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РОССИЙСКОЙ ФЕДЕРАЦИИ
ФЕДЕРАЛЬНОЕ АГЕНТСТВО
ВОЗДУШНОГО ТРАНСПОРТА



MINISTRY OF TRANSPORT
OF THE RUSSIAN FEDERATION
FEDERAL
AIR TRANSPORT AGENCY

Our ref
Наш №

4.02-3

Date
Дата

14.01.2016

Mr. T.H.J. Joustra
Chairman, Dutch Safety Board
PO Box 95404 25 09 CK The Hague

Dear Mr. Joustra,

In September 2015, the Federal Air Transport Agency sent you a letter pointing out a number of contradictions and discrepancies in the investigation into the crash of Boeing 777-200 9M-MRD (Flight MH17) near Hrabove, Ukraine, on July 17, 2014. We have not received any reply to the above letter. The final report released on October 13, 2015, did not reflect many of the important facts that the Russian side had repeatedly drawn your attention to.

The Russian experts who had participated in the investigation continued their research based on the additional data specified in the final report and as a result obtained some new important facts that had been not examined in the course of the investigation.

Based on the provision stipulated by standard 5.13 of Annex 13 to the Chicago Convention, I herewith forward for your consideration and decision-making new important facts that need to be reflected in the final report.

The new important facts obtained by the Russian experts through additional experiments and examinations attest to the fact that the information provided in the final report with regards to the following conclusions was unsubstantiated and inaccurate:

- on the possible presence of heavy air defense systems in eastern Ukraine that were not controlled by Ukrainian government forces;
- that the aircraft was hit by a 9N314M high-explosive fragmentation warhead;

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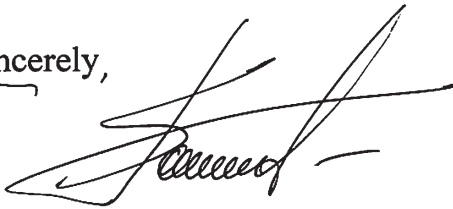
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- that the warhead that hit the aircraft was carried by a 9M38-series missile launched by a Buk surface-to-air missile system;
- on the position of the missile in relation to the aircraft at the moment of detonation, as well as the area it was launched from.

We emphasize that all the statements in this letter are limited strictly to the conclusions drawn by the investigation team regarding the circumstances of the aircraft downing and analysis of Ukraine's failure to close its airspace. This letter does not touch upon the recommendations on the safety of civil aircraft presented in the final report, as the Russian side intends to comment on them separately.

Attachment on 12 pages.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Oleg Storchevoy', with a horizontal line underneath the first part of the signature.

Oleg Storchevoy

Deputy Director,
Federal Air Transport Agency of Russia

Accredited Representative of the Russian Federation to
International Investigation Team on MH17 Crash

Attachment
to the letter of the FATA

14.01.2016 № 4.02-3

1. Grounds for closing Ukraine's airspace prior to the crash of Boeing 777, Flight MH17

The final report reviews requirements contained in the Chicago Convention on International Civil Aviation and its annexes germane to the provision of flight safety over areas that may pose a threat to civil aircraft (Sections 4.2.1 and 4.2.2 of the final report).

The conclusion made in the report (Section 6.6.2 of the final report) that Ukraine, having sovereign control of its airspace, was responsible for ensuring the safety of flights, including situations where another state is the source of a threat, appears to be incomplete and does not reflect the objective fact that Ukraine ignored safety risks for civil aircraft after unleashing hostilities in the east of the country.

The final report names the accidents of an Antonov An-26 on July 14, 2015, and a Sukhoi Su-25 on July 16, 2015, as the only grounds based on which Ukraine should have fully closed its airspace, which is absolutely inadequate.

Standard 3.1.3 of Annex 17 to the Chicago Convention on International Civil Aviation, as well as ICAO Document 9554, require that states keep the level of threat to civil aviation within their territory **under constant review**.

Obviously, the Antonov An-26 and Sukhoi Su-25 accidents cannot be considered as the only grounds based on which the Ukrainian authorities should have made a decision to completely suspend civil flights over the conflict zone. The Ukrainian authorities should have made this decision back in April 2014, when hostilities broke out in eastern Ukraine after the Acting Ukrainian president signed Decree 405/2014 "On the Decision by Ukraine's National Security and Defense Council of April 13, 2014, 'On Urgent Measures to Counter the Terrorist Threat and Preserve the Territorial Integrity of Ukraine,'" after which confrontation between Ukraine's official authorities and opposition forces in eastern Ukraine escalated, creating a conflict zone unsafe for civil flights. After the Ukrainian president issued Decree 405/2014, both military and aviation authorities of Ukraine should have begun implementing coordinated measures to ensure the safety of civil flights over the conflict zone, as recommended by Section 2.15 of ICAO Document 9554.

In addition, while issuing a restriction for the use of airspace below FL260, and then FL320, the Ukrainian authorities failed to develop and publish special procedures for the instances described in ICAO Document 9554, Section 3.9, Subsection E (the last bullet): coordination in the event of civil aircraft emergencies or other unforeseen circumstances. Nevertheless, the final report does not address the question of whether Ukraine prepared appropriate ground infrastructure considering the risks of simultaneous operations by civil and military aircraft over the conflict zone. The report fails to mention that the Dnipropetrovsk ATC Center primary radar outage and the fact that the Ukrainian Air Defense monitoring systems were not integrated as a backup option created additional risks for flights over the conflict zone in the event of further outages of ground-based equipment or other unforeseen circumstances.

Besides, the statements by US and NATO officials presented in the final report (Section 5.4) are limited to speculations on whether Russian troops or the Russian Army's weapons were present in Ukraine, which is not true.

The final report does not provide any facts regarding the presence or the use of Buk surface-to-air missiles in the region, but references to the Antonov An-26 and Sukhoi Su-25 accidents do not rule out such a possibility. Consequently, the conclusion made in the final report that the Ukrainian authorities should have closed their airspace undeservedly narrows down the time when they should have made this decision to July 14-17, 2014, and links it with the alleged appearance of "heavy" air defense systems, not controlled by Ukrainian government forces, in the region.

Also, the final report unfairly obscures the issue of liability, shifting the blame from Ukraine to airlines and international aviation organizations, e.g., ICAO. The final report basically ignores the clarification provided by ICAO in Letter AN13/4.2-14/59 on July 24, 2014, which clearly stresses in paragraph 6 that "the obligations of States under the Convention and the requirements in its annexes should not be confused with hazard notifications circulated in State letters by ICAO under those exceptional circumstances where potential risks to the safety of civil aviation operations are incapable of being effectively communicated by States, whether over sovereign territory or over the high seas."

Sections 7.6.1, 7.6.2 and 7.6.3 of the final report point out the lack of reaction from ICAO and other states and airlines in terms of introducing their own restrictions on flights over Ukraine. Again, the report mentions the Antonov An-26 crash as grounds for making such a decision. But this accident was only reported by the Ukrainian President's Executive Office in a closed briefing for Western diplomats (Section 5.7) and contained obvious discrepancies. (Information provided by the Dutch Military Intelligence and Security Service (MIVD) in Section 5.2.2 of Appendix T of the final report also points out contradictions in official statements by the Ukrainian authorities.)

Throughout the whole period from the beginning of the armed conflict in April up to the MH17 crash in July 2014, the Ukrainian authorities failed to issue a single official NOTAM that would unambiguously, as required by international standards, indicate threats to the safety of international civil aircraft associated with the use of various weapon systems in the region as a consequence of the armed conflict.

The final report does not provide any facts indicating the deficiency of ICAO requirements or national documents of Ukraine which could explain Ukraine's failure to make a timely decision to close its airspace over the conflict zone.

Thus, the Ukrainian authorities deliberately concealed or distorted information on real threats to the safety of civil flights arising from the military activities of Ukraine's Ministry of Defense in abuse of Article 9 of the Chicago Convention on International Civil Aviation, Annexes 15 and 19, as well as ICAO Document 9554. As a result, other states and airlines (including Malaysia Airlines) did not have sufficient official information for making a decision to suspend flights over Ukraine.

2. Conclusion that the aircraft was hit by a 9N314M warhead

Section 10.2 of the final report indicates that:

- the aircraft was struck by a large number of small fragments made of unalloyed steel moving at high velocity, their shape and size consistent with the 9N314M warhead (subsections 5, 6 and 10);
- the location, size and boundaries of the damage, as well as the density of hits on the wreckage, are consistent with the 9N314M warhead (subsections 6 and 10).

Thus, the conclusion that the aircraft was hit by a 9N314M warhead was based on the characteristics of the fragments and the damage on the aircraft wreckage.

2.1. Fragments

Section 2.16 (Fig. 37, Table 11) of the Factual Information part of the final report indicates that a total of two bow-tie shaped fragments consistent with the 9N314M warhead were found:

- Fragment 1: 14 × 14 × 4.5 millimeters, 6.1 grams, found in the cockpit;
- Fragment 2: 12 × 12 × 5 millimeters, 5.7 grams, found in the captain's body.

Yet Section 2.12 of Annex X mentions only one fragment (14 × 14 × 4.5 mm) found in the cockpit (Fragment 1).

The data provided in the final report is inaccurate, because the actual mass of Fragment 1 is 5.5 grams, not 6.1 grams, as evidenced by the photos made by members of the international investigation team during the weighing of this fragment in February 2015 at the Gilze-Rijen air base. In addition, the final report does not specify where exactly the fragment was found in the cockpit.

The captain's body from which Fragment 2 was extracted did not undergo special examination (instead, the body of the Team B captain, who was not present in the cockpit at the time of the accident, was examined).

The new important fact is that, even assuming the aircraft was brought down by a Buk surface-to-air missile, the description of fragments provided in the report does not match the pre-formed fragments used in the 9N314M warhead.

The final report does not take into account the mass of the bow-tie shaped fragments. Compared with standard bow-tie shaped fragments used in the 9N314M warhead, which weigh 8.1 grams and are 8.2 millimeters thick:

- Fragment 1 in reality lost 32 percent of its mass (or, based on the mass indicated in the report, 24.7 percent);
- Fragment 2 lost 29.6 percent of its mass;
- Relative transverse deformation (thickness reduction) of the fragments was over 60 percent.

The significant loss of mass in Fragment 1 cannot be explained by damage because the fragment does not appear greatly damaged (otherwise, it would lose its bow-tie shape).

Fragment 2 shows clear signs of damage, specifically in the transversal section (in relation to the front side). The diminished mass of this fragment can be explained by damage. However, the thickness of the fragment indicates significant deformation (over 60 percent), which is not consistent with its shape.

Russian experts have examined the effects of obstacle penetration on the shape and mass of bow-tie fragments of the 9N314M warhead by staging full-scale experiments and simulating transversal deformation of fragments.

In experiments with the 9N314M warhead, the average mass of bow-tie fragments that preserved their shape after penetrating several aluminum sheets (with a combined thickness of 12 mm) in one case and the cockpit of an Ilyushin Il-86 aircraft in the other case was 7.2-7.9 grams. The average loss of mass was merely 3-12 percent.

The simulation of transversal deformation revealed that the shape of a fragment with 60 percent transverse deformation is very different from the shape of the fragments presented in Section 2.16 (Fig. 37, Table 11) of the Factual Information part of the final report.

The results of these experiments and simulations are consistent with the results of validation tests of the 9N314M warhead, in which 96 percent of bow-tie fragments preserved their shape and lost only 6-7 percent of their mass after penetrating two 5-mm sheets of steel.

Thus, the mass and dimensions of the two fragments (Section 2.16, Fig. 37, Table 11 of the Factual Information part of the final report), based on which the report concludes that the aircraft was hit by a 9N314M warhead, are not consistent with the results of the full-scale experiments and simulations.

Section 2.16.2 and Table 12 of the Factual Information part of the final report provide data regarding the chemical composition of the fragments retrieved from the wreckage and the bodies of the victims.

Russian experts examined the chemical composition of the material used to manufacture pre-formed fragments of the 9N314M warhead and concluded that the chemical composition of the retrieved fragments as published in the final report does not agree with the conclusion that they belonged to a 9N314M warhead.

2.2. Damage to the aircraft wreckage

Section 2.12 of the Factual Information part and Section 3.5 of the Analysis part in the final report, as well as Section 2.13 of Appendix X, indicate the approximate number of penetration holes in the skin of the left-hand side of the cockpit (around 200) and the perpendicular dimensions of 31 penetration holes. No further examination of penetration holes on the aircraft wreckage was performed.

The final report and its appendices fail to provide any information on the shape of penetration holes, whether penetration holes are present in the skin of the right-hand side, or conclusions that can be drawn regarding the characteristics of the warhead based on the fragmentation spray pattern on the aircraft wreckage.

The new important fact is that, even assuming the aircraft was brought down by a Buk surface-to-air missile, penetration holes on the aircraft wreckage are not consistent with those normally created by the detonation of a 9N314M warhead.

Russian experts have performed a full-scale experiment with a 9N314M warhead emulating the engagement conditions presented in the final report. The experiment left a large number of bow-tie shaped holes in the skin of the test aircraft. The wreckage of Boeing 777-200 9M-MRD does not show any bow-tie shaped holes.

Also, unlike the damage observed on the Boeing 777-200 9M-MRD wreckage, in the experiment the windows on the captain's side of the cockpit, as well as the stiffeners over the windows, were completely destroyed. There were also multiple penetration holes on the right-hand side of the cockpit (exit holes) as well and not just on the left-hand side.

The analysis of the fragmentation spray pattern on the aircraft wreckage by Russian experts shows that the total number of fragments and the specifications of the warhead that hit the aircraft (according to the DSB) do not match the specifications of the 9N314M warhead.

3. Conclusion that the warhead which hit the aircraft was carried by a 9M38-series missile launched by a Buk surface-to-air missile system

Section 10.2 of the Conclusions part of the final report indicates that:

- a number of larger fragments found on the ground and a few fragments found in the aircraft wreckage match parts of the 9M38-series missile in the Buk surface-to-air missile system (subsections 7 and 10);
- paint samples taken from the missile parts found in the wreckage area match those found on the foreign objects extracted from the aircraft (subsections 7 and 10);
- traces of the same explosive were found both on the missile parts and on the aircraft wreckage (subsections 7 and 10).

Thus, the conclusion that the aircraft was hit by a 9M38-series missile launched by a Buk surface-to-air missile system was made based on the appearance of missile fragments found on the ground and in the aircraft wreckage, paint samples and traces of explosive.

3.1 Missile fragments

At the meeting of authorized representatives in August 2015, the DSB presented photographs of five fragments found at the crash site and identified as fragments of a 9M38-series missile of the Buk surface-to-air missile system:

- a stabilizer fragment;
- a hatch fragment;
- an antenna fragment;
- a Section 3 encasing fragment;
- a nozzle fragment.

As can be judged by the photo, the Section 3 encasing fragment has no significant damage.

Section 2.12 of the Factual Information part in the final report mentions only three fragments (the Section 3 encasing fragment is not included).

The new important fact is that the appearance of the Section 3 encasing fragment found at the crash site does not match the appearance of fragments of the same encasing normally resulting from the detonation of a 9M38-series (9M38M1) missile.

Russian experts conducted a full-scale experiment with a 9N314M warhead as part of a 9M38M1-series missile, which has the same Section 3 encasing as 9M38-series missiles, emulating the engagement conditions presented in the report.

The test missile was fitted with a used engine; the parameters of all pyrotechnic components corresponded to those 40 seconds after the launch.

In the full-scale experiment, after the warhead detonated, Sections 3 and 4 of the missile disintegrated into large shapeless fragments, with the serial number of the missile still visible on the fragments.

Yet the fragment of Section 3 encasing, supposedly found in the Boeing 777 wreckage area, was only slightly damaged and was not deformed by the explosion. This indicates that, most likely, it was not part of the missile that brought down the aircraft.

3.2. Paint samples and traces of explosive

The fact that paint samples taken from the missile fragments found at the crash site and those from foreign objects found in the aircraft wreckage match does not necessarily mean that the aircraft was hit by a 9M38-series missile of the Buk surface-to-air missile system.

Forensic examination of paint is normally based on the chemical analysis of paint samples. Often, the objective is to establish whether certain pigments are present in the paint. However, due to the fact that the same chemical elements may be present in paints manufactured by different companies, the results of paint analysis can only be considered as indirect evidence corroborating other types of evidence.

The same applies to explosives. Practically all the explosives used in anti-aircraft weapon systems are a mixture of TNT and RDX in various proportions. Hence, the fact that traces of these explosives were found on the missile fragments and the aircraft wreckage does not mean that the aircraft was hit by a 9M38-series missile of the Buk surface-to-air missile system.

In identifying the missile that hit the aircraft, the report completely overlooks a unique attribute of Buk missiles, namely, the algorithm of their proximity fuse. The sections of the final report covering the simulation of the 9M38 missile trajectory (Section 3.8.6 of the Analysis part and Sections 6.19 and 6.20 of Annex X) do not offer any information on the analysis of the performance of the proximity fuse.

The new important fact is that, assuming that the aircraft was indeed brought down by a Buk surface-to-air missile, the engagement conditions as presented in the report do not agree with the algorithm of the proximity fuse used in 9M38-series missiles of the Buk surface-to-air missile system.

According to the data provided by the company that designed the Buk surface-to-air missile system, if a 9M38-series missile approaches an aircraft at the angle presented in the final report, the algorithm of its proximity fuse will detonate the warhead after a certain delay so that the detonation area is 3-5 meters away from the nose towards the tail, which does not agree with the actual data.

4. The position of the missile in relation to the aircraft at the moment of detonation

Sections 3.8.2 through 3.8.5 of the final report estimate the detonation point and orientation of the missile in relation to the aircraft at the moment of detonation. Section 3.8.2 of the final report indicates that the detonation area was determined using a simulation model of the damage boundary constructed by NLR for a pre-determined warhead rather than being identified by the traces of non-perforating ricochet hits.

Figure 61 of the final report shows the area where, according to the DSB, the warhead detonated. The area is less than one cubic meter and is located about 4 meters above the nose tip of the aircraft on the left side of the cockpit.

Table 20 of the final report gives the coordinates of the detonation area. The table distorts the data provided by JSC Concern Almaz-Antey: the coordinates (X, Y, Z) calculated by Russian specialists have been replaced with the coordinates suggested in the initial TNO calculations, which were included in the draft version of the final report circulated in June 2015 among investigation team members for their review in accordance with Annex 13 of the Chicago Convention.

The new important fact is that the location of the missile in relation to the aircraft at the moment of detonation as provided in the final report does not match the fragmentation spray area on the aircraft wreckage.

4.1. Corrections to the fragmentation spray area on the Boeing 777 aircraft

In examining the boundary and dimensions of the fragmentation spray area on the Boeing 777 aircraft in the final report, DSB experts overlooked the damage sustained by an important element of the left side of the aircraft (STA276.5 to STA309.5), even though experts were aware of the location and the appearance of this damage as early as February 2015. The draft version of the final report shows this element on page 140 (Figure 52 - Grid reconstruction of the outside skin of the forward fuselage. The overlaid outline indicates the approximate boundary of the piece prior to dismantling for transport to the Netherlands) as Item 2. The Russian side has copies of PowerPoint presentations with the photos of this fragment which were shown at the meeting of authorized representatives in February 2015.

The analysis of the damage to the top section of the fuselage shown on Fig. 15 of the final report ignored the actual location of this element in the aircraft. The location of this fragment was also shown in the draft version of the final report on page 140 (Figure 52) as Item 1.

Also, the final report does not even mention damage to the fragments of the left upper side of the cockpit (STA287.5 to STA358) which were handed over to Dutch experts after television channel RT aired its “MH17: A Year without Truth” documentary. These fragments were not added to the 3D reconstruction of the fuselage; damage sustained by them was either not examined, or the results of the examination were not added to the final report. The Russian side has photographs of this fragment.

Also, the final report does not contain analysis of the damage sustained by the Boeing 777 frame, specifically formers on the left side from STA172.5 to STA332.5, as well as the central and left side of the top of Section 41.

The actual boundary and dimensions of the fragmentation spray area, taking into account the above elements, have a fundamentally different configuration and in the middle and upper left side of the aircraft significantly exceed the damage area shown in Fig. 58 of the final report. At the same time, the damage area in the lower part of the left side of the aircraft (from STA276.5 on) is significantly less than shown in Fig. 58.

4.2. The missile warhead detonation area

Calculations by Russian experts show that, based on the location and dimensions of the fragment spray area on the aircraft wreckage as well as the orientation and location of grazing hits, the warhead detonation point was outside the aircraft, no more than 1.6 meters away from the captain’s window.

The accuracy of this conclusion was demonstrated at the meeting of authorized representatives at the 3D reconstruction site in August 2015. Yet the calculations of the detonation area by Russian experts were not included in Table 20.

4.3. Discrepancies in static and dynamic warhead simulations

In creating static and dynamic simulations of a 9N314M warhead detonation, NLR experts ignored the data provided by the company which designed the missile. Instead of using the data provided in the design and technical documentation of the 9N314M warhead and confirmed by the reports of state and validation tests, Dutch experts chose their own Design II as the best model (Table 18, Section 3.8.3 Warhead Simulation).

The speed and meridional angles of fragment fly-out in the Design II model do not match the technical specifications and test results of the 9N314M warhead of Buk missiles. Design II takes into consideration only 64 percent of the fragment spray area, ignores significant areas of pre-formed fragment fly-out (68-76° and 112-124°) as well as secondary fragments (fragments of missile section encasings).

A model like Design II can only be used to evaluate damage to typical tactical aerial targets for a specific set of parameters: distance to the target on the X, Y and Z axes and horizontal and vertical angles of engagement.

Such a model cannot be used to examine damage to a Boeing 777, let alone to calculate the engagement parameters. Discrepancies in the rear front of the fragment spray area simulated by Design I and Design II models (with areas of 12-15° left out) automatically generate significant errors in determining the missile trajectory on the horizontal plane, allowing a shift in the estimated warhead detonation area in order to make it appear consistent with one of the theories of how the aircraft was brought down.

5. The area from which the missile that hit the aircraft was launched

The sections of the report covering the calculations of the launch area for the missile that hit the aircraft (Section 3.8.6 of the Analysis part and Sections 6.19 and 6.20 of Appendix X) locate the launch site within an area of 320 square kilometers in eastern Ukraine.

The new important fact is that the location, dimensions and boundary of damage, the number and density of penetration holes on the wreckage and especially the nature of damage to the frame of the Boeing 777 aircraft are not consistent with the warhead detonation point and missile orientation as presented in the final report. As a result, the possible launch area was calculated incorrectly.

The engagement conditions (the detonation area and orientation of the missile in relation to the aircraft) indicated in the final report contradict the technical specifications of the proximity fuse used in Buk missiles. Under these conditions, the warhead detonation point could not be closer to the nose tip of the aircraft than 3 to 5 meters.

Russian experts simulated a number of engagement scenarios based on actual technical specifications of the warhead and proximity fuse used in Buk missiles and came to the conclusion that the damage observed on MH17 can only be explained if the missile was crossing the Boeing 777's trajectory at an angle of at least 50-60° (in the horizontal plane). Otherwise, it is impossible to logically explain the actual fragment spray area and the nature of the damage to the frame of the aircraft by a Buk missile.

Based on the results of the full-scale experiment conducted by Almaz-Antey, if the aircraft was brought down by a Buk missile, it could only be launched from the area near Zaroshchenskoye. The possible launch area indicated in the final report was determined based on an erroneous interpretation of the engagement conditions.

Assuming the aircraft was indeed brought down by a Buk missile, the missile could not approach the plane at an angle of over 50° from any point within the area indicated in the final report (Fig. 62, Section 3.8.6).

Thus, the detonation point, the orientation of the missile and the possible launch area indicated in the final report contradict the specifications of 9M38 missiles and are not consistent with the actual damage to the front section of the Boeing 777 fuselage.

6. Conclusion

The new important facts, which render the information contained in the final report inaccurate, assuming that the aircraft was indeed brought down by a Buk missile, are as follows:

- The description of fragments in the report does not match that of pre-formed fragments in the 9N314M warhead;
- The description of penetration holes on the aircraft wreckage in the report does not match that of penetration holes caused by the detonation of a 9N314M warhead;
- The appearance of at least one missile fragment (Section 3 encasing) found at the crash site does not match the appearance of encasing fragments resulting from the detonation of a 9M38-series missile warhead;
- The engagement conditions do not agree with the algorithm of the proximity fuse used in 9M38 missiles of the Buk surface-to-air missile system;

- The position of the missile at the moment of detonation as described in the report does not match the fragment spray area on the wreckage;
- The conclusion regarding the area from which the guided surface-to-air missile that brought down the aircraft was launched does not match the technical specifications and operational principles of 9M38 missiles.

Also, there is no evidence that two Ukrainian military aircraft, an Antonov An-26 on July 14, 2015, and a Sukhoi Su-25 on July 16, 2015, crashed because they were brought down by “heavy” air defense systems. The Ukrainian authorities should have closed the airspace over the conflict zone back in April 2014, as soon as the conflict entered the active phase.