CIVIL AVIATION SAFETY INVESTIGATION
AND ANALYSIS AUTHORITY (SIAA)

FINAL REPORT

of civil aviation safety investigation

CLASSIFICATION	**Accident**
Operator	AEROWEST
Manufacturer	W.S.K – MIELEC
Aircraft	Antonov AN-2
Registration country	ROMANIA
Registration	YR-PEG
Location	Coordinates: Latitude: 44° 54’ 1.31” N Longitude: 027° 51’ 8.87” E
Date and time	01.08.2015/ 08:05 LT

No. : A 20 - 04
Date : 27.03.2020

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AKNOWLEDGEMENT

This REPORT presents data, analysis, conclusions and recommendations made by the civil aviation safety investigation Commission appointed by the General Director of SIAA.

The civil aviation safety investigation was conducted in accordance with the provisions of the Regulation (EU) no. 996/2010 of the European Parliament and of the Council from 20 October 2010 on the investigation and prevention of accidents and incidents occurred in civil aviation and repealing Directive no. 94/56/CE, the provisions of Annex 13 to the Convention on International Civil Aviation signed at Chicago on 7 December 1944, as well as with the Government Ordinance no. 26/2009, approved with amendments and additions by Law no. 55/2010, modified and completed by Government Ordinance no. 17/2018.

The objective of the civil aviation safety investigation is to prevent the occurrence of accidents and incidents, by determining the facts, causes and circumstances that led to these occurrences and to issue civil aviation safety recommendations.

The civil aviation safety investigation does not establish any legal guilt, responsibility or liability.

Consequently, the use of this REPORT for purposes other than those concerning the prevention of civil aviation accidents and incidents may lead to misinterpretations.

FINAL REPORT

AIRCRAFT LOSS OF CONTROL DURING TAKE-OFF

Aircraft	AN-2 / YR-PEG
Date and time	01.08.2015/ 08:05 LT
Operator	S.C. AERO WEST S.R.L.
Flight type	Aerial work
Persons onboard	The pilot and an aeronautical technician
Victims	The pilot died at the hospital and the aeronautical technician was seriously injured
Pilot	RO/CPL/XXXXXX/A
Co-pilot	N/A
Damages	Aircraft totally destroyed
Location	Work field in the vicinity of Stăncuța commune, Brăila County. Coordinates: Latitude: 44°54'1.31" N Longitude: 027°51'8.87" E

1. HISTORY OF OCCURRENCE

The history of occurrence was established based on the witnesses' statements.

On 31.07.2015, the aircraft AN-2 registered YR-PEG was positioned on a flight field in the vicinity of the farm in Stăncuța commune, Brăila County, being prepared in order to perform several aviochemical flights in Giurgeni area on the following day.

In the morning of 01.08.2015, the pilot and the aeronautical technical staff from his team were informed by the beneficiary of aviochemical works that, because it was raining in Giurgeni area, they will perform some aviochemical flights in Stâncuța area, in the vicinity of the flight field. Consequently, the aircraft was prepared for the flight in the area as follows: 200 l of gasoline were defuelled from the aircraft tanks, the engine was started and the operating parameters were checked according to the specific diagram. The aircraft was supplied with chemical substances for the aerial work and after only a few minutes, the engine was started again, in order to take-off. Onboard there were the pilot and an aeronautical technician (hereinafter referred to as passenger) who occupied the pilot's seat on the right.

The take-off on the S-N direction was normal in the first part. The take-off run was short – approximately 100 m, in the witnesses' opinion – under the conditions of a gusty wind from the E direction, whose speed was gradualy increasing. During the initial climb, at a height of about 15-20 m, the aircraft began to lean to the left and

descend slightly. During this turn in descent, bank angle continued to increase, the aircraft flying with the left wing at very low hight above the aircrafts parked towards the northern end of the flight field. Considering the aircraft evolution and observing that the pilot was not acting for correction, the passenger onboard on the right-hand pilot seat, tried instinctively to turn the aircraft control yoke to the right. According to his statement, he failed to operate the control yoke, considering that this was in a blocking state of which nature he could not specify.

With the engine still running in take-off mode, the aircraft continued to descend, and after passing the parked aircrafts, it hit the ground with the propeller and the left wing tip. The impact of the wing tip determined the aircraft to pivot to the left and make a hard contact with the ground.

The engine stopped because of the shock. An early fire was extinguished by witnesses arrived at the accident site.

Amid the destruction of the cockpit and fuselage, the pilot was thrown out of the aircraft suffering serious injuries. The passenger, who occupied the right-hand seat, managed (after recovering from the shock) to exit the aircraft wreckage.

The pilot and passenger were transported to the hospital.

Later on, the pilot died due to multiple traumatic injuries, and the passenger required a long hospitalization period due to the injuries suffered.

The aircraft was totally destroyed.

There was no other damage in the area.

The aircraft has stopped at the point of coordinates: N 44°54’1.31”; E 027°51’8.87”.

Fig. 1 Aircraft wreckage

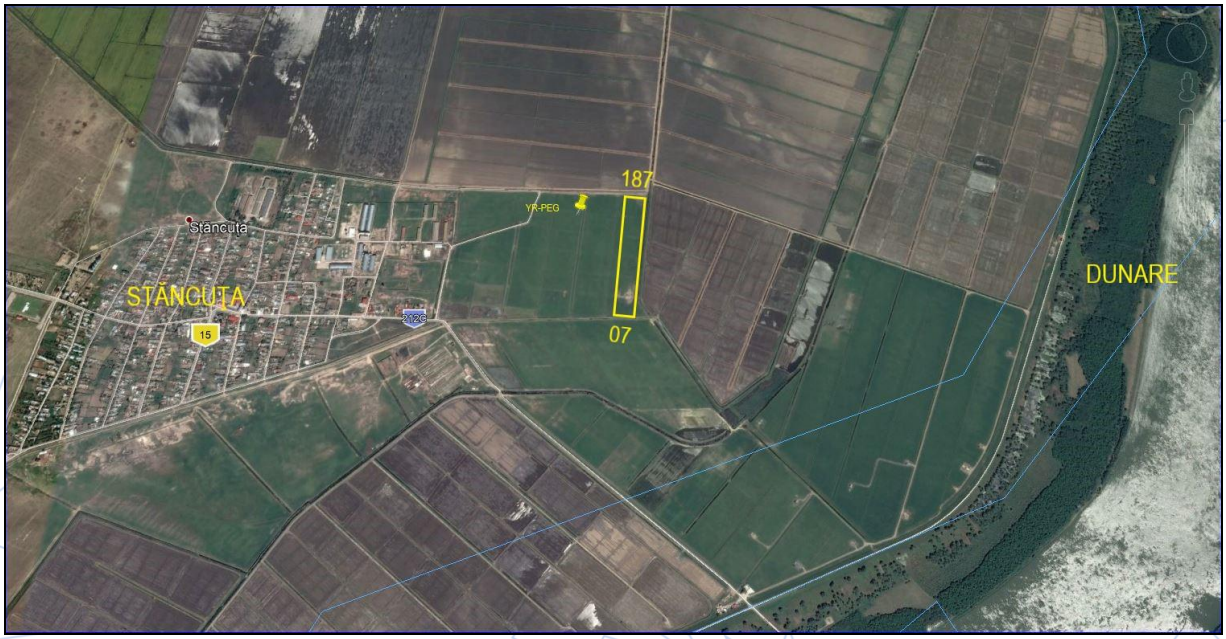


Fig. 2 Wreckage and flight field position

2. ADDITIONAL INFORMATION

2.1 Meteorological situation

On the day and approximately at the time when the accident occurred, based on the information collected, the weather conditions for the area of the flight field were as follows:

- Coverage: 8/8 with the bottom at 2500m (or even more)
- Wind: from north, with 4-5 m/s (initially)
- Air temperature: 18°C
- Atmospheric pressure: 757 mm Hg
- Humidity: 100%
- Visibility over 10 Km

According to the witnesses' statements, at the time of take-off, these general conditions became particular, so it started to rain moderately and the wind intensified, concomitent with the change of its direction from the Danube (right side to the take-off direction).

2.2 Flight field information

In accordance with the provisions of the Romanian Government Decision No. 912 of 25.08.2010, the flight field where the occurrence took place, correspond to other fields than the certified aerodromes from which take-offs and landings of civil

aircraft can be performed. It was arranged on a grassy surface, in the vicinity of a farm, in the area of Stăncuța village, Brăila County.

The runway was positioned on direction: North/South (007°/187°).

Runway available length: 520 m

Elevation: approximately 39 m

Fig. 3 Flight field

2.3 Pilot information

Pilot	Male, 60 years old, Romanian citizen
License	RO/CPL/.....(A), valid
Medical certificate	Class 1, valid
Flight hours	Could not be determined exactly

2.4 Aircraft information

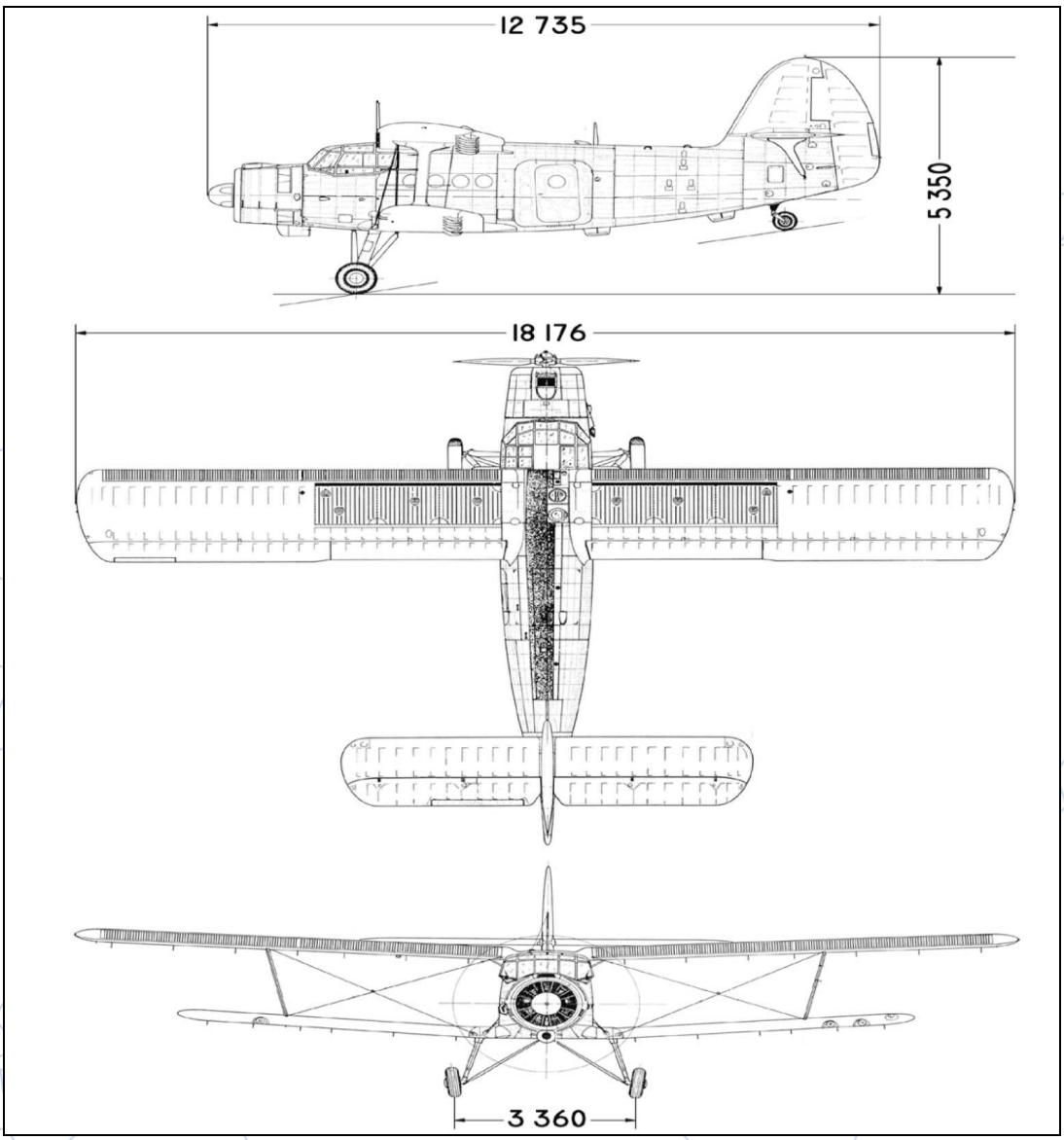
2.4.1 General information

Manufacturer and aircraft type	W.S.K – MIELEC / Antonov AN-2
Serial number and manufacturing year	1-G-19744 / 1982
Registration state and mark	Romania / YR-PEG
Owner	S.C. FITOCOM AGRO INVEST S.R.L.
Operator	S.C. AERO WEST SRL
Engine type and series	AȘ -62 IR /K16510127
National flight permit	Valid
Total number of hours/cycles	6577/NA

2.4.2 Technical characteristics/performances

Aircraft	**Antonov AN-2**
Engine Type / Series	AŞ-62 IR / SN: K16510127
Maximum power (5 min)	1000 CP (take-off)
MTOW	5500 Kg
Approx. empty airplane weight in agricultural work variant (including oil & standard avionics)	3460 Kg
Maximum weight (normal) upon landing	5250 Kg
Standard fuel capacity	1200 litri
Take-off distance (M=5250Kg and Flaps 30°) on grassy runway	200 m
Maximum allowed speed	253 Km/h
Minimum speed in horizontal flight (Flaps 0°)	120 Km/h
Stalling speed (Flaps 39,5°)	~ 50 Km/h
Normal speed for landing	85 Km/h
Maximum autonomy at the altitude of 1000 m	1.390 Km
Maximum flight ceiling (Airplane weight of 5250 Kg)	4.400 m
Initial climb rate	2,9 m/s
Maximum load factor in operation	+3 / -1

Fig.4 AN-2 aircraft



The YR-PEG aircraft was an utility biplane, AN-2 type, provided with an installation for aviochemical works.

The fuselage construction is of semi-monocoque type, with duralumin resistance structure and fabric covering. The resistance structure is made of: 26 frames, beams, slats and cockpit floor.

The wing biplane system is composed of the upper plane, the lower plane, biplane strut, support braces and bearing braces. Throughout the entire length of the lower plane trailing edge and on the inner part of the upper plane trailing edge there are installed trailing edge flaps which are electrically operated. On the leading edge of the upper wing, slats are installed, with automatic extend if the flight speed decreases and/or the wings incidence approaches the critical value. At the trailing edge of the upper plane, in beyond the flaps (towards the wing tip), the ailerons to control the rolling movements are installed. If the upper wing flap is extended, the ailerons will work as flaps. The differentiated deflection of the ailerons is provided by a combining mechanism.

The flaps of the two wings are powered by separate electric motors, without being mechanically interconnected. The flaps position indicator in the cockpit is connected only to the upper flap.

During normal operation the upper and lower flaps extend at the same angular values.

On the wreckage of YR-PEG aircraft, the investigation commission identified the upper flaps extended at 30°, and the lower ones at 18°-20°. Also, the low wing flaps circuit breaker (AZS) was switched off (disconnected).

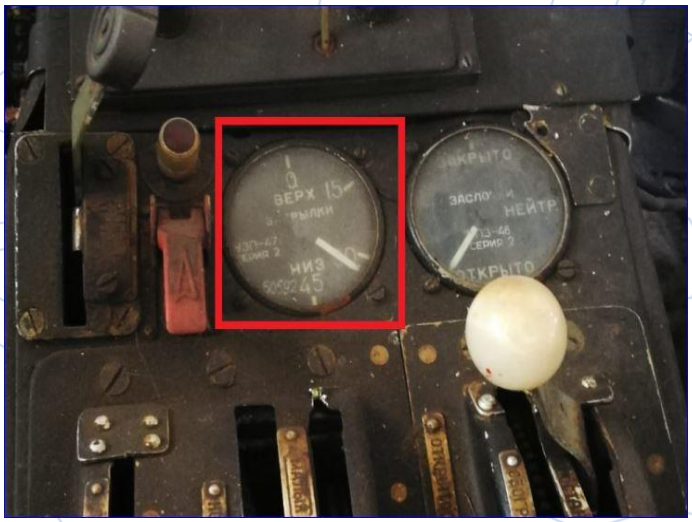


Fig. 6. Flaps position indicator

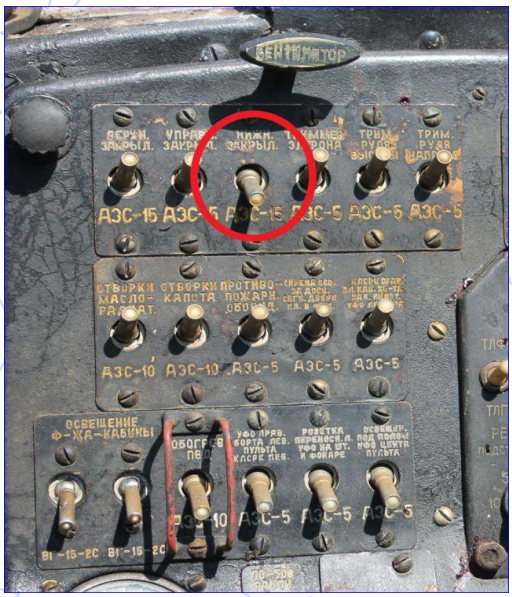


Fig. 7 Low wing flaps circuit breaker (AZS) switched off

Fig. 8 Lower flaps mechanism on YR-PEG aircraft

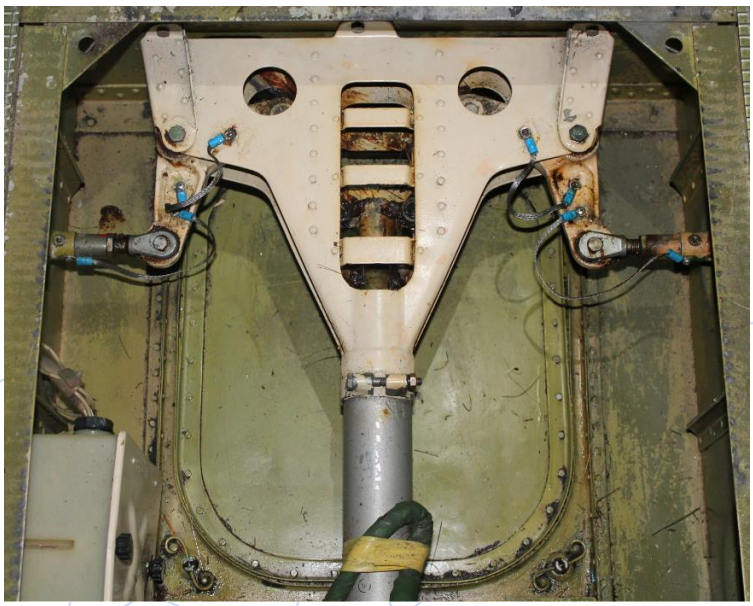


Fig. 9 Lower flaps position 15° at a mechanism on a functional AN2 aircraft

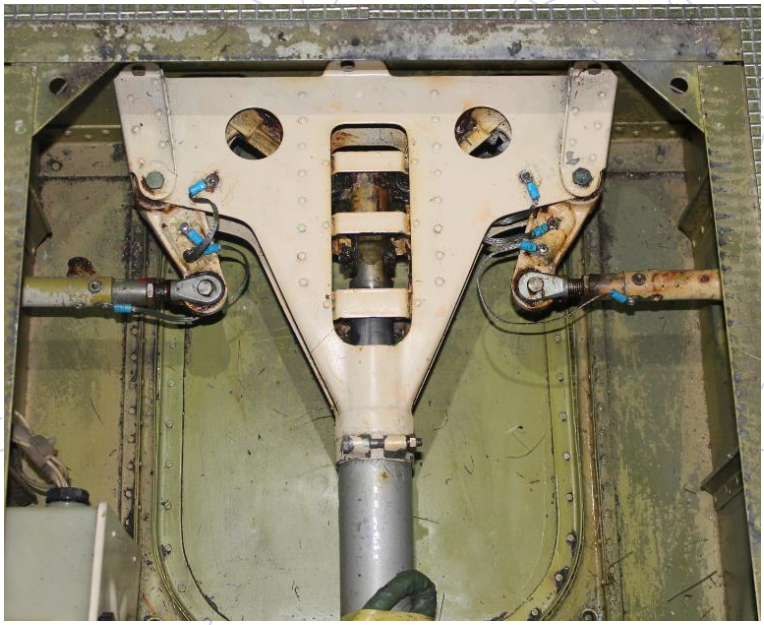


Fig. 10 Position 30° at the same functional electro-mechanism

By comparing the figures 8, 9 and 10, it can be seen that the position of the lower flap was between 18°-20° (no marks for precise identification thereof).

The empennage is of classical type, being composed of the horizontal and vertical empennage. The horizontal empennage includes a fixed stabilizer and an elevator operated by the pilots using the control yoke. The vertical empennage is also composed of a fixed part (the fin) and a movable part (the rudder) operated by the pilot through the rudder pedals.

Inside the fuselage, the controls of ailerons, elevator and rudder are transmitted through cables. The control of the ailerons and flaps in the wing area is transmitted through rigid tubes to the control surfaces.

The ailerons, elevator and rudder are provided with trimmers actuated by electric motors.

The flight controls are operated from the cockpit, through a classic system: the control yoke (for ailerons and elevator) and the rudder pedals (for rudder). There are two pilot seats in the cockpit. Both seats are provided with symmetrical controls, mechanically coupled.

In the upper wing, 6 duraluminum fuel tanks are mounted symmetrically. Out of these, the gasoline is fed by gravity and is directed to the engine through a system of pipes, valves and faucets. A gasoline pump installed on the engine provides under-pressure power to the carburettor through a filter.

The power plant consists of an AȘ-62 IR piston engine and an AV-2 propeller with four metallic blades.

The engine is of radial type (star) with nine cylinders, air cooled. It is surcharged with a centrifugal compressor, mechanically operated, interposed between the carburettor and the engine cylinders.

The tractor propeller is with variable pitch controlled from the cockpit.

The landing gear is fixed, with two main landing gear legs and a tail wheel assembly. It has a robust construction that allows operation even on summary landscaped fields. The main landing gear legs are provided with hydraulic shock dampers and a semi-balloon type wheel to facilitate operation on difficult fields. The main landing gear wheels are provided with pneumatically operated brakes.

2.5 Operational elements

In the Flight Manual of the AN-2 aircraft, a number of operating limitations are provided, including:

a) Take-off and landing limitations, related to the wind:

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Se interzice :

a. *executarea zborurilor acrobatice*
b. *introducerea in zona cu givraj*
c. *executarea zborurilor de noapte fara parasute*
d. *executarea zborurilor fara vizibilitatea solului la centraj peste 30% CMA*
e. *executarea zborurilor de noapte cu copii la bord*

3. *Date privind exploatarea*

A. Suprasarcini admise

Coeficent admis de auprasarcina :

a. pentru varianta agricola (cu prafuitor sau stropitor)..... + 3,0 ; -1,0
b. pentru varianta de transport (sanitara) .....+ 3,7 ; - 1,0

B. Inaltimea maxima admisa in zbor

-cu instalatia de oxigen ..... fara limitari
- fara instalatia de oxigen ..... cu indicatii speciale

C. Viteza admisa Km/h

	varianta Agricola	varianta Transport
- zbor in turbulenta	175	190
-zbor la comanda bruscata	180	195
-zbor in picaj la n_{max} = 2200rot/min	250	300
-pentru bracarea flapsurilor	150	150
-cu flapsuri bracate la 39,5*.	130	130
-cu flapsuri bracate la 30*	150	150

D. Turatia admisa a motorului (ture/minut)

28. nominala ..... n = 2100
29. maxima ..... n = 2200
30. minima la sol ..... n = 550

E.Limitari dupa viteza vantuluia.

a. Decolarea si aterizarea avionului poate avea loc la urmatoarele viteze ale vantului :

	Suprafata normala	Suprafata alunecoasa
- vant de fata	pana la 16 m/sec	pana la 8 m/sec
- vant lateral 45*(de coasta)	7 m/sec	4 m/sec
- vant lateral 90*	5 m/sec	3 m/sec
- vant de coasta 90* la aterizare cu flapsurile deviate	4 m/sec	3 m/sec

Fig. 11 Flight Manual: Take-off/landing operating limitations

b) Recommendations on the use of flaps for take-off/landing:

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1. se efectueaza verificarea conform fisei de la punctul „inainte de decolare"
2. se deconecteaza filtrul de praf , in cazul existentei prafului in aer conectarea filtrului de praf efectuindu-se dupa decolare.
3. vara si iarna decolarea de regula se efectueaza cu incalzirea carburatorului deconectata, cu corectorul de inaltime in pozitia amestec maxim imbogatit.

Amanunte ale utilizarii prin incalzire a carburatorului vezi la punctul 15 „ Exploatarea instalatiei de incalzire a aerului la intrarea in carburator".

7. Decolarea fara utilizarea flapsurilor

1. decolarea fara utilizarea flapsurilor se face utilizind puterea nominala a motorului, adica turatia n = 2100 rot/min si Pk = 900 +/- 10 mmcolHg
2. dupa desprindere, mentinerea avionului se efctueaza marind constant distanta de pamant si marind viteza pina la 140 km/h
3. dupa atingerea vitezei de 140 km/h avionul se stabileste in regim de luare a inaltimii

OBSERVATIE : pe timpul rulajului la decolare apare tendinta de viraj spre stanga

8. Decolarea cu utilizarea flapsurilor.

Utilizarea flapsurilor la rulajul la decolare scurteaza lungimea de rulaj si distanta de decolare cu 30 – 35%. Functie de starea aerodromului si sarcina la decolare, flapsurile se pot braca la 25 si 30*.

1. cand flapsurile sunt bracate la 25*, decolarea se efectueaza la puterea nominala a motorului.
2. in cazul distantei limitate pentru decolare, sau la decolarea avionului cu greutate maxima de decolare (5500 kg) decolarea se efectueaza cu flapsurile bracate la 30*, in regim de decolare al avionului.

OBSERVATIE : desprinderea de sol a avionului cu flapsurile bracate la 25 – 30* are loc la viteza de 85-90km/h. La decolarea cu flapsurile bracate , pe unele avioane fantele automate se deschid la mijlocul intervalului de rulaj la decolare la viteza de aproximativ 50km/h si raman deschise pina la atingerea vitezei de 85 km/h dupa care se inchid complet.

3. dupa atingerea inaltimii de 50m la viteza de 120 km/h, treptat se retrag flapsurile, verificand pozitia acestora dupa indicator si direct prin observarea flapsurilor. Concomitent se marets eviteza de luare a inaltimii in asa fel incat in momentul retragerii totale a flapsurilor sa fie de 135-140 km/h.

4. dupa retragerea flapsurilor se trece la luarea inaltimii.

AVERTISMENT : 1.) daca dupa decolarea cu flapsurile bracate acestea nu se pot retrage din cauza defectarii instalatiei de comanda, este necesar sa se efectueze aterizarea pe aerodromul de decolare. La venirea la aterizare cu flapsurile bracate, la viraje nu se

Fig. 12 Flight Manual: Recommendations on the use of flaps

c) Limitations on the use of flaps upon take-off and landing:

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admite o inclinare mai mare de 10 – 15*, iar viteza de zbor nici intr-un caz nu trebuie sa depaseasca 150 km/h.

2.) se interzice decolarea cu utilizarea numai a flapsurilor superioare sau numai a celor inferioare.

OBSERVATIE : se pot utiliza flapsurile la decolarea avionului numai la viteza vantului de maxim 10 m/sec.

5. decolarea pe schiuri este la fel ca si la un tren obisnuit cu roti.

OBSERVATIE : la decolarea vionului pe schiuri se are in vedere faptul ca la temperatura mediului inconjurator de 0*C si mai ridicata, indeosebi pe zapada umeda, rulajul la decolare se mareste cu 10 – 20% comparativ cu rulajul la decolare la temperatura -10*C.

Lungimea de rulaj la decolare pe zapada batatorita este:

- in regim nominal cu flapsurile escamotate ..... 320 m
- in regim nominal, flapsurile la 25* ..... 260 m
- in regim de decolare, flapsurile 30* ..... 190 m

8. Angajarea (iesirea pe unghiuri de atac critice)

1) in configuratia de decolare si de trecere in al doilea viraj (configuratia cu motorul functionand in regimurile nominal si de decolare) avionul se angajeaza anevoios cu toate ca profundorul este bracat complet iar trimerul este in pozitia corespunzatoare vitezei de echilibrare pentru configuratia data. Angajarea este clasica : avionul nu manifesta tendinta de a intra in vrie sau spirala. Avionul nu avertizeaza inainte de angajare, insa angajarea necomandata este imposibila, deoarece avionul se angajeaza foarte greu.

2) in configuratia zborului de croaziera avionul se angajeaza fara avertizari precise.

3) in configuratia „venirea la aterizare" cu motorul redus avionul nu se angajeaza, atat cu flapsurile escamotate cat si flapsurile bracate.

Viteza minima a zborului stabilizat este de 105 km/h cu un centraj egal cu 30% CMA si greutatea de 5250 kg.

4) angajarea in viraje si angajarea dinamica

Avionul nu se angajeaza in virajele cu un unghi de inclinare mai mare de 30*.

Angajarea dinamica de asemeni nu are caracte de angajare. Aceasta apare numai in configuratia luarii inaltimii la presiunea de admisie de la Pk = 900 mmcolHg si mai ridicata.

10. Luarea inaltimii

Luarea inaltimii urmeaza a se efectua la viteza de 140 – 150 km/h. La atingerea vitezei ascensionale maxime la sol, se recomanda a se efectua luarea inaltimii pina la 500m cu flapsurile bracate la un unghi de 5*; mai sus cu flapsurile escamotate.

1) In caz de escamotare a flapsurilor, luarea inaltimii urmeaza a se efectua utilizand una din variantele enumerate mai jos:

Fig. 13 Flight Manual: Limitations on the use of flaps

d) Limitations on crew composition:

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CAPITOLUL 2

CONDITII DE EXPLOATARE A AVIONULUI SI LIMITARI

1. Echipajul avionului

Echipajul avionului cuprinde minim doi oameni, care au atestarile pentru aviatie respective.

Functie de caracterul zborului echipajul avionului trebuie sa fie format din:

25. pentru zboruri VFR : 2 piloti , pilot si navigator sau pilot si mecanic de bord
26. pentru zboruri IFR : 2 piloti sau pilot si navigator
27. pentru zboruri agrotehnice : 2 piloti sau pilot si mecanic de bord.

OBSERVATIE :

1. in caz ca exista un al treilea membru al echipajului, acesta trebuie sa ocupe un loc in cabina de marfa. Este interzisa sederea pe centurile de siguranta din cabina pilotilor.
2. zborurile agrotehnice (de lucru) pot fi executate numai cu o componenta minima a echipajului (ca mai sus).

2. Moduri admise de zbor.

Avionul este admis pentru urmatoarele zboruri:

A. De scoala (cu limitarea centrajului posterior pina la 30% CMA)
B. De antrenament
C. De noapte (cu limitarea centrajului posterior pina la 30% CMA)
D. De zi si de noapte cu vizibilitate si fara vizibilitatea zborului.
E. Zboruri la mare inaltime conform instructiunilor in vigoare

Fig. 14 Flight Manual: Limitations on crew composition

2.6 Tests and checks

Samples of fuel (gasoline) were collected from tanks and oil from the engine of the wreckage.

Upon their expertise by an authorized laboratory, values corresponding to the standards for their parameters were determined.

2.7 Forensic report

The forensic report established that the pilot's death was due to multiple traumas suffered during the accident and bleeding shocks.

No alcohol was detected in the samples taken.

No test were made on the use of drugs or toxic substances.

It is not mentioned if it is possible that, prior to the death, the pilot might have been temporarily incapacitated.

Although the forensic report did not explicitly highlight such a medical condition of the pilot, several corroborated elements drew the attention of the investigation commission:

- Witnesses who came in contact with the pilot immediately after the accident, until the arrival of the emergency crews, said that he repeatedly asked *"what happened",* not understanding how he got there;
- Witnesses also declared that he claimed that he had recently been diagnosed with a "beginning of diabetes"; (the investigation commission did not identify medical results to confirm this condition)
- The forensic report specifies several elements regarding the medical condition of some vital organs (changes in their condition, prior to the accident).

Therefore, the commission considers that, during the take-off, the pilot could have got in a situation of which he temporarily lost the ability to control the aircraft.

3. ANALYSIS

After the exterior checks of the aircraft have been completed and it was prepared for the flight, the cockpit was occupied by the pilot in the left seat and the passenger in the right seat. The engine was started and the parameters of the engine were checked, according to the specific diagram.

Next, a short taxy was performed, to the place of loading the utility tank of the aircraft with chemicals, where the engine was stopped. The loading was done in about two minutes, after which the engine was restarted and the aircraft performed the taxy and the lineup for take-off.

According to the statements, during the taxy for lineup to take-off the wind was *„quite strong”* and *„from the northeast”.* Immediately after starting the take-off run, it started to rain and the wind speed intensified, concomitantly with the change of its' direction from the east *(„from the Danube”).*

The investigation commission considers that both the rain and the change in the wind direction and speed were elements that probably determined the pilot to speed up the take-off.

During the take-off run, intending to get in the air faster, given the worsening weather conditions, it is possible that the pilot might have decided to gradually increase the flaps deflection angle up to the position of 30º (as it was found on the wreckage - fig. 6).

Given that the lower flap on the wreckage was extended in a position of about18°-20° and that the upper flap was at 30º, the commission considers that during the take-off the pilot may have progressively extended the flap from the initial 15º towards 30º but, during the flaps extension, the circuit breaker (AZS type) of the lower flap motor was accidentally switched off. The indicator on the board panel of the flap position is electrically connected only to the upper flap.

Therefore, the lower flap remained in a smaller extension angle than the upper one, without the pilot noticing that, as he was looking outside to maintain the take-off direction.

The commission considers that another possible explanation for the differences found between the positions of the flaps might be caused by the deformations suffered by the lower wing at impact, when the circuit breaker (AZS) could have been also switched off. In this hypothesis it is possible that during take-off the flaps could have had the same extension angle.

According to the statement of the surviving passenger, after a take-off run of approximately 80-100 m, the aircraft detached relatively abruptly from the ground and started climbing. At the height of 15-20 m above the ground, the aircraft banked to the left and began to descend, heading towards a group of utility airplanes that were parked in the northern end of the flight field.

Considering the aircraft evolution and the pilot's lack of reaction to correct its evolution, the passenger instinctively tried to turn the control yoke to the right, to recover the aircraft.

According to the passenger's statement, the control yoke was positioned for left turn, and when he tried to bring it back to the right, it seemed jammed. He could not determine the nature of jamming.

After overpassing the aircraft parked in the northern end of the runway, the airplane banked *„a lot”* to the left and descended, impacted the ground with the left lower wing and immediately after that, with the propeller and the engine. As a consequence, it pivoted and skidded, reaching a final position with the tail oriented to northwest.

The passenger also declared that during this whole evolution, the pilot did not communicate anything.

The shock of airplane contact with the ground threw the pilot out of the aircraft and the passenger, who remained among the remains of the cockpit, managed (after coming back from the shock) to get out of the airplane. None of the occupants had the seat belts fastened.

During this evolution the engine worked properly. This is also confirmed by the appearance of the propeller blades after the impact.

Fig. 15 Propeller blades after the impact

The Aircraft Operation Manual provides some restrictions and warnings regarding the use of flaps for take-off:

- take-off with the use of only the upper or lower flaps is forbidden (fig.13);

- the flaps can be used during take-off only at a maximum wind speed of 10 m/s (fig.13);

- take-off can be performed when the crosswind speed is of maximum 5 m/s;

- control of the aircraft in crosswind with the flap extended, is very difficult.

The aircraft was operated by an incomplete crew, which in the opinion of the investigation commission would have favoured the failure to observe the decoupling of the AZS circuit breaker and consequently, taking-off with the lower flap set at a smaller angle than the upper one.

Analysing the information collected, the investigation commission considers that the most likely scenario of the occurrence would be the following:

The worsening weather conditions determined the pilot to speed up the take-off process, in particular by shortening of the take-off run distance, as he knew the low handling characteristics of the airplane in gusty wind conditions and blowing from the right side, as it had begun to manifest just before the take-off.

To shorten the take-off run distance and get faster in the air, during the take-off run, the pilot commanded the extension of the flaps from the position of 15º initially, to 30°.

From undetermined reasons, the AZS circuit breaker switched off, and the lower flap stopped in the position of 18°- 20°, without the pilot having noticed that.

With the upper flap at 30° and under the given windy conditions, the airplane got up very fast in the air, but the investigation commission considers that it was more unstable than usual, and therefore more difficult to control.

The pilot had a vast flight experience, and in recent years he had only flown in this area. The commission assumes that the pilot performed take-offs before with the flaps extended to 30º.

All the elements specified above and in addition:

- the fact that the control yoke got in the left turn command, instead of the right turn (as it was supposed to be in order to counteract the influence of the wind);
- the pilot's complete lack of reaction (he did not communicate anything during the whole evolution);
- the pilot's blockage on the controls (so that the passenger did not manage to move the control yoke to the right)

led the commission to the conclusion that the reason that can justify the pilot's lack of reaction to recover the aircraft evolution, consists in a temporary inability to act, which occurred after the aircraft was airborne.

The pilot's temporary incapacitation led to an involuntary command that caused the aircraft to enter in a left turn and in a slightly descent.

If the pilot would have been aware, he had initiated an immediate landing, in the take-off direction (because he had enough space to continue) or, if he had decided to continue the take-off and the flight, he would have operated the controls, to counteract the influence of the wind that was blowing from the right.

The investigation commission excluded from this scenario the possibility of the aircraft uncontrolled stalling in the take-off configuration, because according to the flight manual, this is impossible (fig.16).

8. Angajarea (iesirea pe unghiuri de atac critice)

1) in configuratia de decolare si de trecere in al doilea viraj (configuratia cu motorul functionand in regimurile nominal si de decolare) avionul se angajeaza anevoios cu toate ca profundorul este bracat complet iar trimerul este in pozitia corespunzatoare vitezei de echilibrare pentru configuratia data. Angajarea este clasica : avionul nu manifesta tendinta de a intra in vrie sau spirala. Avionul nu avertizeaza inainte de angajare, insa angajarea necomandata este imposibila, deoarece avionul se angajeaza foarte greu.

2) in configuratia zborului de croaziera avionul se angajeaza fara avertizari precise.

3) in configuratia „venirea la aterizare" cu motorul redus avionul nu se angajeaza, atat cu flapsurile escamotate cat si flapsurile bracate.

Viteza minima a zborului stabilizat este de 105 km/h cu un centraj egal cu 30% CMA si greutatea de 5250 kg.

4) angajarea in viraje si angajarea dinamica

Avionul nu se angajeaza in virajele cu un unghi de inclinare mai mare de 30°.

Angajarea dinamica de asemeni nu are caracte de angajare. Aceasta apare numai in configuratia luarii inaltimii la presiunea de admisie de la Pk = 900 mmcolHg si mai ridicata.

Fig.16 Extract from the Flight Manual

This specification in the manual is likely to reinforce the only plausible explanation for the aircraft evolution (inclination to the left in descend): the pilot's state of temporary incapacitation and his blockage on the commands in a posture that controlled the further evolution of the aircraft.

4. CONCLUSIONS

4.1 Findings

- The pilot held license and medical certificate, both valid;
- The aircraft was in a proper technical condition;
- The flight was performed with an incomplete crew;
- Take-off was performed on N direction in the conditions of a gusty wind from E-NE direction;
- The engine worked properly during the take-off;
- The AZS (circuit breaker) of the electro-mechanism of the lower flap actuation, was switched off;
- The flap position indicator (from the cockpit) indicated the position of 30°;
- The upper wing flap was in the position of 30°;
- The lower wing flap was in the position of 18-20°;
- The rudder and elevator control chains were operational;
- The ailerons control chain was removed from the normal configuration, because the left upper wing suffered a sharp deformation upon the contact with the ground.

4.2 Causes of accident

The probable causes of this accident are the following:

- temporary incapacitation of the pilot;

- use of flaps upon take-off in the conditions of deterioration/modification of weather conditions during take-off (wind direction and speed)

- aircraft operation with incomplete crew.

5. Safety recommendations

It is recommended to the Romanian Civil Aeronautical Authority to identify and implement solutions to prevent the operation of AN-2 aircraft in aviochemical missions with an incomplete crew.

Note: The documents and analysis objects used for the issuance of the flight safety investigation Report are confidential and are archived at the Civil Aviation Safety Investigation and Analysis Authority, according to legal provisions.