

# FINAL REPORT

on

Investigation of Aircraft Accident with An-12 aircraft, registered LZ-BRP,  
owned by Air Operator Bright Aviation Services, occurred on 01.01.2004 at  
Tehran Airport, Islamic Republic of Iran.



2004

The materials on the aviation occurrence have been classified under state file number 01/01.01.2004.

**Operator:** Bright Aviation Services Ltd., with main office in Sofia 1606, 31 Luylin Planina St., entrance 1.

**Aircraft Manufacturer:** MAP, USSR.

**National and Registration Marks:** LZ-BRP, according Certificate for Registration, issued on 17.11.2003 by CAA.

**Place and Date of Occurrence:** Tehran Airport, Islamic Republic of Iran, on 01.01.2004, at 16:55 UTC.

**Notified:** Civil Aviation Authority (CAA) and Aircraft Accident Investigation Unit.

In accordance with the requirements of Art.142, Para.2 of Civil Aviation Act and Art.2, Para2 of Regulation No 13/27.01.1999 of the Ministry of Transport, an inspector of aeronautics in UKPOIB Directorate, was appointed as an authorized representative to take part in the investigation by an order No RD-08-16/14.01.2004 of the Minister of Transport and Communications, accompanied by three technical experts:

**Type of the Flight:** Cargo flight Tehran – Kermanshakh - Bam – Tehran.

On the 01.01.2004 at 16:55 UTC during the landing of An-12 aircraft of Bulgarian air operator on runway 29R at the Teheran Airport at touch-down the aircraft commander, piloting pilot, set the throttle of engines No1 & No2 on the left-hand half-wing at ground idle position. As a result of the emerged yawing moment the aircraft turned to the left and despite of the consequent activities of the crew it left RWY 29R, crossed the ground between the RWY 29L and RWY 29R, hit a concrete column 1.6 m high with the left-hand fore part of the fuselage and tore the skin in the area between 6<sup>th</sup> and 19<sup>th</sup> strength ribs. The aircraft continued on runway 29L and stopped, whereupon on self-moving and accompanied by a pilot car and fire-engine, taxied to the defined tarmac.

There were no consequences for the crew.

Consequences for the aircraft: crippling of the skin between the 6<sup>th</sup> and 19<sup>th</sup> strength ribs in the area of the pressurized and cargo compartments. In accordance with the additional provisions of Regulation No 13/27.01.1999 of the Ministry of the Transport, the occurrence was classified as an Air Accident.

## **1. Factual Information**

### **1.1 History of the Flight**

The flight assignment was given verbally by the air operator to a crew consisting of: commander, first officer, navigator, flight engineer, flight radio-operator and two technical persons.

#### **1.1.1 Flight Number:**

Flight No BRW 200

### **1.1.2 Flight Preparation and Description**

The crew performed preliminary and preflight briefing for the flight Tehran – Kermanshakh – Bam – Tehran. The aircraft took-off from Tehran at 07:15 UTC and landed at Kermanshakh at 08:25 UTC. After loading with equipment and foodstuffs the aircraft took-off at 10:25 UTC and landed at Bam at 12:40. After unloading the aircraft took-off for Tehran at 14:45 UTC. The flight passed without peculiarities till the phase of flare out.

After the flare out during the phase of holding-off and touch-down on the runway the piloting pilot inadvertently put the power levers of engines No 1 & No2, installed on the left-hand half-wing, into 0°-position according UPRT – “ground idle”.

The power levers of engines No 3 & No4, installed on the right-hand half-wing, were on 16° according UPRT – “in-flight idle”. As a result of the yawing moment, created by the difference between the propeller thrust force on the left-hand and right-hand engines the aircraft turned sharply to the left, changing the course by 25-30° from the landing course, left RWY 29R to the ground between RWY 29R and RWY29L, where hit a concrete column about 1.6 m high by its left-hand part of the fuselage.

As a result of the impact the skin was torn in the area between 6<sup>th</sup> and 19<sup>th</sup> strength ribs. The aircraft went on runway 29L and stopped; the pressurized part of the cabin was damaged between 6<sup>th</sup> and 13<sup>th</sup> strength ribs.

The aircraft movement proceeded in straight line; the aircraft left the ground and stopped on RWY 29L. Accompanied by a pilot car and a fire-engine and after control tower operator permission the aircraft on self-moving taxied to the defined tarmac (vide Fig.1 & Fig.2).

### **1.1.3 Location of the Occurrence**

The air occurrence emerged at Tehran Airport with coordinates N 35°41’21.00” and E 051°18’48.30”, elevation 1208 m at 16:55 h UTC (19:55 local time), night.

## **1.2 Injures to Persons**

No injures to crew and passengers.

## **1.3 Damages to Aircraft**

- Tearing and crippling of the pressurized part of the fuselage from 6<sup>th</sup> to 13<sup>th</sup> strength ribs;
- Tearing and crippling of the non-pressurized part of the fuselage from 13<sup>th</sup> to 19<sup>th</sup> strength ribs;
- Deformed skin supporting elements between 6<sup>th</sup> and 19<sup>th</sup> strength ribs.

## **1.4 Other Damages**

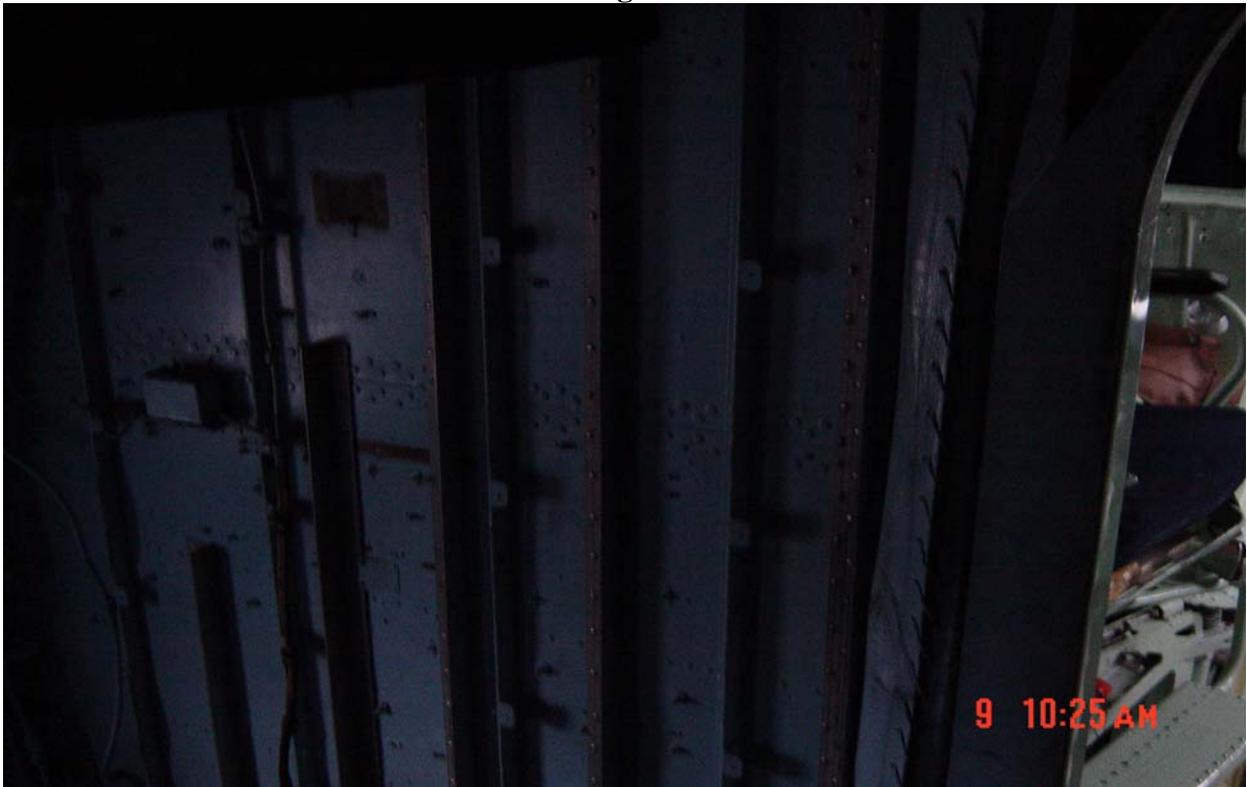
No other damages.

According to the technological calculations and under the Antonov Construction Bureau representative instructions a repair was made in order to permit technical flight to a base airport, such as:

- The skin intactness of the lower left-hand part of the fuselage between 6<sup>th</sup> and 19<sup>th</sup> strength ribs was restored (vide Fig.3);
- In the torn area the skin was strengthen from inside by additional L-shaped aluminum ribs;
- The partition wall in the pressurized part of the cabin was additionally strengthen by L-shaped aluminum profiles (vide Fig. 4)]
- After the technical flight the aircraft was transferred to Letetz workshop and it was liable to repair after the damage.



**Fig. 3**



**Fig.4**

## **1.5 Personnel Information**

**1.5.1 Commander – male, aged 50, with a valid pilot license and medical certificate.**

**1.5.2 First Officer – male, aged 48, with a valid pilot license and medical certificate.**

**1.5.2 Flight Engineer – male, aged 43, with a valid pilot license and medical certificate.**

## **1.6. Aircraft information**

### **1.6.1. Airworthiness information**

An-12BP aircraft, registered LZ-BRP was manufactured in year 1964 by Ministry of Aviation Industry (MAP) of USSR and possessed Certificate of Airworthiness, issued on 17.11.2003 by CAA and valid until 30.05.2004.

The aircraft has accumulated 24812:49 hrs total time since new and 9913 cycles since new. Total technical life time is 35000 hrs, 12000 cycles and 39 years 10 months (according a decision of Antonov design bureau of 19.11.2003). After an overhaul the aircraft has flown 3412:24 hrs and 1149 cycles, having time between overhauls 4750hrs and 2000 cycles (established by Antonov design bureau of 19.11.2003).

Four engines AI-20 were installed on the aircraft.

Engine No 1 serial number N2936013 has flown 20029 hrs since new with total life time of 20600 hrs. The engine has flown 2542 hrs after overhaul with time between overhauls of 3095 hrs, 13 years.

Engine No 2 serial number N220262223 has flown 15178 hrs since new with total life time of 20000 hrs. The engine has flown 3755 hrs after overhaul with time between overhauls of 4500 hrs, 13 years.

Engine No 3 serial number N2016008 has flown 17527 hrs since new with total life time of 20000 hrs. The engine has flown 5966 hrs after overhaul with time between overhauls of 6555 hrs, 15 years.

Engine No 4 serial number N2336079 has flown 13055 hrs since new with total life time of 20000 hrs. The engine has flown 4314 hrs after overhaul with time between overhauls of 4519 hrs, 13 years.

The engines worked with four propellers AV-68I, 04A series.

Engine No 1's propeller serial number N011270017 has flown 12573 hrs since new with total life time of 15000 hrs, 30 years. The propeller has flown after overhaul 2727 hrs with time between overhauls of 3000 hrs.

Engine No 2's propeller serial number N094300062 has flown 8190 hrs since new with total life time of 15000 hrs, 30 years. The propeller has flown after overhaul 2200 hrs with time between overhauls of 3000 hrs.

Engine No 3's propeller serial number N080260447 has flown 5965 hrs since new with total life time of 15000 hrs, 30 years. The propeller has flown after overhaul 2655 hrs with time between overhauls of 3000 hrs.

Engine No 4's propeller serial number N023280914 has flown 9857 hrs since new with total life time of 15000 hrs, 30 years. The propeller has flown after overhaul 857 hrs with time between overhauls of 3000 hrs.

The aircraft maintenance was performed according the approved by CAA program under a contract with the maintenance organization Inter Trans Air, licensed according the requirements of Regulation No 145 of the Ministry of Transport and Communications - License No MOA – 82/1101, valid till 23.11.2004. The aircraft possesses a Certificate for Maintenance No 02/24.11.2003. According this certificate the scheduled maintenance was performed on the aircraft in the volume of Form F11 and seasonal technical servicing.

The last 100-hrs maintenance form – Form G (even) was performed on 30.12.2003.

On the ground of the abovementioned the conclusion could be made that as at the moment of air accident the aircraft was airworthy.

### **1.6.2. Airplane performance**

Maximum take-off weight of the airplane is 64000 kg according to the Antonov Design Bureau Decision from 19.11.2003. Take-off weight for the flight BRW 200 according to the flight logbook No 0080171 it was 44000 kg. Estimated landing weight at Tehran airport, which was registered in the flight logbook, was 39500 kg. On the base of the data in the balance sheet the centering of the aircraft was in the operational range.

- landing configuration - landing gear extended, flaps at 35°;
- landing approach speed 260 km/h;
- touch down speed 190 – 240 km/h.

### **1.7. Meteorological information**

Calm, visibility 10 km, temperature +5°, RWY 29R, dry

### **1.8. Airport**

Air occurrence emerged at Tehran Airport (Mehrabad), ICAO code OIII, RWY29R, airport reference point N 35°41'21.00", E 051°18'48.30" and elevation 1208 m. Coordinates RWY 29R threshold are N 35°41'04.35" and E 051°20'01.30", asphalt runway pavement. Available distances are as follows:

- Landing distance available (LDA) 3992 m;
- Take-off distance available (TODA) 4297 m (vide Fig.5).

## **2. Analysis**

The crew activities and the nature of aircraft movements, leaded to the air occurrence were analyzed.

There were no deviations of the estimated parameters during the take-off from Bam Airport, climb, en-route flight and descend for landing. After the phase "Descent for landing" during the aircraft flare-out and touch-down the piloting pilot (aircraft commander) inadvertently put the power levers of engines No 1 & No 2, installed on the left-hand half-wing, into 0°-position according UPRT – "ground idle". The power levers of engines No 3 & No 4, installed on the right-hand half-wing, were on 16° according UPRT – "in-flight idle" (vide Fig. 6).



**Fig. 6**

The aircraft movement trajectory, described by the center of gravity is formed by the acting forces and moments. In case of above shown position of power levers there was a presence of difference between engine No1 & No 2 on the left-hand half-wing and engines No 3 & 4 on the right-hand half-wing, conditioned by the principal of operation of the turboprop engine AI-20.

During engine power reduction from 16° UPRT to 0° UPRT with constant aircraft speed (200...220 km/h in case), the propeller pitch is changing (lessening), which led to respective lessening of their angle of attack. In the mentioned range from 16° UPRT to 0° UPRT the angle of attack at this speed moves from about zero values to negative values and the propeller turns to regime of deceleration. In this regime the engine works at idle and the power is not enough to rotate Propeller – Compressor – Turbine system and the lacking energy is taken from the air, which attacks the propeller vanes. As a result of this engines No 1 & No 2 on the left-hand half-wing, working at ground idle - 0° UPRT created negative thrust.

The propeller rotation speed is kept constant by the speed regulator. Engines No 3 & No 4 on the right-hand half-wing worked at “in-flight idle” - 16° UPRT, and the propeller vanes had a positive angle of attack close to 0°. At this regime at a constant airspeed of 200...220 km/h their thrust was close to 0 kg.

As a result of such positioning of the power levers, the summary thrust of engines No 1 & No 2 on the left-hand half-wing was negative and at this airspeed it was about 600 kg and the summary thrust of the engines No3 & No4 on the right-hand half-wing was close to 0 (vide Practical

Aerodynamics of An-12 aircraft, Moscow, 1973, page 85, Figure 3.12 – graphic presentation of engine thrust depending on airspeed and engine regime).

The vector of the summary thrust of engines No 1 & No 2 on the left half-wing ( $P_{1,2}$ ), directed in opposite direction of the flight, and the arm of force from the point of origin of the force of this vector to the aircraft symmetrical plane (L) created considerable yawing moment  $M_{y1,2}$  :

$$M_{y1,2} = P_{1,2} \cdot L$$

Having in mind that engines No 2 & No 4 worked at "in-flight idle" - 16° UPRT and they didn't create any thrust because of their vanes angle of attack was close to 0°, the value of actually created yawing moment should be:

$$M_{y1,2} = 600 \times 4 = 2400 \text{ kgm},$$

which turned the aircraft to the left from the landing course.

From the explanations of the piloting pilot and other crew members it was clear, that the inadvertent action by power levers found the crew unprepared for reaction against the already created moment and it resulted in:

- at  $V=220...200$  km/h for a time of  $t = 1,5...2$  s the aircraft changed the course and left the runway;
- after the created by the piloting pilot controlling moment by the rudder:

$$M_{\text{cont}} = - Z_{\text{rud}} \cdot L_{\text{cg}},$$

where

$$L_{\text{cg}} = (X_{\text{frud}} - X_t),$$

as a reaction at the situation emerged (after touch-down of the nose landing gear the control "from pedals" of the rudder and the nose landing gear was switched on automatically) and the aircraft maintained the new course until the impact into the concrete column;

– restoration of the previous course of the aircraft was impossible because of the progressive deceleration of the aircraft speed (on quadratic dependence) and of respective decreasing of controlling moment.

In An-12 Aircraft Operation Manual (AOM), Chapter 4.7 "Landing Approach and Landing", p. 4.7.2 "Landing" there is a special note: "... for preservation of the direction it is necessary to use the taxiing control of the nose landing gear and brakes".

It is written in An-12 AOM, Section 2 "Operational limitations", p. 2.3 "Limitations of overloading and maneuvering", that the maximum speed for using of taxiing control in emergency situations - danger of collision into an obstacle or impossibility to keep the aircraft on the runway by brakes – is limited up to 150 km/h.

In the situation described above keeping the aircraft on the runway at a speed of 220...180 km/h by taxiing control was impossible, inexpediently and in contradiction with the above mentioned limitation.

### 3. Conclusions

The technical investigation and analyses conducted gave the grounds for the conclusion, that the aviation accident was a result from the following

**Main cause**

Inadvertent and wrong actions of the aircraft commander with aircraft engine power levers, led to complication of the flight conditions and a damage of the aircraft.

**Contributing factors:**

1. Unclear distribution of functions between the aircraft commander (piloting pilot), first officer and flight engineer.
2. Inaccurate adherence of the consistency of operation of engine power levers, given in An-12 AOM, Section 4, Chapter 4.7, p. 4.7.2.

Having in mind the causes of the air accident emerged and the conditions for it, I propose to take the following

**Safety recommendation:**

1. The crew members should pass a medical examination at AMCC after an air occurrence realized in accordance with Article 21, Para.4 of Regulation No 21 of the Ministry of Transport and Communications of 20.04.1999.

Person responsible: Director of CAA. Time: 10.02.2004.

2. Flight Operation Inspection at CAA to conduct an exam with the crew on functional duties of each crew member and their in-flight interaction.

Person responsible: Director of CAA Time: 25.02.2004.

3. The aircraft commander, first officer and flight engineer should fulfill three flights on An-12 simulator and work through:

- take-off and landing with critical engine inoperative;
- landing approach by ILS with critical engine inoperative;
- landing approach by VOR-NDB with critical engine inoperative;

Person responsible: Managing Director of Air Operator Time: 20.04.2004.

4. Aircraft commander should fulfil two training and one control en-route flights.

Person responsible: Managing Director of Air Operator Time: according conditions

5. Execution of safety recommendations should be registered in the crew flight log books.

Person responsible: Managing Director of Air Operator Time: after execution

6. Air Operator should develop and submit for approval by CAA updated Instruction for distribution of in-flight functions and interaction between crew members.

Person responsible: Managing Director of Air Operator Time: 30.03.2004.

7. Air Operator to ensure continuous book keeping of the documents on organization, planning and execution of each flight.

Person responsible: Managing Director of Air Operator Time: continuous