

FINAL REPORT

on

**investigation of a serious incident with Diamond DA 42 aircraft,
registration No LZ-ASH, operated by air operator Air Scorpio, realized on
27.09.2007 at Gorna Oryakhovitsa Airport.**



2008

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Enclosure No 1
Enclosure No 2

LIST OF ABBREVIATIONS

AO	- Air operator;
ATrC	- Air Training Center;
BAC	- Bulgarian Aeronautical Center;
AC	- Aircraft;
MD CAA	- Main Directorate of Civil Aviation Authority;
ACr	- Aircraft crew;
CAA	- Civil Aviation Act;
ACC	- Aircraft commander;
ARP	- Airport reference point;
ACT	- Airport Control Tower;
MT	- Ministry of Transport;
SN	- Since new;
MO	- Maintenance organization;
RWY	- Runway;
SM	- Scheduled maintenance;
ATC	- Air Traffic Control;
AOM	- Aircraft Operation Manual;
FCO	- Flight control officer;
ATC-T	- Air Traffic Controller - Tower;
AAIU	- Air Accident Investigation Unit
AOM	- Aircraft Operation Manual;
CATS	- Computer aided training system;
CRM	- Crew resources management;
NOTAM	- Notice to airmen.

Introduction

On the 27.09.2007 the crew of Diamond DA 42 Twin Star aircraft, reg. No LZ-ASH, was conducting instructional training flight at Gorna Oryakhovitsa Airport. During the conducting of a simulated landing with one inoperative engine the aircraft landed at RWY27 with retracted landing gear.

The aviation occurrence didn't lead to any consequences for the crew.

On the base of Article 139, Para1 of the Civil Aviation Act of Republic of Bulgaria, published on the 01.12.1972 (last changes and additions from 30.01.2007) and in implementation of Article 5, Para1., point 1 of , Regulation № 13 of the Ministry of Transport of the 27.01.1999 (last changes and additions from 16.01.2007) the following organization have been notified about the air occurrence: Air Accident Investigation Unit and Directorate General of Civil Aviation Authority at the Ministry of Transport of Republic of Bulgaria, National Bureau of Air Occurrences Investigation of Republic of Austria.

On the base of Article 9, Para. 1. Rev. - SG, No 83 of 2004, addition, No 77 of 2005) and in accordance with Para.3, p.1 (б) of additional provisions of Regulation No 13 (last revisions and additions 16.01.2007) of 27.01.1999 of the MT, the aviation occurrence is classified by AAIU as a serious incident. The materials on the aviation occurrence are classified under state file number No 02/29.01.2008 in the archives of AAIU.

On the base of Article 142, Para. 2, of Civil Aviation Act of Republic of Bulgaria of 01.12.1972 (last revisions and additions SG No 10 of 30.01.2007) and Art. 10, Para.1 (Rev. - SG No 83 of 2004), in relation with Art. 2, Para. 1 of Regulation No13 of MT of 27.01.1999 with an order No RD-08-344/ 16.07.2007 of the Minister of Transport, as an authorized body for conducting of the investigation, a commission for investigation was appointed.

No authorized representative of the Republic of Austria has been presented.

On the base of Article 19, Para. 1 of Regulation No13 of 27.01.1999 of MT of the Republic of Bulgaria, the Commission has prepared the Final Report.

The Commission has visited the place of the aviation occurrence, the working station at Airport Control Tower (ACT) at Gorna Oriakhovitsa Airport and conducted an inspection of the aircraft. The radio exchange between the aircraft and Air Traffic Controller (ATC) at Gorna Oriakhovitsa ACT has been listened to, as well as all the internal communication. Written explanations from the aircraft crew members has been taken. Interviews were conducted with the witnesses of the aviation occurrence.

Aircraft landing without landing gear extended is a serious aviation occurrence, which might lead to severe consequences because of the hazard of destruction of the construction and initiation of a fire.

The difference between the local time and UTC is + 3 hours.

1. Factual Information

1.1 History of Flight

1.1.1 Flight Number:

The number of flight is the number of aircraft registration: LZ-ASH.

Type of Flight:

Instructional training flight in flight maneuvering area for working through emergency case in flight - engine failure by simulation of an engine failure, followed by 3 circling flights for working through emergency cases during take-off and landing by engine failure simulation.

Last departure point: Gorna Oryakhovitsa Airport.

Departure time: 09:25 local time.

Planned arrival point: Gorna Oryakhovitsa Airport.

1.1.2. Preparation and Description of the Flight

The preliminary preparation has been conducted in the day of the aviation occurrence from 06:30 till 08:50 in the room from preliminary preparation at Gorna Oryakhovitsa Airport together with preflight preparation of Air Scorpio AO according to the plan and the documents of Air Scorpio AO.

According to the preliminary planning it has been envisaged a flight in flight maneuvering area for working through emergency case in flight - engine failure by simulation of one engine failure, followed by 3 circling flights for working through emergency cases during take-off and landing - again by engine failure simulation. All flights according to the crew explanations have been conducted by touch-and-go.

The aircraft crew has performed pre-flight check of the aircraft and no failures have been found. The pre-flight check has been certified by the instructor who is certified do to this.

At 09:25 the aircraft took-off from Gorna Oryakhovitsa Airport. The flight started according the preliminary requested plan.

The flight in the flight maneuvering area proceeded uncomplicated. After the report for the end of working the trainee aircraft commander has left the flight maneuvering area, entered the airdrome circling for landing at RWY27 and at 09:56:20 received clearance for landing and performed a touch-and-go. After the touch-and-go and landing gear retraction the trainee aircraft commander piloted the aircraft in airdrome circling at Gorna Oryakhovitsa. Under instructor's command the trainee aircraft commander moved the engine throttle of the right-hand engine back (for engine failure simulation), increased the left-hand engine speed to 90% and retracted flaps at APP (Approach) position. The joining into traffic circuit was between along the downwind leg at a height of 1100 ft. The flight along the base leg was conducted at a height of 500-700 ft at a speed of about 90kts. The aircraft crew didn't read the check list for landing with one inoperative engine because of lack of such a list on-board. The audio warning sounded in the cockpit for retracted landing gear. This signalization should be activated at a rotation speed of one of engines less than 25%.

After taking the landing course (270^0) the trainee aircraft commander extended the flaps in landing position LDG (Landing). At this flight heading at 09:56 the sunshine lighted up the displays and prevented the aircraft crew from seeing the light signalization about the landing gear position. At the same time the audio signalization for non-extended landing gear position proceeded to work till the aircraft touched on the RWY.

On the final the instructor instructed the trainee to keep the same speed and heading and to remove the side-slip emerged. At the same the crew didn't control the landing gear lever position in situation of continuation of activated emergency audio signalization about the non-extended landing gear and took decision for landing.

During the flare up at the first touch of aircraft propellers into the RWY and the beginning of their destruction the instructor established that the landing gear wasn't extended and moved the lever into "Extended" position and the landing gear remained at the intermediate position because of insufficient height for full extending. During the last stage of its movement along the RWY the aircraft turned to the right at about $30-40^0$ and stopped. The aircraft crew turned off fuel supply and electric supply of aircraft electrical system and left the aircraft.

The touch-down on RWY as conducted in the middle of RWY27 at a distance of 1100m from RWY27 offset threshold.

On Figure No 1&2 of Enclosure No 1 the general aircraft view after the realization of aviation occurrence is given.

1.1.3. Location of the Aviation Occurrence:

Coordinates of the landing point: N 43°09'04" and E 025°43'02" on RWY27 at Gorna Oryakhovitsa Airport. Time of origin of the aviation occurrence: 09:58 local time.

1.2 Injuries to Persons

No injuries caused to crew members and other persons as a result of the aviation occurrence.

1.3. Damage to Aircraft

During the inspection of the accident site the commission found the following damages to the aircraft:

- Destroyed No1 engine propeller blades;
- Flat tire and filing of the wheel cover of left-hand main landing gear.
- Destruction (filing) of the composit coating of the bottom surface of engine nacelle of No1 engine;
- Destruction (filing) of exhaust tube of No1 engine;
- Destruction (filing) of the breather tube of No1 engine;
- Worn-out (filed) left-hand step;
- Filing of the bottom surface of the tail bumper;
- Worn-out (filed) right-hand step;
- Destruction (filing) of the composit coating of the bottom surface of engine nacelle of No2 engine;
- Destruction (filing) of exhaust tube of No2 engine;
- Destruction (filing) of the breather tube of No2 engine;
- Blown tire and filing of the wheel cover of right-hand main landing gear.
- Destroyed propeller blades on No2 engine;

The aircraft damages are shown on Figure 3 to Figure 7, Enclosure 1.

1.4. Other Damages

No other damages.

1.5 Personnel Information

1.5.1 Information about the Crew

1.5.1.1. Pilot-instructor: a 56 years old, male, having valid pilot license and medical certificate.

1.5.1.2. Student Pilot: a 38 years old, male, having valid pilot license and medical certificate.

On the 05.07.2007 the trainee aircraft commander has been involved in a serious incident with DA 42 aircraft. reg. No LZ-ADS at Plovdiv Airport – landing with non-extended landing gear.

In the process of investigation the commission has determined that CAA has sent a letter reg. No 40-01-945/06.07.07 to the Director of Air Scorpio, by which the trainee aircraft commander's rights to fly have been suspended till the end of investigation of the serious incident with his participation, realized on 05.07.2007 at Plovdiv Airport, but missed to inform the trainee pilot. As to the date of origin of the serious incident with LZ-ASH aircraft, the investigation hasn't been closed and the trainee aircraft commander hasn't been permitted for flights.

1.5.2. Other Personnel Information

Air traffic controller working station at Control Tower - Gorna Oriakhovitsa Airport:

- Age - 56 years;
- License - ADI-TWR;
- Information about duty time:
- for the last 48 hours - N/A;

1.6. Aircraft information

1.6.1. Airworthiness information

DA 42 aircraft, reg. No LZ-ASH, has been manufactured on the 05.09.2006 by Diamond Aircraft Industries GmbH - Austria. The aircraft possesses Certificate for Registration. The Certificate for Airworthiness under was issued on 24.01.2007. The last verification of the Certificate has been made on 24.01.2007 and is valid till 01.11.2007. Till 27.09.2007, the aircraft has accumulated 171:54 hrs since new (before the serious incident). In accordance with the documentation of the manufacturer the aircraft has no limitation of the total life time.

Two engines TAE 125-01 are installed on the aircraft.

The engine on No1 position (left-hand) is produced on the 12.04.2006.

The engine on No2 position (right-hand) is produced on the 12.04.2006.

Both engines have been installed on the aircraft by the manufacturer and have total life time of 1000 hours. As to the moment of the occurrence the residual life time of both engines is 828:06 hours each.

The aircraft power plant includes two propellers MTV-6-A-C-F / CF 187-129 type. The propellers have time-between-overhauls of 1500 hours. As to the moment of the occurrence the residual time-between-overhauls of the both propellers is 1328:06 hours each.

Aircraft maintenance is performed on the grounds of approved by CAA Maintenance Program for aircraft with mass less than 5700 kg of Air Scorpio Airline. In implementation of this program on the 04.07.2007 a scheduled maintenance check of the aircraft for 100±10 hrs was certified, when the aircraft has accumulated 102,48 hrs. For execution of this maintenance a Release to Operation Certificate No DA 42-ASH-001 has been issued by the Air Scorpio Maintenance Organization, which is approved according Regulation 145 under the Certificate No BG CAA - 0021.

In accordance with the Maintenance Program, the aircraft line maintenance includes the following inspections and checks:

- first flight for the day;
- pre-flight inspection of the cockpit;
- pre-flight check along the approved inspection route;
- post flight inspection.

Air Scorpio AO uses for registration of the line maintenance a technical log book, which has been completed at the day of origin of the occurrence under No 0000000241. The pre-flight

inspection has been registered in the technical log book by the instructor, who is authorized for this with permission No ASP001. During the pre-flight preparation there were no registered revealed and eliminated malfunctions. There were no registered malfunctions in the technical log book from the previous flight day also.

No note for post flight inspection is provided in the technical log book blank.

Having in mind the above mentioned, the conclusion could be made that as to the moment of the start of the flight, in which the occurrence has been realized, the aircraft has been airworthy.

1.6.2. Airplane performance

In accordance with the Airworthiness Certificate the aircraft take-off mass is 1785 kg. Aircraft empty mass is 1296.5 kg. According to the aircraft load-sheet & trim-sheet completed for the flight on 27.09.2007 г., the aircraft dry mass was 1481.5 kg. In the report about the flight the following fuel quantity was registered at engine start-up: 41 US gal, equal to 125 kg. Aircraft take-off mass was 1606.5 kg. The Center-of-Gravity for this loading is 2.43 m and it is in the admissible limits. Hence, the aircraft loading and center-of-gravity has not influenced the air occurrence emerged.

Maximum allowable speed V_{NE} - 194 KIAS

Maximum cruising speed V_{NE} - 155 KIAS

Maximum speed for landing gear extension is V_{LOE} - 194 KIAS.

Maximum speed for landing gear retraction is V_{LOE} - 156 KIAS.

Normal operational speed range is from 62 to 155 KIAS.

Operational speed range with fully extended flaps is 56 -111 KIAS.

On the scheme on Fig. 7, Enclosure 1, the main components of aircraft DA 42 landing gear are shown. It is retractable, tricycle, nose-wheel landing gear. The primary struts of the landing gear are retractable into niches in the wing, located between the engine nacelles and the fuselage, and the nose strut in a niche in the nose part of the fuselage. Landing gear retraction and extension is conducted by hydraulic system with electrical delivery pump. The hydraulic pump keeps the nose and main struts in retracted position. The struts are kept in extended position by geometrical lock (inner obtuse angle) and latch. In case of hydraulic system failure the pilot might extend the landing gear by moving the landing gear lever into the lower position. The weight of the landing gear, assisted by a spring, will cause its extension. When the landing gear is fully extended, a spring should activate the latch and keep the geometrical lock in extended position. The pilot might conduct normal landing. The pilot couldn't retract the landing gear with the hydraulic system failed.

A failure of aircraft electrical system should cause automatic extension of the landing gear. The hydraulic pump doesn't work and the two solenoid-operated valves are opened. The locking in extended position is conducted by a geometric lock.

The hydraulic system reservoir volume is 1.5 liters. The normal filling of the hydraulic reservoir is 0.9 liters. There is a liquid level control window on the reservoir. On figure 8, Enclosure 1, a photo of the hydraulic reservoir and liquid level control window is shown. The picture was taken after the realization of the aviation occurrence. The liquid level is normal.

When the pilot has a problem with normal extension of the landing gear, the emergency landing gear extension system might be used. The emergency landing gear extension lever is situated in the left-hand part of the cockpit, under the instrument panel. A micro-switch is installed on the emergency landing gear extension valve in order to isolate the hydraulic pump when the valve is in emergency position.

The lever for landing gear retraction and extension is in the middle of the dash board. It has up and down position. Next to the landing gear retraction and extension lever there are 3 green and 1 red indication lights. There is respective green light for each strut. The green indicating lights are on, if the lever for retracting and extension is positioned in down position and all landing gear struts are at extended position and are locked. The green indicating lights

should be off, if the lever for retracting and extending is up and all struts are at fully retracted position. During the movement of the struts for retracting or extending of the landing gear a red indication light should be on, and the green indication lights should be off. The red indication light should be on, if one or more struts of the landing gear are not fully retracted when the lever for retracting or extending of the landing gear is up.

The red indicating light should be on, if one or more struts of the landing gear are not locked in fully extended position, when the lever for retracting or extending of the landing gear is in lower position. The respective green lights should also be off.

The operability of the green and red indication lights and audio signalization is checked by pushing of a test button.

The emergency audio signalization should be on when the landing gear is in retracted position and the flaps are in landing position or at least one of engine throttles is below 25% position.

There is a switch on the left-hand main strut, which should be activated after strut compression by the aircraft weight. The switch opens the electric circuit of the solenoid valves of hydraulic supply and isolates the landing gear control system in order to keep the landing gear at extended position, when the aircraft is on the ground.

1.6.3 Fuel

The aircraft was refueled with 41 US gal JET-A1 fuel according to the flight report. In the technical log book for the flight it is written 110 liters (29 US gal). According to the engine time counter the flight lasted 30 min and the fuel after landing was registered as 37 US gal and the flight time was registered as 35 min. After the occurrence the remaining fuel was 42 US gal according to the readings of G 1000 display. Independently of discrepancies of the fuel quantity in the different documents, the fuel available was enough for the flight and its quantity had no contribution to the occurrence.

1.7. Meteorological information

Factual conditions during the aviation occurrence were as follows: Wind - variable from 220° to 310° / 2 kt. and visibility over 10km, clear.

Day conditions - daylight.

1.8. Aids to navigation

Standard for DA 42 aircraft.

1.9. Communications

On the 27.09.2007 all the communication equipment used at Gorna Oryakhovitsa airport was normally operational. A record of radio exchange at Gorna Oryakhovitsa Airport Control Tower frequency and intercom at the moment of the aviation occurrence is enclosed to the deed.

1.10. Airport

Gorna Oryakhovitsa Airport is with the following coordinates of the airport reference point: N 43°09'06", E 025°42'43" and elevation of 85 m. RWY 094°/274° (designated as 09/27), 2450m long and 45m wide. RWY27 threshold is with 200m offset to the west.

1.11 Flight data recorders

No flight data recorders are used on the DA 42 aircraft for registration of the flight parameters.

1.12 Wreckage and impact information

The first touch between the aircraft and RWY is with coordinates N 43° 09' 03.6" and E 025° 43' 02" by the right-hand ladder tread, which is visible from the trace on the runway, the left-hand one has touched the runway 13m further. Together with these traces the traces from the propellers are visible. There are 6 traces on the asphalt concrete surface from the propeller of the throttled right-hand engine spread in 7m, and from the left-hand propeller - 23 traces in 13m. In this phase of aircraft movement trajectory there is a dispersion of pieces from the blades of left- and right-hand propellers. The traces from the tires were in parallel with the traces of the steps. The aircraft made a small bank to the right in order to keep the direction over the runway.

Sliding along the runway without landing gear, after 48m the aircraft deviated to the right, crossed the center line and with the following deviation to the left managed to keep the direction along the runway. During the last 31m the aircraft made intensive turn to the right and stopped in the right part of the runway at a point with coordinates N 43° 09' 05.3" and E 025° 42' 49.6", without leaving the runway and with heading of 310°.

The aircraft stopped as a result of the friction with the asphalt-concrete surface of the steps, upper surface of engine nacelles, tail bumper and tires at 219m from the first touch into the runway and at 15m to the right of the center line, at 8.5m from the right edge of the runway in northwest heading, what is visible on the sketch in Enclosure 1.

1.13 Medical and pathological information

N/A

1.14 Fire

No fire appeared.

1.15 Survival aspects

The crew was with fastened safety belts, which contributed the injuries avoidance. No torn safety belts or damages of the seats have been found.

After the aircraft stopped on the RWY the Gorna Oryakhovitsa Airport's emergency group was informed. The group arrived at the place within 3 minutes after the alarm signal given by the Gorna Oryakhovitsa Airport's Control Tower. A NOTAM for closure of Gorna Oryakhovitsa Airport was issued.

Because of lack of fuel spillage after the landing it wasn't necessary to conduct a treatment of a spillage by the fire brigade.

Air cushions have been used for lifting of the aircraft; they were with lifting capacity up to 1.5 tons and were part of the standard equipment of the fire brigade engine at Gorna Oryakhovitsa airport. The commission determined that the cushions did not possess the sufficient height to lift the aircraft in order to extend and lock the landing gear struts.

During the aircraft lifting a fuel leakage started which imposed to be treated with foam solution by the fire brigade.

The aircraft removal from the runway was conducted using airport equipment.

The commission determined that the Air Operator did not have spare tires at Gorna Oryakhovitsa Airport, which complicated the aircraft removal from the runway.

1.16 Tests and research

For the purpose of the technical investigation the following have been accomplished:

- Investigation on the incident site, aircraft traces on the runway at Gorna Oryakhovitsa Airport and presence of debris;
- Inspection of the aircraft and ascertainment of damages and destructions emerged;

- Inspection of the landing gear and assessment of the condition of structural elements, including locks and micro switches for landing gear positions;
 - Listening and analyses of the records of radio exchange between the aircraft crew and air traffic controller at Gorna Oryakhovitsa Airport Control Tower;
 - Inspection of the records in the aircraft operational documentation;
 - Inspection of documents, related to the student pilot training;
 - Inspection of the content and nature of the preliminary and pre-flight preparation of the crew;
 - Inspection of the operational documentation of the Air Operator;
 - Comparative analysis of emergency procedures, given in the check lists of ATrC, aircraft manufacturer and Airplane Flight Manual of DA 42 aircraft.
 - Logical and probabilistic analyses of the possible causes for the aviation occurrence.
- The materials and results of the tests and researches are enclosed to the deed.

1.17. Organizational and management information

1.17.1. Air operator

- Information about organizational structure and functions:

Organizational structure of „Air Scorpio” ATrC and its functionality are directly related with aircraft operation. In the process of investigation the commission has determined that some basic measures have not been conducted with the instructors and student pilots, such as: in-depth and qualitative analyses of the previous aviation occurrence with DA 42 aircraft, reg. No LZ-ADS; no standard operational procedures developed by ATrC for the type of aircraft; the place and significance of the concept of „Checklist” is not specified in the standard operational procedure for the type of the aircraft; the place and significance of the concept of „Memory items” in case of shortage of time for one-pilot aircraft; no practices are introduced and maintained for procedures and elements, such as: decision altitude, announcement of "Landing" decision; repetitive check immediately before decision announcing: „Gear, flaps, lights”. It reveals that there is no training methodic at the ATrC and the training of the instructors is not at the necessary level.

On the 06.07.2007 the Director General of CAA notified by letter No 40-01-945/06.07.2007 Air Scorpio manager about the trainee aircraft commander suspension till the end of the investigation of another serious incident with the same type of aircraft and involving the same trainee aircraft commander. The letter has been received by the Executive Director of ATrC, but he hasn't acquainted himself with it and allowed the trainee aircraft commander to fly again on the 27.09.2007.

1.18. Additional information

According to the written explanation of ATrC manager, the trainee pilot has declared verbally that he had no ban imposed by CAA in relation with his participation in the serious incident with DA 42 aircraft, reg. No LZ-ADS, emerged on 05.07.2007 at Plovdiv Airport.

2. Analysis

During the training flight, landing with one inoperative engine has been worked through, and according to the instructor's command the trainee aircraft commander throttled the engine below 25% in order to be trained for landing with an engine throttled. The signalization for non-extended landing gear has been activated, which according the both pilots statement has worked till the landing. According Section 3.5.7, Landing with one engine inoperative, item 3, page 3-30 of Chapter 3 "Emergency Procedures" of Airplane Flight Manual - AFM of DA 42 aircraft the pilot should check the functionality of the

signalization of landing gear position, and in item 7 of the same section and the same check list - to extend the landing gear and assure himself that three green lights are on. This checklist, applicable for the case of landing with a simulated engine failure, has not been conducted by the crew according to the explanation of the trainee pilot. The commission determined that such checklist is missing in the on-board set of checklists for emergency procedures. The on-board present checklists were not approved by the CAA.

The commission has checked all the checklists on-board and compared them with Edition 14 of checklists of the aircraft manufacturer and has not determined any discrepancies between them. At the same time the aircraft manufacturer has written on each page of the checklists that they don't substitute AFM, i.e. the leading document on-board is the AFM. In the set of documents, taken by the commission from the aircraft after realization of the aviation occurrence, there was no AFM. In Flight Operation Manual, Part B, Aircraft Operational Matters, Type of Aircraft - DA 42 (AOM) there are references to AFM, but this document is actually missing on-board, which is a violation of Article 20, Para. 1, item 3 of Regulation No 6/14.06.2001 on aircraft operation of the Minister of Transport, which has been in force as to the moment of the aviation occurrence realization, as well of JAR.OPS 1.130 regarding the on-board obligatory presence of actual Aircraft Operation Manual for the aircraft operated. The commission has made a comparison between the emergency procedures, given in ATrC checklists and aircraft manufacturer and these in AFM, Revision 4. The comparison is shown in Table 1 of Enclosure No 2.

It is visible from Table 1, that not all emergency procedures, given in AFM are available in the set of checklists of the manufacturer, respectively in the ATrC set. This is the reason for the manufacturer to write on each page of the set that this set doesn't substitute AFM.

The lack of AFM on-board and respective check list for one engine inoperative didn't permit the crew to conduct correctly the procedure for landing with one engine inoperative, given in 3.5.7 "Landing with one engine inoperative" of Chapter 3 "Emergency Procedures" in AFM of DA 42 and created a precondition for omitting of some items of the procedure, especially in conditions of increased working loading, stress and lack of distribution of the obligations between the crew members. Such conditions for increased working loading are present during the approach and landing with simulated engine failure. In such conditions the continuous operation of non-extended landing gear signalization turns solely into a noise background for the crew and they ignored it.

According the explanation of the trainee pilot during the flight no check lists for normal operation have not been read (except those for take-off), as well ones for emergency in-flight situations (such as engine failure). There is no distribution of the obligations between the crew members.

The commission has established that the AO has no methodic for training for the specific type of aircraft and standard operating procedures, what is a pre-requisite for committing errors by the piloting pilot and instructor and non-observance of the mandatory requirements of the manufacturer, given in the Aircraft Operation Manual and respective check lists.

The lack of methodic for training of the type of aircraft, absence of an on-board AFM, inappropriate CRM acting and non-reading of the checklists have led to the fact that the instructor and trainee pilot did not retracted the landing gear during approach till the moment of the contact between the aircraft and runway.

3. Conclusions

On the base of the facts determined and the analyses conducted, the commission has made the conclusion that the serious incident occurred because of the following

Main cause:

Lack of methodic for training on DA 42 aircraft, that led to violation of the landing procedure for landing with one inoperative engine and landing with the landing gear retracted.

Immediate cause:

Crew incompliance with the procedure for one inoperative engine landing, that led to a landing with retracted landing gear and with the audio signalization for landing gear retracted activated.

As contributing factors the commission has determined:

1. Lack of methodic for flight training at Air Scorpio ATrC for DA 42 aircraft with detailed description of elements and parameters of the exercises taking into account the specificity of DA 42 aircraft.
2. Lack of standard operating procedures for DA 42 aircraft, developed by ATrC.
3. Lack of distribution of the obligations between the instructor and trainee pilot on-board (Crew Resource Management - CRM)
4. Non-reading of the checklists for normal and emergency operation of DA 42 aircraft, which is a prerequisite for omissions during the execution of the respective procedures, regulated by the aircraft manufacturer in AFM and the set of check lists.

4. Violations and irregularities determined:

1. The Director of Air Scorpio ATrC permitted the trainee aircraft commander to conduct flights in violation of the entered into force by letter No 40-00-945/06.07.2007 of CAA suspension of flights.
2. The Chief Pilot of Air Scorpio AO permitted continuation of flight training program without performing the basic measures with instructors and trainee pilots, such as: n-depth and qualitative analyses of the previous aviation occurrence; the place and significance of the concept of „Checklist” is not specified in the standard operational procedure for the type of aircraft; the place and significance of the concept of „Memory items” in case of shortage of time for one-pilot aircraft; exam of instructors and trainee pilots about the standard operating procedures for the type of aircraft and assimilated material; introduction and maintenance of settled habits for concepts such as: decision altitude, announcement of decision "Landing"; repetitive check immediately before decision announcing: „Gear, flaps, lights”.
3. No note for post flight inspection has been provided in the technical log book blank.
4. Inaccuracy in recording of the fuel quantity in the aircraft.
5. Gorna Oryakhovitsa Airport does not possess air cushions pursuant to the category of emergency equipment at the airport.
6. The aircraft touched down the runway outside the TDZ

5. Safety recommendations

1. Air Scorpio ATrC to develop and submit for approval to CAA methodic for training for each specific type of aircraft, used by ATrC, in which to develop in details the exercises for each task showing all characteristic parameters of each phase of flight, taking into account the peculiarities of the airfields used for training and the manufacturer's requirements, given in AOM for type of aircraft used.

Time: 90 days after the date of handing over of the final report.

Person responsible: Manager of Air Scorpio ATrC

2. All AO, operating DA 42 aircraft, to introduce a checklist "Landing with one engine inoperative" in the set of emergency checklists of DA 42 aircraft and to submit the checklists to CAA for approval.

Time: 30 days from the date of sending of the final report to CAA

Person responsible: Executive Director of GD CAA.

3. Air Scorpio ATrC to ensure the presence on-board of all aircraft, owned by the Air Operator approved by CAA checklists and valid Aircraft Operation Manual of the respective aircraft.

Time: 30 days after the date of handing over of the final report.

Person responsible: Manager of Air Scorpio ATrC.

Air Scorpio ATrC to conduct an analysis of the aviation occurrence with the instructing personnel and to review the peculiarities in training on DA 42 aircraft paying special attention to the cases of triggering of the extended landing gear signalization and actions to be taken (required) by instructors in such cases by the trainee aircraft commanders. The analysis should be confirmed by a protocol sent to AAIU.

Time: 30 days after the date of handing over of the final report.

Person responsible: Chief Pilot of Air Scorpio ATrC

5. Air Scorpio ATrC to conduct a lesson with the instructor personnel regarding the mandatory knowledge of check lists during the pilot's training paying special attention to the Crew Resources Management during the training of pilots for CPL.

Time: 30 days after the date of handing over of the final report.

Person responsible: Chief Pilot of Air Scorpio ATrC

6. CAA to conduct an exam to the instructor on the methodic of flight training, aerodynamics, aircraft design and systems of DA 42 aircraft.

Time: 30 days from the date of handing in the report.

Person responsible: Executive Director of MD CAA.

7. Measures for control of refueling and recording of fuel quantity to be included in the Quality Assurance Plan.

Time: 14 days from the date of handing in the report.

Person responsible: Manager of Air Scorpio ATrC.

8. The blank of the aircraft log book for DA 42 aircraft to be remodeled in order to make a note about the post-flight inspection.

Time: 30 days from the date of handing in the report.

Person responsible: Manager of Air Scorpio ATrC.

9. The aircraft manufacturer – Diamond Aircraft Industries GmbH – Austria to assess the possibility for alteration of the sound of the emergency audio signalization for non-retracted position of the landing gear and for changing of the logic of activation of this signalization.

10. The aircraft manufacturer - Diamond Aircraft Industries GmbH – Austria to reconsider the possibility to include a procedure 3.5.7. "Landing with one engine inoperative" of AFM into the set of check lists, supplied to the users.

11. CAA to start a procedure for supply of air cushions for Gorna Oryakhovitsa Airport with capacity to lift the types of aircraft which might use the airport in consideration of its category for emergency equipment.

Time: 3 months after the date of sending of the final report.

Person responsible: Executive Director of GD CAA

12. CAA to consider the level of training of the trainee aircraft commander and to determine an individual program for his training, containing ground and flight training on DA 42 aircraft.

Time: 1 month after the date of sending of the final report.

Person responsible: Executive Director of GD CAA

The Commission reminds to every organizations concerned that on the ground of Article 19, Para. 7 they are obliged to inform AAIU and CAA about the status and implementation date of the safety measures.

ENCLOSURE No 1



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5



Figure 6



Figure 7

ENCLOSURE No 2

Table 1

No of emergency procedure of manufacturer's AFM	Presence of such a procedure in the check lists of emergency procedures of ATrC	Presence of such a procedure in the check lists of emergency procedures, proposed by the aircraft manufacturer
Introduction	N/A	N/A
3.2.2. L/R ENG TEMP – Raised temperature of refrigerating fluid of left/right engine.	Available	Available
L/R ENG TEMP – Raised oil temperature of left/right engine.	Available	Available
3.2.4 L/R OIL PRES – Low pressure of oil of left/right engine.	Available	Available
3.2.5 L/R GBOX TEMP – Raised temperature in the gearbox of left/right engine.	Available	Available
3.2.6 L/R FUEL TEMP – Raised fuel temperature.	Available	Available
3.2.7 L/R ALTN AMPS – Raised value of current of left/right alternator.	Available	Available
3.2.9 L/R STARTER – No switching off of left/right starter.	Available	Available
3.2.10 DOOR OPEN.	Available	Available
3.3.1 RED X – Red „X” on the display.	N/A	N/A
3.3.2 POSN ERROR – GPS position error.	N/A	N/A
3.3.3 ATTITUDE FAIL – no aircraft attitude information on displays received from AHRS.	N/A	N/A
3.3.4 AIRSPEED FAIL – No speed information on displays, received from air signals computer.	N/A	N/A
3.3.5 ALTITUDE FAIL - No altitude information on displays, received from air signals computer.	N/A	N/A
3.3.6 VERT SPEED FAIL - No information about the vertical speed on displays,	N/A	N/A

received from air signals computer.		
3.3.7 HDG - No heading information on displays, received from AHRS.	N/A	N/A
3.3.8 WARN.	N/A	N/A
3.4.1 NAVIGATION INFORMATION FAILURE – Lack of navigation information.	N/A	N/A
3.4.2 PFD OR MFD DISPLAY FAILURE – Display failure.	N/A	N/A
3.4.3 AHRS FAILURE	N/A	N/A
3.4.4 AIR DATA COMPUTER (ADC) FAILURE	N/A	N/A
3.4.5 ERRONEOUS OR LOSS OF ENGINE AND FUEL DISPLAYS	N/A	N/A
3.4.6 ERRONEOUS OR LOSS OF WARNING/CAUTION ANNUNCIATORS	N/A	N/A
3.5.1 DETECTING THE INOPERATIVE ENGINE	N/A	N/A
3.5.2 ENGINE TROUBLESHOOTING	Available	Available
3.5.3 ENGINE SECURING (FEATHERING) PROCEDURE	N/A	N/A
3.5.4 UNFEATHERING & RESTARTING THE ENGINE IN FLIGHT.	Engine Restart only	Engine Restart only
3.5.5 ENGINE FAILURE DURING TAKEOFF	Available	Available
3.5.6 ENGINE FAILURES IN FLIGHT.	N/A	N/A
3.5.7 LANDING WITH ONE ENGINE INOPERATIVE.	N/A	N/A
3.5.8 GO-AROUND / BALKED LANDING WITH ONE ENGINE INOPERATIVE.	N/A	N/A
3.5.9 FLIGHT WITH ONE ENGINE INOPERATIVE.	N/A	N/A
3.6.1 LANDING GEAR UNSAFE WARNING.	Available	Available
3.6.2 MANUAL	Available	Available

EXTENSION OF THE LANDING GEAR.		
3.6.3 LANDING WITH GEAR UP.	Available	Available
3.6.4 LANDING WITH A DEFECTIVE TIRE ON THE MAIN LANDING GEAR.	Available	Available
3.6.5 LANDING WITH DEFECTIVE BRAKES.	Available	Available
3.7.1 COMPLETE FAILURE OF THE ELECTRICAL SYSTEM.	Available	Available
3.7.2 HIGH CURRENT.	Available	Available
3.7.3 STARTER MALFUNCTION.	Available	Available
3.8.1 ENGINE FIRE ON GROUND.	Available	Available
3.8.2 ENGINE FIRE DURING TAKE-OFF.	Available	Available
3.8.3 ENGINE FIRE IN FLIGHT.	Available	Available
3.8.4 ELECTRICAL FIRE ON GROUND.	Available	Available
3.8.5 ELECTRICAL FIRE IN FLIGHT.	Available	Available
3.9.1 SUSPICION OF CARBON MONOXIDE CONTAMINATION IN THE CABIN.	Available	Available
3.9.2 UNLOCKED DOORS.	Available	Available
3.9.3 DEFECTIVE PROPELLER RPM REGULATING SYSTEM.	Available	Available
3.9.4 UNINTENTIONAL FLIGHT INTO ICING.	Available	Available
3.9.5 FUEL SUPPLY FAILURE.	N/A	N/A
3.9.6 RECOVERY FROM AN UNINTENTIONAL SPIN.	N/A	N/A
3.9.7 EMERGENCY DESCENT.	Available	Available
3.9.8 EMERGENCY EXIT.	N/A	N/A