Ministerstwo Obrony Narodowej
Podkomisja ds. Ponownego Zbadania Wypadku Lotniczego

STATUS REPORT ON THE STATE OF INVESTIGATIVE WORKS AS OF APRIL 4, 2019

1. THE ESTABLISHMENT OF THE SUBCOMMITTEE AND ITS WORKING CONDITIONS

The Subcommittee established for the Re-examination of the Aircraft Disaster (*Pol.: Podkomisja do Ponownego Zbadania Wypadku Lotniczego*)

(henceforth referred to as the "Subcommittee") was appointed by the Minister of National Defense of the Republic of Poland in 2016 as a result of a large number of irregularities, errors, omissions, and even intentional concealment and falsification of evidence by the State Aviation Accident Investigation Commission (referred to hereafter as the "KBWLLP"), chaired by Mr. Edmund Klich and Mr. Jerzy Miller, and which operated in the years 2010-2011 (referred to hereafter as the "Miller Commission"). In addition, information and evidence was disclosed, which was not considered by the Miller Commission and which may affect the determination of the circumstances and causes of the aviation disaster which occurred in Smolensk, Russia on April 10, 2010.

The Technical Report presented by the Subcommittee on April 11, 2018, summarized the work of the Subcommittee completed or commenced by April 2018. The report focused on the most important findings, in particular, facts and evidence that were not considered in the Miller Commission's final report and its findings, which in the light of conducted research turned out to be untrue. The Technical Report stated that the main cause of the Tu-154M No.101 aviation disaster was an explosion, which, according to the Subcommittee's findings to date, occurred while the aircraft was still airborne, thereby causing the destruction of the aircraft's structure and death of all its passengers.

The list of supportive evidence presented in the Technical Report, as well as research and experiments carried out by the Subcommittee, was not final, which was stated in the following document (a link to the text of the Report can be found here):
http://podkomisjasmolensk.mon.gov.pl/pl/1_36.html

2. WORK ON THE DRAFT FINAL REPORT

After the presentation of the Technical Report, the Subcommittee continued with its work in order to better identify the causes and circumstances of the aviation disaster and present its findings in the final report.

The Subcommittee analyzed research conducted in 2013 by the Police Department's Central Forensic Laboratory (*Pol.: Centralne Laboratorium Kryminalistyczne Policji – "CLKP"*) and revealed the presence of traces of explosives in 107 out of 215 samples taken. These tests, carried out using liquid chromatography techniques, confirmed earlier screening test results conducted in 2012, and further confirmed in 2019 by lab tests carried out by the Forensic Explosives Laboratory, a laboratory subordinated to the British Ministry of Defense.

The presence of explosives on the aircraft wreckage was detected using various methods, at both Polish and in foreign locations. Among aircraft fragments on which the CLKP revealed the presence of explosives, there was also a section of the left wingtip, which the Subcommittee indicated in the Technical Report as the location on which an explosion had occurred.

The explosion, as the cause of the studied aviation disaster, is also indicated, among others, by investigations conducted by the Subcommittee on the traces of damage on parts of the aircraft identified at the site of the wreckage, in particular, the left wingtip and a part of the left fuel tank caisson, located under Lounge 3 of the Tu-154M aircraft. An important piece of evidence includes dozens of burnt and partially melted-down parts of the aircraft found by Polish archaeologists nearly 110 meters before the site of the first impact of the aircraft with the ground. Another important premise is also the scattering of aircraft parts over a width of some 80 meters at a distance of nearly 120 meters before ground impact had occurred. The likelihood of this thesis is also indicated by the analysis of the positioning of the left passenger door of the Tu-154M aircraft, which was found driven into the ground and the degree of destruction of the bodies of the victims and their location/positioning over the wreckage site. The explosion is also confirmed by witnesses' testimonies gathered by the Subcommittee, including Poles who witnessed the explosion. The information obtained by the Subcommittee does not confirm the assumption popularized by the military prosecutor's office, that soldiers who had contact with explosive materials found on the aircraft's remains had earlier travelled on the plane after its renovation and left these traces behind. Soil samples taken at the site of the wreckage, conducted by the CLKP in 2013, ruled out the presence of explosives. Works are being carried out in accordance with the agreed schedule.

The list below shows some of the research areas that have been the subject of the Subcommittee's work during the past year.

2.1. Aircraft overhaul and flight preparation

The Subcommittee conducted its analysis of documentation related to repairs, break-downs and preparation for the implementation of assignments to be undertaken by the Tu-154M aircraft, designed to transport government VIP's, as well as the activities of institutions and persons having influence over it. In particular, certain decisions, which led to entrusting the repair of the aircraft to

the *MAW-Telecom* and *Polit-Elektronik* consortium - indicated by the Russian side - and cooperating with the Aviacor facilities in Samara, were analyzed. On September 9, 2009, the Undersecretary of State at the Ministry of National Defense informed the Minister of National Defense, that:

"The repair of the Tu-154M aircraft is also supervised by the II Department of the Federal Service for Military and Technical Cooperation with Foreign Countries and the Russian Federation (Pol.: II Departament Federalnej Służby ds. Współpracy Wojskowo-Technicznej z Zagranicą Federacji Rosyjskiej – "FSWTW"), which has agreed to carry out of repairs of the Tu-154M aircraft at the OAO Aviacor Samara facility".

The Federal Military and Technical Cooperation Service (FSWTW) is headed by officers of the Russian special services.

In this context, the role of the leadership of the Ministry of National Defense and the special services was analyzed. The analysis of flight preparations on April 10, 2010 was also carried out, including the activities of the Chancellery of the Prime Minister, the COP MON (*Pol.: Centrum Operacji Powietrznych Ministerstwo Obrony Narodowej*), and technical and security services.

On this basis, the Subcommittee decided that the management of the Polish Ministry of Defense (*Pol.: MON*) should have known that, when selecting a consortium indicated by the Russian side, it is transferring the repair of aircraft transporting the most important persons in the country to the hands of the Russian special services. The Subcommittee also determined that the persons responsible for organizing the departure details of the President of the Republic of Poland were not familiar with HEAD instructions and thus did not apply them to the organization of the flights. In particular, when preparing the Tu-154M flight with the President of the Republic of Poland on board on April 10, 2010, not all the required decisions were issued, for example, the need for a spare, back-up aircraft. In this respect, the proceedings preceding the Tu-154M flights with Prime Minister Donald Tusk on April 7, 2010 and with President Lech Kaczyński three days later differed substantially, also with regard to arrangements for controlling the airport in Smolensk.

2.2 The Hearings

Ongoing analysis and verification of more than 15,000 documents of the Public Prosecutor's Office of the Republic of Poland is being carried out, as a result of which applications are underway for supplementing earlier-submitted materials and witnesses are being questioned again by the Subcommittee. To date, 119 witnesses of the incident have been questioned (see Table 1).

On the basis of these hearings, findings were reached by the Subcommittee in the following areas:

1. The organization of President Lech Kaczyński's visit to Katyń
2. Flight security of the Tu-154M flight on April 10, 2010
3. Prevailing weather conditions in Smolensk on April 10, 2010
4. Russian Federation security services' operations
5. Course of events associated with the aviation disaster
6. Acquisition and verification of film materials and photographs

Table. 1. Witnesses questioned

1.	Media representatives present at the scene of the incident	36
2.	Soldiers and employees of the former 36th Special Regiment of Aviation Transport (*Pol. acronym "SPLT")*	26
3.	Soldiers and employees of the Center for Hydrometeorology (*Pol.: Centrum Hydrometeorologii*)	18
4.	Soldiers and employees of the Air Operations Center (*Pol.: Centrum Operacji Powietrznych*)	13
5.	President Lech Kaczyński's chancellery staff	10
6.	Government Protection Bureau officers (*Pol. Acronym - "BOR")*	6
7.	Soldiers and employees of the Air Transport Branch *(Pol.: Oddział Transportu Lotniczego)*	3
8.	Employees of the Embassy of the Republic of Poland in Moscow	3
9.	"CLKP" officers	2
10.	Soldiers of the 8th military base in Balice	1
11.	Air Force Command *(Pol.: Dowództwo Sił Powietrznych)*	1
	Total	**119**

2.3 Reconstruction and model building work

During the course of its research activity, the Subcommittee carried out a number of reconstruction and model building works. One hundred and thirty (130) studies were prepared (and successively updated) concerning the reconstruction of the aviation disaster of April 10, 2010, which are presented in the tables below.

Table. 2. List of reconstructions

1.	Reconstruction of elements of the Tu-154M aircraft wreckage	55
2.	Analyses of factual manipulations	23
3.	Distribution of aircraft debris at the scene of the disaster	16
4.	Weather conditions	13
5.	Terrain damage	13
6.	Witnesses' reports	10
	Total	**130**

Including reconstructions of the following elements:

1. Left and right wing slots of the Tu-154M aircraft.
2. Left wing nosepiece
3. Left wing girders and center wing box
4. Structural "ribs" and longitudinal bracings of the left wing and center wing box.
5. Top and bottom sheathing of the left wing and center wing box.
6. Left and right side of the horizontal stabilizer.
7. Leading edge of the vertical stabilizer
8. Caisson console construction of the detachable wing section from the point of the torn-off wing tip.
9. Top sheathing of the fuel tanks – standard (main) fuel tanks and ballast tanks.
10. Left wing detachable deflector structure
11. Left wing detachable flap structure
12. Left and right sides of the TU-154 M fuselage
13. Underside and roof section of the TU-154M fuselage.
14. External doors of the TU-154M aircraft

15. Cold and warm air installation on the left section of the center wing box.
16. Left wing and center wing box cavitation installation.
17. Turbo-cooler and radiator of the left nose section of the center wing box.
18. Specification and inventory projection on a field grid map (sectors 1-15), positioning of TU-154M aircraft debris.

Table 3. Reconstruction models of elements of the TU-154M air craft.

No	Reconstruction	Scale
1.	Reconstruction of the second section of the wing's center slot, based on recovered debris fragments models	1:5
2.	Aircraft degradation scheme of basic sections of the aircraft structure	1:100
3.	Reconstruction (from recovered debris fragment models) of fuel tank caisson No. 3 of the detachable section of the left wing at the point of the breakthrough	1:5
4.	Reconstruction (from recovered debris fragment models) of the top sheathing of fuel tanks No.1 and No. 4	1:5
5.	Reconstruction of structural girder No.1, where the left wingtip had been torn off	1:1
6.	Reconstruction (from recovered debris fragment models) of the left wing structure at the point of the breakthrough	1:5
7.	Reconstruction (from recovered debris fragment models) of the left wing top sheathing at the point of the breakthrough	1:5
8.	Model of a segment of the "Bodin birch tree" at the point of its fracture	1:1
9.	Reconstruction illustrating the decomposition of the left part of the center wing box structure	1:50

The reconstruction models were helpful in the preparation of the analyses concerning:

1) the destruction of the left wingtip of the TU-154 M aircraft,
2) the disintegration of the left-wing structural caisson of the TU-154M aircraft,
3) the disintegration of the left portion of the center wing box,
4) the mechanism of the disintegration of the TU-154 M aircraft fuselage.

2.4 Analysis of injuries and disposition of bodies of the victims of the Smolensk tragedy

Analyses were carried out to arrive at conclusions as to the causes of injuries and the disposition of bodies and their fragments at the scene of the aircraft disaster.

The Subcommittee used reliable sources, of the most possible primary kind. It received such evidence after almost two years of activity - at the end of the year 2017. This was done during the inspection of the scene of the aircraft disaster.

The Subcommittee verified some 7,282 photographs of various objects and the place of the aircraft disaster, with descriptions of its activities included in 40 protocols of inspection from the disaster site, all in terms of the compatibility of the descriptions and the number of found remains. The subject of the assessment was also checked in terms of compliance with and correctness of its operations with International Civil Aviation Organization (ICAO) recommendations.

Beginning in 2018, the Subcommittee began determining the location of the remains of the victims at the scene of the aircraft disaster, which is one of the most important stages of its work, in order to investigate the causes and course of the incident. The Subcommittee has in its possession verified, source iconographic material, inspection protocols from the site of the aircraft disaster, and 9,945 pages of partial medical documentation files in the form of 96 expert opinions from audits of medical documentation prepared by the Russian side.

The Subcommittee found that there were descriptions of 464 remains of the victims in the documentation. By the end of 2018, the Subcommittee identified and determined the precise location of 212 remains of that number. The data obtained was plotted on maps prepared for each of the victims.

In 2017 and 2018, members of the Subcommittee participated as observers in repeat post-mortem examinations ordered by the Prosecutor's Office. The Subcommittee awaits receipt of the complete documentation of the autopsies and examinations that had been conducted, which are at the disposal of the Prosecutor's Office. In addition, the Subcommittee requested the Prosecutor's Office to provide it with access to medical documentation, previously excluded from the investigation file, comprising about 120 volumes of files and about 1,600 primary source documents.

Work was also carried out on statistics of injuries to the victims' bodies. A comprehensive list of injuries was prepared for each victim, with a simultaneous determination of the severity of injuries incurred according to a unified, numerical scoring system (excluding burn injuries, which will be the subject of a separate analysis and the occurrence of numerous debris fragments found in the bodies of some of the victims). The Subcommittee has established the seats occupied by 63 out of the 96 passengers in the aircraft; work in this area is continuing.

Work conducted to-date and analyses as concerns the victims exclude the possibility of a gradual disintegration and destruction of the passengers' bodies solely as a result of their movement over the ground surface or the destructive impact on the victims with obstacles in the field, including trees. The location of bodies and fragments of bodies of crew members excludes the effect caused by the crushing of the cockpit due to first contact with the ground and confirms that the cockpit has been earlier torn apart and that crew members' bodies were subsequently thrown out of the cockpit.

The Subcommittee ruled out aviation fuel as a high-energy factor causing such extensive damage to the bodies. The Subcommittee, together with forensic experts, conducted a number of experimental studies on the effects of the detonation of explosives on the human body. The results of this research will be used as comparative material for the analysis of injuries incurred by victims of the disaster.

2.5 The Flight recorders

The Subcommittee examined documentation available on the recovered flight recorders at the scene of the aircraft disaster and the circumstances surrounding the subsequent multiple copies of the recordings on these devices. This information is scattered about in over 760 volumes of the

Prosecutor's files (147,432 cards), in the materials compiled by the Miller Commission (including 118 CDs and DVDs) as well as in Russian documents.

As flight recorders are a key element in the analysis of the causes and course of any air disaster, ICAO rules strictly require that the "black boxes" be opened and opened only in the presence of all interested parties. In the case of the Smolensk aircraft disaster, all recorders were recovered and collected without the presence of representatives of the Republic of Poland.

In the materials that the Subcommittee had the opportunity to familiarize itself with, there are two protocols from the time of the recovery of the black boxes by the Russians, differing in the time of their recovery and description of the recorders. There are no protocols on finding the QAR ("quick access recorders").

The MARS-BM voice recorder started to be reviewed and listened to prior to the arrival of Polish specialists, and the KZ-63 was declared as lost, although fragments of its casing located among intact parts of the flight recorder's immediate surroundings are visible on photos taken after the first hours since the crash. In the available documentation, there are no flight recorder opening or removal of original recorded data protocols signed by representatives of the Polish side. The way in which the flight recorders were protected at the crash site is evidenced by the fact that initially, the Polish side received an American TAWS device from Russia instead of the Polish ATM recorder.

The Subcommittee analyzed the catastrophe flight data recordings found on board the TU 154-M on the Russian flight data recorder (*Polish acronym: MŁP)* and the cockpit voice recorder (*Polish acronym: MARS*) as well as the operational flight data recordings found on the Russian KBN ("flight data recorder") and the Polish-made ATM ("quick access recorder") equipment.

2.5.1 The Flight data recorders

The following data was used for analysis:

- The ATM flight records from April 6, 2010 and April 7, 2010 and three records from April 10, 2010;
- Records supplied by the Russians from April 10, 2010 - two from the recorder of the MŁP and one from the KBN ("flight data recorder").

During the analysis, records were used of the last 50 errors and alerts from the TAWS ("Terrain Awareness Warning System") device and the memory reading of the FMS ("Flight Management System") navigation computer, which were attached to the Universal Avionics report.

The Subcommittee studied the readings of the ATM recorder directly from the compressed and un-rescaled copy of the device's memory from April 19, 2010. This reading enabled the first reconstruction of the full ATM record (the Miller Commission used a version prepared from a combination of data fragments from the ATM and MŁP recorders).

For further work with this set of data, utilization was made from the scaling of individual sensors made during the aircraft renovation in Samara and the terrain profile for the last 10 km prepared on the SRTM1 ("Shuttle Radar Topography Mission") basis.

Investigating flight parameters (50 continuous parameters, 55 discrete), four tape tracks from the MARS recorder, 5 TAWS alarms and FMS memory content required time synchronization of these individual recordings. Optimal shifts were determined with the use of statistical functions on the basis of data available to the Subcommittee. Interpretation of the obtained results took under consideration the location of the sensors in the aircraft, the range and accuracy of measurement, as well as limited transmission bandwidth between the sensors and recorders and the relationships between the individual parameters.

The digitalization of graphs from the MAK report, its appendix and reports from Russian research carried out in 2011-2012 showed a consistent shift of parameters presented there by about 0.5 to 1 second in relation to the copies in possession of the Subcommittee.

It was also found that the only copy of the KBN flight register recorder made available to the Polish side is shorter by 4 seconds than the one presented in the MAK report, taking into account the shift. The order of messages, alarms and failures as well as flight parameters in the last 15 seconds of the flight (in the scale of time synchronized to UTC time and distance from the threshold of the runway) was established precisely. This allows for a comprehensive analysis of data from many sources, including satellite images in possession of the Subcommittee.

2.5.2 The Cockpit Voice Recorder (CVR)

Separate investigations were made on materials described as copies of recordings from the Russian catastrophe voice recorder ("MARS").

The Subcommittee read and analyzed this material confirming the accuracy of the readings made by the Institute of Forensic Research in Krakow (*Pol.: Instytut Ekspertyz Sądowych im prof. dra Jana Sehna w Krakowie – "IES"*),

and the CLKP. The Subcommittee also pointed out the lack of original tape readings among the available documents, to the unreliability of the recordings and to outside interference.

Apart from comparative analyses of the results contained in the available reports and expert opinions of various research centers, the Subcommittee conducted its own research of the three copies at its disposal:

- dated April 12, 2010, prepared without the participation of representatives from the Polish side;
- dated May 31, 2010, (in which there are more than ten seconds missing);
- dated June 9, 2010.

In addition to sound recordings recorded on three separate channels, the fourth channel of the MARS recorder records the clock pulses in half second intervals. It is therefore possible to determine the chronology of recorded events with somewhat more accuracy. There are 41 identical fragments which have been separated out in terms of what was said or commands given.

A drastic difference, exceeding 10 seconds, was found between the MAK transcription and the transcriptions established by Polish research centers.

The construction of the MARS-BM recorder is distinguished by a drive system which is not "symmetrical" for both directions of the magnetic tape run. This is a consequence of the use of an engine-spring drive system.

The consequence of the asymmetry of the drive system is the asymmetry of the tape-run speed, which means that we are dealing with faster and slower tape movement, according to the direction of motion. This design construction feature of the unit allowed for additional verification of the continuity of recording with the help of specialized software that allows one to trace the frequency structure of recorded sounds and its time-condensing changes within the framework of the entire recording. An analysis of the separated characteristic frequencies and their harmonics was performed, with the separation of discontinuities indicating outside interference in the recording. Such an analysis was not performed by any of the centers that had previously examined copies of recordings from the MARS-BM recorder.

Using computer simulations and over 30 thousand photos from the disaster site, an analysis is underway of the compatibility between the different copies of the recordings, the integrity of the parameters recorded by them, their convergence in the last seconds of the flight with the documented destruction of area greenery and the distribution of destroyed/scattered aircraft parts. Such tests allow for verification of the records on the basis of independent sources, which is exemplified by the fact established by the Subcommittee that the magnetic direction recorded by the recorders is incompatible with the place where the aircraft struck the ground. The trajectory indicated by the data found on the ATM recording runs at 6 meters above the terrain, which means that the left wing of the aircraft would have to had cut down trees growing there at a height of 1-2 meters, which was not the case. The lack of such damage places into question the accuracy of the data stored in the ATM unit. Together with the above-mentioned irregularities, this indicates the unreliability of the Russian recorders' taped material and brings forth the necessity to analyze each parameter separately.

Investigations of the flight recorders' data are being conducted in coordination with specialized centers in Sweden, Great Britain and the USA. This is necessary to perform a simulation of the last seconds of the flight based on verified data.

2.6 The Engines

Works connected with research and analysis of the Tu-154M aircraft engines are in progress in order to prepare a comprehensive expertise in this field. The available primary source material indicates the lack of investigative work conducted by the Polish side at the site of the wreckage at the same time as the Russians performed their work. More in-depth work was conducted only after the engines were transferred to the apron. This did not apply to all of the engines and did not include laboratory tests of damaged parts. As concerns the jet propulsion system, the Subcommittee supplemented the factual documentation on the Tu-154M No. 101 with new source material from the site of the disaster and the concrete apron on which the wreck is stored. Calculations of gyroscopic moments occurring in the last seconds of the flight were made. Preliminary calculations indicate a significant impact of these moments on the trajectory of the flight fragments of the plane and the right engine mounts. The analysis of forces acting on engine mounting nodes from gyroscopic moments was performed. Calculation works of moments of inertia of the fan rotor blades according to the method provided by the European Space Agency (ESA) and research on explaining the reasons for the twisting of the low-pressure system front shaft (*UNC – Pol.: ...przedniego wału układu niskiego ciśnienia*) are in progress. Works are also being carried out to determine the forces and stresses generated in the low pressure left engine compressor blades during the rapid rotation deceleration of the low-pressure compressor rotors in the last seconds of engine operation. This confirms engine failure during the flight. It is also indicated by the records of the engine operation recorders and numerous and reliable accounts of witnesses of the disaster, who saw a flame and smoke coming from the engines and heard an intermittent and unnatural sound.

2.7 Cooperation with the National Institute for Aviation Research

The Subcommittee is working closely with the National Institute for Aviation Research (NIAR) in the USA, which, using the Non-linear Finite Element Method, can accurately model, reflect, and predict the consequences on aircraft design and its passengers with ground impact or an impact preceded by an airborne explosion. The NIAR is recognized by the Federal Aviation Administration (FAA) as a leading provider of comprehensive virtual accident calculations that fully and accurately reflect the course and effects of these studied accidents. NIAR's methodology is tested experimentally from the basic level of materials used, through aircraft components and combinations thereof, up to the entire aircraft structure.

The NIAR, commissioned by the Subcommittee, is in the process of constructing an accurate model of the Tu-154M No. 101 on the basis of data obtained from scanning the entire twin Tu-154M No. 102, with an accuracy of one hundredth of a millimeter with full dimensioning. The next research stage will be a simulation of the behavior of the aircraft in accurately reflected conditions such as those that prevailed on April 10, 2010 (the location of the aircraft and tree stand, the characteristics of the soil and terrain).

The subject of detailed research and measurements were also the Tu-154M aircraft passenger seats.

For the purposes of simulations and studies planned by the NIAR, an exact 3-D model of the birch tree was made, which according to the Russians, came into contact with the left wing of the Polish aircraft during the flight. This was done on the basis of available photographs from Smolensk, including those taken by prosecutors from Poland.

The remaining experiments were conducted in cooperation with other research institutions in order to characterize and model the behavior of aircraft materials during an explosion.

The Subcommittee and the NIAR are working independently to recreate the horizontal and vertical trajectories of the last minutes of the flight by using aerodynamic models and comparing available evidence, including the location of remains found on the ground at a significant distance from the site of the aircraft disaster.

The Subcommittee provided NIAR with the necessary documentation for their research (including 15,000 photographs, 3,000 – 360-degree photographs; films; 50 highly accurate, sub-millimeter 3-D laser scans by

independent Polish companies; 12,500 measurements taken with very accurate digital measuring devices). This is documented on 18,888 pages, which were submitted to the NIAR, including the most important subject areas, including the structure and behavior of the Tu-154M aircraft and its left wing, which according to the Russian side, was to have made physical contact with a birch tree. This work is verified by independent measurements and scans carried out by NIAR staff of the other Tu-154M twin aircraft, the No. 102.

The Tu-154M No. 101, which crashed in Smolensk, disintegrated into more than 30,000 pieces and its passengers were overloaded by a g-force load factor of up to 100. The Miller Commission reiterated the MAK report's thesis that such significant damage was the result of flight towards the ground at a small angle. During other such aircraft disasters, planes flying at a small angle and hitting soft ground disintegrated into at most a few larger parts; a significant furrow in the ground or crater was visible where the fuselage made contact with the ground and typical g-force load factors acting on passengers was 25 g or less.

In order to analyze the hypothesis of the nature of hitting the ground, a series of simulated crash hits with the ground is planned. These will be carried out by the NIAR, which has recognized experience in this field. For this purpose, a 3-D model of the aircraft and material characteristics of the samples taken from the Tu-154M No. 102, located in Minsk Mazowiecki, will be used. The aim will be to scientifically explain the scale of damage and to obtain detailed information on the forces to which the passengers were exposed. This information will help to explain the scale of injuries suffered by the victims of the disaster.

Using the same Tu-154M model, the NIAR will carry out activity simulations to answer the question about the impact of the left wing with the birch tree with a diameter of 45 cm, which was described in the MAK report.

The NIAR reconstructed 90% of the Tu-154M model utilizing the CAD system. All the CAD data was used for applying the finite element method (*FEM- Pol. Acronym – "MES"*). The individual elements were connected to each other, just like in the real aircraft. Contact surfaces were defined between the individual components. At this stage, there are more than 10 million elements involved in the application of the finite element method (FEM). Work is to be completed by the end of 2019.

The results of the tests and simulations performed by the NIAR will be presented in the final report.

2.8 The work of the numerical modeling study group

The Subcommittee is also conducting research using advanced techniques of numerical modeling of experiments and physical phenomena.

The Numerical Modeling Research Group has been established to directly supervise and perform numerical modeling studies. Most modern research methods are being employed, combining numerical representation of reality with aerodynamic, mechanical and material science expertise.

Research groups have been set up in the field of reverse engineering and materials' characteristics. Other research activities are also being conducted in cooperation with various scientific institutions.

Structural damage to the Tu-154M aircraft is compared with the results of experiments carried out in wind tunnels using numerical modeling techniques in order to obtain a travel trajectory in accordance with the laws of physics during the last seconds of flight. Material characteristics of metal alloys and other materials of which the Tu-154M was constructed are being carried out in order to numerically reflect the behavior of the Tu-154M and its fragments when hitting field obstacles, such as trees, as well as to determine the interaction during the aircraft's impact or its fragments with the ground and the impact of an explosive wave on the Tu-154M structure.

The material dynamic characteristics of the ground (soil) in Smolensk is also being analyzed to reflect the numerical model of the impact of the aircraft and its fragments with the ground.

Work is in progress on the material dynamic characteristics and numerical model prepared by the NIAR for live trees based on an experimental program. This is being done to verify the destruction of the aircraft or its fragments when hitting trees. The conformity of numerical simulations with these experiments exceeds 95%.

Verification experiments have been carried out to confirm that the Tu-154M door as found in Smolensk was driven into the ground, almost perpendicularly to the ground surface, to a depth of 1 meter, with damage concentrated on the edge of the door hitting the ground. The results of NIAR's analyses to date have been verified by the Subcommittee's foreign expert partners.

The final conclusion confirms that there was an explosion in the fuselage - a force that created the conditions necessary to vertically drive the Tu-154M door into the ground at the moment of the incident. However, none of the test methods employed of driving the door into the ground through the fuselage has provided the same result as was the actual case in Smolensk, i.e. exhibiting greater damage at the edge of the impact, as the door does not penetrate the ground vertically, but sculpts a hole in the ground and stops at its bottom in a horizontal position.

2.9 Explosive experiments

In 2018, the Subcommittee conducted experiments on models of the wing segment (scale of 1:4 and 1:1) applying to it a simulation of aerodynamic forces. The results show that the wing with fuel in it and fuel vapor can be destroyed by explosive charges (without an explosion of the fuel occurring) with similar characteristics of structural damage as observed at the wingtip connection breakthrough, as was the case in Smolensk.

Furthermore, the tests confirmed that a lightweight (70 g) explosive charge planted in an aircraft wing is capable of damaging the wing's structure in a linear manner (a 5 mm wide and 1 mm thick explosive application), by securing it to the inside of the wing under access conditions to the inside of the fuel tank caisson and protected (secured) against the effect of aviation fuel on it in such a way that it cannot be detected during pyrotechnic examination. The continuation of the testing on the 1:1 scale model of the wing fragment under static conditions without aerodynamic simulation showed that the fuel was detonated and the destruction was characteristic of a spatial explosion.

This leads to the conclusion that the way of cutting off the wing tip will be linear, and the rest of the wing may evidence local fuel ignition points. All the effects of the explosion observed in the course of experimental research correspond to the features occurring in the case of the Smolensk aircraft disaster.

Moreover, the characterization of explosive charges is carried out in order to determine damage to closed-form structures on the basis of real validation experiments with the use of explosives and experimental programs used for numerical testing of damage to closed duralumin structures as a result of detonation. These works are being conducted by the Numerical Explosion Prediction Group.

All the works described above are carried out in cooperation with Polish scientific institutions, European experts and the world's leading research institutions.

2.10 Psychological determinants

The Subcommittee carried out a critical analysis of both reports in the part concerning the psychological analysis of the Tu-154M crew's performance. It was found that the conclusions presented in the documents referred to above were based on hypotheses that had questionable foundations (for example, by emphasizing the conviction about the alleged conformism of the crew commander, unjustified by the results of psychological tests, and using terms not used in psychology, such as "cognitive tunneling" – (*Pol.: "tunelowanie poznawcze"*).

The analysis of psychological factors of the MAK and KBWLLP reports shows that their basic theses were not confirmed in reality, but were only speculations aimed at adjusting the presented findings and conclusions to the theses set forth at the beginning of the proceedings about the lack of guilt of the Russian side and about the crew's responsibility, and about the pressure allegedly exerted by the Air Force Commander (*Pol.: DSP- Dowódcy Sił Zbrojnych*), who purportedly was present in the cockpit. The work carried out by the Subcommittee in this respect allows us to state that the DSP was present in the presidential lounge in the final phase of the flight, as shown, among others factors, by the analysis of the location of the bodies of the victims. From the place where the body of the DSP was found, it appears that immediately before the aircraft disaster, he was in the right part of the presidential lounge.

On this basis, and using a reading of the CVR (Cockpit Voice Recorder) made by the Prof. Dr. Jan Sehn Institute of Forensic Expertise in Krakow (*Pol.: IES - Instytut Ekspertyzy Sądowej)*, as well as analyzing the testimony of the Polish witnesses who first listened to copies of the CVR, the Subcommittee found that in the last moments of flight, the DSP was not in the cockpit, and that the theses presented in the MAK report concerning the location of the DSP and the place where his body was later found were not true. Thus, there is no justification for speculating about his alleged actions and their impact on the course of events.

The work of the Subcommittee on psychological circumstances, which has been completed so far, allows us to formulate the following final conclusions:

2.10.1 The Tu-154M crew worked together as a team and understood each other. This is confirmed by the number of joint flights they had. The commander and the co-pilot performed 65 joint flights on Tu-154M aircraft, and the co-pilot and flight attendant performed 117 of them. The crew members knew the scope of their duties and tasks. The alleged lack of experience of the crew members in the MAK and KBWLLP reports is not confirmed by the evidence presented there. There was a sense of calm and order in the cockpit, there was no need for excessive clarification of tasks, commands were given in accordance with procedures, the crew spoke Russian fluently and the information received from the controllers regarding the distance from the airport was answered by the commander, stating the height above the runway level.

2.10.2 This contrasted with the behavior of the Russian flight controllers at Smolensk airport, where chaos and nervousness bordering on panic prevailed, as evidenced by the conversations recorded at the flight control post. The analyses carried out show that they had the necessary experience, so they had to know that their actions could lead to a disaster. Despite proper preparation, knowledge and experience, the Russian inspectors did not perform their duties properly. The actions taken by them had the characteristics of fake actions (ex. searching for alternate airports for the Tu-154M aircraft), aimed at avoiding possible accusations related to a drastic reduction of the level of flight safety of the Tu-154M No. 101 flight.

2.10.3 Given the context of the situation, it is likely that the Russian air traffic controllers acted in accordance with orders given by their superiors in Smolensk and Moscow, aimed at implementing a prepared plan. Therefore, they deliberately gave false information about the location of the aircraft to the Polish crew.

2.10.4 At their workstation post in Smolensk, the work of the flight controllers was directed by Col. Nikolai Krasnokutski, and in Moscow, at the base code named 'Logic' (*Pol.: "Logika"*), and decisions concerning the Tu-154M were made by Gen. Vladimir Benediktov, Deputy Commander of Transport Aviation of the Russian Federation. According to regulations in force in the Russian Air Force, none of them had the right to directly influence the activities of the personnel in Smolensk and to take over command.

2.10.5 Significant differences were found in the number of flight commands made and information on weather conditions given to the crews of the Russian Ił-76 and the Polish Tu-154M aircrafts and the manner of their administration. This suggests a thesis that the Tu-154M was consciously wrongly being brought in for landing and then the Polish crew was left alone in the last, most difficult phase of the flight (Col. Krasnokutski directly forbade Colonel Plusnin to deal with the Tu-154M in the last phase of the flight): *"First of all, prepare the aircraft for a repeat landing approach. And .... a repeat landing approach and that's it. And then .... he made the decision himself, let him go on ... ."*)

2.10.6 The Tu-154M crew did not attempt to land and the "departure" command was made at a safe altitude. The decision was made to attempt an approach, after which (if the weather conditions would not allow landing), there would be a departure to the alternate airport. The analysis of the crew members' conversations with one another and with the Director of Diplomatic Protocol

contradicts the thesis that the pilots were afraid of the First Passenger's reaction and indicates their full situational awareness and sense of responsibility for all the passengers. Linking the decisions made by the crew (including especially by the flight commander) with the fear of the First Passenger's reaction in the context of earlier events during the flight to Georgia should be considered unjustified, because the findings and analyses to date show that pilots put the passengers' safety above their wishes and independently made necessary decisions on their own. This was the case during the flight to Georgia on August 12, 2008 and during the flight on April 10, 2010.

2.10.7 There were no indications that psychological causes for this disaster had to be sought in the personalities of the pilots. The actions taken by the crew during the Tu-154M flight were correct and consistent with their knowledge, experience, training and personality traits. The crews' actions were not the cause of the disaster, as from the first hours after the event representatives of the Russian side baselessly declared, without any evidence. The unfoundedness of this thesis indicates that the causes of the catastrophe should be looked at as coming from external factors.

When examining the psychological aspects/conditions of the Smolensk catastrophe, the Subcommittee used the following sources.

1) Errors in previous reports:
- analysis of the MAK and KBWLLP reports; results of psychological tests from the flight and medical crew cards; hearings of witnesses; description of the commander and crew members - hearings of witnesses from the prosecutor office's files, the KBWLLP report, part 2.11, Attachment 7.3 – "Psychological Analysis of the Personality, Intellectual and Psychomotor Efficiency of the TU-154M crew members"; the "silent cockpit" issue, the presence of the SP (*Pol.: Sił Powietrznych*) Commander; operations of the Flight Controllers Group (*Pol.:Grupa Kierowania Lotami – "GKL*") – the KBWLLP report.

2) Opinions concerning the flight crew members:
- results from aviation-medical chart investigations (documentation provided by the Military Institute of Aviation Medicine (*Pol.: WIML-Wojskowy Instytut Medycyny Lotu*); data from WIML's judicial-psychological opinion of May 13, 2013. (*record No.: PO. Śl. 54/10*); opinion of a team of experts in aviation psychology on the conditions for the use of aviation psychology in the decision-making process by the Tu-154 M aircraft crew No. 101 during the flight on April 10, 2010 - attachment No. 5.2, record No. PO. Śl. 54/10; testimonies of witnesses from the Prosecutor's Office files.

3) Crew co-operation analysis:
- listening sessions of the MARS recorder from the pilots' cabin; transcripts from the MARS recorder listening sessions; transcripts from conversations at the flight control post in Smolensk; WIML opinion from the Prosecutor's Office files.

4) Psychological determinants affecting the crew members of the TU-154M aircraft "no departure" after the first activation of the "PULL UP" alarm:
- transcripts from conversations at the flight control post in Smolensk and from conversations with Tu-154M pilots; training instructions in force at the 36th Special Transport Aviation Regiment (*Pol.: 36. Specjalny Pułk Lotnictwa Transportowego*); transcripts from crew members' conversations.

5) Influence of the incident in Georgia on decisions taken by the Crew Commander during the flight on April 10, 2010:
- hearings of witnesses from the Prosecutor's Office files.

6) Impact of the flight controllers' actions on the Smolensk catastrophe:
- transcripts of interviews conducted at the air traffic control post: IES transcriptions - No. Dz. E. 1286/2011/KF, IES opinion dated January 12, 2015 CLKP transcript (attachment No.7 to the opinion No. E-fon-5/11 dated January 16, 2011), ABW - BBK opinion 1959/16/MAW dated July 28, 2016, KBWLLP transcription - a copy of correspondence from the flight control tower at the Smolensk North Airport, registered on a P-500 tape recorder on April 10, 2010. (KBWLLP, Sub-Annex 8.1), playback monitoring.

7) Other psychological factors:
- The MAK report; the KBWLLP report; documentation available at the Subcommittee; hearings of witnesses; results of ethyl alcohol tests and their interpretation - IES, Department of Forensic Toxicology (*Pol.: Zakład Toksykologii Sądowej*), No. E. 4000/2012/T; transcripts from cockpit conversations.

3. CLOSING REMARKS

The Subcommittee was faced with a difficult task, mainly due to limited access to evidence. The situation was caused by the actions of the Russian side and actions and omissions by the government of Donald Tusk after the aircraft disaster of April 10, 2010, as well as by the decision of the then parliamentary majority of the Polish Parliament (the PO-PSL political parties), which on May 6, 2010 rejected the resolution calling for a request to transfer the conducting of proceedings to the Polish side in respect of the Tu-154M aircraft disaster, which took place on April 10, 2010. (doc. No. 3032).

Moreover, already in December 2010, after having familiarized themselves with the draft MAK report, the KBWLLP demanded new proceedings in this matter (in the study: "Remarks of the Republic of Poland ..." dated December 19, 2010). However, this position was not accepted by the decision-makers and thus not considered in the Miller Commission's report.

The lack of free and unrestricted access to evidence by competent authorities of the Republic of Poland significantly hinders the proceedings. Polish specialists present in Smolensk since the evening hours of April 10, 2010 did not have such access, because the Minister of National Defense, Mr. Bogdan Klich, appointed the KBWLLP only as of April 15, 2010, so the commission with full powers was established when the main works at the site of the wreckage had already been completed and the

remains of the aircraft were transferred to the airport apron. The possibility of direct examination of original evidence, which at that time was being destroyed, hidden and falsified by the Russian side, was irretrievably lost. Also, representatives of the foreign service of Donald Tusk's government were directly involved in directing activities aimed at preventing registration of the evidence and its destruction. Then, under the leadership of Minister Jerzy Miller, the KBWLLP took part in falsifying and concealing materials collected during the work, motivating such action, among others, with the need to obtain results consistent with the conclusions of the MAK report. At the same time, the Russian side systematically refused to return the illegally detained aircraft wreckage as well as recorders and other parts of the Tu-154M equipment, whose comprehensive investigation should be an important element of the proceedings explaining the reasons for the investigated event. In view of the repeated refusals to return Polish property held by the Russian side, contrary to ICAO provisions, in March 2018 the Subcommittee requested the Russian Federation to allow the reconstruction of the plane in Smolensk in accordance with procedures recommended by the ICAO. The Russian side refused, citing the threat of deformation of a part of the aircraft during its reconstruction.

This forced the Subcommittee to develop and use other research methods, which were used in cooperation with renowned Polish and foreign scientific and academic centers. Cooperation was also established with leading aviation experts from third countries, including Sweden, the United Kingdom and the USA. The Subcommittee also initiated actions on the international forum, undertaking cooperation with the Parliamentary Assembly of the Council of Europe in order to obtain international support for Poland's position on the return of the wreckage and other evidence. Thanks to this, the conclusions of the work of the Subcommittee, as well as the position of the Polish authorities on the issue of returning the aircraft wreckage to its rightful owner (the Republic of Poland), were summoned and received strong support in the report and resolution of the Council of Europe in September 2018.

Only the Citizens' Platform (*Pol.: PO - Platforma Obywatelska*) political party members abstained from voting in favor of the resolution. In the adopted resolution, the Parliamentary Assembly of the Council of Europe unequivocally states and points to the mistakes of Donald Tusk's government, which made it impossible to objectively examine the causes and circumstances of the aircraft disaster and led to the evidence being left outside the territory of Poland:

"[...] Despite the fact that Poland had the right to conduct its investigation, the Polish government agreed with its Russian counterpart that the investigation into the causes of the disaster would be carried out by the Russian Interstate Aviation Committee (as the competent authority in the affected country), with the participation of Polish experts. Both countries agreed that the main technical investigations should be carried out in accordance with the International Standards and Recommended Practices (SARP) set out in Annex 13 to the Convention on International Civil Aviation (Chicago Convention), which normally apply to civil aviation, despite the fact that the Polish Tu-154 was registered as a State aircraft and its flight was intended for governmental purposes".

The preliminary report to the adopted resolution presents a position, preceded by a thorough analysis of international law, on the return of evidence to the Republic of Poland:

" […] in accordance with Annex 13 to the Chicago Convention, the State where the event occurs is required to return the wreck and other evidence to the State where the aircraft is registered as soon as the technical aviation safety investigation is completed, which occurred in January 2011. The continued refusal of the Russian authorities to return the wreck and other evidence is an abuse of law and fuels speculation on the Polish side that Russia has something to hide. The Assembly therefore calls on the Russian Federation to hand over, without undue delay, the wreckage of the Polish Tu-154 aircraft, in close cooperation with Polish experts, in such a way as to avoid further destruction of potential evidence [...]".

The report and resolution of the Parliamentary Assembly of the Council of Europe recalls the position of the Polish State on the Smolensk catastrophe contained in the Technical Report presented by the Subcommittee on April 11, 2018.

On April 9, 2019, the Subcommittee for the Re-examination of the Aviation Disaster (*Pol.: Podkomisja do Ponownego Zbadania Wypadku Lotniczego*) submitted a motion to the Prosecutor's Office stating the suspicion of a crime having been committed by Chairman Jerzy Miller and the KBWLLP under Article 231, par. 1 and 2 of the Penal Code, Article 239 of the Penal Code and Article 239 par.1 of the Penal Code and Article 271 of the Penal Code. The Subcommittee submitted a separate motion to the Chairman of the KBWLLP, Mr. Jerzy Miller, under Article 129 of the Penal Code.

Translated by: Jan Czarniecki