independently to the effect of directing aircraft crews to alternate airfields,
  - Act to abort tasks performed by aircraft crews in case of identifying any discrepancies between airspace, meteorological, and/or ornithological conditions and due and proper air mission conditions".
- Item 108. –The inner zone ATC shall be obliged to: transfer (assume) air control of aircraft crews within designated boundaries".
- Item 110. –The inner zone ATC shall have the right to: (...) define the landing approach for aircraft crews".
- Item 115. –The Landing Zone Controller shall have the right to:
- Order aircraft crews to perform a go-around within boundaries of radio communication/visibility,
  - Notify aircraft crews as being ~~on~~ "on glide path, on course" provided that no error detected exceeds one-third of linear variation tolerance against the zone area".
- Item 216. –ATC Group personnel shall be cleared for flight control upon having passed relevant qualification exams (*Flight Operations Manual* for the given airfield area [airfield hub], flight and tactics for local airbase aircraft, data and principles of using means of communication and of securing radio communication for flights in the given airfield area, sequence of actions for specific flight circumstances), having completed practical training, and having been tested in flight control skills".
- Item 217. –ATC Group personnel shall be cleared for flight control by order of their respective commander, with all clearances duly noted in personal ATC Group service logbooks, according to the ATC Group Special Training Course, and the Command Position Military Support Course".
- Item 462. –Aircraft shall be cleared for landing at designated landing airfields provided that weather conditions at the airfield are above the meteorological condition minima

for aircraft crew commanders (albeit no lower than the airfield's weather condition minima)".

- Item 551. ~~The transfer of flight control of any aircraft between competent (flight control) authorities shall take place at specific boundaries and at pre-agreed altitudes".~~
- Item 552. ~~Flight control shall be deemed assumed once the authority assuming flight control establishes two-way communication with the aircraft crew, locates the radio position of the flight, communicates flight control takeover to the aircraft crew, and duly notifies the flight control transferring authority – via ground communication or aircraft crew".~~
- Item 554. ~~The airfield Air Traffic Controller shall control flights personally, and/or with the assistance of ATC Group personnel".~~
- Item 557. reference No. \*9: ~~When performing a landing approach, the aircraft crew commander shall report *Visual on RWY* to ATC, no later than at the time of reaching the aircraft's minimum, once the runway becomes visible to the aircraft crew (at the time of passing the outer NDB in normal weather conditions). Should the aircraft crew fail to report *Visual on RWY* (on the runway area) on the landing approach glide path until the moment of the aircraft reaching the aircraft crew commander or airfield minima, ATC shall be obliged to order the aircraft crew to abort the descent, and to perform a go-around at higher altitude".~~
- Item 573. ~~Persons not involved in flight control shall be prohibited from entering locations reserved for ATC Group personnel (...)"~~

On the day of the accident, the SMOLENSK NORTH airfield was a joint use airbase, and as such, according to Items 8.9.1, 8.9.2, and 8.9.3 of *Federal Aviation Regulations. Preparation and Performance of Civilian Aviation Flights in the Russian Federation*, whenever supporting aircraft landing approaches in conditions of cloud base at 200 m or lower, and/or of visibility below 2,000 m<sup>134</sup>, the ATC Group was obliged to secure such approaches with the use of a RLS (PCII) radar:

- 8.9.1. ~~All radio communication and technical devices installed at civilian airfields and **joint use airfields** shall be duly certified. All radio communication and technical facilities serving purposes of flight support shall conform to proper operability requirements".~~

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<sup>134</sup> On April 10<sup>th</sup> 2010, meteorological conditions in the SMOLENSK NORTH airfield area involved a cloud base below 200 m, and visibility below 2,000 m during the landing approaches of the Yak-40, IL-76, and Tu-154M aircraft.

8.9.2. –All radio communication and technical facilities serving purposes of flight support shall be listed in the order below as per the Air Traffic Controller’s decision:

- **Landing systems** (radio communication & lighting landing system, landing system equipment, **landing radio-locator system**) – no later than within 15 minutes prior to the duly calculated aircraft landing time. Moreover, the landing radio-locator system shall be switched on and used for purposes of landing approach control for light and superlight airplanes and helicopters upon request by aircraft crew. **For all other aircraft, it shall be switched on and used in conditions of cloud base at 200 m or lower, and/or of visibility below 2,000 m.** Whenever the landing radio-locator system is in use, all landing approaches of all aircraft shall be duly evidenced and logged.
- Other airfield radio communication and technical facilities – no later than within 30 minutes prior to the duly calculated aircraft landing (fly-by) time.”

8.9.3. –Meteorological conditions notwithstanding, all radio communication and technical facilities serving purposes of flight support shall be switched on upon request of aircraft crews”.

#### **2.12.6.Explanations to the transcript of radio and telephone communications and recordings from the external microphone on the inner ATC station**

MINSK CONTROL – air traffic controller in the Belarus Republic aerospace

Yak-40 – PLF 031 airplane crew

ATC – air traffic controller of the SMOLENSK NORTH airfield

TWR - air traffic controller of the SMOLENSK NORTH airfield

Il-76 - 78817 airplane crew

MUDC – Tver air base Military Unit Deputy Commander

101 – crew (aircraft commander) of the Tu-154M airplane

LZC – Landing Zone Control of the SMOLENSK NORTH airfield

Meteo – head of the meteorology station of the SMOLENSK NORTH airfield

AATC – Assistant Air Traffic Controller

... – unidentified person present in the Inner Air Traffic Control Station

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## **2.12.7 Analysis of Work<sup>135</sup> of Air Traffic Control on April 4th, 2010.**

On April 4th, 2010, the Air Traffic Controller was responsible for supporting aircraft flight within the area of the SMOLENSK NORTH airfield. He was guiding three aircraft: Yak-40, IL-76 and Tu-154M, and maintained control over actions of the ATC Group personnel.

### **2.12.7.1. Analysis of the Air Traffic Controller's Work in the Inner Zone**

#### Landing approaches of Yak -40 and Il-76 aircraft.

The crew of the Yak-40 aircraft, upon approaching the Waypoint ASKIL, received instruction from the MINSK CONTROL to switch to communication with MOSCOW CONTROL at<sup>136</sup> 124.00 MHz:

**MINSK CONTROL** – „Air Force zero three one contact Moscow on one two four decimal zero”.

**Yak-40** „Moscow: one two four, zero, Polish Air Force zero three one”.

ATC had no information about the flight of the Yak-40 aircraft until 0453:24, when the controller received information that Yak-40 was approaching waypoint ASKIL, to be reached at 0455. „...в пятьдесят пять минут ASKIL. Первый поляк ноль тридцать один ПЛФ.” (*...at minute fifty five ASKIL. First Polish zero thirty one PLF*).

The Yak-40 crew, upon approaching waypoint ASKIL, received instruction from the MINSK CONTROL controller to establish communication with MOSCOW CONTROL at the inappropriate radio frequency of 124.00 MHz, used by the ATC Group of the SMOLENSK NORTH airfield.

The commander of the Yak-40 aircraft, in executing the above instruction, established communication with ATC at the SMOLENSK NORTH airfield, instead of MOSCOW CONTROL. ATC took over the guiding of the aircraft without co-ordination with the Air Traffic Control authority (MOSCOW CONTROL)<sup>137</sup> and ordered the crew to descend and

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<sup>135</sup> Due to the Russian side not making procedures used by ATC Group procedures, both within the visual control zone, and in the inner zone of the SMOLENSK NORTH airport area, as contained in the “Air Control Manual”, and the “Instructions for flights within the area of the SMOLENSK NORTH airport”, the Air Traffic Control Group analysis was prepared on the basis of FAP PP GosA and the “Rules and Terminology in Radio Communication for Flight Preparation and Air Traffic Control”.

<sup>136</sup> The frequency of the MOSCOW CONTROL sector is 128.8 MHz. The 124.0 MHz frequency is that of the SMOLENSK NORTH airfield.

<sup>137</sup> Lack of coordination between air traffic services was incompliant with FAP PP GosA item 108, item 551 and the “Rules and Terminology in Radio Communication for Flight Preparation and Air Traffic Control”. item 9.5. “In the course of supporting the flight of each aircraft, Air Traffic Control controllers agree conditions of entry and exit to and from the adjacent zone”.

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change course beyond his area of responsibility<sup>138</sup>. Coordination and handing over of aircraft guiding between adjacent Air Traffic Control services should follow a procedure involving the following steps:

- a) notification of flight and proposed conditions for handing over the guiding of an aircraft;
- b) coordination and agreement of conditions for handing over an aircraft (hand-over point and altitude);
- c) handing over the guiding to the air traffic service taking over.

0455:53 – **Yak-40** *Aaah Moscow control, PAPA LIMA FOX, aaah, zero three one, good day. Descent flight level: three thousand three hundred meters, approaching waypoint ASKIL.*

0456:06 – **KL** *„А, PAPA LIMA zero three one, ы, Корсаж вызывали?” (Aaah, PAPA LIMA zero three one, aaah, have you called Korsazh?).*

0456:37 – **Yak-40** *„Вышка, PAPA LIMA FOX, ы, ноль три один. Снижаем, эшелон три три ноль ноль метров” (Tower, PAPA LIMA FOX, aaah, zero three one. Descending, level three three zero zero meters).*

0456:48 – **KL** *„PAPA LIMA zero three one, занимайте эшелон тысяча пятьсот с курсом тридцать градусов” (PAPA LIMA zero three one, take level fifteen hundred at thirty degrees heading).*

0457:01 – **Yak-40** *„Занимаю эшелон, ы, три, ы, пять, ы, ноль, ноль метров, с курсом, ы, тридцать” (Taking level, aaah, three, aaah, five, aaah, zero, zero meters, on heading, aaah, thirty).*

After making contact with ATC, the Yak-40 crew did not specify how they would approach landing. The ATC did not do that, either, although he was entitled to do so<sup>139</sup>.

The ATC did not advise the Yak-40 crew about the transition level.

0458:55 – **ATC** *„На Корсаже, ы, дымка, видимость четыре километра, ясно. Давление семь сорок пять, семь сорок пять. Посадочный два пять девять” (One Korsazh, aaah, fog, visibility four kilometers, clear sky. Pressure seven four five, seven four five. Heading for landing two five nine. ).*

After making contact with the crew of the IL-76 (817), ATC transmitted information on the transition level and type of approach.

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<sup>138</sup> The border of the inner zone of the SMOLENSK NORTH airfield is 60 km of the central point of airfield. Waypoint ASKIL is located 70 km away from the airport.

<sup>139</sup> In accordance with FAP PP GosA item 110, ATC had the right to do so, as the acting inner zone manager.

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0457:20 – **И-76** „Ы, Корсаж-Старт, ы, семьдесят восемь, восемь семнадцать готовы”  
(*Aaah, Korsazh-Start, aaah, seventy-eight, eight seventeen ready*).

0457:24 – **АТС** „А, восемь семнадцать, на Корсаже три балла, дымка, видимость четыре. Ветер сто сорок градусов, два метра, температура плюс два. Давление семь сорок пять, семь сорок пять. Посадочный два полсотни девять, эшелон перехода: тысяча пятьсот, заход по ОСП с РСП” (*Aaah, eight eighteen, at Korsazh three degrees, fog, visibility four. Wind one hundred and forty degrees, two meters, temperature plus two. Pressure seven four, seven, forty five. Heading for landing two and a half hundred nine, transition level one thousand five hundred, approach by OSP from RSP*).

At 0511:16, ATC notified the crew of the IL-76 of visibility reduced to 1,000 m. The crew of the IL-76 wrongly confirmed the value given (not as 1,000 m, but as 1,500 m) which was not noticed or corrected by ATC.

0511:09 – **АТС** „Ы, три тыщи, три тысячи на привод. Значит видимость ухудшилась. Дымка, тысяча метров” (*Aaah, three thous, three thousand on the beacon. So the visibility has deteriorated. Fog, one thousand meters.*).

0511:16 – **И-76** „А, информацию прослушал. А, видимость тысяча (пятьсот?)”  
(*Aaah, copy that. Aaah, visibility one thousand (five hundred)?*).

ATC did not communicate that information to the Yak-40 crew and did not assure that it was received by them during radio communication with the IL-76. Visibility of 1,000 m was one of the borderline values in defining the SMOLENSK NORTH airfield minima (visibility 1,000 m, cloudbase 100 m).

When supporting the Yak-40, IL-76 and Tu-154M aircraft flights, ATC defined the approach time (by ОСП с РСП) only for the IL-76 crew.

After initiating the final leg of approach, radio communication with the Yak-40 crew was taken over by Landing Zone Control (LZC).

#### Landing approach of the Tu-154M

The crew of the Tu-154M received an order from the MINSK CONTROL Air Traffic Control authority to switch to communication with the MOSCOW CONTROL air traffic authority at 128.8 MHz. MOSCOW CONTROL order further descent and communication to be established with the ATC Group of the SMOLENSK NORTH airfield at the frequency of

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124.00 MHz. The commander of the Tu-154M aircraft established communication with ATC, communicating descent to 3,600 m and tracking to outer NDB, but without declaring landing approach intentions. ATC did not do that, either, even though he had the right to do so, as he did at landing of the Yak-40 aircraft.

After establishing communication, ATC asked the aircraft commander about remaining fuel and alternate airfields, which indicates that he undertook actions specified in the procedure for handing over the aircraft to an alternate airfield due to weather conditions at the airfield (pursuant to item 96 of the FAP PP GosA). ATC, however, did not know the alternate airfields of the Tu-154M or of the IL-76, which was in breach of item 96 of FAP PP GosA.

0623:47 – **MUDC** „...остаток топлива запроси и запасной аэродром” (*...ask about fuel remaining and alternate airfield*).

0623:50 – **ATC** „А. PLF Foxtrot, aaah, one zero one, остаток топлива, топлива сколько у вас?” (*Aaah, PLF Foxtrot, aaah, one zero one, fuel remaining, how much fuel have you got left?*).

0623:58 – **101** „Осталось, ы, одиннадцать тонн” (*Remaining, aaah, eleven tons*).

0624:01 – **MUDC** „Это до Внуково хватает? Запасной аэродром (скажи?)” (*Will that be enough to reach Vnukovo? Alternate airfield (say?)*).

0624:03 – **ATC** „Запасной аэродром у вас какой?” (*What is your alternate airfield?*).

0624:07 – **101** „Витебск, Минск” (*Vitebsk, Minsk*).

ATC did not communicate information about clouding or vertical visibility to any of the crews, even though relevant measurements could be taken with devices installed at Inner ATC Post, inner NDB and outer NDB.

### **2.12.7.2. Analysis of Work of the Air Traffic Controller in the Visual Area**

#### **Landing approach of the Yak-40 aircraft**

Landing approach of the Yak-40 from 14 to 1 km before RWY 26 was supported by ATC. Final communication confirming the aircraft's position in relation to glide path and runway centerline was received by the Yak-40 crew at a distance of 1 km from RWY 26 threshold. From that point, ATC should establish visual contact with the aircraft.

At 0517:00, ATC asked the Yak-40 crew whether they had established visual with the RWY. As there was no response, ATC did not grant permission to land. Following 6 s, when he saw the Yak-40 at an excess altitude in relation to the appropriate flight trajectory, he



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ordered the crew to go around<sup>140</sup>. The commander of the Yak-40, according to his testimony, did not hear his order and performed the landing.

ATC did not order the crew to explain their failure to follow the go-around, but instead commented on the Yak-40 pilot's behavior, saying „Молодец” (*Good job*).

- 0516:48 – **LZC** „Один на курсе, глиссаде” (*One on course, on glide path*).
- 0516:53 – **АТС** „Не видно, пока не вижу” (*Can't be seen, I cannot see yet*).
- 0517:00 – **АТС** „Где?! Где?!” (*Where to?! Where?!*).
- 0517:00 – **АТС** „Полосу наблюдаете? Выше!” (*Can you see the runway? Higher!*).
- 0517:04 – „[vulg.], уход на...” ([vulg.], *go around...*).
- 0517:05 – „[vulg.], надо уход” ([vulg.], *need to go around*).
- 0517:06 – **АТС** „Уход на второй круг” (*Going around*).
- 0517:11 – **АТС** „Да иди, [vulg.], [vulg.] тут, [vulg.], сядет! Сядет тут!” (*Come on,, [vulg.], [vulg.] here, [vulg.], he will land! He will land here!*).
- 0517:26 – „...нормально шёл” (*...he was approaching well*).
- 0517:30 – **АТС** „Посадка” (*Touch down*).
- 0517:31 – **АТС** „РАРА ЛИМА zero three one. После остановки, на сто восемьдесят. Молодец” (*PAPA LIMA zero three one. Backtrack after landing. Good job*).
- 0517:39 – **Yak-40** „Повторите” (*Repeat*).
- 0517:41 – **АТС** „На сто восемьдесят” (*Backtrack (one eighty)*).
- 0517:42 – **АТС** „Посадка Як сорокового!” (*Yak-40 touchdown!*).
- 0517:49 – „Ты видел как он торец прошёл?” (*Did you see how he passed the threshold?*).

In accordance with the SMOLENSK NORTH approach chart, when descending the Yak-40 crew reached the minimum altitude of the airfield (100m) in the inner NDB area. Upon reaching the position, ATC was not observing the aircraft and did not receive information from the crew regarding RWY visibility.

Pursuant to FAP PP GosA item 557 ref. \*9, ATC, after receiving information from LZC about the position of the aircraft on the first kilometer, due to his failure to make visual with the aircraft receiving no information about the crew having visual of the RWY, should have ordered the Yak-40 crew to go around at the time.

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<sup>140</sup> Assuming that approach speed of the Yak-40 was 225 km/h (62.5 m/s), after passing the inner NDB, until the “go around” command, he was at a distance of ca. 250 m before RWY 26 threshold when he was spotted by ATC.

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Considering weather conditions in the airfield area, ATC should specify the minimum descent altitude for the Yak-40 in accordance with airfield minima (100 m), which he did not do in this case, or during the IL-76 approach. He did, however, specify such altitude for the Tu-154 crew.

ATC did not ask the Yak-40 crew about weather conditions during their landing approach<sup>141</sup>, although the IL-76 was queued for approach .

#### Landing approach of the IL-76

During its two approaches, the IL-76 crew received final communication on the aircraft's position with relation to the glide path and RWY center line at a distance of 1 km from RWY 26 threshold.

As there was no visual contact with the aircraft at a distance of 1,000 m from RWY 26 threshold, ATC did not issue permission to land on the first or the second landing attempts .

ATC only established visual with the aircraft at the first landing attempt, when the aircraft was just before the RWY26 threshold, left of its center line, at very low altitude in relation to the airfield plane. The crew of the IL-76 made a failed attempt at bringing the aircraft to the RWY center line in order to land. According to witnesses, the crew, while going around after the failed approach, made an abrupt maneuver of banking right, with the right wing tip around 3-5 m above airfield plane. In accordance with FAP PP GosA item 557 ref. \*9, ATC – just as had the case been with the Yak-40 aircraft – should have ordered the IL-76 crew to go around earlier.

The delayed go-around order, and actions of the IL-76 crew resulted in a maneuver threatening flight safety.

0527:35 – **LZC** „Один на курсе, глиссаде” (*One on course, on glide path*).

0527:47 – **ATC** „Наблюдаешь?” (*Can you see?*).

0527:51 – **ATC** „Уходи на второй круг” (*Go around*).

0527:56 – „Уход” (*Go around*).

0527:56 – **ATC** and **MUDC** „...! ...! [vulg.]! [vulg.]! [vulg.]!”.

0528:05 – **ATC** „Уход на второй круг. Уход” (*Go around. Go around*).

0528:08 – „Ясно” (*Clear*).

0528:12 – „...,[vulg.], ...”.

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<sup>141</sup> In accordance with FAP PP GosA item 96, ATC was required to report and analyze on a regular basis, the weather conditions and bird presence situation within the area of his own airfield and alternate airfields according to reports of crews.

ATC twice permitted the IL-76 crew to approach twice in weather conditions below approach minima according to OCH c PCII<sup>142</sup> (in accordance to findings of the Committee, horizontal visibility at the time was between 500 m – 300 m, and cloud base below 50 m). Such ATC action was in conflict with FAP PP GosA items 20, 96, 98, 462 and 557 ref. \*9.



Fig. 24. Il-76 at first landing approach

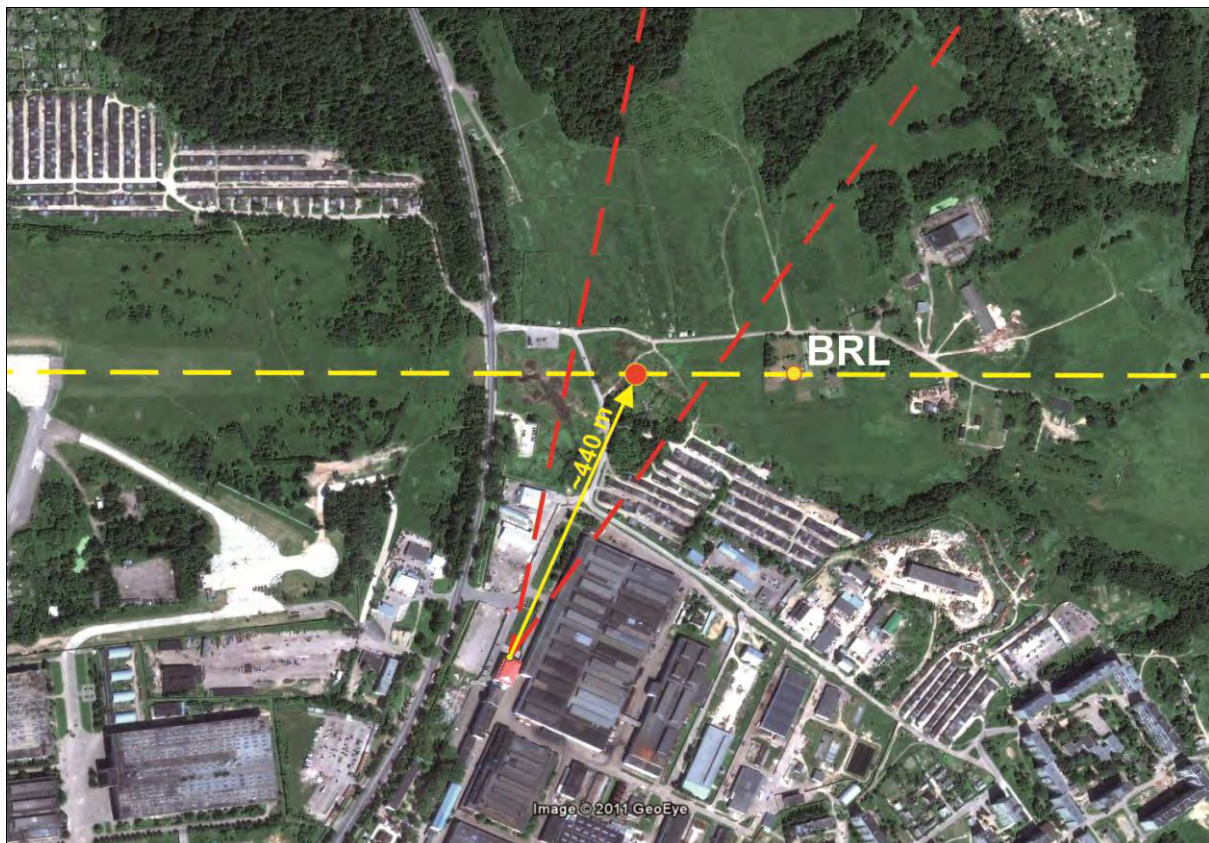


Fig. 22. Location of the photograph of the Il- 76 aircraft

#### Landing approach of the Tu-154M aircraft

<sup>142</sup> Minimum weather conditions for landing for the IL-76 are: cloud base 100 m, visibility 1,000 m.

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Between 0605:42-0606:02 (17 min 33 s before establishing communication with the crew of the Tu-154M), ATC received information from the weather forecasting station of the SMOLENSK NORTH airfield, that in lieu of the weather conditions in place, a STORM warning should be issued. On basis of weather conditions below airfield minima, and of information received from the head of the meteorological station, ATC should have motioned his superiors to close the airport, subject to consultation with the weather forecaster on duty at the Tver meteorological office (in accordance with FAP PP GosA item 96).

0605:42 – **Meteo** „Сейчас, ы, восемьдесят на восемьсот даю. Штормовую погоду” (*Now, aaah, I give eighty by eight hundred. Stormy weather*).

0605:48 – **АТC** „Ну шторм выписал?” (*So, have you issued a storm (warning)?*).

0605:49 – **Meteo** „Ы, ну в Тверь доложил, это самое, но он как не оправдавшийся шторм” (*Aaah, well I reported to Tver (sic!), you know, but he said that storm is not forecasted*).

0605:54 – **АТC** „Что, что, что?” (*What, what, what?*).

0605:55 – **Meteo** „Он как не оправдавший ...Ну как ы, как ы реально возникший. Ну шторм-то не выписывал” (*He said as not forecast... He said, aaah, storm actually arriving. But I did not issue a storm (warning)*).

0606:00 – **АТC** „Ну а сейчас так что, нету шторма?” (*What is this now, not a storm?*).

0606:02 – **Meteo** „Сейчас штормовая погода” (*It is stormy weather now*).

The landing approach procedure of the Tu-154M aircraft from 14 km was supported by the LZC; the crew received final communication confirming the correct position of the aircraft in relation to the glide slope and RWY center line – “two on course, on glide path” at a distance of about 2,500 m from RWY 26 threshold.

During the landing approach procedure, the Assistant Air Traffic Controller (AATC) communicated on 124.00 MHz: „Полоса свободна” (*Runway free*). On the basis of radio, telephone communication and all Inner ATC Post channel recordings, the Committee concluded that AATC did not communicate such information during approaches of Yak-40 and Il-76 aircrafts.

Having received the „Полоса свободна” (*Runway free*) information from AATC, ATC permitted the crew to continue approach, issuing the „Посадка дополнительно” message and stating wind direction and speed.

0639:40 – **ААТC** „Полоса свободна” (*Runway free*).

0639:44 – ATC „Посадка дополнительно, сто двадцать, три метра” (*Landing additionally, one hundred twenty, thirty meters*).

The ATC issued subsequent instructions to the crew of the Tu-154M after 2.5 s as of the AATC’s order to proceed to horizontal flight.

0640:58 – ATC „Контроль высоты, горизонт” (*Altitude control, horizon*).

Subsequent instructions „Уход на второй круг!” (Go around!) were issued 7 seconds later. At that time, the aircraft was making an uncontrolled left rotation after losing part of the wing as a result of tree impact.

Other ATC instructions were issued after the aircraft hit the ground.

#### 2.12.8. Analysis of the Work of Landing Zone Control Officer

On April 10<sup>th</sup>, 2010, the Landing Zone Control officer was responsible for supporting landing approaches as of the moment of final approach commencement until the moment of the crew making visual contact with the RWY area, and/or within ranges limited by the technical radar capacity.

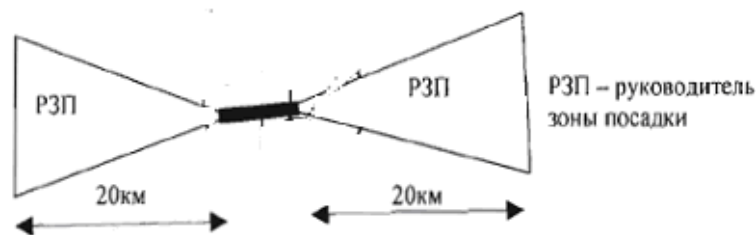


Fig. 23. Jurisdiction Area of SMOLENSK NORTH LZC

Despite ATC not communicating the type of landing approach to Yak-40 and Tu-154M crews, LZC supported their approach by PCII radar<sup>143</sup>, in accordance with item 8.9.2 of FAP PP GosA.

The LZC should inform crews of approaching aircraft about their position in relation to the RWY center line and the glide slope, and their distance from the RWY threshold, on the basis of marker observation on radar displays.

In accordance with FAP PP GosA item 115, LZC had the right to notify the crew about the correct flight path in relation to the RWY center line and glide slope as “on course and on glide path” only when the plane’s marker was within 1/3 of the value of maximum linear deviations from the required glide path.

<sup>143</sup> As in case of the IL-76, whose crew were notified of the type of landing approach by the inner zone officer.

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In the deposition made, LZC confirmed that the initial indications of the glide path on April 10<sup>th</sup>, 2010 corresponded with the angle of 2°40', i.e. in accordance with the value published on approach charts, which were available to the Yak-40 and Tu-154M crews.

#### Landing approach of the Yak-40 (PLF 031) aircraft

The first message given by LZC to the Yak-40 aircraft crew contained information on having reached the final approach leg, and the distance from the RWY 26 threshold (at 0513:38). In response, the crew requested clearance for straight turn into landing. LZC granted clearance and communicated the distance to RWY 26 threshold (fifteen). The crew of the plane did not receive<sup>144</sup> information, and asked again for permission to commence base leg. Initially LZC spoke, then ATC, clearing the turn and notifying the Yak-40 crew of the distance from RWY 26 threshold (fourteen).

In his subsequent communication, LZC informed about the 10 km distance from RWY 26 threshold, and position of 100 meters left of RWY center line, and reaching the glide path.

0514:43 – **LZC** „Тридцать один, удаление десять, левее сто, вход в глиссаду” (*Thirty one, distance ten, one hundred left, glide path entry*).

0514:47 – **ATC** „Медленно говори, чтобы он...” (*Speak slowly, so that he...*).

0514:54 – „...(может надо?)...Конечно” (*...(maybe we need to?)...Of course*).

0515:00 – „Где он?” (*Where is he?*).

Information about reaching the outer NDB was communicated by LZC 50 s after the previous message. Subsequent communications of LZC pertain to the appropriate position of the Yak-40 aircraft in relation to the glide path and RWY axis.

The expression: „Где он?” (*Where is he?*) recorded at inner LZC (0515:00) suggests probable difficulty in continuous visual on the plane's marker on radar displays. This could have been caused by LZC failing to notify the aircraft crew about having passed the 8 km distance, and uncertainty as to what to say upon the aircraft reaching the outer NDB (0515:22-0515:25): „Давай, давай, ему говори” (*Come on, come on, tell him* – **ATC instruction**); „А что ему говорить?, блин, всё нормально” (*What should I tell him? Damn, everything is alright* – **LZC speaking**). The failure to communicate the aircraft having reached 5 km could have been caused by radio communication of the IL-76, or difficulty in

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<sup>144</sup> Or did not understand due to insufficient command of the Russian language.

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keeping a visual on the aircraft's marker. The above faults in LZC's work infringed on rules of radio communication (item 6.4.4.2)<sup>145</sup>.

The crew of the Yak-40 did not confirm LZC instructions on flight altitude; ATC did not order the crew to confirm information on aircraft location, nor did it react to incorrect radio communication by LZC, in breach of FAP PP GosA item 96.

#### Approaches of the Il-76 aircraft

The first message issued by LZC to the IL-76 crew was clearance for the final approach leg, and notification of the distance of 17 km from RWY 26 (0523:59). At 0524:42, LZC transmitted the message: „(Восемь?) семнадцать, удаление четырнадцать на посадочном” (*(Eight?) seventeen, distance fourteen on landing course*). Subsequent communication by LZC at 0525:27 notified of the distance of 10 km and the aircraft reaching the glide path. During landing approach, LZC informed the the IL-76 crew of distances: 10, 8, 6, 5, 4, 3, 2 and 1 km from RWY 26 threshold, respectively, providing information on the correct position of the aircraft in relation to the RWY center line and the glide path.

The Il-76 crew confirmed the information from LZC, declaring their flight altitude only during approach to 8 km.

5:38:37 – LZC „Восемь – семнадцатый, удаление восемь, правее полсотни, на глиссаде” (*Eight - seventeenth, distance eight, half hundred to the right, on glide path*).

5:38:40 – **И-76** „Четыреста” (*Four hundred*).

LZC incorrectly informed the crew of the aircraft of the 2 km distance, stating that the aircraft was at 3 km distance. The error was noticed by the crew of the IL-76 and by ATC, and duly corrected by LZC.

0527:22 – **ИЛ-76** „Два” (*Two*).

0527:24 – **АТС** „Два?” (*Two?*).

0727:24 – „Да” (*Yes*).

0727:25 – „Да, да” (*Yes, yes*).

0727:26 – **LZC** „Ошибочно, два” (*Correction, two*).

0527:35 – **LZC** „Один на курсе, глиссаде” (*One on course, on glide path*).

0527:46 – „...” (”,...”).

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<sup>145</sup> On final approach, information about the distance of aircraft from the runway threshold is communicated to the crew by the controller: until passing the outer NDB – no less frequently than every 2 km, after passing the outer NDB – no less frequently than 2 km, after passing the outer NDB – no less frequently than 1 km.”.

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0527:47 – ATC „Наблюдаешь?” (*Can you see?*).

During the second approach, LZC instructed the IL-76 crew to initiate final approach, and communicated distance of 15 km from RWY 26 threshold (0537:07). At 0538:08, LZC informed: „Восемь – семнадцатый, удаление десять, на курсе, вход в глиссаду” (*Eight-seventeen, distance ten, on course, entering glide path*). During landing approach, LZC was updating the IL-76 crew on distances: 8, 7, 6, 5, 4, 3, 2 and 1 km from RWY 26 threshold, and on the correct position<sup>146</sup> of the aircraft in relation to the RWY center line and the glide path.

During the second landing approach, the crew of the IL-76 confirmed the messages received from LZC with the current altitude twice only (at kilometers 8 and 2).

0538:37 – LZC „Восемь – семнадцатый, удаление восемь, правее полсотни, на глиссаде” (*Eight-seventeen, distance eight, half hundred to the right, on glide path*).

0538:40 – И-76 „Четыреста” (*Four hundred*).

0540:09 – LZC „Два на курсе, глиссаде” (*Two on course, on glide path*).

0540:11 – И-76 „Сто тридцать” (*One hundred and thirty*).

As was the case with the Yak-40 approach, ATC did not order the crew to confirm information on the aircraft’s location with altitude, nor did he react to breaches of radio communication rules by LZC, contrary to FAP PP GosA item 96.

According to witnesses of IL-76’s approach, both attempts ended at low altitude, with deviation left of the RWY 26 center line.

#### Tu-154M approach

#### **Figure of Tu-154M Aircraft Landing Approach.**

In order to perform a detailed analysis of the landing approach of Tu-154M, a graphical representation of flight trajectory<sup>147</sup> drafted by the Committee was used alongside a voice recording transcript from the cockpit, and at Inner ATC Post. Displaying the aircraft’s position on WISP-75 radars<sup>148</sup> was possible thanks to a special flight of Tu-154M tail number 102 on April 28<sup>th</sup> 2011, at the MIROŚLAWIEC airfield, in the course of which the flight trajectory of Tu-154M tail number 101 of April 10<sup>th</sup>, 2010 was reconstructed.

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<sup>146</sup> He communicated deviation from RWY centerline only at a distance of 8 km: –Восемь – семнадцатый, удаление восемь, правее полсотни, на глиссаде” (*Eight-seventeen, distance eight, half hundred to the right, on glide path*).

<sup>147</sup> Graphic approach trajectory has been attached hereto in Appendix no. 1 to the Final Report.

<sup>148</sup> According to the Russian party, radar screen display on LZC position was not recorded due to signal cable failure.



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Please find below a description of markings used for graphical representation of chart components:

1) glide path chart:

- a) blue color represents the area of acceptable maximum dimension of linear deviations ( $\pm 30'$ ) from the required glide path ( $2^{\circ}40'$ );
- b) green color marks the area or linear extent tolerance of the deviation zone (1/3 of the value of maximum linear deviation from the  $2^{\circ}40'$  glide slope), the presence of the marker allowing LZC to communicate information on correct position: "on glide path" to the aircraft crew;

2) landing course lines chart:

- a) grey color marks the area of acceptable extent of linear deviation  $\pm 2^{\circ}$  in relation to runway center line;
- b) the transparent zone shows the acceptable extent of linear deviation (1/3 of the value of maximum dimension of linear deviation from the extended RWY 26 center line), the presence of the marker allowing LZC to communicate information on correct position: "on glide path" to the aircraft crew.

On basis of an analysis of radio communication and "background" recorded by the microphone in the Tu-154M cockpit, communications and conversations have been overlaid on the landing approach chart. Individual statements are color coded (see side box).

|   |                                  |
|---|----------------------------------|
|  | KL (kierownik lotów)             |
|  | KSL (kierownik strefy lądowania) |
|  | I pilot (w eter)                 |
|  | I pilot (do załogi)              |
|  | II pilot                         |

The first LZC communication to the Tu-154M crew was clearance to enter final approach leg following information from the Tu-154M aircraft commander about its commencement (0637:29). LZC did not inform the aircraft crew of the distance<sup>149</sup> from the RWY 26 threshold.

At 0639:12 LZC communicated: „Сто первый, удаление десять, вход в глиссаду” (one zero one, distance ten, entry into glide path). According to calculations by the Committee, the aircraft reached the correct position to initiate descent for landing approach<sup>150</sup> (the aircraft was at a distance of ca. 10 km of RWY 26 threshold, at an altitude of ca. 500 meters above airfield level, within the RWY center line).

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<sup>149</sup> Of the four aircraft approaches on April 10<sup>th</sup>, 2010, LZC did not confirm distance at initiation of final approach for the Tu-154M only.

<sup>150</sup> From that point, the Tu-154M crew should be notified of their position. In case of deviation from the RWY center line, LZC was required to communicate such deviation immediately .

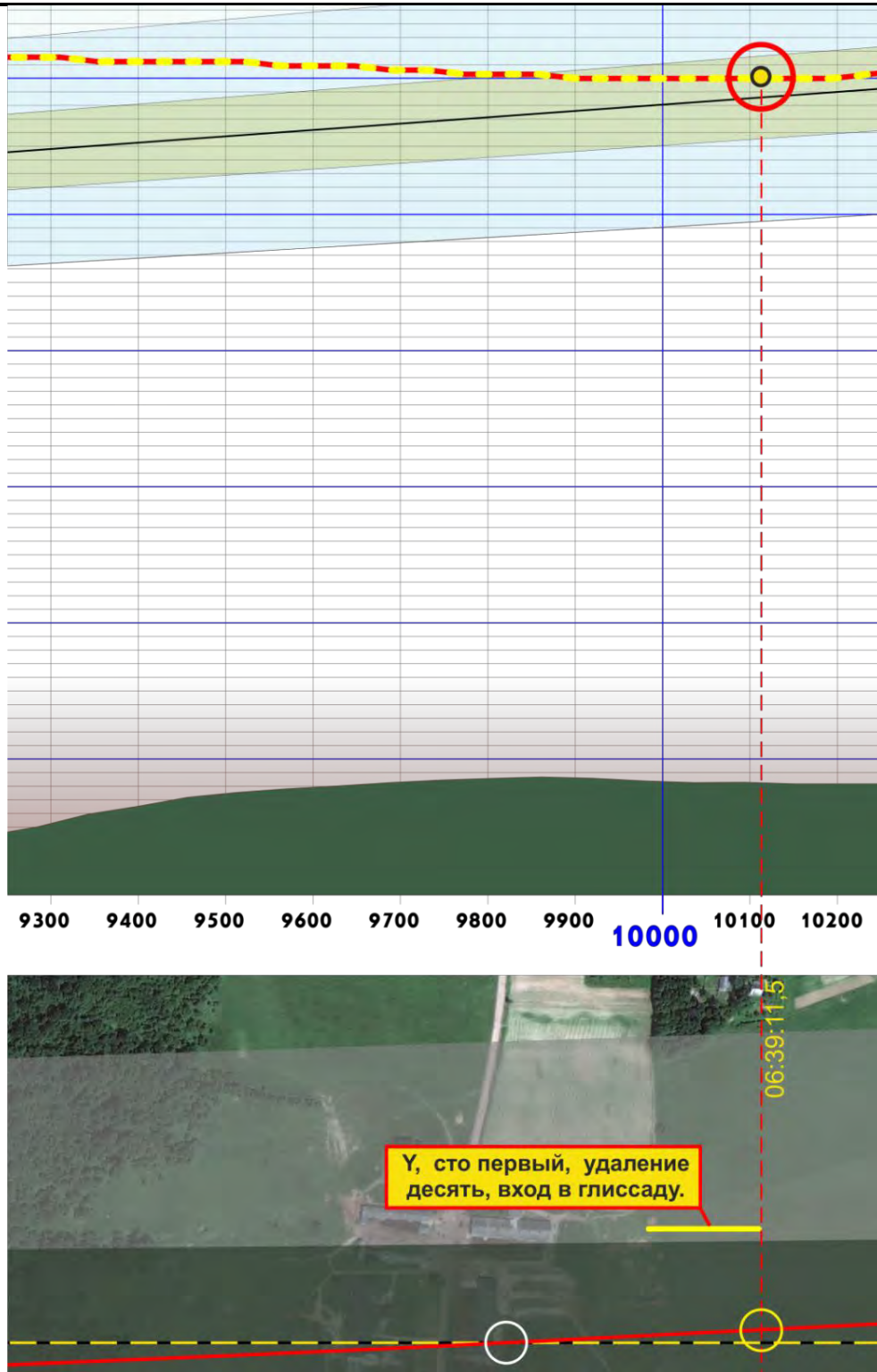


Fig. 24. Location of the aircraft at the moment of command: „Сто первый, удаление десять, вход в глиссаду”  
(One zero one, distance ten, entry into glide path)

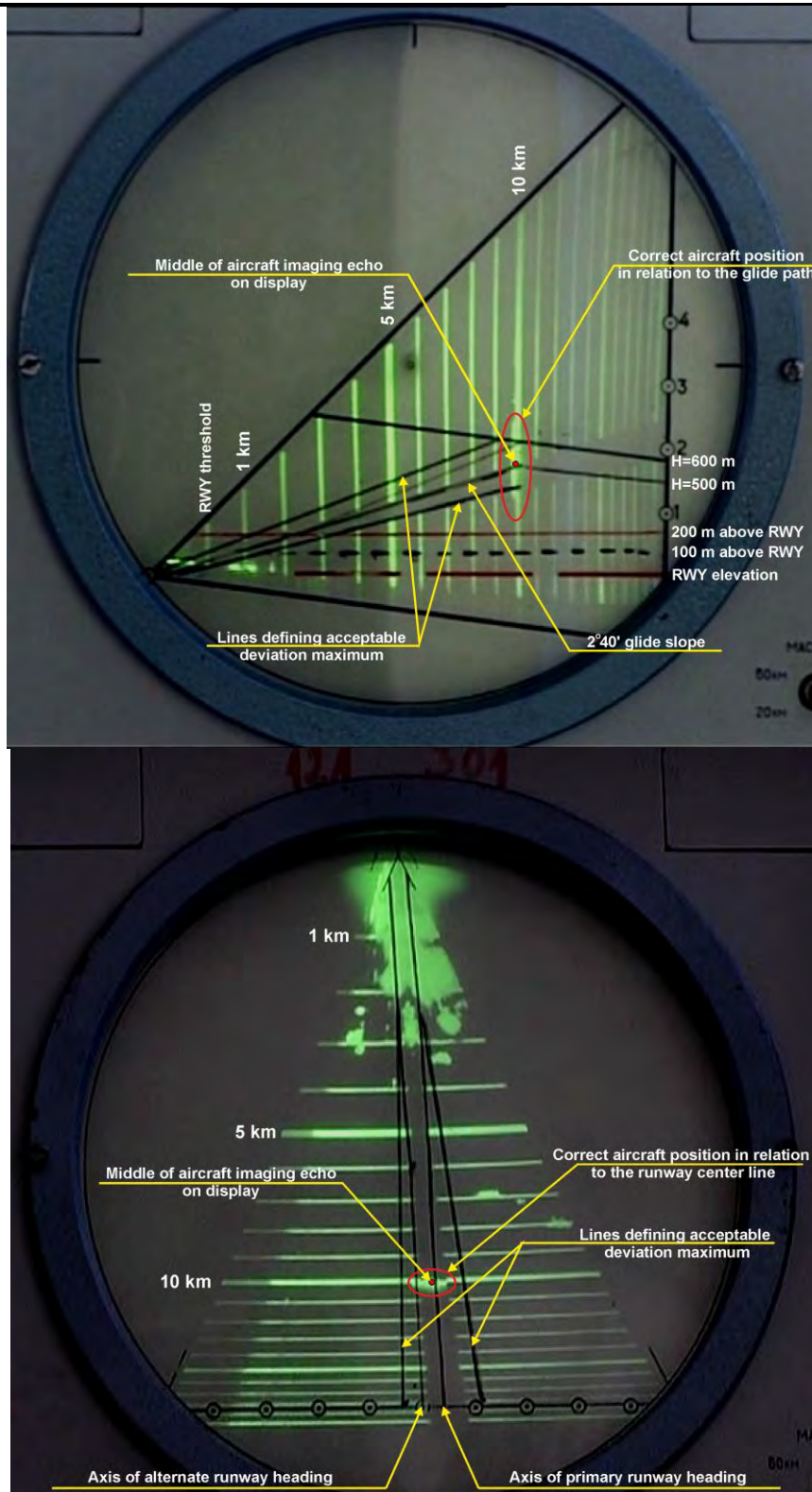


Image 25. Imaging of aircraft position in relation to the glide path and RWY center line on WISP-75 displays

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After approaching 10 km<sup>151</sup>, the aircraft crew did not initiate descent, and continued horizontal flight. This caused the aircraft to fly above the glide slope. At a distance of 9.7 km from RWY 26 threshold, the aircraft left the sector within 1/3 of acceptable deviation<sup>152</sup> ( $\pm 10^\circ$ ). At a distance of 9 km from RWY 26 threshold, the aircraft was already outside of the maximum deviation zone ( $\pm 30^\circ$ ).

LZC communicated subsequent information after 21 s (0639:33): „Восемь на курсе, глиссаде” (*Eight on course, on glide path*), when the aircraft was at 130 m above the glide path, 65 m to the left of RWY center line (at 528 m above airfield level, at a distance of 8,300 m from RWY 26 threshold). LZC did not react to the incorrect position of the aircraft. On basis of an analysis of voice recordings at Inner ATC Post, one can conclude that the absence of reaction was caused by radar malfunction (no gain adjustment possible), which was evidenced by statement (0638:13): „Нет усиления, для регулировки...” (*No gain for adjustment...*).

0638:10 – „Да нет, тут усиление выбивает, [vulg.]” (*No, gain is broken here, [vulg.]*).

0638:13 – „Нет усиления, для регулировки...” (*No gain for adjustment...*).

0638:20 – „Позвони...” (*Call...*).

0638:21 – „Вот он появился, вот он, вот он” (*It has appeared now, here, this is it*).

0638:21 – „Аха” (*Aha*).

0638:27 – „(Что-то?)...” (*(Something?)...*)

0638:28 – „Не, не, не, нормально, нормально...” (*No, no, no, alright, alright ...*).

0638:38 – „Позвони, это самое, да” (*Call, you know, like that*).

0638:40 – „Давайте, поставим нормально...” (*Come on, let us set it to normal*).

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<sup>151</sup> The point of initiating descent was designated at 10.42 km.

<sup>152</sup> At the time, LZC should have notified the crew of their location above the glide path.

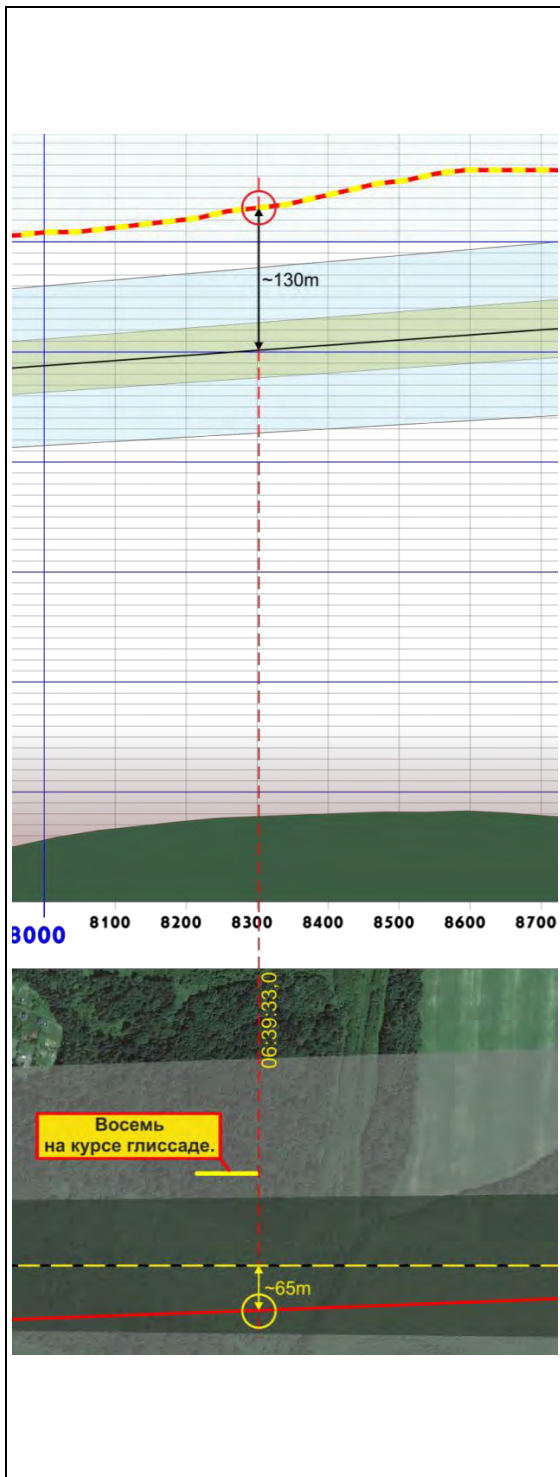


Fig. 25. Location of the aircraft at the moment of command: „Восемь, на курсе, глиссаде” („Eight on course, glide path”)

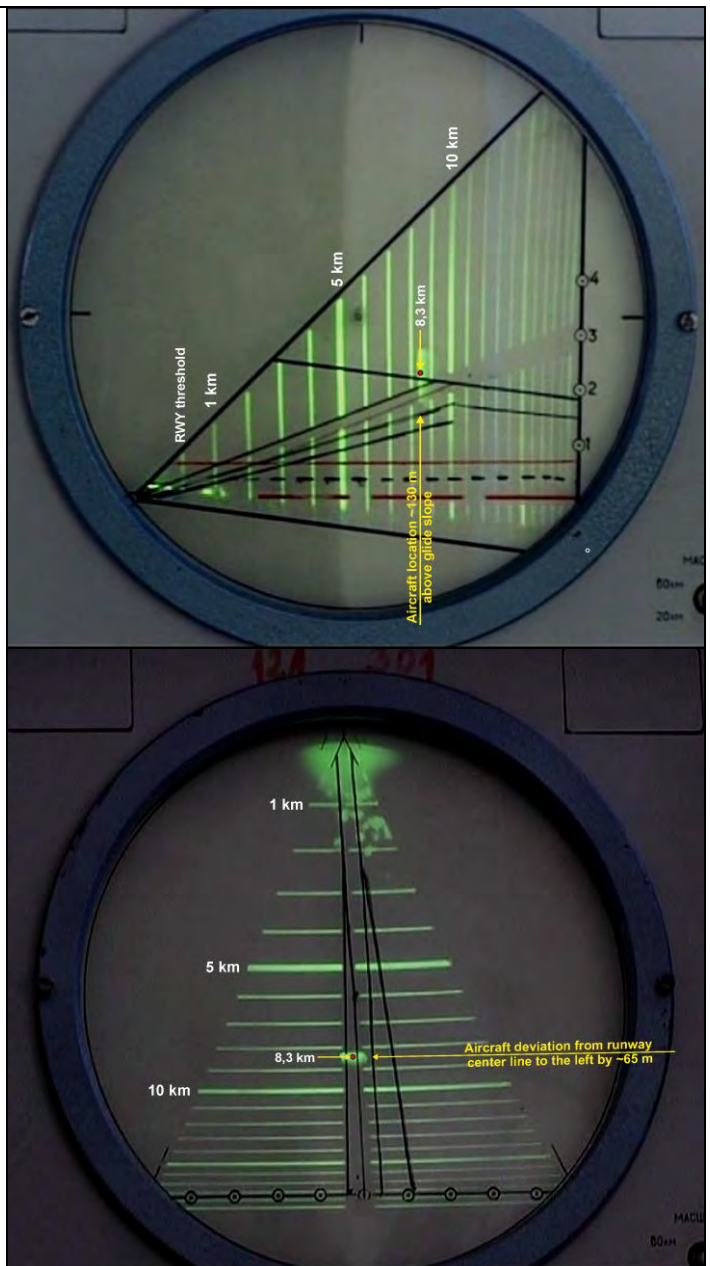


Image 26. Imaging of aircraft position in relation to the glide path and RWY center line on WISP-75 displays

Subsequent communication on the distance and correct location on the glide path<sup>153</sup> was given issued by LZC after 20 s. That was inconsistent with the actual position, as it was actually at 120 m above glide path at the time, 115 m left of RWY center line (444 m above airfield level, 6,649 m from RWY 26 threshold), i.e. outside of the border of maximum acceptable linear deviation ( $\pm 30'$ ) from the glide slope as instructed ( $2^{\circ}40'$ ). Commander of the Tu-154M aircraft incorrectly confirmed the distance from the RWY 26 threshold as „cztery” (*four*) instead of six. The mistake went unnoticed by LZC and ATC.

In the opinion of the Committee, given the weather conditions on site, and incorrect position of the aircraft (excessive deviation from glide path and course, small distance from RWY 26 threshold) LZC should have asked the crew for their decision regarding continued approach, or recommend that it be discontinued.

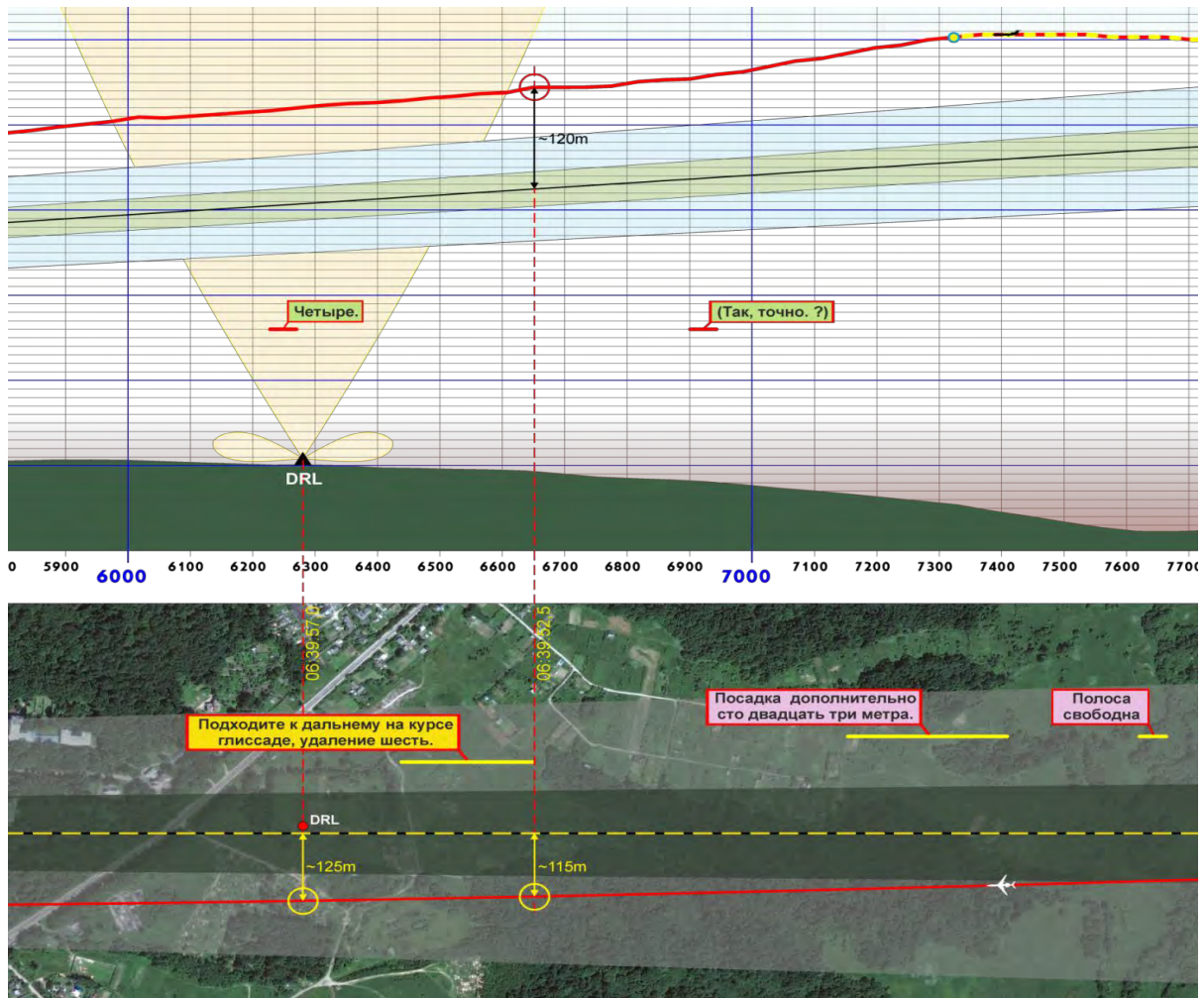


Fig. 26. Aircraft location at the time of the command: „Подходите к дальнему, на курсе глиссаде, удаление шесть” (*You are approaching the outer, on course, on glide path, distance six*)

<sup>153</sup> „Подходите к дальнему, на курсе глиссаде, удаление шесть” (*You are approaching the outer, on course, on glide path, distance six*).

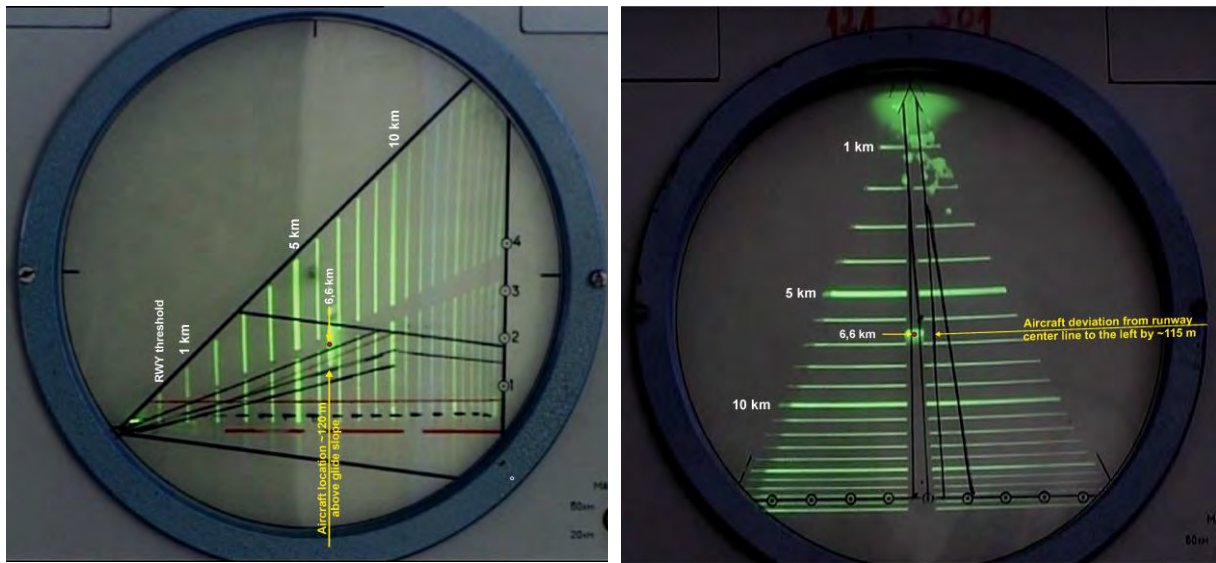


Image 27. Imaging of aircraft position in relation to glide path and RWY center line on WISP-75 displays

Subsequent communication was issued by LZC after 24 s<sup>154</sup>, at a distance of ca. 4,600 m from RWY 26 threshold. LZC was still issuing communication to the crew about correct aircraft position, even though the aircraft was 60 m above glide path, 130 m left of RWY center line (at the altitude of 287 m above airfield level, 4,591 m from RWY 26 threshold).

LZC did not notify the aircraft crew about passing the fifth kilometer, which was contrary to rules of radio communication (item 6.4.4.2): –On final approach, information about the distance of aircraft from runway threshold shall be given:

- until passing the outer beacon – no less frequently than every 2 km;
- after passing the outer beacon – no less frequently than every 1 km”.

Voice recordings at Inner ATC Post (0640:07-0640:17) may indicate further problems with keeping a visual on the aircraft’s position on displays, or giving distance from RWY threshold in advance, which was probably intended to cause the crew to make the decision to discontinue approach sooner: „I dodawaj odrobinę. Dawaj odległość” (*Add a little bit more. Give them the distance*), which resulted in LZC communicating information about passing the 4<sup>th</sup> kilometer 600 m in advance. The aircraft commander confirmed receipt of the message by repeating „na kursie ścieżce” (*on course, on glide path*).

- „А он ответил?” (*And he answered?*).
- 0640:07 – „И чуть-чуть добавляй...” (*And add a little bit more...*).
- 0640:13 – „Давай... удаление...” (*Give them... the distance...*).

<sup>154</sup> О 0640:16,5: „Четыре на курсе, глиссаде” (*Cztery na kursie, ścieżce*).

0640:17 – LZC „Четыре на курсе, глиссаде” (*Four on course, on glide path*).

0640:20 – 101 „На курсе, глиссаде” (*On course, on glide path*).

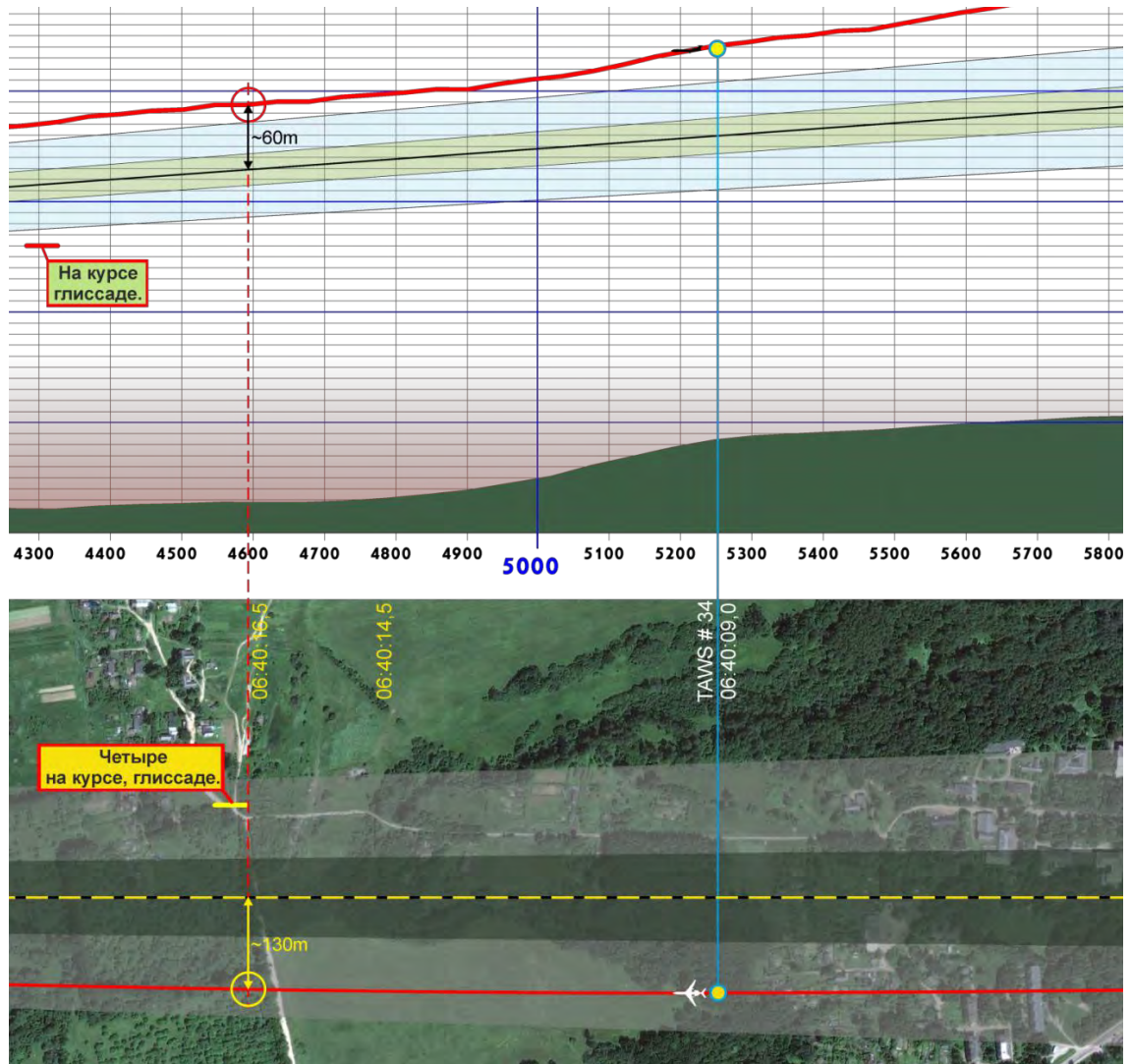


Fig. 27. Aircraft location at the time of the command given: „Четыре на курсе, глиссаде” (*Four on course, on glide path*)



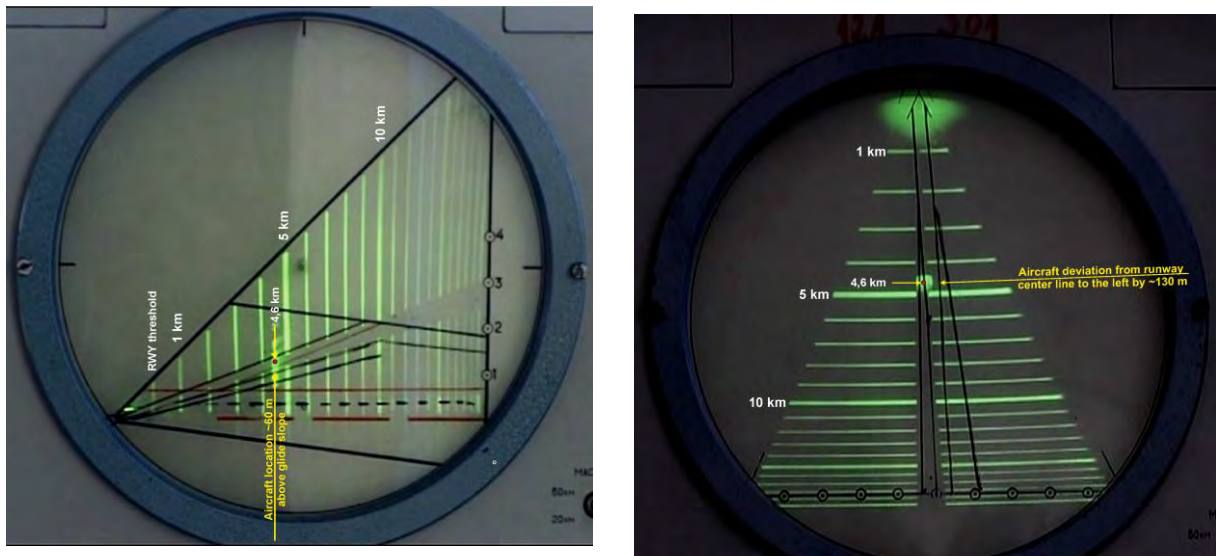


Image 28. Imaging of aircraft position in relation to glide path and RWY center line on WISP-75 displays

Subsequent communication by <sup>155</sup> LZC was issued after 13 s (3460 m from RWY 26 threshold). LZC kept informing the crew of correct plane position on course and glide path, while in reality the aircraft was at the upper limit of acceptable linear deviation (+30') from the commanded glide path, and 100 m left of RWY center line.

<sup>155</sup> At 0640:29.5 LZC transmitted: „Три на курсе, глиссаде” (*Three on course, on glide path*).

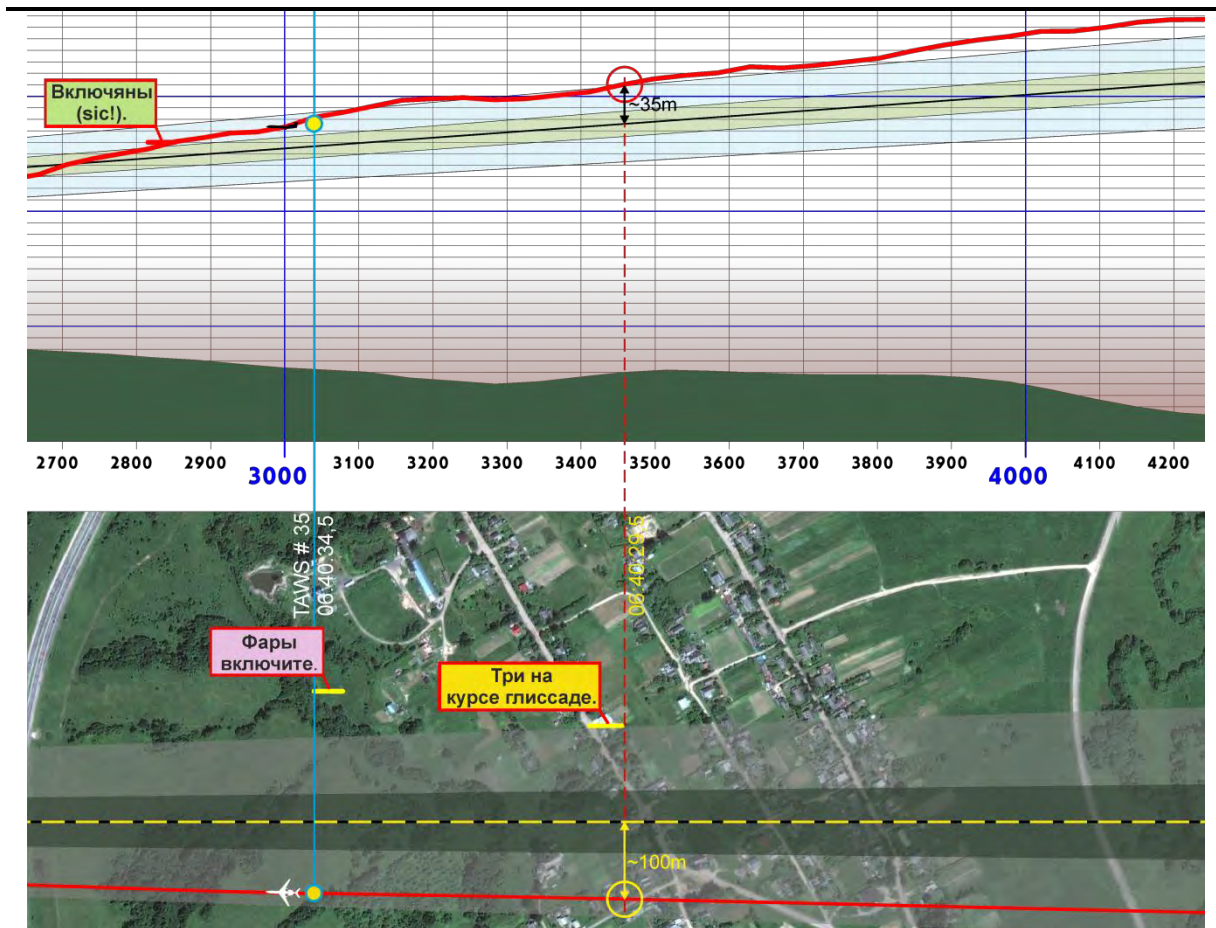


Fig. 28. Location of aircraft at the time when command was given: „Три на курсе, глиссаде” (*Three on course, on glide path*)

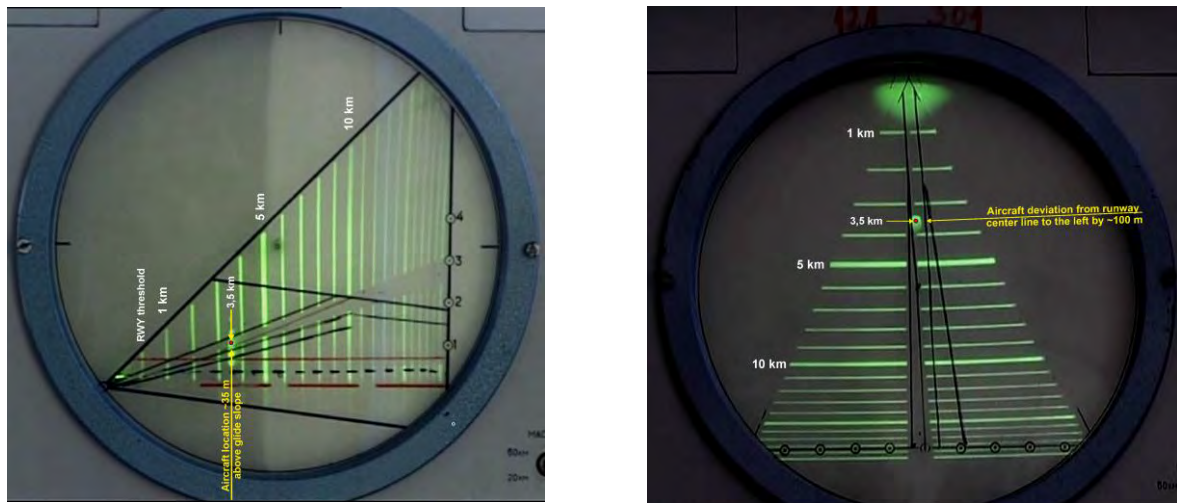


Image 29. Imaging of aircraft position in relation to glide path and RWY 26 center line on WISP-75 displays

At a distance of 2,700 m from RWY 26 threshold, the aircraft “crossed” the glide slope downwards, and the crew continued descent below the required glide path, to which LZC did not react in any way.

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Subsequent communication<sup>156</sup> was transmitted by LZC after 12 s, at a distance of about 2,500 meters from RWY 26 threshold. LZC informed the crew again about correct aircraft position, while in fact the aircraft was 20 m below the glide path, and 80 m left of RWY center line (114 m above airfield level). The crew continued descent below glide path, threat to flight safety increasing by the second. At a distance of 2,300 m from RWY 26 threshold, the aircraft reached the altitude of 100 m above airfield level (minimum descent altitude for this type of approach and airfield minimum), while at the same time flying outside the zone of acceptable maximum linear dimension of deviation ( $-30^\circ$ ) from the required glide path.

Determining the direction of aircraft movement on the WISP-75 display on the basis of two data refresh periods using the RSP-6M2 system requires a time of 2 s. The time needed to analyze the direction of movement of the aircraft and to making a decision adds a further 2 s, and the time needed to communicate the information to the aircraft crew on their incorrect position and/or to command them to proceed to horizontal flight adds 1 s. With correct display operation, LZC should notify the crew information on aircraft position below the required glide slope after 5-6 s.

According to findings of the Committee, the aircraft crossed the glide path from above at the distance of 2,700 m (0640:39) and continued descent. At a distance of ca. 2,600 m, the aircraft got out of the area 1/3 of acceptable value of maximum dimension of linear deviations from the required glide slope of  $2^\circ 40'$ , the presence of the aircraft's marker allowing LZC to notify crews of aircrafts of their correct position –on glide path". At a distance of about 2,500 m (from RWY 26 threshold), when the aircraft was below the lower limit of the zone mentioned above, LZC informed the crew about correct aircraft position –on course and on path", which he had no right to do. At that stage of flight, LZC should have informed the crew about their position below the glide path, and order them to change to horizontal flight or to discontinue approach, which he had the right to do, in accordance with FAP PP GosA item 115<sup>157</sup>. At the distance of 2,300 m (0640:44.5), the aircraft was below glide path, within the lower  $-30^\circ$  limit of acceptable maximum deviation from glide path, at an altitude of 100 m from airfield level.

The aircraft passed the section described above (from 2,700 to 2,300 m) in a time of 5.5 s, while reducing its altitude by 40 m. At the 2,300 m distance, LZC should have absolutely commanded the crew of the Tu-154M aircraft to discontinue approach and go around.

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<sup>156</sup> At 0640:41.5 LZC communicated: „Два на курсе, глиссаде” (*Two on course, on glide path*).

<sup>157</sup> LZC has the right to issue orders to crews: to go around within the radar marker visibility area.

In the opinion of the Committee, the probable reason for LZC not reacting to the aircraft's location below the glide path was the incorrect visual (or nil visual) of the Tu-154M aircraft on displays, caused by:

- 1) malfunction of the RSP-6M2 radar (e.g. malfunction of the automatic range gain adjustment and manual gain control);
- 2) presence of terrain obstacles (group of trees) in the RWY 26 approach area, which may have restricted continuous observation of the aircraft's marker on radar display through the presence of constant reflections from terrain features;
- 3) LZC's errors in manual tuning of the RSP-6M2 radar for the following reasons:
  - a) On April 10<sup>th</sup> 2010, LZC was supporting approaches to the SMOLENSK NORTH airfield for the first time in unfavorable meteorological conditions;
  - b) little experience in flight support as LZC over the previous 12 months (9 shifts, only 2 shifts in unfavorable meteorological conditions, including April 10<sup>th</sup> 2010)
  - c) lack of practice and practical testing as LZC of the SMOLENSK NORTH airfield, as is necessary for guiding flights clearance (in breach of FAP PP GosA item 216).

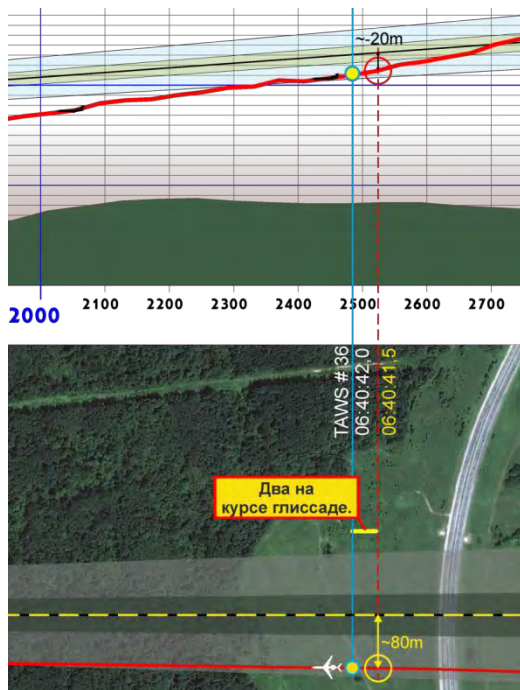


Fig. 29. Location of aircraft at the time command was given: „Два на курсе, глиссаде” („Two on course, on glide path”)

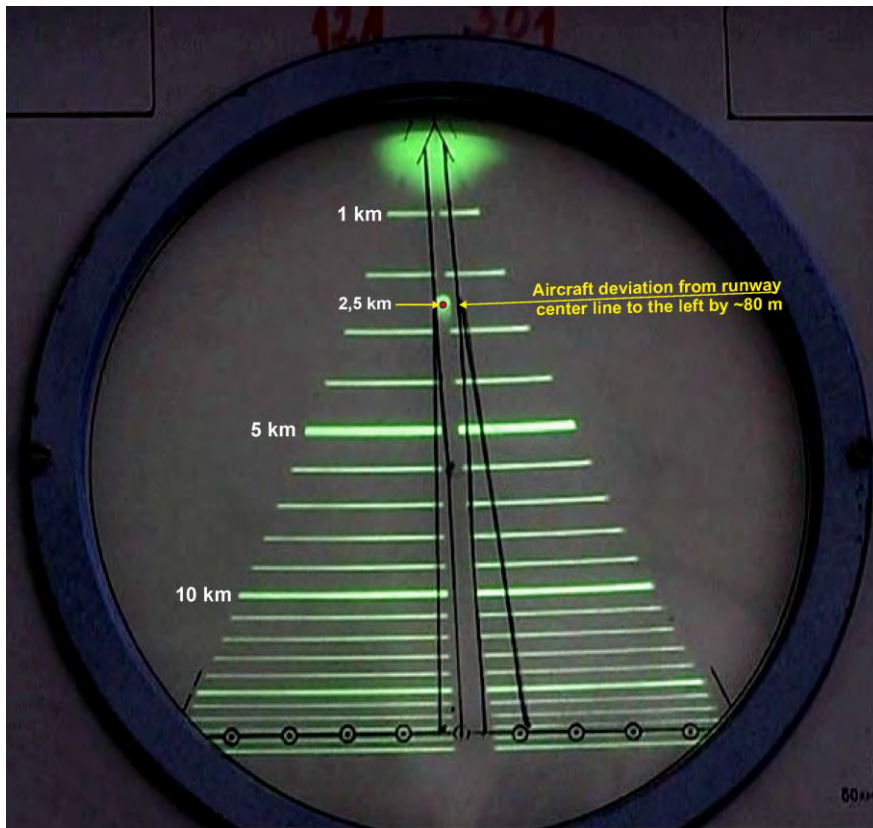
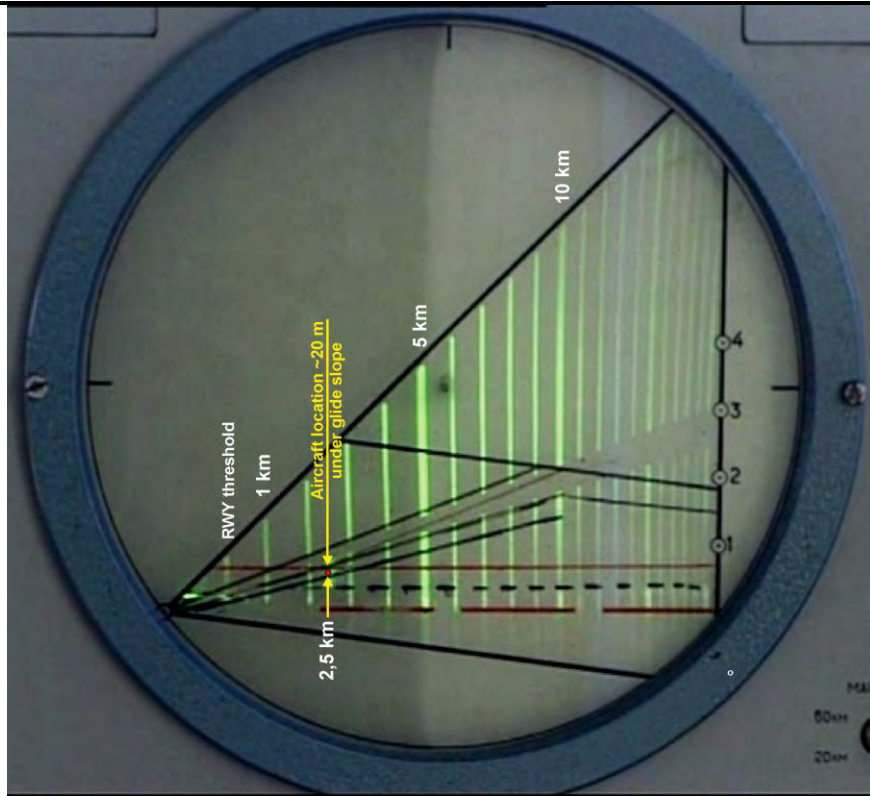
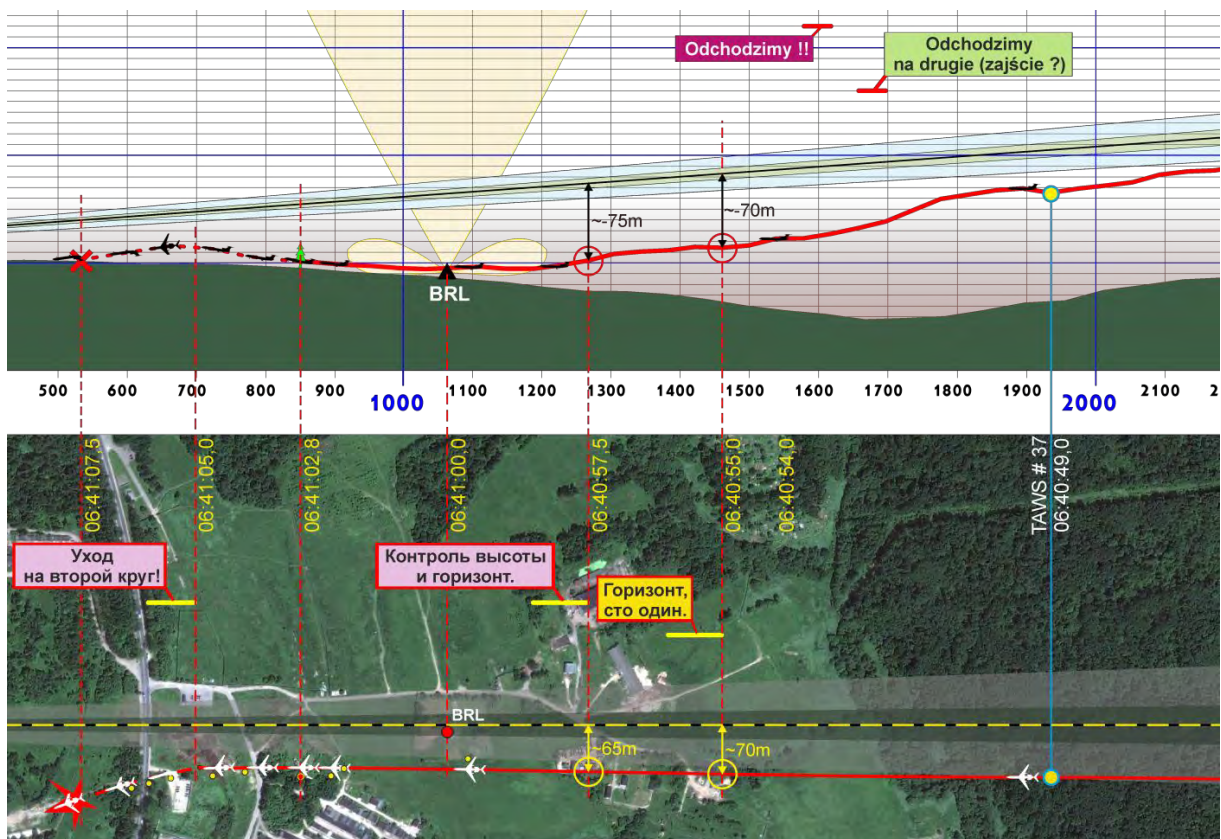


Image 30. Imaging of aircraft position in relation to glide path and RWY 26 center line on WISP-75 displays

The command ordering change to horizontal flight „Горизонт, сто один” („Horizon, 101”) was issued by LZC after 13.5 s as of the communication “Two on course, on glide path”. At the time, the aircraft was at an altitude of about 14 m above airfield plane and **could not be seen on radar displays anymore**. Two seconds before the „Horyzont 101” (Horizon 101) command, the aircraft commander made the decision to go around (altitude above airfield level 39 m).

According to the Committee’s findings, the command „Горизонт, сто один” (*Horizon, one zero one*) should have been issued 10 s sooner (0640:44.5), i.e. when the aircraft was well below the glide path, at the lower limit of acceptable minimum deviation from glide path (-30°).



“Odchodzimy !!”; “Odchodzimy na drugie (zajscie ?)” (*Going around !!; Going around for a second (approach?)*); BRL = inner NDB

Fig. 30. Imaging of the last phase of flight of the Tu-154M

The crew of the Tu-154M aircraft did not confirm LZC’s commands as received by responding with altitude communication, which prevented LZC from verifying the correctness of radar readings with reference to the aircraft’s position on the glide slope.

ATC did not order the crew to confirm information about their position with altitude, just as he had not done in case of Yak-40 or Il—76 crews, nor did he react to the incorrect radio exchange by LZC, contrary to provisions of FAP PP GosA item 96.

The analysis indicated that flights support by LZC did not comply with FAP PP GosA regulations, or with the “Rules and Terminology in Radio Communication for Flight Preparation and Air Traffic Control”, as most of Tu-154M’s flight on approach was outside the area of acceptable deviation from the glide path. Between 9,300 m and 2,900 m from RWY 26 threshold, the aircraft remained above the glide path, and between 7,400 m and the moment of ground impact, the aircraft was flying left of RWY 26 center line.

According to LZC information, the aircraft was on the correct glide path and course. Actual facts suggest that LZC had no right to inform the Tu-154M crew to the effect of correct approach, because **the aircraft’s deviation from glide path and course was in excess of one third of linear dimensions of the area of acceptable deviation.** That was contrary to item 115 of FAP PP GosA.

In the opinion of the Committee, errors of LZC and deviations from principles of servicing landing approaches using radar equipment involved the following:

- 1) informing the crew about the aircraft’s correct position “on course and on glide path”, while their position in reference to RWY center line and glide path was outside of the acceptable deviation zone;
- 2) communicating information about distance to RWY 26 500-600 m in advance;
- 3) no reaction (for a period of 10 s) to the crew’s continued descent beyond maximum acceptable deviation (-30’).
- 4) delayed issue of the command „Горизонт, сто один” (*Horizon, one zero one*) to the Tu-154M crew.

**In circumstances where, during final landing approach, LZC experienced difficulty keeping a visual on the aircraft on the glide path or course display, he should have immediately duly notified the aircraft crew. LZC notifying the Tu-154M crew of the aircraft’s correct position “on course, on glide path”** contrary to its actual position, may have reassured the crew about the correct execution of approach, and correct flight trajectory.

LZC’s priority was to ensure safe performance of landing approaches by aircraft crews on April 10<sup>th</sup> 2010. The quality of his performance was a crucial element in the circumstances of flight under analysis. Due to the Russian party not having provided important documents, and not having permitted a repeated interrogation of the ATC Group, the Committee based its

analysis primarily on the actual flight trajectory of the Tu-154M aircraft, and on voice recordings at Inner ATC Post and in the aircraft cockpit. Lack of LZC's reaction to further deviation of the aircraft below the glide path was an important factor in the accident. It is impossible to speculate what the crew's reaction would have been if they had heard the command from LZC ordering the approach to be aborted, at the time when they were moving out of the area of maximum acceptable deviation from the glide path. Such command, however, should have been communicated to the crew by the LZC at least 10 s before it actually had been.



## 2.13. Decision-Making Process Analysis: ATC Group

Description of abbreviations used in the stenogram of voice and communication recording at

Inner ATC Post:

- MATMC - Main Air Traffic Management Center, Moscow;
- OC - Operations Center, Moscow (telephone codename: LOGIKA);
- KORSAZH - SMOLENSK NORTH military airfield codename;
- CP - command position at the SMOLENSK NORTH airfield;
- BSKL - Inner (ATC) Position;
- Q - Operations Officer at Operations Center;
- MUC - Military Unit Commander, Unit 21350 at Tver (codename ZHELEZNIAK)
- MUDC - Military Unit Deputy Commander, ATC Group Coordinator –Unit 21350 at Tver;
- ATC - Air Traffic Control at the SMOLENSK NORTH airfield;
- ATC/CP - Air Traffic Controller at the CP;
- LZC - Landing Zone Control;
- METEO (M) - Head Meteorologist SMOLENSK NORTH airfield;
- AATC - Assistant ATC;
- APC - SMOLENSK NORTH Airfield Control;
- A (1, 2) - unidentified callers;
- MUDC? - probable comment by MUDC;
- ATC? - probable comment by ATC;
- 817 - call sign of IL-76 aircraft;
- 031 - (PLF 031) call sign of Yak-40 aircraft;
- 101 - (PLF 101) call sign of Tu-154M aircraft;
- 331 - TRANSAERO aircraft;
- [vulg.] - vulgar expression in comment;
- APS - APP-90P Airfield Projector Station.

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Air traffic in classified airspace of the Russian Federation was supervised by the Main Air Traffic Management Center, Moscow.<sup>158</sup> The Operations Center in Moscow ensured air traffic coordination in unclassified airspace (SMOLENSK NORTH airfield airspace). MUC was responsible for supervising the preparation and execution of all special flight support measures. MUDC was responsible for the coordination and direct supervision of all SMOLENSK NORTH airfield services. ATC/CP was notified of all aircraft arrivals. ATC was responsible for control within the inner and visual airfield zones, and for managing ATC Group within the scope as described:

- RWY and TWY readiness;
- Radio and communication systems operability, and radiocommunication/visual flight control preparation;
- Current weather information;
- Ground Traffic Control.

LZC was the acting Landing Zone Controller.

After having taken over duty at Inner ATC Post, at approximately 0438<sup>159</sup>, ATC attempted to obtain information from the Operations Center concerning the take-off of the Polish aircraft (Yak-40).

0442:51 ATC: „Вот скажите, у вас насчёт поляков никакой информации нет, да?”  
(*Please advise, do you have any information concerning Poles?*).

0442:54 Q: „Нет, вот то, что вчера раскопали только...” (*No, only what we unearthed yesterday*).

0442:56 ATC: „Аха! А вот такой телефончик запишите” (*Ah. Then please take down the following phone number*).

0442:59 Q: „Давайте” (*Alright*).

0442:59 ATC: „Двести тридцать один...” (*Two three one...*).

0443:01 Q: „БХЫ” (*Mhm*).

0443:02 ATC: „...пятьдесят шесть...” (*...five six...*).

0443:03 Q: „БХЫ” (*Mhm*).

0443:03 ATC: „...девяносто три” (*...nine three*).

0443:04 Q: „Аха” (*Ah*).

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<sup>158</sup> Drafted as per: Telegram No. 134/3/11/102 of March 13th 2010 on the preparation and execution of support measures for special aircraft Yak-40 and Tu-154M flights in April 2010, *Air Traffic Control Group Preparations for Flight Control on April 10<sup>th</sup> 2010*, and transcripts of voice recordings at Inner ATC Post on April 10<sup>th</sup> 2010.

<sup>159</sup> Established on the basis of transcript of voice recordings at Inner ATC Post.

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0443:05 ATC: „Это главный центр УВД. Там наверное должны знать – вылетел, не вылетел...” (*This is the Main Air Traffic Management Center. They should know if he took off or not*).

0443:10 Q: „Да, ну в главном я уточню. Так, хорошо” (*Yes, I'll ask at the Main Center. Yes, alright*).

0443:13 ATC: „И позвоните сюда” (*And please call us*).

0443:14 Q: „Хорошо. БХы” (*Alright. Mhm*).

At 0445:48, ATC was advised by the Operations Center that the Polish aircraft had not taken off yet, and assured that he would be notified as appropriate immediately after take-off. Voice recordings at Inner ATC Post indicate, however, that ATC was not convinced of the credibility of information obtained from the Operations Center.

0646:19 ATC: „Может и правда, а может неправда” (*Maybe, maybe not*).

At 0446:43, ATC was notified by ATC/CP that an IL-76 aircraft had taken off from the VNUKOVO airfield. ATC advised MUDC immediately and confirmed that nothing was still known about the flight of the Polish aircraft. Further exchanges at Inner ATC Post prove that ATC remained unconvinced that the first Polish flight had not taken off as yet.

0452:35 ATC: „Но я попросил это...оперативного »Логика« по одному телефону выйти московскому. Он вышел, говорит: »Пока не вылетал«. А там правда, неправда” (*Well, I asked the... LOGIKA operations guy to call this Moscow number. He called them, and says, “They haven't taken off yet.” And I don't know if that's true or not*).

When analyzed, voice recordings indicate that ATC knew<sup>160</sup> the planned flight takeoff times on April 10<sup>th</sup>. He did not passively await notification concerning the take-off of Polish aircraft, but was actively seeking it. The lack of aircraft take-off confirmation distorted his action plan, and triggered his concern that aircraft arrival would be delayed. Notification of the IL-76 aircraft take-off was a factor increasing ATC's concern, as the IL-76 was scheduled to land after the landing of the first Polish aircraft (the Yak-40 aircraft was to land at SMOLENSK at approximately 0500, but took off from Warsaw with a 25-minute delay).

The lack of information concerning the flight of the Polish aircraft was the only factor affecting ATC's action plan at the time, as the meteorological conditions were appropriate for

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<sup>160</sup> Subsequent action proves that Inner ATC Post had not received flight plans, as ATC and MUDC had no knowledge of alternate airfields for either the IL-76 or the Tu-154M aircraft.

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flight reception (4 km VIS with mist [BR] and smoke [FU], slight wind, nil low clouds), and the forecast did not suggest a possibility of the conditions becoming worse.

Voice and communication recordings at Inner ATC Post prove that MUDC was the acting coordinator and superior of all airfield staff. He had initially remained outside Inner ATC Post (most probably at CP), and ATC had kept him notified of all actions taken by the ATC Group.

0449:33 ATC: „Так, пока информация, что ...Ил летит. Другой информации нет” (*So, I notify that... the IL is flying in. No other information*).

0449:38 MUDC: „Во сколько этот Ил?” (*That IL, what time?*).

0449:41 ATC: „Где-то минут двадцать десятого” (*Twenty past nine, roughly*).

At 0453:24, the ATC/CP notified the ATC that the first Polish aircraft would reach waypoint ASKIL at 0455, and requested ATC to find out whether the zone (OC or the Main Air Traffic Management Center would approve flight control over the aircraft to be taken over locally.

0453:24 KTR: „[imię], в пятьдесят пять минут ASKIL. Первый поляк ноль тридцать один ПЛФ” (*[first name], ASKIL in minute fifty-one. First Pole PLF zero thirty one*).

0453:31 ATC: „Понял” (*I copy*).

0453:32 KTR: „Спроси у него, зона разрешила забрать нам [lub: к нам]” (*Ask him if the zone let us take him [or: take over]*).

0453:35 ATC: „Понял” (*I copy*).

ATC notified MUDC of the above immediately, and took action to prepare the airfield to receive both aircraft (Yak-40 and IL-76). Notification of the Yak-40 aircraft flight a few minutes before flight control was taken over locally forced ATC to take rapid action. He had to obtain current weather conditions information from METEO, coordinate the taking over of flight control over the incoming aircraft, issue an order to set up the Airfield Projector Station (APS), and supervise the approach of two aircraft.

0454:06 ATC: „[imię], »Логика« обманула, тут по наземной прошло, что в пятьдесят пять минут ASKIL проходит” (*[first name], LOGIKA cheated us, ground told us that he is passing ASKIL at minute fifty one*).

0454:59 M: „Метео, старшина [surname]” (*Meteo, sergeant [surname]*).

0455:00 ATC: „Давай погоду!” (*Give me the weather!*).

0455:01 M: „Полностью?” (*Full?*).

0455:02 ATC: „Да” (*Yes*).

- 0455:03 M: „За десять часов отмечаем три балла верхней ...” (*Over ten hours we recorded three tenths of upper...*).
- 0455:07 M: „... а, дымка, дымы, видимость четыре километра” (*aaah mist, smoke, visibility four kilometers*).
- 0455:10 M: „Нижняя (*lub*: нижний) район, ы, ветер сто сорок градусов два метра, плюс два запятая четыре, влаги восемьдесят семь процентов” (*Lower zone, aaah wind one hundred and forty degrees, two meters, two point four above, humidity eighty-seven percent*).
- 0455:18 M: „Давление семь сорок четыре запятая пять, ы, приведённое семь шестьдесят семь запятая три, без изменений” (*Pressure seven forty four point five, aaah, reduced seven sixty seven point three, no change*).
- 0455:24 ATC: „Хорошо” (*Alright*).
- 0501:41 ATC: „Давай. Давай, выезжай срочно. Только по разрешению чтоб” (*Come on, move it, leave quickly. Just make sure there's clearance*).

*Unintelligible speech.*

- 0501:52 ATC: „Бегом тогда!” (*Move it, then!*).

After ATC obtained weather forecast, commander of the Yak-40 aircraft established contact with him. ATC took over flight control, albeit he had not managed to coordinate the takeover with the zone (Main Air Traffic Management Center). Communication with the crew of the Yak-40 aircraft was made more difficult by the use of two languages: English (commander of the Yak-40) and Russian (ATC).

At the same time, contact was established again by the crew of the IL-76. The expected landing time was identical for both aircraft (0520). ATC notified MUDC of action taken – the Yak-40 was queued first for landing, and ordered by ATC straight downwind (accelerated approach procedure); the IL-76 was to land second.

- 0500:21 ATC: „Значит первого рассчитываю Як сороковой, потом наш будет” (*So, it's the Yak forty first, and then ours*).
- 0500:25 MUDC: „А удаление Як сорок (сколько?)?” (*What about the distance? The Yak forty, how much?*).
- 0500:27 ATC: „Сорок восемь” (*Forty-eight*).
- 0500:30 MUDC: „...”
- 0500:31 ATC: „Нет, ко второму развороту уожу и потом на посадку” (*No, I am leading him downwind, and then the landing*).

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ATC's decision to set up the APS caused concern with the MUDC. This could have been related to the deterioration of weather conditions (fog was recorded 3 minutes later at the SMOLENSK SOUTH airfield).

0502:59 MUDC: „... чего-то не так, значит... будем ставить прожектора” (... *something 's wrong, so... we will be setting up the projectors*).

0503:11 ATC: „Я уже дал команду ставить” (*I already gave the order to set it up*),

or to a concern that the evolution would not be over before the touchdown of the first aircraft:

0503:14 MUDC: „Да они всё знают. Не успеют наверное” (*But they know about everything. They will probably not make it*).

0503:16 ATC: „Но они по команде. Вот сейчас у меня запросят, я смотрю на обстановку” (*But they follow orders. Oh, now they will ask me, I am checking the situation out*).

In reality, personnel setting up the APS was not managing very well, which upset ATC (as suggested by the high number of vulgar expressions in his comments to the APS setup, and by orders repeated accelerate the process).

0504:04 ATC: „Ну что, готов? ГОТОВЫ, нет?” (*Well, you ready? Ready or not?*).

0504:19 ATC?: „[wulg.], вас всех вместе...” ([*vulg.*], *all of you ...*).

0504:43 ATC: „[wulg.], и там...” ([*vulg.*], *and there...*).

0505:05 ATC: „Давай быстрее, быстрее, быстрее, [wulg.],...” (*Come on, faster, faster, faster, [vulg.]...*).

The hurried setting up of the APS and related issues led to ATC's excessive concentration on that particular evolution. ATC was operating on an ever-increasing time shortage – the Yak-40 was approaching the landing pattern, followed by the IL-76, with communication distorted by the Yak-40 commander's poor command of the Russian language, and ATC's poor command of English.

0506:28 ATC: „ПАПА ЛИМА FOXTROT zero three one, ы, высота?” (*PAPA LIMA FOXTROT zero three one, aaah, altitude?*).

0506:38 031: „Один пять ы, ноль ноль метров” (*One five aaah zero zero meters*).

0506:41 ATC: „One five zero zero?” (*One five aaah zero zero?*).

0506:44 031: „Affirm” (*Affirm*).

0506:45 ATC: „Чего?” (*What?*).

0506:46 LZC: „Сколько он сказал?” (*How much did he say?*).

Concurrently, meteorological conditions deteriorated rapidly.

0506:07 ATC: „[wulg.], на «Южном» уже туман” ([vulg], *there is fog already at SOUTH*).

0509:47 ATC: „[wulg.], думал, опять погода будет хорошая” ([vulg.], *I thought we would have nice weather again*).

ATC notified the crew of the Yak-40 aircraft accordingly.

0510:10 ATC: „РАРА ЛИМА ФОТРОТ zero three one, я КОРСАЖ” (*PAPA LIMA FOXTROT, this is KORSAZH*).

0510:15 031: „Слушаем” (*We copy*).

0510:17 ATC: „Видимость тысяча пятьсот. One five zero zero видимость” (*Visibility one thousand five hundred. One five zero zero visibility*).

During the final approach of the Yak-40 aircraft, MUDC requested information from ATC concerning weather conditions and the APS setup.

0511:57 MUDC: „Старт первому?” (*We have the first one?*).

0511:59 ATC: „Да” (*Yes*).

0512:01 MUDC: „Как видимость? ...?” (*How's the visibility?*).

0512:02 ATC: „Ну дальний я ещё вижу, порядка где-то тысяча двести, тысяча триста, вот так” (*Well, I can see the outer one, at about one thousand two hundred, one thousand three hundred, let's say*).

0512:08 MUDC: „Прожектора...?” (*Projectors...?*).

0512:10 ATC: „Да, всё включено” (*Yes, everything is on*).

0513:24 ATC: „[imię], я тебя убью, [vulg.!] Эти бойцы опять на полосе, [vulg.!] Но ты... в торце, есть с ними связь?” (*[first name], I will [vulg.], kill you! These soldiers are on the runway again, [vulg.!] You... at the threshold, do we have radio contact with them?*).

ATC was constantly absorbed by people in the vicinity of the runway. During the final approach of the Yak-40 for landing, MUDC appeared at Inner ATC Post. According to the Committee, MUDC noticed that ATC was not managing the situation, as indicated by his comments suggesting that ATC take specific action.

0515:54 ATC: „А, восемь семнадцатый, тысяча пять... Ы, занимайте две сто, пока на привод. Две сто” (*Aaah, eight seventeen, one thousand and five... aaah, take position at two one hundred, track to NDB for now. Two one hundred*).

0516:00 817: „Ы, две сто, правая большая” (*Aaah, two one hundred, right-hand big circuit*).

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0516:01 MUDC: „Да, пока не снижай его” (*Yes, don't take him lower just yet*).

0516:07 MUDC: „Фары. Фары. Фары, [vulg.]. Это самое ...” (*Projectors, projectors, projectors, [vulg.]. That's...*)

0516:09 АТС: „Фары, [vulg.]” (*Projectors, [vulg.]*).

0516:10 АТС: „Фары включите” (*Switch the projectors on*).

0516:13 MUDC: „Давай, давай, давай!” (*Do something!*)

During the final approach of the Yak-40 for landing, MUC called MUDC. MUDC then for the first time communicated information about the rapid deterioration of meteorological conditions.

0516:05 *Cell phone ringing.*

0516:16 MUDC: „[имię], удаление два, Доброе утро. Заходит первый” (*[first name], distance two. Good morning. The first one approaching*).

0516:21 MUDC: „Прикрыло... Прикрыло нас туманом, вот сейчас, десять минут. Сейчас вот ... Я перезвоню” (*We are covered with fog, right now, have been over the past ten minutes. Right now... I'll call you back*).

The landing of the Yak-40 aircraft caused major upset at Inner ATC Post. ATC spotted the aircraft very late, and in a position he believed to be precluding safe landing.

0517:00 АТС: „Где?! Где?!” (*Where to? Where to?*).

0517:00 АТС: „Полосу наблюдаете? Выше!” (*Do you see the runway? Higher!*).

0517:04 MUDC?: „[vulg.], уход на...” (*[vulg.], initiate go-around*).

0517:05 MUDC?: „[vulg.], надо уход” (*[vulg.], you need to go around*).

0517:06 АТС: „Уход на второй круг” (*Initiate go-around*).

Despite the go-around order, the Yak-40 aircraft landed. Following the landing, most confusion was caused by an erratic reaction of the Yak-40 aircraft crew to ATC's taxiing orders.

0518:51 „Куда он рулит?” (*Where is he taxiing to?*).

0518:56 АТС: „Ну чего, куда он рулит?” (*Well, what's this, where is he taxiing to?*).

0519:03 АТС: „Смотри, если будет влево, пускай по левой, чтоб...” (*Watch him, if he goes left, let him go left, so that...*).

0519:09 АТС: „...[vulg.] знает. [vulg.], говоришь ему вправо, он пойдёт влево, [vulg.],...Уже десять раз сказал: рули прямо!” (... *[vulg.] knows, [vulg.], you tell him go right, he'll go left, [vulg.]. ... I've told him ten times already: taxi straight ahead!*).



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0519:19 ATC: „Чего-то я от него ни одну квитанцию не получил” (*I seem not to have gotten any affirm from him*).

0519:20 MUDC?: „...по-польски?” (*... in Polish?*).

0519:22 ATC?: „Вообще ничего не говорил” (*He said nothing at all.*).

0519:23 „Нет, он по-русски говорит?” (*No, he speaks Russian?*).

0519:24 „Да” (*Yes*).

0519:24 ATC: „Ну и по-русски...” (*Well, in Russian...*).

Paradoxically, the Yak-40 aircraft landing resulted in a positive assessment of the Polish pilots' skills, aircraft equipment, and the capacity for Polish aircraft to perform safe landings in unfavorable weather conditions.

0517:31 ATC: „РАРА LIMA zero three one. После остановки, на сто восемьдесят. Молодец” (*PAPA LIMA zero three one. Backtrack after landing. Good job.*).

0523:17 MUDC: „...Ну нормально он зашёл. Я думаю там оборудование у него такое, самолёт неплохой. Ну в принципе нормально зашёл, сработали хорошо. Я думал, честно, на второй круг” (*Well, he actually landed. I think he's got proper equipment, the plane isn't bad. Basically he landed without a problem, they did a good job. Frankly, I thought that we would have a go-around*).

When ATC was involved with the taxiing Yak-40 aircraft, MUDC suggested that projector beams be raised (albeit such action should have been ordered by ATC).

Several minutes later, MUDC notified MUC that the Yak-40 aircraft landed, and that the IL-76 was approaching. He also notified MUC of plans for the remaining part of the day, and only at the end of the conversation did he say that meteorological conditions deteriorated, despite no forecast to that effect. Nonetheless, his comment suggested that the deterioration of weather conditions was temporary, and that conditions would definitely improve for the Tu-154M aircraft approach.

0523:17 MUDC: „...Слушай ты, восемь пятьдесят у него посадка. Вот сейчас видимость вот сейчас уже улучшается. Ну ни, никто, и [nazw.] вчера весь день говорил, ы, никто туман не обещал, и утром всё нормально. Вот сейчас в девять часов раз и затянуло. Видимость где-то тысячу двести. (...) Значит ну в принципе всё и я думаю в десять тридцать сейчас температура пойдёт. Ну во всяком случае хуже полтора не должно

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быть” (*Listen, he’s landing at eight fifty. Visibility is improving now. But no, nobody, and [last name] said that yesterday, aaah, no one predicted fog, and everything was fine in the morning. And now, at nine, fog. Visibility is about one thousand two hundred. (...) So actually I believe that’s all, and I think that temperatures will rise at ten thirty already. Whatever happens, shouldn’t be worse than one-and-a-half thousand*).

The reaction of Inner ATC Post personnel to the faulty landing of the IL-76 aircraft, and the pitch of their voices suggest that both ATC and MUDC were aware of the threat.

0527:51 ATC: „Уходи на второй круг” (*Initiate go-around*).

0527:56 ? : „Уход” (*Initiating go-around*).

0527:56 ATC and MUDC: „...! ...! [vulg.]! [vulg.]! Ой, [vulg.]!” ( „...! ...! [vulg.]! [vulg.]! Oh [vulg.]!”).

0528:05 ATC: „Уход на второй круг. Уход” (*Go around. Go around.*).

After the IL-76 aircraft went around, MUDC calmed down, and ordered ATC as appropriate.

0528:16 MUDC: „Топлива сколько у них?” (*How much remaining fuel do they have?*).

0528:20 MUDC: „Подожди, топлива сколько у них?” (*Just a minute, how much fuel do they have?*).

0528:33 MUDC: „Спроси, прожектора он видел...” (*Ask him if he saw the projectors...*).

The Committee believes that MUDC assumed part of ATC’s duties. He suggested the need to notify the crew of the Tu-154M aircraft of weather conditions unsuitable for landing at the SMOLENSK NORTH airfield.

0528:39 MUDC: „Надо полякам сказать - какой для них вылет. Передать им надо, [vulg.]. Ну глянь, вон уже этот...” (*We should tell the Poles that it makes no sense to take off. We have to tell them, [vulg.]. Look, this one already...*).

Despite weather conditions below airfield minima (0537:37: „Туман есть туман”. *Fog is fog.*), ATC did not forbid the crew of the IL-76 to go around, but he did not believe they could land.

0530:28 ATC: „[vulg.], по-моему пока его не надо заводить, пока смысла нет. Я не вижу сейчас...” ([vulg.], *I think we should not bring him in, it makes no sense right now. Now I don’t see...*).

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Since ATC's attention was constantly absorbed by soldiers in the vicinity of the runway and the APS, MUDC asked whether ATC had really explained to them (the soldiers) how to behave.

0532:26 ATC: „[vulg.], я...уже десять раз рассказал, пускай объяснит, слева, справа от полосы. [vulg.]! Значит давай сам в торец полосы, а этих разгоняй, [vulg.], будут писать объяснительные, чего они бегают взад-вперёд, [vulg.]!!!” ([vulg.], *I... said ten times already, let him explain, left, or right of the runway. [vulg.]! So just move it to the runway threshold yourself, and get them out of there, [vulg.], and they can all write explanations why they are running around here and there [vulg.]!!!*).

0532:40 MUDC: „Ты им объяснял что ли?” (*Have you explained it to them?*).

0532:41 ATC: „Да уже десять раз, [vulg.]! Сюда вызывал, показал вот здесь, [vulg.]! [vulg.]!” (*Ten times already, [vulg.]! I called them here, I showed them, right here, [vulg.]! [vulg.]!*).

0532:48 „...всё нормально” (... *everything's alright*).

0532:50 ATC: „...на полосу не выбегай, [vulg.] этих с оцепления, угоняй оттуда, с торца” (... *don't run out on the runway, [vulg.], get the security guys out of there, off the threshold*).

0532:56 „Вправо, вправо” (*Go right, right*).

0532:57 ATC: „Уходят они, махни им туда!” (*They're leaving, wave them over!*).

*Unintelligible speech.*

0533:06 MUDC: „Да пусть заходит. Ведь всё равно... Чего ты, чего ты будешь делать? Ещё один тут заходит (*lub: заходик*). Сколько у него останется?” (*Well, let him approach. It's all the same... What's this, what are you doing? Another one approaching (or: Another approach)*).

MUDC's last comment may suggest that ATC wanted to abort further Inner ATC Post operations, seeing no option of performing a safe landing, given meteorological conditions, and MUDC reacted to the abort attempt vigorously.

During the second approach of the IL-76 aircraft, ATC became increasingly agitated (as suggested by the high number of vulgar expressions in speech, and by MUDC's attempts to calm him down). The Committee believes that the agitation was due to a conviction that the IL-76 aircraft was being guided to landing in meteorological conditions below airfield minima. MUDC ordered ATC to order the crew of the IL-76 aircraft to go around.

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- 0540:22 **LZC:** „Один на курсе, глиссиде” (*One on approach, on flight path*).
- 0540:29 **АТC?:** „[wulg.], ...” ([*vulg.*], ...).
- 0540:31 **MUDC:** „Не дèргайся” (*Stop fussing!*).
- 0540:38 **MUDC?:** „Угоняй его...” (*Get him out...*).
- 0540:42 **АТC:** „Выполняйте уход на второй круг” (*Go around*).
- 0540:44 **817:** „Ухожу на второй круг, восемь семнадцатый” (*Going around, eight seventeen*).
- 0540:48 **MUDC:** „Не дèргайся” (*Stop fussing!*).

After the crew of the IL-76 aircraft performed a go-around, ATC agreed on its departure to an alternate airfield, and the MUDC notified OC of weather conditions, suggesting that the crew of the Tu-154M aircraft be notified ASAP of unsuitable landing conditions, and of the need to redirect the aircraft to an alternate airfield. OC’s officer on duty asked whether the ATC Group had obtained and duly analyzed weather radar data, and assured MUDC that he would convey the information obtained to the Main Air Traffic Management Center.

- 0542:01 **MUDC:** „У меня вопрос какой. По моим данным Тушка вылетает, ы, польская, [wulg.] Они к нам не запрашиваются, то есть они летят сами. Надо им передать, что нас закрыло” (*I have the following question: My data tells me that the Tu, aaah, the Poles, are taking off, [vulg.]. They have not announced their arrival, I mean they are flying in by themselves. They have to be told that we have fog cover*).
- 0542:10 **Q:** „Ну я сейчас на главный центр подскажу ...дело” (*Well, I will let the Main Center know... deal*).
- 0542:11 **MUDC:** „Подскажите, да, потому что в прогнозе не было. Влажность восемьдесят процентов. Откуда он взялся в девять часов? Но накрыло капитально, видимость сейчас метров четыреста максимум” (*Do tell them, yes, because the weather forecast didn’t show. Humidity eighty percent. Where did it come from at nine o’clock? But we have total cover, visibility now around four hundred meters max*).
- 0542:20 **Q:** „Да, локацию делали там?” (*Yes, you checked the weather radar?*).
- 0542:21 **MUDC:** „Всè чисто” (*All clear*).
- 0542:22 **Q:** „Всè чисто, да?” (*All clear, yes?*).

0542:23 MUDC: „Так, безоблачно. Видимость более десяти была. Всё, мы разрешения выдали, в прогнозе ничего нет” (*Yes, nil clouds. Visibility over ten. And we have given clearance already, the forecast shows nothing*).

0542:28 Q: „Аха” (*Aha*).

0542:28 MUDC: „И вдруг ни с того, ни с сего вот это всё дело понесло” (*And, all of a sudden, everything got flummoxed*).

At that time, OC’s officer on duty notified MUDC that Tu-154M had taken off 15 minutes before. Despite his astonishment, MUDC suggested that action be taken immediately to redirect the aircraft to an alternate airfield, albeit expecting that the crew would attempt to perform a trial approach to minimum height. OC’s officer on duty assured MUDC that he would duly notify the Main Air Traffic Management Center.

0542:31 Q: „Да. Я понял. Ну большая Тушка вылетела в двадцать семь к вам” (*Yes. I copy. The large Tu took off for SMOLENSK NORTH at twenty-seven past*).

0542:35 MUDC: „Тушка вышла в двадцать семь?” (*Tu took off at twenty-seven past?*).

0542:36 Q: „Да, в девять двадцать семь” (*Yes, at nine twenty-seven*).

0542:37 MUDC: „Ну тогда надо запасной ему искать, это раз, если он готов. Внуково там или что-то такое” (*Well, given the circumstances, we have to find him an alternate, that’s the first thing, if he’s ready. Vnukovo, or something*).

0542:42 Q: „Ну Внуково...” (*yeah, Vnukovo...*)

0542:42 MUDC: „Контрольный заход то он сделает, вопросов нет, до своего минимума” (*He will probably perform a trial approach, no problem, to his minimum*).

0542:46 MUDC: „Но у нас нет ни минимума по данным, ничего нет” (*But our data shows that there is no minimum, there is nothing*).

0542:49 Q: „Я понял. Ну это ж ниже, всё равно, минимума аэродрома” (*I copy. But all the same, it’s below the airfield’s minima*).

0542:52 MUDC: „Конечно. Нет, я имею в виду до ка, до какого мы его снижать будем, до какой высоты” (*Sure. No, what I mean is, how low do we bring him, to what altitude*).

0542:56 Q: „А, ну там хороший минимум у гражданского аэродрома” (*Ah, well, a good minimum, a civilian airfield minimum*).

0542:57 ATC?: „До ста метров” (*One hundred meters*).

0542:58 MUDC: „Так, а по аэродрому сто на один, хуже я не могу” (*Yes, and according to the airfield it’s one hundred to one, can’t do any lower*).

0543:01 Q: „Так я же говорю, что минимум аэродрома, так всё равно...” (*Well, this is what I'm saying, the airfield minimum, so it's all the same...*)

0543:03 MUDC: „Конечно” (*Certainly*).

0543:04 Q: „...ниже не опустится” (... *He won't get any lower*).

0543:04 MUDC: „Ну ладно, если он идёт в контрольный заход, то и сделает. У меня единственное по топливу как он сможет после одного захода зайти, куда его отправлять?” (*Alright, if he's planning a trial approach, he will perform it. I have one question concerning fuel: if he makes it after a single approach, where do I direct him?*).

0543:11 „...точно не знает...” (... *doesn't know exactly...*)

0543:12 Q: „Ну я полагаю на Внуково, потому что надо найти таможенную и границу” (*I assume it will be Vnukovo, because a customs authority and a border crossing will be needed*).

0543:14 MUDC: „Ну давайте тогда так хорошо” (*Well then, let's do it, that's good*).

0543:16 Q: „Ну я главному центру подскажу, они там разрулят” (*I'll notify the Main Center, they will decide*).

0543:17 MUDC: „Да. Хорошо” (*Yes. Alright*).

At 05:43:30 MUDC makes the first attempt to obtain current weather conditions information from METEO.

0543:24 „Значит ты сейчас (на метео?), [vulg.], немедленно...” (*So you're (at meteo) now, [vulg.], immediately...*).

0543:26 „Значит, кто должен нам сказать, что такое, [vulg.]... Сколько ждать-то?!” (*So who should be telling us what's up, [vulg.] ...How long do we have to wait?!*).

0543:30 MUDC: „Метео!” (*Meteo!*).

0543:32 M: „... (на связи?)” (... *(copy?)*).

0543:33 MUDC: „Ну и сколько будет туман стоять?!” (*So, how long will this fog keep up?!*).

0543:36 „Ну нет, ну это вот сейчас стоит” (*Well no, it's there now*).

*Unintelligible speech.*

Until ATC/CP communicated the Tu-154M aircraft having reached waypoint ASKIL, all subsequent ATC and MUDC action had been taken with the objective to redirect the Tu-154M aircraft to an alternate airfield under Main Air Traffic Management Center jurisdiction.

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MUDC exited Inner ATC Post to notify persons in the vicinity of the Yak-40 aircraft that the aircraft carrying the President of the Republic of Poland would not be landing at the SMOLENSK airfield due to unsuitable meteorological conditions<sup>161</sup>.

ATC made sure twice that the OC had duly notified the Main Air Traffic Management Center as informed by MUDC, and that a decision had been made to redirect the aircraft to an alternate airfield.

0552:48 ATC: „Смоленск. Надо для основного поляка уточнить запасной, потому что пока погоды нет и я чего-то не вижу улучшения” (*Smolensk. We have to agree an alternate for the Pole, because we just don't have the weather, and I see no improvement*).

0552:54 Q: „С главным центром пообщался, во Внуково заберут” (*I contacted the Main Center, they will take him to Vnukovo*).

OC's initial communication suggested that the decision to redirect the Tu-154M aircraft to an alternate airfield had been made already, but the response conveyed two minutes later only hints at such probability.

0554:59 ATC: „Нужно как-то выйти на главный центр, чтобы основному поляку... Алло” (*We have to contact the Main Center somehow, so that the main Pole... Hello*).

0555:06 Q: „Да, да, да” (*Yes, yes, yes*).

0555:06 ATC: „...передали во-первых что он бы, чтобы он был готов к уходу на запасной. Вот, уточнить сколько у него топлива, потому что он по-русски то практически не понимает ничего” (*... is told, firstly, to prepare for a turnaround to an alternate. Oh, and find out how much remaining fuel he's carrying, because he understands virtually no Russian*).

0555:17 Q: „Я думаю главный центр разберётся. Я сказал, что в Смоленске погоды нет” (*I think that the Main Center will decide. I said that the weather in Smolensk is unsuitable*).

On every occasion of OC confirming the Main Air Traffic Management Center's readiness to take over the Tu-154M aircraft, ATC duly notified MUDC:

0553:22 ATC: „Ы, первый” (*Ah, number one?*).

0553:25 MUDC: „Отвечил первый” (*Number one here*).

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<sup>161</sup> Information obtained from MUDC during the hearing at SMOLENSK.

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0553:27 ATC: „Внуково запасной” (*Vnukovo alternate*).

0553:29 MUDC: „Я понял. Значит во Внуково подтвердить, (точнее?)... передать какой у него остаток топлива, то есть...(тут?) метео даёт вроде как...это дело. Если...будет заход, может быть...” (*I copy. So, we affirm with Vnukovo, (actually?)... notify them of how much remaining fuel he has, that is (here?), or... meteo actually tells us... the issue. If... there is an approach, maybe...*).

0553:48 ATC: „Я понял, хорошо” (*I copy, affirm*).

0556:29 ATC: „Значит, главный центр в курсе, что у нас погоды нет и они будут своё решение принимать, возможно сразу на Внуково уйдёт...” (*So the Main Center knows that we have unsuitable weather, and they will make their own decision, possibly they will fly to Vnukovo immediately...*).

0556:38 MUDC: „Я понял,... пройдёт, пока условий нет, если что-то нужно будет, вот через Минск тогда передадите...” (*I copy... it will pass, we have no conditions now, should you need anything, communicate through Minsk...*).

0556:46 ATC: „Да, да” (*Yes, yes*).

Despite OC’s assurances of redirecting the Tu-154M aircraft to an alternate airfield, ATC and MUDC were preparing to receive the aircraft, which suggests a lack of confidence in declarations that action shall be taken at higher command levels (OC). ATC checked if METEO had issued a STORM warning, which would probably allow ATC to apply to his superiors for flights to be suspended or restricted. He learnt that the personnel of the Tver meteorological station believed that there were no grounds to issue a STORM warning (0605:49), and METEO would not make such a decision himself.

0605:41 ATC: „Сейчас что даёшь?” (*What are you broadcasting now?*).

0605:42 M: „Сейчас, ы, восемьдесят на восемьсот даю. Штормовую погоду” (*Now, aaah, I am broadcasting eighty over eight hundred. Storm weather.*).

0605:48 ATC: „Ну шторм выписал?” (*Well, have you issued a STORM<sup>162</sup>?*).

0605:49 M: „Ы, ну в Тверь доложил, это самое, но он как не оправдавшийся шторм” (*Aaah, I notified Tver, well, but it is not forecast as a storm*).

0605:54 ATC: „Что, что, что?” (*What, what, what?*).

0605:55 M: „Он как не оправдавший...Ну как ы, как ы реально возникший. Ну шторм-то не выписывал” (*As an unforecast... Well, as, aaah, it is there. But I did not issue a storm (warning)*).

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<sup>162</sup> Storm warning.



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0606:00 ATC: „Ну а сейчас так что, нету шторма?” (*And what’s going on now, there is no storm?*).

0606:02 M: „Сейчас штормовая погода” (*Now it’s stormy weather.*).

ATC summarized the meteorologists’ work at 0606:34.

0606:20 ATC: „Я что-то с нашим метео, [vulg.]...” ([vulg.], *with this meteo of ours...*).

0606:34 ATC: „Вообще, [vulg.]... вот от них толку, [vulg.]! Поставь на [vulg.] здесь кто умеет давление мерить, [vulg.], температуру, [vulg.]. Всё, [vulg.]. ... их здесь держать?! На [vulg.] оно нужно, [vulg.], много человек?” (*They are [vulg.] absolutely useless, [vulg.]! Just give me someone [vulg.] who knows how to measure pressure, [vulg.], temperature, [vulg.], and that’s it. And [vulg.] knows why to keep them here?! What the [vulg.] for, such a lot of people?*).

Worried that as in case of the Yak-40 aircraft crew, the crew of the Tu-154M aircraft will not speak Russian, ATC asked an individual over the loudspeaker system to provide him with a number of aviation phrases in the English language, to facilitate ATC’s communication with the Polish crew:

0607:09 ATC: „А, давай” (*Come on.*).

0607:13 ATC: „Как?” (*How?*).

0607:14 A1: „Down...” (*Down...*).

0607:17 ATC: „Down?” (*Down?*).

0607:18 A1: „Go...” (*Go...*).

0607:19 ATC: „Как?” (*What?*).

0607:20 A1: „Go” (*Go.*).

0607:22 ATC: „Call again?” (*Call again?*).

0607:24 A1: „Go around” (*Go around.*).

0607:27 ATC: „Call around?” (*Call around?*).

0607:28 A1: „Go! Go!” (*Go! Go!*).

0607:29 ATC: „Go...Go around, да?” (*Go...Go around, yes?*).

0607:32 A1: „Да, да, go around again” (*Yes, yes, go around again.*).

0607:39 ATC: „Go around again” (*Go around again.*).

0607:42 A1: „Это уход на второй круг” (*This means „go around’?*).

0607:43 ATC: „Аха” (*Aha.*).

0607:45 A1: „Уход на запасной аэродром” (*Go around to an alternate airfield?*).

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0607:51 ATC: „Да” (*Yes.*).

0607:52 A1: „Go to” (*Go to.*).

0607:54 ATC: „...to?” (*...to?*).

0607:56 A1: „Нет, другое слово. Go...” (*No, another word. Go...*).

At 0610:42 - 0611:34, ATC was contacted by the crew of the TRANSAERO 331 aircraft, requesting a weather conditions update for purposes of forwarding it to the crew of the Polish Tu-154M aircraft, then flying in the Belarussian Republic’s airspace.

0610:42 331: „Корсаж, ответьте Трансаэро триста тридцать один” (*Come in, KORSAZH, respond to Transaero three three one.*).

0610:46 ATC: „А, Корсаж ответил. Y” (*KORSAZH, coming in.*).

0610:48 331: „Доброе утро, будьте любезны Ваша фактическая погода” (*Good morning, we request your current TAF.*).

0610:53 ATC: „А, значит фактическая, туман, видимость порядка четырёхсот, где-то не более четырёхсот метров” (*Aaah, so, current TAF: fog, visibility around four hundred, no more than four hundred meters.*).

0611:01 331: „А температура есть какая, давление?” (*What about some kind of temperature and pressure reading?*).

0611:03 ATC: „А, температура плюс два, давление семь сорок пять. А вы для польского борта работаете?” (*Aaah, temperature two above, pressure seven four five. You working for the Polish aircraft?*).

0611:10 331: „Нет, мы (просто?) пролётом летим, нас Москва попросила” (*No, we’re (simply?) in transit, Moscow asked us.*).

0611:14 ATC: „Пока условий для приёма нет, передайте” (*For now conditions are unsuitable to receive them, tell them.*).

0611:18 331: „Хорошо, спасибо большое” (*Alright, thank you very much.*).

0611:21 „...”

0611:23 „Что?” (*What?*).

0611:24 331: „А у вас, ы, прогноз какой-нибудь есть вообще, нет?” (*And what about you, aaah, you do have some kind of forecast, right?*).

0611:27 ATC: „Прогноз тут в новом облике, блин, вообще не ожидали тумана, вот обещают где-то час еще, что туман будет” (*We have a forecast in new form, hell, there was no fog forecast at all, and they are just saying that we will have fog for another hour.*).

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0611:34 **331:** „Ну понятно, ещё раз извините, спасибо” (*Affirm, I apologize again, thank you*).

ATC commented on the development in hope that someone higher up had actually become worried at the information received from SMOLENSK.

0612:15 **ATC:** „Вот и хорошо, [vulg.]. Это значит там уже забеспокоились...” (*Good, [vulg.]. Someone got worried over there...*).

Between 0612:48 and 0616:22 MUDC kept requesting ATC for any news concerning the decision to redirect the Tu-154M aircraft to an alternate airfield. ATC repeatedly and to no avail attempted to obtain such information from OC (0616:22-0620:45). At 0621:13, ATC learned from ATC/CP that Tu-154M is approaching the waypoint ASKIL, and is tracking to SMOLENSK. ATC then contacted the SMOLENSK SOUTH airfield ATC, and was notified that the Tu-154M aircraft was directed to the SMOLENSK airfield by the Main Air Traffic Management Center. During that exchange, ATC made a final attempt to prove the unjustifiability of directing the aircraft to the SMOLENSK airfield.

0623:06 **ATC:** „А, добрый день. С »Северного« беспокоят. Под чьим управлением сейчас идёт польский борт?” (*Aaah, good morning. Am calling from the Northern. Who is now controlling the Polish aircraft?*).

0623:12 **PLD:** „Москва руководит” (*Moscow is the controller.*).

0623:13 **ATC:** „А?” (*What?*).

0623:13 **PLD:** „Москва руководит” (*Moscow is the controller.*).

0623:14 **ATC:** „Ну им надо как-то передать, пока они работают нормально, [vulg.], что у нас туман, видимость менее четырёхсот метров, [vulg.]. Чего его к нам-то сейчас гнать?” (*Well, they need to be told somehow, as long as they are fully operational, [vulg.], that we have fog and visibility below four hundred meters, [vulg.]. Why push him this way now?*).

0623:25 **ATC:** „Ну передайте ещё Москве, у вас есть связь, у нас с ними нет, сейчас выйдет. Если он ещё русский не знает, [vulg.], то это будет вообще” (*And tell Moscow also, you have radio contact with them, we don't – it will turn out soon. And if he doesn't speak Russian either, [vulg.], there's going to be a real mess.*).

ATC's further attempts to cause OC or the Main Air Traffic Management Center to redirect the Tu-154M aircraft to an alternate airfield were terminated by contact established by the crew of the Tu-154M aircraft. MUDC ordered ATC to ask the crew for information

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concerning remaining fuel and alternate airfields, which according to regulations of the Russian Federation initiates the procedure of redirecting an aircraft to an alternate airfield.

0624:14 ATC: „Надо его угонять, [wulg.]” (*We have to chase him away, [vulg.]*).

0624:15 MUDC: „Значит скажи, у нас условий нет, видимость, (это ?)” (*So tell me, we have unsuitable conditions, and visibility (is)?*).

Despite ATC having communicated the current meteorological conditions and conditions unsuitable for landing, the commander of the Tu-154M aircraft requested clearance for a trial approach. At this point, communication was taken over by MUDC, and after having confirmed that following the trial approach the aircraft shall have sufficient fuel to depart for an alternate airfield, accepted the crew’s decision. MUDC conveyed the crew’s decision to ATC/CP, and ATC ordered the aircraft to be brought down to 100 m.

0626:02 MUDC: „...значит, делает контрольный заход, решение командира, делает контрольный заход до высоты принятия решения сто метров, уход, готовность Минска, Витебска на запасной пусть запросят” (*... so he will perform a trial approach, that’s the commander’s decision, he will perform a trial approach to an altitude of one hundred meters, then he goes around, so, they should ask if Minsk or Vitebsk are ready as alternates*).

0626:12 KTR: „Принял” (*Affirm*).

0626:19 MUDC: „[imię], доводишь до 100 метров. 100 метров. Без разговоров, [wulg.],...” (*[first name], you bring him down to one hundred meters. One hundred meters. Not a word, [vulg.]...*).

From that moment on, ATC’s and MUDC’s actions focused on agreeing the departure of the Tu-154M aircraft to an alternate airfield <sup>163</sup> after the expected go-around. MUDC exited Inner ATC Post, and established contact with ATC after 4 minutes requesting confirmation that the commander of the Tu-154M aircraft had not changed his intentions.

0630:34 ATC: „Алло” (*Hello*).

0630:35 MUDC: „Чего, он запрашивает?” (*What, he intends to approach?*).

0630:36 ATC: „[wulg.], к нам заходит пока, да” (*[vulg.], he is approaching us at the moment, yes*).

0630:40 ATC: „Ну так, так сказали, [wulg.], заводите пока” (*Well yes, that’s what they said, [vulg.], bring him down for the time being*).

0630:52 MUDC: „Ну ладно” (*Well, OK*).

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<sup>163</sup> Actions taken prove that neither ATC nor MUDC had knowledge of alternate airfields planned for all aircraft scheduled to land on April 10<sup>th</sup> 2010.

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After having confirmed the crew's intentions, MUDC ordered ATC to communicate the minimum descent altitude.

0631:45 MUDC: „Нет, мы свою обязанность выполним” (*No, we're going to do our duty.*).

0631:51 MUDC: „Предупреди его, что у нас сто метров, решение доложить на ста метрах” (*Tell him that it's one hundred meters here, communicate the decision at one hundred meters.*).

0631:56 MUDC?: „Всё” (*That's it.*).

ATC made an attempt to find out whether any improvement in weather conditions had been recorded. Both ATC and MUDC assessed the information received as not credible, as it indicated a visibility of 800 m, whereas it was 200-300 m from Inner ATC Post.

0633:20 ATC: „Он даёт сейчас восемьсот метров” (*It shows eight hundred meters now.*).

0633:22 MUDC: „Какие восемьсот?!” (*What do you mean, eight hundred?!.*).

0633:29 MUDC: „Ну вот сейчас восемьсот метров, а туда вообще. Глянь, туда хоть метров двести, триста точно есть, а туда метров двести максимум” (*That's it, now it's showing eight hundred meters, and there's nil there. Look, it's something like two or three hundred meters there, and two hundred max over here.*).

Between 0633:53-0634:22 an unidentified general called MUDC's cell phone, and MUDC communicated the airfield's full readiness to receive the Tu-154M aircraft.

Upon the Tu-154M aircraft's base leg approach, ATC asked the crew whether they had performed military airfield landings before, and notified them of the APS day mode.

0634:58 ATC: „А, пятьсот метров, а, на военном аэродроме посадку осуществляли?” (*Aaah, five hundred meters, aaah, have you performed military airfield landings before?*).

0635:04 101: „Да, конечно” (*Yes, of course.*).

0635:06 ATC: „Прожектора по-дневному, слева справа в начало полосы” (*Projectors in day mode, left-hand side, beginning of runway.*).

0635:13 101: „Понял” (*I copy.*).

Between the base leg and the final approach, ATC ordered the crew to prepare for a go-around from an altitude of 100 m.

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0635:24 **ATC**: „А, польский сто один, и от ста метров быть готовым к уходу на второй круг” (*Ah, Polish one zero one, and prepare for a go-around from one hundred meters.*).

Concurrently, MUDC checked for any improvement in meteorological conditions at the SMOLENSK SOUTH airfield. According to information communicated, meteorological conditions improved slightly – visibility increased to 600 m.

Upon the aircraft’s final approach, ATC expressed doubt as to the landing’s success for the last time.

0637:36 **ATC?**: „Он не зайдёт (тут ?)” (*He will not be able to approach (here?).*).

0637:44 **MUDC**: „Ты главное дай на второй круг. А ещё... на второй круг и всё. А там дальше он (пусть висит?). Сам принял решение, пусть сам и далее...” (*The main thing is, prepare him for a go-around. And also... a go-around, that’s it. And then let him (hang?) there. It was his call, let them continue by themselves...*).

The above comment proves that ATC and MUDC abandoned any further attempts to prevent the landing approach of the aircraft in weather conditions well below the airfield’s minima, shifting liability for any further action to the aircraft commander.

An analysis of Inner ATC Post voice recordings has proven that during the Tu-154M aircraft’s final approach, RLS indicator readings were watched by Landing Zone Control (LZC), ATC, and MUDC. Despite the incorrect glide performed by the aircraft’s crew (delay in initiating the descent, excessive flight altitude over the outer NDB, double the correct rate of vertical descent, and the aircraft’s descent below the glide path at final approach), no one at Inner ATC Post reacted to the aircraft’s incorrect position in relation to the approach path or the RWY axis. LZC notified the crew of their correct position “~~on~~ on course and on glide path”, which could have assured the crew that they were performing a correct approach, and carried no warning of the necessity of performing an immediate go-around. From the viewpoint of psychology of risky behavior, nil communication would have been much better than erroneous communication. A sense of impending physical threat (much stronger in crew members than in ATC Group personnel) could have caused the crew to make an earlier go-around decision.

0640:30 **LZC**: „Три на курсе, глиссаде” (*Three on course, on glide path.*).

0640:32 **MUDC**: „Фары пусть включит” (*Tell him to switch his landing lights on.*).

0640:33 **101**: „...” (...).

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0640:34 ATC: „Фары включите” (*Switch landing lights on*).

0640:37 101: „Включены” (*Landing lights on*).

0640:40 ...

0640:42 LZC: „Два на курсе глиссаде” (*Two on course, on glide path*).

0640:53 ...

0640:55 LZC: „Горизонт, сто один” (*Horizon, one zero one*).

0640:58 ATC: „Контроль высоты, горизонт” (*Altitude control, horizon*).

0641:01 ?: [*vulg.*].

0641:02 ATC: „Сколько ждали?” (*How long have we waited?*).

0641:03 ?: „Да нет его... всё...” (*But he's not there... everything...*).

0641:05 ...

0641:05 ATC: „Уход на второй круг!” (*Go around!*).

0641:09 ATC: „Уход на второй круг” (*Go around*).

On April 10<sup>th</sup> 2010, emotions at Inner ATC Post ran high, climaxing during landing approaches performed by consecutive aircraft. Communication and exchanges at Inner ATC Post, as well as all emotions related, suggest little trust of the service personnel in the reliability of information conveyed by OC. Such circumstances, coupled with an absence of higher-level decisions to redirect the Tu-154M aircraft to an alternate airfield, resulted in distraction to ATC/CP, the absence of appropriate control over all developments, and ostensible anxiety.

The Committee believes that on the critical day, ATC was incapable of assessing the situation in a comprehensive, critical, and decisive manner. His duties were gradually being taken over by MUDC, who actively intervened in flight control. The atmosphere of mounting emotional tension and a low level of assertiveness in contact with his superiors prevented ATC from making independent decisions. The following have been recognized as key factors influencing ATC's behavior:

- Absence of trust in communication from OC and METEO,
- Presence of superior issuing orders at Inner ATC Post,
- Pressure of the VIP rank of the flight,
- Progressively deteriorating weather conditions, and nil decisions made by superiors,
- Attention focused on secondary (less important) objectives.

Albeit the Federal Aviation Principles for State Aviation in the Russian Federation stipulate a number of duties for ATCs, they also equip them with considerable decision-

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making powers. Given the weather conditions on April 10<sup>th</sup>, 2010 at the SMOLENSK NORTH airfield, the ATC had the right to apply to his superiors with an initiative to close the airfield, following the second failed approach attempt of the IL-76 aircraft.

The wish to avoid responsibility for altering the original plan was probably key to the motivation of all individuals engaged in the decision-making process. Not only did this result in the absence of a decision to close the airfield, but it also had a direct impact upon the air traffic control process. The correct procedure provides for major decisiveness of the ATC Group personnel, and had been tantamount to their joint responsibility for all developments. The absence of action at the OC or Main Air Traffic Management Center levels, despite ATC's and MUDC's efforts to redirect the Tu-154M aircraft to an alternate airfield sufficiently early, led to ATC accepting the decision of the Tu-154M aircraft crew which should not have been accepted.

The evasion of responsibility in relation to altering the original flight plan (landing at the SMOLENSK NORTH airfield), resulting from organizational and line-of-command reasons alike, the absence of efficient cooperation or proper training, and the task overload of individual staff all contributed to circumstances which then determined the actions of the crew of the Tu-154M aircraft, as well as of ATC/CP personnel. With regard to the aircraft crew, key impact factors included information overload, flight errors, poor cooperation among the crew, and indirect pressure closely related to the prominence of the task at hand. With regard to ATC/CP personnel, those factors included the absence of independent decision-making, avoidance of responsibility, the lack of a clear decision to close the airfield for reasons of weather conditions remaining below airfield minima, and errors in precise aircraft guidance. In both cases, the predominant direct mechanism was that of a loss of circumstantial awareness (understanding and predicting flight circumstances, knowledge of the aircraft's precise position, and knowledge of potential solutions to difficulties arising).

## **2.14. Technical Condition of the Aircraft at the Time of Accident**

The technical condition of the aircraft was assessed against the following evidence:

- 1) The aircraft's technical documentation,
- 2) An analysis of flight data, FMS, and TAWS recorders,
- 3) An analysis of the aircraft's configuration at the time of impact,
- 4) Visual inspection of aircraft wreckage,
- 5) Visual inspection of the accident location.

The Committee found that prior to flight on April 10<sup>th</sup>, 2010:



- 1) The Tu-154M aircraft tail number 101 had all maintenance and service works performed as due, and had been certified for further service and overhaul cycle life.
- 2) Airframe and powerplant service life data required correction in regard of differences resulting from failure to regularly update the aircraft's service log, and from errors in flight hours and the number of landings. The discrepancies identified did not result in operational irregularities, or affect any required dates of maintenance and service works performed.
- 3) No discrepancies and irregularities (as described in detail in sections 1.5 and 1.18.5 hereof) existent prior to April 10<sup>th</sup>, 2010, contributed to the accident.
- 4) In the course of direct flight line preparation of the Tu-154M aircraft tail number 101 for the flight, during which the accident occurred, the technical staff of the 36 Regiment duly performed all works required.
- 5) All airframe and powerplant components of the aircraft were filled and installed in conformity to technical specifications.
- 6) The amount of fuel in the aircraft's tanks prior to take-off was sufficient to reach the destination as planned, or an alternate airfield.

A detailed description of the operability of the aircraft's systems as per flight data recorder readings, the aircraft's configuration upon impact, and the assessment of systems operability on basis of visual inspection of post-accident aircraft wreckage has been contained in Annexes Nos. 2, 3, 4, and 5 to the Final Report.

Following examination and analyses of the powerplant, fuel, control system, onboard instrument readings, and all key systems of the Tu-154M aircraft tail number 101 on basis of the aircraft's wreckage and flight data recordings available, the Committee found that:

- 1) During the period from take-off from the WARSAW-OKECIE airfield until the moment of impact against obstacles during the approach to land at the SMOLENSK NORTH airfield, no emergency signals were detected by flight data recorders. No lines of flight parameters recorded indicate faulty operation of the aircraft's machinery, systems, or other devices at any point of the flight until the moment of the aircraft's collision with an obstacle (tree), which resulted in separation of a part of the wing and aileron.
- 2) Onboard CVR recordings contain no comments by the crew to the effect of incorrect in-flight aircraft operation.
- 3) A viewing of aircraft wreckage enabled a verification of all flight data recorder readings.

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- 4) At the time of the accident, the aircraft was in landing configuration. The incorrect configuration of the aircraft's interior consisting in a change in the number of passenger seats was not a factor in the accident.
  - 5) All engines were stable, with in-flight operation parameters consistent with technical requirements as of the moment of engine start-up, throughout the flight time from the OKECIE airfield until the time of the accident. No engine showed casing damage typical to incidents of in-flight disintegration of rotating engine components. Neither engines nor their casings showed traces suggesting fire. The nature of damage to engines proves them to have been operational at the time of the accident. No damage or other traces potentially proving engine failure other than that caused by ground impact was found. No correlation was found between the powerplant's technical condition and operation and the accident.
  - 6) No discrepancies were found between yoke and pedal movements and aircraft controls at any point during the flight. Flaps and slats remained operational until impact. Engine speed values had been changing consistently with changes in the position of respective engine control levers.
  - 7) Fuel used in the tanks of the Tu-154M aircraft tail number 101 during the period of March 26<sup>th</sup> through April 9<sup>th</sup> 2010 had conformed to the list of fuels approved by the manufacturer for use in aircraft of that type. Laboratory tests of fuel used in the tanks of the aircraft on April 9<sup>th</sup> proved that the fuel complied with all quality requirements.
  - 8) No traces of explosives detonation or jet fuel explosion had been found. A minor fire, started in the course or immediately upon ground impact, had spread over a few components of aircraft wreckage. No traces typical for in-flight fire were detected.

Tests and examinations of onboard flight instruments demonstrate the following:

- 1) The (co-pilot's) WM-15PB pressure altimeter No. 1188008 showed no traces of inoperability prior to its destruction in the course of the accident; at time of impact, the altimeter settings read 745 mmHg.
- 2) UWO-15M1B altimeter No. 1196652 (VBE-SVS) showed no traces of inoperability prior to its destruction in the course of the accident; at time of impact, the altimeter settings read 745 mmHg.
- 3) Components of the ARK-15M automatic direction finding equipment showed no traces of inoperability prior to the aircraft's ground impact; the display showed the following frequency settings, respectively:
  - Control dial -P" (left) 630 kHz;
  - Control dial -H" (right) 306.5 kHz.

At the time of damage, ARK-15M automatic direction finding equipment was set to KOMPAS (DIRECTION FINDING) mode. Heading settings on E9905 and I549 receivers read 165° i 140°, respectively. Given the considerable kinetic inertia of the system, an examination of course settings displayed by the devices described at the time of power loss is imposible. Respective display readings for unit RMI-2B No. 480638 were as follows:

- Hand  $\rightarrow$ : 162°;
- Hand  $\leftarrow$ : 120°;
- Magnetic heading: 165°.

Readings of the other RMI-2B unit could not be examined for reasons of damage to the unit.

- 4) One of the radio altimeters displayed an altitude setting of 60-65 m; readings of the other radio altimeter could not be examined due to damage to the device.

**On the basis of all analyses and examinations performed, the Committee found no correlation between the technical condition of the aircraft and the accident.**

### 3. CONCLUSIONS

#### 3.1. Committee Findings

Due to a multifaceted nature of the examination, the Committee findings were grouped into the following topic categories:

##### **Flight organization**

- 1) ~~Instruction on HEAD Flight Operations~~”, Warsaw 2009, WLOP 408/2009 was introduced for use without repealing section 1.17.3, points 4, 5, 7.
- 2) The institutions commissioning the VIP transport did not have any internal instructions and collaborative procedures for transport coordination.
- 3) The commissioning requests for the special air transport for April 7<sup>th</sup> and 10<sup>th</sup> did not contain certain information required by the HEAD Instruction.
- 4) The number of the Tu-154M passengers submitted by the commissioning institution for the flights on April 7<sup>th</sup> and 10<sup>th</sup> exceeded the actual number of available passenger seats which lead to the 36 Regiment performing an unauthorized reconfiguration of passenger seats from 90 to 100.
- 5) The Coordinator did not file a request for special air transport on April 10<sup>th</sup>, 2010 to the Air Command, 36 Regiment or BOR, which constituted a violation of the provisions of the HEAD Instruction.
- 6) 36 Regiment and the Air Force Command did not have established procedures for assessing feasibility of conducting a mission to an airfield indicated by the commissioning institution with respect to the available aviation and meteorological documentation, local radionavigational aids, air control services, and search-and-rescue capabilities.
- 7) The 36 Regiment’s declining having a leader present on board of the airplanes on the April 7<sup>th</sup> and 10<sup>th</sup> and acceptance of such decline by the Russian party constituted a violation of the requirement stipulated in § 3.10, GEN 1.2-9 AIP RF and CIS („Aeronautical Information Publication Russian Federation and Countries of The Commonwealth of Independent States”).
- 8) At 36 Regiment, there were no designated guidelines for operational supervision, including operation communication.
- 9) The request for clearance for the flight and landing of the airplanes on the SMOLENSK NORTH airfield (*claris*) on April 10<sup>th</sup>, 2010 did not include

the Yak-40 airplane tail number 045, which the 36 Regiment commander designated as the means of transport for journalists on April 10<sup>th</sup>, 2010.

- 10) In the order of the day by the 36 Regiment commander for April 10<sup>th</sup>, 2010 no backup airplane for the upcoming HEAD flight and no backup crew were designated.
- 11) The report by the reconnaissance mission to Smolensk on March 24<sup>th</sup>-23<sup>rd</sup>, 2010 contains the following statement: „The Russian side declared that all flights would be accepted and the requested Smolensk military airfield parameters would be notified to the Polish MoFA‘.
- 12) The diplomatic consent for the flights to be performed on April 7<sup>th</sup> and 10<sup>th</sup>, 2010 did not contain any special conditions pertaining to the flight despite the requirement to that effect stipulated in § 3.10, GEN 1.2-9 AIP RF and CIS.

### **Crew training**

- 13) The flight training on the Yak-40 and Tu-154M airplanes was conducted on the basis of the outdated PSzLT-73 document. Hence, the training items related to the new aircraft instruments were omitted which lead to degradation of safety of the flight operations performed.
- 14) No flight simulators were used in the processes of conducting rudimentary flight training on the Tu-154M and Yak-40 machines, piloting skills retention, training crew behavior in emergency situations, in evaluating their collaborative skills, and in crew resources management, in practicing response to alerts and warnings generated by the aircraft (TAWS, TCAS). Occasional training on the Tu-154M flight simulator took place only during the airplane hand-overs following overhauls and did not fulfill the description of planned and structured training activity.
- 15) In the 36 Regiment, no effective process of making the crews acquainted with new equipment (TAWS, TCAS) was established. Based on the flight recorder analysis it seems that the pilots had often ignored the TAWS alerts which indicates inadequate familiarity with the system.
- 16) In the flight training process in the 36 Regiment, information from the analysis of flight recorder data was not used.
- 17) In the 36 Regiment, no analysis of the flight recorder data was conducted (e.g. instances of TAWS-generated warnings and non-stabilized approaches) with a view to identifying incorrect actions by the flight crews. Hence, it could not stimulate any corrective measures being applied in the process of flight crew training.

- 18) The instances of awarding and maintaining validity of certificates of the crew commander, co-pilot, and navigator took place in violation of the training methodology guidelines and provisions of the RL-2006, IOLP-2005, and other training documents.
- 19) Regularity of training tasks (exercises) as mandated by the training program was not observed with respect to the flight crew members, which is not in keeping with the training methodology. That fact had a negative impact on the entire training process and the level of skills achieved by the pilots.
- 20) The training process and the level of preparedness for the operational tasks of the aircraft commander, co-pilot, and navigator were improperly supervised.
- 21) The examination of the training documentation of the flight crew established:
  - a) numerous cases of reporting worse WC than those actually encountered during the exercise;
  - b) differences existing among the personal, squadron, and regimental records regarding certification for flights using certain landing aids and at corresponding minimum WC;
  - c) improper documentation of training in obscured cockpit;
  - d) flight records were kept using the local time for Poland rather than UTC time.
- 22) The 36 Regiment applied a different interpretation of the § 23 para 15 RL-2006 (conducting flights in simulated weather conditions) in order to maintain its operational capabilities. Such practices had an impact on the flight training process.
- 23) Validity and expiry dates of certificates, checkrides and training flight consistency were not observed with respect to the crew commander, co-pilot, and navigator, with a resulting expiry of the flight into the zone checkride for the aircraft commander and co-pilot, and of the navigating checkride for the navigator.
- 24) The aircraft commander did not perform any training flights in 2009 and 2010.
- 25) Awarding the test pilot 3<sup>rd</sup> class certificate for the Tu-154M aircraft to the aircraft commander took place in violation of the regulations in force.
- 26) The co-pilot's and navigator's training for the flight navigator seat was conducted in violation of the PSzLT-73 document.
- 27) In the 36 Regiment, internal regulations on the minimum flight experience required for HEAD mission clearance were not observed.

- 28) Aeronautical medical training as provided for in the –Aeronautical medicine special training guidelines for the Polish Armed Forces air crews”, fiche –Zdrowie 244/2008”, was not provided.

### **Crew resource management**

- 29) In the training process in the 36 Regiment, pilots used the following outdated documentation:
- a) „Crew resource management technique for the Tu-154M aircraft”, published by PLL LOT 1989.
  - b) „Tu-154M Aircraft Flight Manual”, published by PLL LOT 1994. The most recent update took place on February 7<sup>th</sup>, 1994.
- 30) The 36 Regiment did not have a standard procedures manual for the four-person crew of the Tu-154M aircraft.
- 31) No CRM, MCC, nor ORM specialized training was conducted in the 36 Regiment.
- 32) Isolated training exercises in multi-crew teamwork did not ensure the required knowledge and skill level among the crew members.
- 33) An examination of the training of and the actions taken by the Tu-154M crew confirmed that the crew members did not possess the drilled and consolidated crew management skills. The crew members passively participated in the entire decision-making chain, uncritically accepting all decisions of the crew commander.
- 34) The need to maintain operational capabilities of the Regiment resulted in a situation where the pilots conducted flights on various aircraft types and in various seats. Such constant changes in positions rendered impossible the consolidation of skills required for safe flying in any given seat and on any aircraft type.

### **Maintenance crew training**

- 35) The maintenance crew training process was conducted in violation of the document –Flight Engineering Service personnel training program for the specialties: airframe and powerplant, avionics, radio and electronics for the Tu-154M aircraft” in force in the 36 Regiment - in particular with respect to the number of hours devoted to individual topics, theory and hands-on training, as well as to the use of training aids.
- 36) The training system for the 36 Regiment's FES technicians on the Tu-154M aircraft relied mainly on self-education and as such could not possibly guarantee the acquisition of the required skills.

- 37) The documentation setting out the system for skill verification and conducting flights in the position of the flight engineer including the specificity of the Tu-154M airplane contains numerous contradictions.

### **Operations of the 36 Regiment**

- 38) The Regiment executed its tasks in a way that violated the regulations on standard limits of the total flight hours, flight time, and resting periods already at the planning stage.
- 39) The flight crew resources were insufficient for the number and the types of aircraft in service and with respect to the conducted flight missions.
- 40) The 36 Regiment did not have any data gathering procedures with respect to equipment and condition of the destination airfields.
- 41) The unit failed to develop standard pre-flight briefing drills depending on the nature of the task at hand. Such recommendation was a part of the § 13 para. 16 „Immediate preparation” IOL-2008 document.

### **Supervision of the 36 Regiment operations**

- 42) From 2004 until the accident date, two comprehensive inspections, four problem-related inspections, and three Air Force Command inspections were conducted in the 36 Regiment.
- 43) The Air Force Command inspections did not reveal any significant irregularities in the flight training process or in the flight records.
- 44) The comprehensive and problem-related inspections demonstrated a series of recurring irregularities, including, among others, deficiencies in accident prevention activities and in theoretical training.
- 45) The comprehensive inspection conducted by the MoND Inspection Department in 2004 established that the specificity of tasks conducted by the 36 Regiment required a particular oversight of flight training activities.
- 46) Repeating accident prevention recommendations issued as result of the inspections carried out by various units indicate a low level of supervision by the Air Force Command of the accident prevention measures applied in the 36 Regiment.
- 47) From 2004 until the accident date, no detailed inspections of flight training, flight organization, and certification of the Tu-154M flight crews were conducted in the 36 Regiment.



- 48) No study of impact of a large number of operational tasks on the training of flight crews was performed as part of the 36 Regiment oversight.
- 49) Deficient headcount of the Tu-154M flight crews resulted in excessive workload imposed on the crews and made training and exercising difficult.

**Standard setting documentation pertaining to conducting flights by the aviation of Polish Armed Forces**

- 50) The RL-2006 document does not contain any provisions on the CRM which led to omitting that topic in the training programs and operational documents.
- 51) The RL-2006 document does not set out the procedure for extending the co-pilot multi-crew certificate.
- 52) The RL-2006 document, while setting the minimum conditions for the crew based on the minimum conditions for the CC, marginalizes the role of the co-pilot in the crew.
- 53) The RL-2006 document does not contain any provision demanding that in case of differences in training level of the crew members, the most restrictive minimum should apply.
- 54) The RL-2006 document does not contain any provisions limiting the access by third parties to the cockpit.
- 55) The RL-2006 document does not contain any provisions referring to the categories of airfields<sup>164</sup> which inhibited proper planning and preparation of a flight mission to a given airfield.
- 56) The RL-2006 document does not provide any detailed regulations on conducting flights on multiple aircraft types and in various crew capacities (commander, co-pilot, navigator).
- 57) The study of the RL-2006 document showed ambiguity of provisions. In § 19 para. 24 items 4 and 5 it mandates interruption of a descent on the glide slope in adverse flight conditions and/or weather phenomena while in § 23 para 17 it allows to continue the approach for landing regardless of any previously obtained WC information.
- 58) The PSzLT-73 document does not contain the requirement to use flight simulators in the training process.

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<sup>164</sup> Determining airfield with consideration of restrictions in terms of operational parameters (length, altitude above sea level), navigational and emergency equipment, availability of air traffic services, regulations in force on site.

- 59) Despite the reference to the Doc. 8168 document in the RL-2006 document which among other things defines the stabilized approach criteria, no relevant procedures were defined.
- 60) The document 'Guidelines for radio correspondence in the Polish Armed Forces aviation networks' tentative publication, Poznań 1999, WLOP 291/99, which was in use by the 36 Regiment, was not referred to in the RL-2006 document as a mandatory document.
- 61) The INOP WPL WARSZAWA OKECIE – EPWA refers to the 'Guidelines for supporting and performing flights of the –HEAD' status aircraft over the territory of the Republic of Poland - tentative', WLOP 341/2004, which was decommissioned in 2009.
- 62) No regulations which are in force in the aviation of Polish Armed Forces demand that documents confirming performance of the maintenance activities on the aircraft and the airplane trimming sheets must remain at the departure airfield.

#### **Meteorological preparation**

- 63) Access to weather data from the Russian Federation's military airfields by the Polish side is insufficient to ensure proper preparation of international flights.
- 64) The weather information from the SMOLENSK NORTH airfield was not available in Poland.
- 65) In 2009, the chief of staff of the 36 Regiment filed a request with the Air Force Command concerning acquisition of weather data from the SMOLENSK NORTH airfield. That request has not been pursued until the accident date.
- 66) When planning flights to the SMOLENSK NORTH airfield, the weather data from the SMOLENSK SOUTH weather station were used which is situated 10 km away and which transmits weather data every 3 hours.
- 67) In the CH SZ RP WA forecasting process at the SMOLENSK NORTH airfield, neither the weather satellite data nor NOAA were used in the format specifically designed for detecting fog banks and stratus clouds.
- 68) The study of the satellite photographs and aerologic probing would have lead to forecasting of advection-radiation fog forming in the general Smolensk area, combined with low ceiling stratus overcast.
- 69) The weather measurement and observation system at the SMOLENSK NORTH airfield was incompatible with the most rudimentary ICAO and WMO requirements. The placement of the weather station and of the measurement equipment at the airfield

was incorrect which resulted in non-representative measurements and observations being taken at the airfield.

- 70) Upon landing of the Yak-40 airplane at the SMOLENSK NORTH airfield, the military airfield controller did not establish telephone communication with its crew in order to obtain information on the WC at the airfield.
- 71) Upon arrival in SMOLENSK NORTH, the Yak-40 crew failed to transmit to the military airfield controller the information on dangerous weather conditions.
- 72) Meteorological preparation of the Tu-154M flight was incorrect with respect to:
- a) the fact that the weather forecast for SMOLENSK NORTH prepared by the local meteorologist on duty were transmitted to the HEAD flight crew instead of the forecast developed by the Polish Armed Forces Hydrometeorological Center;
  - b) the quality of the weather forecast for the SMOLENSK NORTH airfield developed by the shift on duty at the weather office of the TVER air base; that includes the reported lack of fog despite the information that such fog had already formed in the advection direction.
  - c) organization and performance of weather measurements and observations at the SMOLENSK NORTH airfield;
  - d) transmitting incomplete WC information by the SMOLENSK NORTH ATC to the flight crews.
- 73) The WC on the approach to the SMOLENSK NORTH RWY 26 threshold did not allow to conduct a flight below the minimum descent limit for the Tu-154M airplane and contributed to the accident.

#### **Flight preparation by the crew – preliminary activities**

- 74) The Tu-154M crew was designated on April 9<sup>th</sup>, 2010.
- 75) Before designating the crew, the commanding officer of the 1<sup>st</sup> air squadron did not verify the validity of certificates, piloting skills, or checkride certificates of the individual crew members.
- 76) By signing the Tu-154M's mission order to SMOLENSK for April 10<sup>th</sup>, 2010, the unit commanding officer approved the crew composition and its readiness for flight.
- 77) Preliminary flight preparation was conducted on individual basis. The crew did not have the opportunity to meet the day before departure in full composition (for more than one hour) to discuss all phases of the flight.

- 78) During the preliminary flight preparation, the crew used outdated SMOLENSK NORTH approach charts (provided to the 36 Regiment in 2009).
- 79) The filed flight plans for April 10<sup>th</sup>, 2010 were duplicates of the respective plans for the PM flight to SMOLENSK on April 7<sup>th</sup>, 2010 as corroborated by the fact of choosing VITEBSK as an alternate airfield. While the VITEBSK airfield was in operation on April 7<sup>th</sup>, it was closed on April 10<sup>th</sup> according to AIR RF and CIS (holiday) and hence could not serve as an alternative destination.
- 80) The navigator did not have sufficient command of Russian to be able to conduct radio correspondence in that language.
- 81) Due to the delayed arrival from Gdansk on the previous day and the need to take additional preparatory steps for the upcoming flight the following day, the navigator did not have sufficient minimum resting period between flights.

#### **Immediate flight preparations**

- 82) The engine test took place in absence of the airplane and helicopter test flight committee representative.
- 83) The crew failed to perform a comprehensive pre-flight visual check of the airplane when receiving it from the FES.
- 84) The pre-flight crew briefing took place most likely on board of the airplane between 04:21 and 04:46.
- 85) The immediate preparation by the aircraft commander, co-pilot, and navigator was taking place in a time deficit due to their delayed arrival at the airport by about 30 minutes.
- 86) During the pre-flight preparations, no notice was taken of the facts that the flight weather report was prepared by an incorrect function holder, that the VITEBSK airport, assumed as an alternate airport, was closed, and that TAF for that airport was outdated.
- 87) The aircraft commander failed to confirm the airplane acceptance in the airplane's maintenance book.

#### **Supervision of the immediate flight preparation activities**

- 88) Absence of the Air Force Command and 36 Regiment supervisors of the immediate flight preparation activities between 0300 and 0400 hours contributed to the failure of coordination of the decision-making with respect to the HEAD backup airplane, which violated the provisions of the 'HEAD instruction'.

- 89) Delayed transmission of the Yak-40 weather report from the time of landing from the military AC to the weatherman on duty inhibited the AOC activities.

### **Flight**

- 90) The crew received the airplane in a flight configuration which was not compliant with its flight manual and with the manufacturer's documentation.
- 91) In the flight plan, the crew indicated a flight time based on the amount of fuel including the ballast fuel which was incorrect.
- 92) The crew entered the coordinates of the navigation waypoints published on the SMOLENSK approach charts into the FMS without verifying the datum.
- 93) The crew failed to perform the noise suppression procedure upon departure from EPWA.
- 94) The crew retracted the flaps to 0° at insufficient airspeed.
- 95) Upon departure from WARSAW, the crew exceeded 250 knots below FL100.
- 96) Upon passing ASKIL, the crew departed from the planned flight route without reporting it to ATC.
- 97) The crew maintained the altitude of 3,700 m instead of 3,600 m to which it was instructed to descend.
- 98) The aircraft commander failed to discuss the approach with the crew, to determine the allowed decision window before leaving for to the alternate airfield, and to check the WC at the selected alternate airfields.
- 99) Before descent, the aircraft commander failed to agree the minimum descent altitude with the crew.
- 100) The crew failed to verify the maximum permissible weight of the aircraft for landing on RWY 26 in the current WC.
- 101) The low altitude warning value on the radio altimeter of the aircraft commander was actually set to 65 m even though the commander had announced setting it at 100 m during the 'Before descent' checklist.
- 102) The crew failed to set up TAWS correctly. Since the use of the QFE mode was impossible (as the TAWS database did not contain the SMOLENSK airfield data), the crew should have set the TERRAIN INHIBIT mode as described in a flight manual attachment.
- 103) The flight engineer failed to report to the commander the switching of the fuel system mode from manual to automatic.

- 104) The purser reported the cabin prepared for landing although she had failed to check whether the passengers fastened their seat belts for landing (many victims did not have their seat belts fastened).
- 105) The crew were conducting radio communication during final descent in a manner which was contrary with "Guidelines for radio correspondence in the aviation of the Polish Armed Forces networks" – provisional edition – Poznań 1999".
- 106) Resetting the altimeters to the pressure value of 745 mmHg/993 hPa by the crew prior to descending to the transition flight level violated the ATC instructions and the common guidelines.
- 107) The crew read out the 'Transition altitude' checklist too early.
- 108) The crew used the FMS as the input source for ABSU during descent, which was incompatible with the Flight Manual supplement on the UNS-1D equipment.
- 109) During approach, the crew members did not use barometric altimeters, which violated the RL-2006 provisions.
- 110) During approach, the crew did not set the flaps at 45° but used the 36° setting instead.
- 111) The crew did not commence approach at the location specified by LZC as point of entry into glide slope.
- 112) The crew members failed to report reaching and exceeding the minimum descent altitude.
- 113) The crew failed to respond to engine speed being too low at 200 m during approach with autothrottle which violates the provisions of the Flight Manual.
- 114) The crew members failed to respond to the PIC's not maintaining the prescribed air speed and his exceeding the descent rate of 5 m/s during approach.
- 115) The navigator was calling out altitude readings from the radio altimeter from the level of 300 m rather than 60 m as prescribed by the Flight Manual.
- 116) When the PIC switched the WBE-SWS altimeter to standard pressure, the altitude value indicated by that altimeter increased by 168 m.
- 117) The crew failed to carry out the go-around procedure in accordance with the Flight Manual despite exceeding the minimum descent altitude, which also violated the provisions of the RL-2006 document.
- 118) Simultaneous performing of the PIC tasks and maintaining radio traffic by the aircraft commander imposed an excessive workload on him during the entire flight and particularly in its final phase.

### **Medical issues**

- 119) Death of the crew and passengers resulted from massive multiorgan injuries incurred as result of deceleration forces upon impact of the airplane with the ground and consequent destruction of its structure.
- 120) Absence of ophtalmic glasses recommended by WKLL to the navigator and flight engineer did not affect their activities.
- 121) In the 36 Regiment, instances of conducting flights by pilots without valid hypobaric chamber tests were discovered.
- 122) The health condition of the Tu-154M crew did not contribute to the flight accident.

### **Aviation technology**

- 123) The Tu-154M airplane underwent all the required overhauls and maintenance activities and its service life and time-between-repairs were duly established.
- 124) The irregularities which occurred before April 10<sup>th</sup>, 2010 with respect to both maintenance of the airplane and in-flight operation did not contribute to the accident.
- 125) During the immediate preparation of the Tu-154M airplane for the fatal flight, the maintenance crews of the 36 Regiment performed all their duties correctly.
- 126) All airframe and engine systems were filled up in accordance with the specifications.
- 127) During the entire flight on April 10<sup>th</sup>, 2010, the ARM-406P<sup>165</sup> radio remained switched off, a fact that did not contribute to the accident.
- 128) On April 10<sup>th</sup>, 2010, from the engine start before the departure from the WARSZAWA-OKECIE airport until the impact against the terrain obstacles on the final approach at the SMOLENSK NORTH airfield, the propulsion systems and all systems, installations, and equipment on board of the Tu-154M were operating normally.
- 129) No causality was established between the technical condition and operation and maintenance of the airplane, and the incident.
- 130) The 36 Regiment maintenance crews which performed maintenance operations on the Tu-154M were certified on the basis of the regulations in force in the aviation of Polish Armed Forces.

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<sup>165</sup> Serves as a homing beacon for locating the aircraft after accident.

- 131) The expiry and/or lack of consistency between certain documents governing the FES of the aviation of Polish Armed Force and other standardization documents contributed to irregularities in general adherence to regulations.
- 132) Established irregularities in the operation on the 36 Regiment FES crews with respect to adherence to regulations did not contribute to the accident.
- 133) Given the nature of tasks performed and the number of types and versions of the aircraft operated by the 36 Regiment, the structure and manpower of the Maintenance Section did not guarantee a correct supervision of operating the aircraft and training of the FES personnel.
- 134) Operating within the structures which were unsuitable for the tasks it was performing, pursuant to outdated regulations and with inadequate support by the supervising institutions, the FES of the 36 Regiment performed their duties adequately to the extent of their limited capabilities, and their actions did not contribute to the accident.
- 135) Deploying new avionics and navigation equipment systems on the Tu-154M airplane was conducted without having conducted any impact assessments.
- 136) The airplane's documentation was never translated from Russian into Polish despite a request by the 36 Regiment to that effect. That fact made the FES' and flight crews' job difficult.

#### **SMOLENSK NORTH airfield**

- 137) Despite numerous deficiencies, the SMOLENSK NORTH approach charts were sufficient for a safe approach and landing on the RWY 26.
- 138) The condition of the lighting system was incompatible with the specifications required of visual nav aids.
- 139) The terrain immediately ahead of the RWY 26 threshold was overgrown with trees which were taller than the permissible height of terrain obstacles in that area. The trees:
  - a) obscured the components of the approach lighting system in limited visibility conditions, which impeded visual orientation abilities of the air crews and impaired the AC's ability to monitor the air traffic on approach to RWY 26;
  - b) generated many fixed radar echoes (reflections from terrain obstacles) which might have limited the capabilities of the landing radar, especially in the final approach stage.



c) constituted a serious hazard for the aircraft approaching the RWY 26 threshold as soon as these deviated from the prescribed glide slope, in particular in limited visibility conditions and at night.

**140)** The SMOLENSK NORTH airfield was not adequately prepared to receive aircraft in a manner ensuring safe conduct of air operations.

#### **Air traffic control services**

**141)** The military air traffic controllers did not have the capabilities to maintain short-wave radio communication with the 36 Regiment's flight crews due to the absence of such equipment on their stations.

**142)** Landing Zone Controller (LZC) instructed the Yak-40 crew to commence descent and change course while outside his sector remit and without proper coordination and hand-overs between the neighboring ATC authorities.

**143)** LZC failed to advise the approach type to the Yak-40 and Tu-154M crews.

**144)** LZC failed to advise the overcast and vertical visibility to the Yak-40, Il-76, and Tu-154M crews in spite of his capability of taking the respective measurements at the Inner ATC Post (BSKL), outer NDB, and inner NDB.

**145)** LZC did not demand from the crews (Yak-40, Il-76, and Tu-154M) to respond to all AC commands by stating the current altitude.

**146)** LZC failed to interrupt the approach performed by the Il-76 as soon as the WC deteriorated below the minimum WC for the airfield.

**147)** LZC gave the go-around instructions to the Yak-40 and Il-76 too late.

**148)** LZC failed to consult the Tver airbase meteorologist on duty about the WC at the airfield; nor did he request from his superiors that the SMOLENSK NORTH airfield be closed as soon as the WC deteriorated below the minimum WC for the airfield thus mandating issuance of a STORM warning.

**149)** AC failed to respond to the incorrect radio correspondence conducted by LZC.

**150)** AC was not taking sovereign decisions concerning traffic control.

**151)** Over the past 12 months, LZC acted as LZC only occasionally (9 shifts with only 2 shifts in difficult weather conditions including that on April 10<sup>th</sup>, 2010).

**152)** LZC had neither undergone a break-in training nor passed a practical air traffic control exam at the SMOLENSK NORTH (in violation of item 216 of the FAP PP GosA).

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- 153) AC kept informing the Tu-154M crew about the correct position during approach contrary to the actual position of the airplane in relation to the RWY axis and the glide slope.
  - 154) LZC failed to advise the position of the airplane to the Tu-154M crew when the airplane was outside the area corresponding to 1/3 of the maximum linear deviation from the advised glide slope.
  - 155) LZC failed to interrupt the Tu-154M approach even after the airplane exceeded the maximum deviation from the lower glide slope boundary.
  - 156) LZC issued the command to stop the descent and to level out too late: „Горизонт, сто один” (–Horizon, 101”).
  - 157) AC and LZC were performing their traffic control duties in violation of the provisions of the FAP PP GosA and of the 'Inflight and traffic control radio correspondence guidelines and codes'.

#### **Altitude bail-out systems and emergency services**

- 158) The medical infrastructure of the SMOLENSK NORTH airfield was not capable of providing medical assistance to 96 persons on board of the Tu-154M airplane.
- 159) The local fire brigade failed to conduct efficient rescue and firefighting operations at the SMOLENSK NORTH airfield.
- 160) The Committee did not establish a causality between preparation and use of the crew altitude bail-out systems and the airplane's rescue systems on one hand and the flight accident on the other.
- 161) The 36 Regiment's altitude bail-out services were acting correctly.
- 162) The crew was correctly equipped for the flight and fully trained in deploying the rescue systems they were issued and in taking rational actions in an emergency situation.
- 163) In the 36 Regiment, no altitude rescue training in terms of parachute jumps took place.

#### **3.1.1. Summary of findings concerning aircraft operation and personnel training in the 36 Regiment**

The findings show absence of an effective supervision and control system of aircraft in the aviation of Polish Armed Forces which led to the following irregularities:

- a) The FES structure was incompatible with the needs of the 36 Regiment, in particular with regards to the number of personnel in the Aircraft Maintenance Section. There are 6 types of aircraft in operation in the Regiment, including two versions of M-28

airplanes and two versions of W-3 helicopters; that necessitates familiarity with separate, sometimes completely different sets of documentation. The regular staffing of the Aircraft Maintenance Section of the 36 Regiment comprises the Head of Section, three engineers, each for one of the core specialties (airframe and powerplant, avionics, radio and electronics) and one officer-specialist in aviation logistics. In the aviation technology subcommittee's opinion, given inadequate staffing of the Aircraft Maintenance Section, it was not possible to properly monitor operational maintenance of all aircraft (including analyzing flight control documents and developing preventive actions), carry out the commissary helicopter and airplane test flights prior to HEAD missions, train the ground and flight crews, and plan and supervise other tasks prescribed in the respective regulations (e.g. annual maintenance, technology days).

- b)** Absence of up-to-date, clear regulations setting out the standards for the FES personnel in the aviation of Polish Armed Forces. Following decommissioning of two fundamental documents<sup>166</sup> to that effect pursuant to the order no. 6 by the Air Force Commander of January 1<sup>st</sup>, 2008, no new documents were issued. The 1991 issue of the document –“FES Guidelines of the aviation of Polish Armed Forces” Part 1, WLOP 21/90 does not take into account the changes which took place in the past 20 years which renders most of it obsolete. That actually forces the FES crews in the Air Force units into taking 'adapting measures' (interpretation and application) with respect to certain provisions contained therein to make them useful in today's environment.
- c)** Inadequate staffing with well trained specialists in the 36 Regiment's FES. Continuous restructuring of the Armed Forces and ensuing frequent position changes depleted the ranks of experienced FES personnel. That shortage could not be easily mitigated by recruiting well trained successors as the training centers for lower- and middle-ranking technicians in Oleśnica and Zamość had been disbanded. The NCO academy in Dęblin which was established in their stead offered the students a more general, rather than specialized, military training program. The whole situation deteriorated further when the Military Academy of Technology discontinued educating of management level staff for the Flight Engineering Service. The staffing system failed to take into account the need for a proper personal development of the engineers including such a career path that would enable them to gain hands-on experience as they move up. A serious

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<sup>166</sup> –“Provisional instructions for the aviation engineering service”. Part II. Framework scope of duties and rights of function personnel of the aviation engineering service of units of aviation of the Polish Armed Forces”, Lot. 1877/78; and Provisional instructions for the aviation engineering service”. Part III. Guidelines for planning the activities, records and report in regard of technical service of aviation equipment in units of aviation of the Polish Armed Forces”, Lot. 1878/78.

flaw in the staffing system constituted the failure to recognize differences in the technician positions reserved mainly for the FES officer-ranking personnel. In the wake of the staffing changes in 2004, the lowermost officer job with the FES corresponded with captain's payroll which effectively stemmed the inflow of newcomers. Furthermore, the Tu-154M airplane's degree of technical complexity necessitated, and still does, several years of hands-on experience before one can master its maintenance to a sufficient degree.

### **3.1.2. Summary of findings concerning the flight crews**

The flight crew of the airplane in question was not sufficiently prepared for the task at hand given the complexity of the situation the crew encountered during their last flight.

The aircraft commander, co-pilot, and navigator had been trained hastily, haphazardly, and in violation of the respective training regulations.

Despite obtaining formal certificates confirmed in the orders by the unit commanding officer, the crew did not meet **the criteria for fully trained pilots who are competent in performing the duties required on their jobs**. The crew had little experience in conducting flights in difficult WC using non-precision landing systems such as RSL, 2 x NDB, USL + RSL. Most of the flights the crew conducted during their training process involved excellent WC and the landings were executed with use of the ILS which, in the Committee's opinion, affected the experience level of the crew. Little experience of the flight engineer (in terms of his seniority in that seat) led to his passive attitude during the flight.

The 36 Regiment was missing adequate training facilities, instructors, and time necessary to assure a proper level of training of the pilots of the Yak-40 and Tu-154M airplanes.

The way the process of maintaining operational readiness of the airplane and the crews was organized (training and skill retention) indicates a series of errors which led to a dramatic deterioration of the training and aircraft maintenance levels. The external circumstances, i.e. the relations with the VIP flight commissioning institutions (absence of clearly defined guidelines of requesting, preparation, and organization of the VIP flights) had a further negative impact on the process.

The 36 Regiment operated under a very peculiar set of circumstances:

- High churning rate of pilots resulting from resignations. No mechanisms were developed with a view to extending professional careers of military pilots in general and in the 36 Regiment in particular. Increasingly younger pilots with less and less

experience would qualify as instructors over a shrinking period of time whereupon they would start training their successors.

- The new job system introduced in 2004 to the Polish Military failed to deliver the expected results with respect to the way how Air Force units were operating. It limited the career opportunities for the pilots and led to yet another onslaught of pilots leaving the ranks;
- The pressure by the VIP institutions on their flight requests being executed and the awareness of the importance of the Regiment's tasks amongst the commanding staff and flight crews resulted in taking up the requests which the Regiment was incapable of handling while at the same time maintaining the required flight safety level with the available resources (number of aircraft, experienced pilots, and ground crews). That resulted in exceeding the maximum permissible flight hours and flight times by the crews. In the past years, the commanding staff of the Regiment had been increasingly confronted with the need to reconcile the operational missions with the flight crew training which led to many deficiencies in the aviation training process;
- The Regiment's commanding officers were lacking adequate support by the Air Command in resolving their problems. Despite the reduced number of aircraft and the crews (job redundancies), the number of operational tasks which the Regiment was required to execute remained at the same level. When the commanding officers reported problems to their superiors, the latter would dismiss them as inability to exercise authority. The Committee established that such criteria of personnel evaluation were indeed applied, based on depositions by the former 36 Regiment's commanding officers. Each of them confirmed having reported various problems to the superiors which they eventually had to resolve on their own at the end of the day as any support by the superiors was denied to them. The most telling is the quote from the letter<sup>167</sup> by the 36 Regiment commanding officer to the Commander-in-Chief of the Polish Air Force: **'despite numerous difficulties and risks which my staff is confronted with in their daily duties, I do not expect any precipitating threats to the high quality of transportation tasks and other tasks executed by the Regiment'**.

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<sup>167</sup> Letter no. 1235/08 of November 25<sup>th</sup>, 2008

## **3.2. Cause and Circumstances of the Accident**

### **3.2.1. Cause of Accident**

The immediate cause of the accident was the descent below the minimum descent altitude at an excessive rate of descent in weather conditions which prevented visual contact with the ground, as well as a delayed execution of the go-around procedure. Those circumstances led to an impact on a terrain obstacle resulting in separation of a part of the left wing with aileron and consequently to the loss of aircraft control and eventual ground impact.

### **3.2.2. Circumstances Contributing to the Accident**

- 1) Failure to monitor altitude by means of a pressure altimeter during a non-precision approach;
- 2) failure by the crew to respond to the PULL UP warning generated by the TAWS;
- 3) attempt to execute the go-around maneuver under the control of ABSU (automatic go-around);
- 4) Approach Control confirming to the crew the correct position of the airplane in relation to the RWY threshold, glide slope, and course which might have affirmed the crew's belief that the approach was proceeding correctly although the airplane was actually outside the permissible deviation margin;
- 5) failure by LZC to inform the crew about descending below the glide slope and delayed issuance of the level-out command;
- 6) incorrect training of the Tu-154M flight crews in the 36 Regiment.

### **3.2.3. Conducive circumstances**

- 1) incorrect coordination of the crew's work, which placed an excessive burden on the aircraft commander in the final phase of the flight;
- 2) insufficient flight preparation of the crew;
- 3) the crew's insufficient knowledge of the airplane's systems and their limitations;
- 4) inadequate cross-monitoring among the crew members and failure to respond to the mistakes committed;
- 5) crew composition inadequate for the task;
- 6) ineffective immediate supervision of the 36 Regiment's flight training process by the Air Force Command;

- 7) failure by the 36 Regiment to develop procedures governing the crew's actions in the event of:
  - a) failure to meet the established approach criteria;
  - b) using radio altimeter for establishing alarm altitude values for various types of approach;
  - c) distribution of duties in a multi-crew flight.
- 8) sporadic performance of flight support duties by LZC over the last 12 months, in particular under difficult WC, and lack of practical experience as LZC at the SMOLENSK NORTH airfield.

#### 4. SAFETY RECOMENDATIONS

On the basis of the inquest, the Committee developed the following safety recommendations:

**Prime Minister**

Commission a revision of the documents referred to in section 1.17.3 of this Report with respect to the VIP air transport.

**Prime Minister Office**

**Office of the President of the RP**

**Sejm and Senate Offices**

**Commander-in-Chief of the Polish Air Force**

Draw up coordination guidelines for the process of commissioning VIP air transport by the Institutions which are entitled to commissioning such services from the Air Force Command.

**Minister of National Defense**

**Minister of Foreign Affairs**

**Prime Minister Office**

**Office of the President of the RP**

**Sejm and Senate Offices**

**Air Force Commander**

Draw up coordination guidelines between the commissioning institution and the flight dispatcher for the VIP flights so as to give the flight dispatcher a possibility to perform a safety evaluation of such task.

**Minister of Foreign Affairs**

***in collaboration with Minister of National Defense***



Establish procedures for acquisition of weather information from the airfields which do not transmit international weather data, with respect to conducting flight missions to such airfields.

**Minister of National Defense**

Consider amending the “HEAD aircraft flight instruction” with a view to dispensing with the obligation to conduct commissary test flights of the aircraft equipped with state-of-the-art on-board recorders.

**Chief of Staff of the Armed Forces**

1. Verify regulations pertaining to the manner and scope of supervision by Air Force Command of training activities in the 36 Regiment.
2. Verify the archiving systems of maintenance documentation of the aircraft operated by the aviation of Polish Armed Forces. One of the criteria that a correct system must meet is the possibility to retrieve the complete maintenance history of each aircraft from its commissioning to decommissioning.

**Commander-in-Chief of the Polish Air Force**

1. Verify validity of certifications of the 36 Regiment flight crews.
2. Draw up new guidelines for instructor pilot training and certification. Inflight instructor pilot training should be preceded by a centralized theoretical training ending with an exam. The Air Force Commander should be the authorized body for awarding instructor pilot certificates.
3. Draw up and implement such theoretical and practical training curriculum for the Tu-154M crews which takes into account the current aircraft systems and involves training on simulators.
4. Draw up a document mandating the use of flight recorder data in the flight training process and in operational flights for all types of aircraft.
5. Introduce periodic lectures and training workshops on CRM, MCC and ORM in specialized training facilities.

6. Draw up multi-crew coordination manuals (for both flight and cabin crews) containing a set of standard crew procedures in each flight phases including emergency situations.
7. Draw up the annex to the “Polish Air Force flight manual” to set out the guidelines for conducting multi-crew flights. Include multi-crew specificity also in the regulations and guidelines referred to by the “Polish Air Force flight manual”. Consult EU-OPS regulations for that purpose.
8. Introduce provisions into the “Polish Air Force flight manual” and the “HEAD aircraft flight instruction” which mandate developing weather forecasts and notices for the HEAD flights by the Hydrometeorological Service of the Polish Armed Forces.
9. Develop guidelines enabling the flight dispatcher to set out the minimum conditions for a flight at a higher level than the minimum WC of the crew depending on the difficulty of the task, available aid equipment at destination, and crew experience.
10. Develop operational supervision guidelines for international flights (including maintaining radio contact).
11. Conduct a training on 'Functional duties with respect to meteorological support for the HEAD flights' with the Air Operations Center and traffic controllers (coordinators).
12. Verify the altitude bail-out training implementation with respect to parachuting skills of the flight engineering staff.
13. Have the documentation of the aircraft operated by the 36 Regiment translated into Polish or organize language courses for the flight and ground crews.
14. Verify the quality assurance system in place in the 36 Regiment.
15. Consider requesting from OKB 'Tupolev' a change in the location of the ARM-406P radio and its antennas on the Tu-154M tail number 102.
16. Consider the need to operate the Tu-154M #102 in various cabin configurations. If necessary, commission with OKB „Tupolev” the development of the respective documentation to enable reconfiguration of the cabin by the 36 Regiment's personnel.
17. Draw up a detailed scope of competencies and duties of the airplane and helicopter test flight committee.
18. Adjust the FES structures of the 36 Regiment in keeping with the tasking of the Regiment.

**Commander-in-Chief of the Polish Air Force**  
**and Chief of Inspectorate of Armed Forces Support**

1. In the aircraft operated by the aviation of Polish Armed Forces which are obligated to maintain high range communication, commission deployment of such means of communication that allow to maintain such communication during international flights.
2. Develop guidelines and means for the flight crew technical training process, establish supervision mechanisms of the implementation and verification of such training and certifications, and identify the responsible body.
3. Verify the FES personnel qualifications for airborne duty.

**Chief of Inspectorate of Armed Forces Support**

1. Verify the criteria for selection and qualification of the FES personnel for supervision-free aircraft servicing.
2. Draw up a new document setting out the standards for the FES in the aviation of Polish Armed Forces in line with the changes to the Armed Forces structure and amendments to the relevant documents.
3. Verify the service manual (RO-86) of the Tu-154M #102. Issue the proper document mandating implementation of the updated service manual in the aviation of Polish Armed Forces. Decommission outdated documentation.
4. Develop guidelines mandating that the documents confirming preparation of the aircraft for the mission be left at the airport of departure. Refer to EU-OPS, EASA Part M, Part 145.
5. Examine the existing system of acquiring and implementing the maintenance bulletins and other documents enabling changes in the Tu-154M aircraft maintenance. Coordinate the distribution rules with OKB 'Tupolev'. Verify the bulletins and other issued documents.

**Air Force Chief of Training**

Conduct consistent aerospace medical training as an integral part of the flight training for the Polish Armed Forces' flight crews.

**Commanding Officer of the 36 Regiment**

1. Develop the guidelines for air mission preparation and for process documentation. Consult the EU-OPS.
2. Develop the guidelines for classification of airports and airfields which may be used as air mission destinations.
3. Develop the guidelines of transmission to the 36 Regiment traffic coordinator of warnings about dangerous weather phenomena and dangerous weather conditions by the air crews.
4. Have the specialized training of the FES of the 36 Regiment commissioned with specialized facilities in Poland and/or abroad.
5. Develop a Minimum Equipment List (MEL) which would enable to operate the Tu-154M with the defects listed on MEL.
6. Establish a database of non-labeled on-board equipment, such as passenger seats, sofas, tables, passenger compartment décor items, galley equipment etc.
7. Draw up a new operating manual for the WARSZAWA-OKĘCIE military airport.

**Chief of Hydrometeorological Service Headquarters of the Armed Forces**

1. Draw up guidelines for organization and implementation of meteorological support for the airports and airfields which were designated as HEAD mission destinations and which do not have meteorological support.
2. Improve training quality of the meteorologists in the aviation of Polish Armed Forces taking into account the use of modern weather data sources.

**Chief of Military Medical Service**

Establish a system for monitoring the validity of hyperbaric chamber certificates and of the recommendations of the military medical commission by the subordinated flight personnel and enforce keeping of the relevant records in the Air Force units.

**Russian Federation**

Consider supplementing the AIP RF&CIS with the provisions on planning and conducting flights outside the classified airspace including the information exchange procedure.

## **5. ANNEXES**

Annex 1 – ~~Tu-154M flight trajectory~~".

Annex 2 – ~~Description and examination of the on-board systems of the Tu-154M 101 aircraft~~".

Annex 3 – ~~Aircraft configuration at the time of the accident~~".

Annex 4 – ~~Aircraft impact geometry~~".

Annex 5 – ~~Description of the aircraft damage~~".

## **SIGNATURES OF THE COMMITTEE MEMBERS**

|               |     |     |                         |
|---------------|-----|-----|-------------------------|
| Chairman      | 1.  | /-/ | Jerzy Miller            |
| Vice Chairman | 2.  | /-/ | Mirosław Grochowski     |
| Secretary     | 3.  | /-/ | Agata Kaczyńska         |
| Members:      | 4.  | /-/ | Robert Benedict         |
|               | 5.  | /-/ | Bogusław Biernat        |
|               | 6.  | /-/ | Dariusz Dawidziak       |
|               | 7.  | /-/ | Leszek Filipczyk        |
|               | 8.  | /-/ | Bogdan Fydrych          |
|               | 9.  | /-/ | Wiesław Jedynak         |
|               | 10. | /-/ | Ryszard Krystek         |
|               | 11. | /-/ | Artur Kułaszka          |
|               | 12. | /-/ | Agnieszka Kunert-Diallo |
|               | 13. | /-/ | Maciej Lasek            |
|               | 14. | /-/ | Krzysztof Lenartowicz   |
|               | 15. | /-/ | Piotr Lipiec            |
|               | 16. | /-/ | Edward Łojek            |
|               | 17. | /-/ | Dariusz Majewski        |
|               | 18. | /-/ | Dariusz Majewski        |
|               | 19. | /-/ | Władysław Metelski      |

20. /-/ Sławomir Michalak
21. /-/ Mirosław Milanowski
22. /-/ Cezary Musiał
23. /-/ Janusz Niczyj
24. /-/ Maciej Ostrowski
25. /-/ Jacek Przybysz
26. /-/ Jerzy Skrzypek
27. /-/ Kazimierz Szostak
28. /-/ Waldemar Targalski
29. /-/ Olaf Truszczyński
30. /-/ Mirosław Wierzbicki
31. /-/ Andrzej Winiewski
32. /-/ Wiesław Wypych
33. /-/ Stanisław Żurkowski
34. /-/ Marek Żylicz