

MINISTRY OF INFRASTRUCTURE

AIR, MARINE AND RAILWAY ACCIDENT AND INCIDENT
INVESTIGATION UNIT

Tržaška cesta 19, 1000 Ljubljana

T: 01 478 81 10

E: mzi.airsafety@gov.si

www.mzi.gov.si



Number: 37200-4/2024/99
Date: 23. 1. 2025

Unofficial translation

FINAL REPORT

ON THE INVESTIGATION OF THE AIRCRAFT Air Tractor AT-802 Fire Boss, reg. mark S5-BZR, on Portorož airport - LJPZ, July 22, 2024

Republic of Slovenia

» 2024 «

TABLE OF CONTENTS

INTRODUCTION	2
1 SUMMARY	3
2 FACTS	4
2.1 FLIGHT INFORMATION.....	4
2.2 PILOT INFORMATION	5
2.2.1 <i>Pilot License Information</i>	5
2.2.2 <i>Medical Certificate Information</i>	5
2.2.3 <i>Pilot Experience and Flight Hours</i>	5
2.3 AIRCRAFT INFORMATION	6
2.4 MAINTENANCE INFORMATION.....	7
2.5 METEOROLOGICAL DATA	7
2.5.1 <i>Weather Conditions Around the Airport Between 16:00 and 18:30 Local Time</i>	7
2.5.2 <i>METAR reports</i>	10
2.5.3 <i>Weather Summary</i>	11
2.6 ATS (AIR TRAFFIC SERVICES) DATA	11
2.6.1 <i>Voice Communication Transcript</i>	12
2.6.2 <i>Summary of the ATS Controller's Statement</i>	13
2.7 INVESTIGATION DATA	13
2.8 OPERATOR DATA	14
3 ANALYSIS	15
3.1 GENERAL.....	15
3.2 LANDING GEAR OPERATION ANALYSIS	15
3.3 ANALYSIS OF OPERATIONAL PROCEDURES FOR THE CONTRACTED OPERATOR.....	16
3.4 INFLUENCE OF HUMAN FACTORS.....	17
3.5 ANALYSIS OF REGULATIONS.....	19
4 SAFETY RECOMMENDATIONS	22

INTRODUCTION

The final aircraft serious incident investigation report contains the facts, analysis, causes, and safety recommendations of the serious incident investigation commission based on the circumstances in which the accident occurred.

In accordance with point 3.1 of chapter 3 of Annex 13 to the Convention on International Civil Aviation (13th edition, July 2024), Article 1 of Regulation (EU) no. 996/2010 of the European Parliament and of the Council of 20 October 2010 on investigations and prevention of accidents and incidents in civil aviation (L 295/35), the fourth paragraph of Article 137 of the Aviation Act (Official Gazette of the Republic of Slovenia, No. 81/10 – official consolidated text, 46/16 an 47/19) and According to Article 2 of the Regulation on the Investigation of Air accidents, Serious Incidents and Incidents (Official Gazette of the RS, No. 72/03, 110/05 and 53/19), **the purpose of the final report on the investigation of an serious incident is not to establish guilt or responsibility.**

The final investigation report must undoubtedly benefit aviation safety.

It is important that the final investigation report be used to prevent aviation accidents or incidents. Using the final aircraft accident report for other purposes may lead to misinterpretation.

1 SUMMARY

Date and time of the incident: 22 July 2024 at 18.09 local time
Place of the incident: Portorož Airport - LJPZ, N 45°28'24" E 13°36'54"
Type of flight: Aerial work¹ - aerial firefighting

Aircraft:

- **Aircraft manufacturer:** Air Tractor Inc. Olney, Texas 76374, ZDA
- **Manufacturer's mark:** AT-802F Fire Boss
- **Aircraft registration:** S5-BZR
- **Aircraft serial number:** 802-0990
- **Airworthiness validity:** 9. 5. 2025
- **MTOM:** 7 257 kg

Owner/Operator: Administration of the Republic of Slovenia for Civil Protection and Disaster Relief

Crew and passenger information:

- **Crew:** pilot (1)
- **Number of passengers:** 0
- **Total number:** 1

Consequences:

- **Injuries:**

<i>Injuries</i>	<i>Crew</i>	<i>Passengers</i>	<i>Others</i>
Fatal	/	/	/
Major	/	/	/
Minor / None	0/1	/	

- **Aircraft and equipment:** Minimal

¹ Air operations with state aircraft where the aircraft is used for military, customs, police, or other state internal services.

2 FACTS

2.1 Flight Information

The operator - Administration of the Republic of Slovenia for Civil Protection and Disaster Relief - activated two AT802 Fire Boss aircraft at 16:24 to extinguish the afternoon fire that spread in the area of Ilirska Bistrica. The planes took off from their home airport, LJLJ, at 17:10 local time. After capturing water in the vicinity of Ankaran, they extinguished the fire in such a way that, in the first sortie, both planes successfully performed the task without any special issues. In the continuation of the firefighting operation, after capturing water at sea, they encountered a band of storms on their flight to the scene of the fire, so they interrupted the firefighting and, after dumping the water in the Piran Bay, headed towards Portorož airport with the intention of landing. Upon arrival for landing, the ATS controller provided the pilots with weather information, cautioned them about maintaining a safe distance between the planes, and, in response to the deteriorating weather and reduced external visibility, activated the lights on the runway, RWY15. Immediately before arriving for landing, it started to rain more heavily in the airport zone. The first aircraft, S5-BZR, landed without its landing gear extended, gliding down the runway in a line approximately 300 m long to a stall point approximately 10 m forward of the TWY B intersection. The pilot of the second aircraft, S5-BZT, received information that the runway was occupied, so he decided to continue the flight to Brno airport LJLJ, where he later landed safely. After landing, the S5-BZR pilot left the aircraft unharmed.



Slika 1: S5-BZR at the stopping point after landing at LJPZ²

² Source - Administration of the Republic of Slovenia for Civil Protection and Disaster Relief

2.2 Pilot Information

A 43-year-old pilot of Spanish nationality holds:

- CR(A) AT-4/5/6/8 SET pilot license, valid until April 30, 2026.
- Valid rating and endorsements: IR(A)SE, valid until February 28, 2025.
- A Class 1 and Class 2 medical certificate for aviation personnel, issued on November 19, 2023, valid until November 21, 2024, issued by the authorized organization E-AME-2144.

The pilot's total flight time up to the date of the accident was 3625 hours 7 minutes.

2.2.1 Pilot License Information

TYPE OF LICENCE:	PILOT - CR(A) LICENSE
Issuing Country:	Kingdom of Spain
Issuing Authority:	AESA – Agencia Estatal de Seguridad Aerea ³
License Issue Date:	April 13, 2022
Notes (from license):	/

2.2.2 Medical Certificate Information

Medical Certificate Type: (Validity):	1 // 2 // LAPL NOVEMBER 11, 2024 // NOVEMBER 11, 2024 // NOVEMBER 11, 2025
Issuing Country:	Kingdom of Spain
Authorized Medical Examiner Number:	E-AME-2144
Medical Examination Date:	19. 11. 2023
Limitations (From license)	/

2.2.3 Pilot Experience and Flight Hours

The pilot's logbook shows that he is experienced, with a total flight time of 3625 hours and 7 minutes up to the date of the accident. According to the data provided by the pilot, he has accumulated 237 hours on the aircraft type (Air Tractor Fire Boss). The pilot regularly

³ Link: <https://www.seguridadaerea.gob.es/en>

maintains his qualifications on the aircraft type as well as in the aerial firefighting operations category. The logbook records the pilot's flight time as follows:

- Flight hours in the last 90 days: 34 hours
- Flight hours in the last 30 days: 18 hours
- Flight hours in the last 24 hours (prior to the event): 2 hours 30 minutes

2.3 Aircraft Information

General information	<ul style="list-style-type: none"> • Registration: S5-BZR • Manufacturer: Air Tractor Inc. • Model: Air Tractor AT-802 • Serial Number: 802-0990 • Year of Manufacturer: 01. 11. 2022
Engine	<ul style="list-style-type: none"> • Manufacturer: Pratt & Whitney Canada • Model: PT6A-67F • Serial Number: PCE-RZ0325
Propeller	<ul style="list-style-type: none"> • Brand: Hartzell • Model: HC-B5MA-3D
Aircraft Flight Classification ⁴	<ul style="list-style-type: none"> • Category: Large Aeroplane • Purpose: Aerial work; VFR aircraft • Operation Type: (A) Aerial firefighting • Approval Number: 37236-62/2023/13 • Issued: July 19, 2023 • Validity: N/A
Technical Specifications – Dimensions	<ul style="list-style-type: none"> • Wingspan: 18.06 m • Height: 4.94 m • Length: 10.97 m
Aircraft Limitations	<ul style="list-style-type: none"> • Maximum Takeoff Weight: 7.257 kg • Minimum Crew: One pilot

⁴ ARC - Airworthiness Review Certificate in accordance with M.A.901 Annex I Vb (Part M) to Regulation (EU) no. 1321/2014

2.4 Maintenance Information

The aircraft, including the engine and equipment, has been in service with the operator since May 2024. Up to the date of the event, it had accumulated 81 hours and 45 minutes of flight time and performed a total of 61 landings.

Recent maintenance inspections by the authorized organization:

- November 3, 2023: Annual+Lubrication Schedule,
- July 4, 2024: The monthly inspection and ELT test
- July 19, 2024: 25FH Wipline inspection

The aircraft has undergone inspections in accordance with the approved maintenance program 4M/AMP/AT-802 No. 2, revision 0, issued on February 14, 2024. The monthly inspection was performed on July 4, 2024, when the aircraft had 59:15 hours and 37 landings, with interim inspections scheduled at 25 and 50 hours. The next monthly inspection was scheduled for August 3, 2024. The 100-hour inspection is planned at 135 flight hours, and the 200-hour inspection is planned at 235 flight hours. The aircraft documentation revealed no discrepancies or malfunctions related to the landing gear system operation.

2.5 Meteorological data

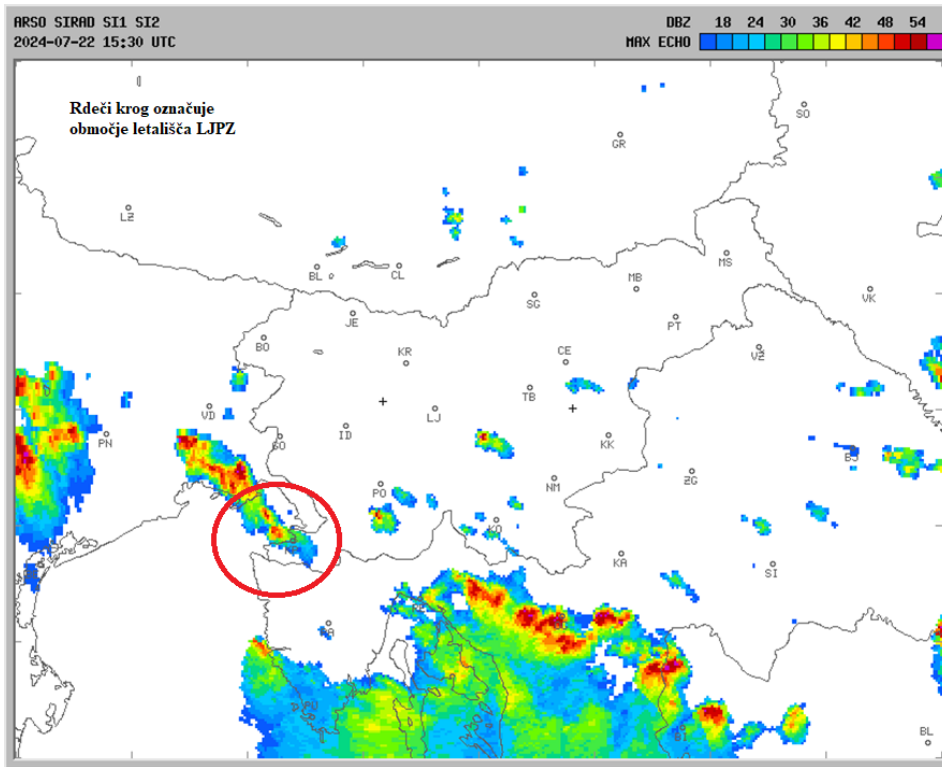
Weather conditions on July 22, 2024

A low-pressure area over Scandinavia, with a weather front extending through Eastern Europe to the Alps and a cold air mass moving toward the southeast through Italy and the southern Adriatic, influenced the weather. Eastern winds at lower altitudes and northwesterly winds at higher altitudes brought moist, relatively warm air toward the region.

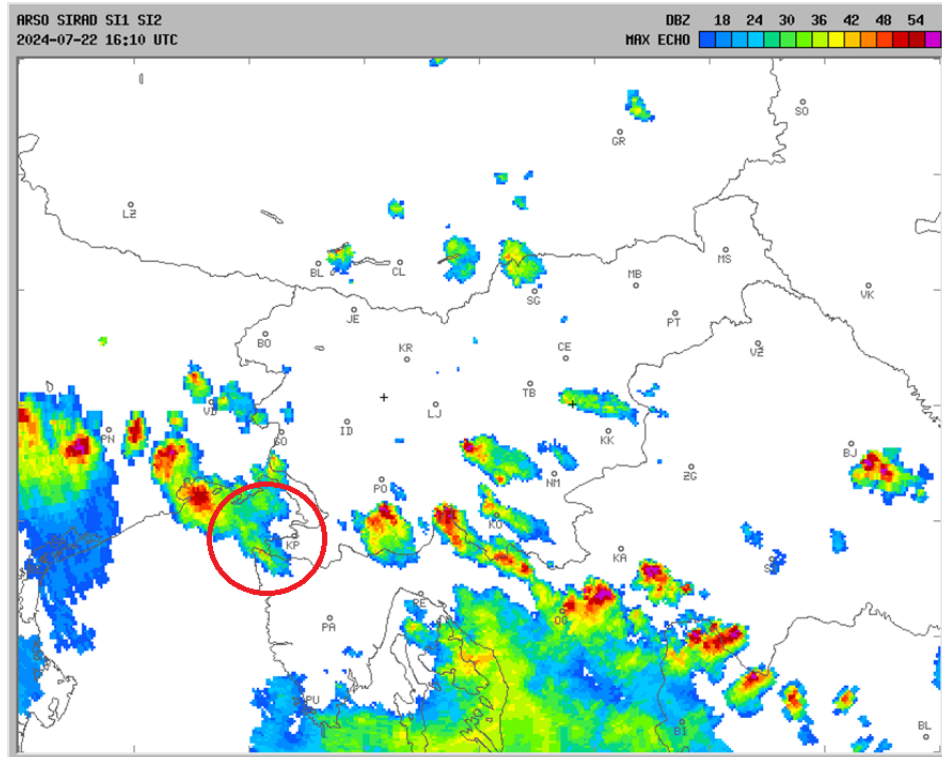
2.5.1 Weather Conditions Around the Airport Between 16:00 and 18:30 Local Time

Partly clear weather with cumulus clouds prevailed. Thunderstorms developed in Istria, Kvarner, and the northern Gulf of Trieste. Between 17:30 and 18:00, a rain shower approached the airport from the north (see images 2 and 3). From 18:00 to 18:30, light precipitation

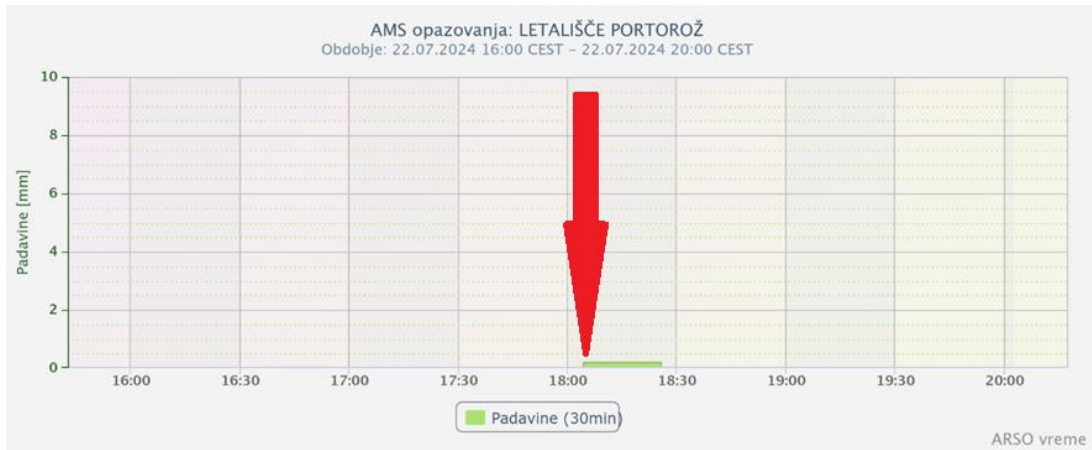
occurred. Near Ilirska Bistrica, a cloud began forming around 17:30, which later developed into a thunderstorm. Image 4 displays the precipitation data.



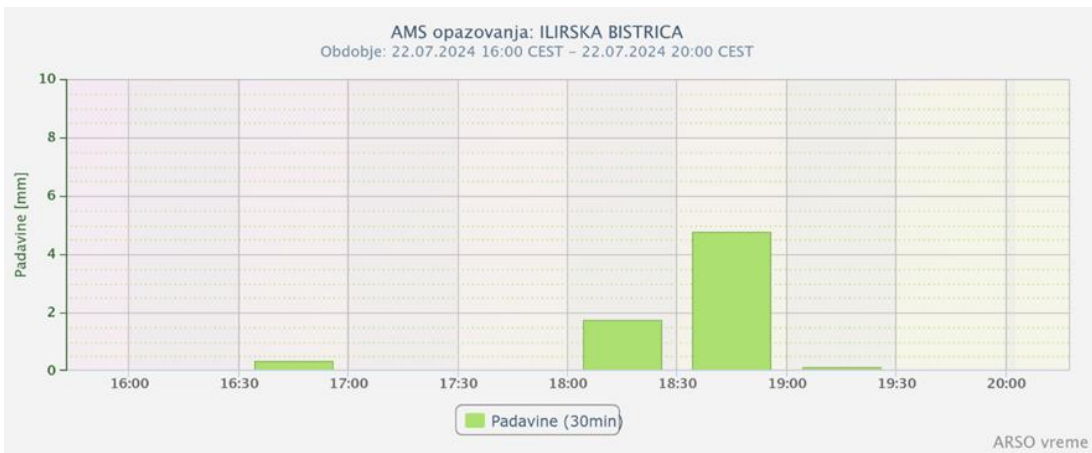
Slika 2: Reflectivity radar image at 17:30 local time



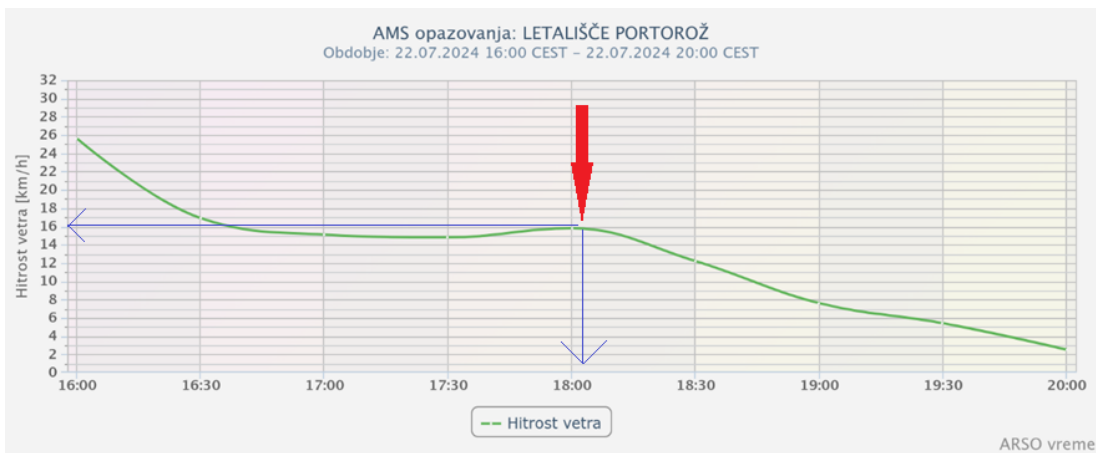
Slika 3: Reflectivity radar image at 18:10 local time



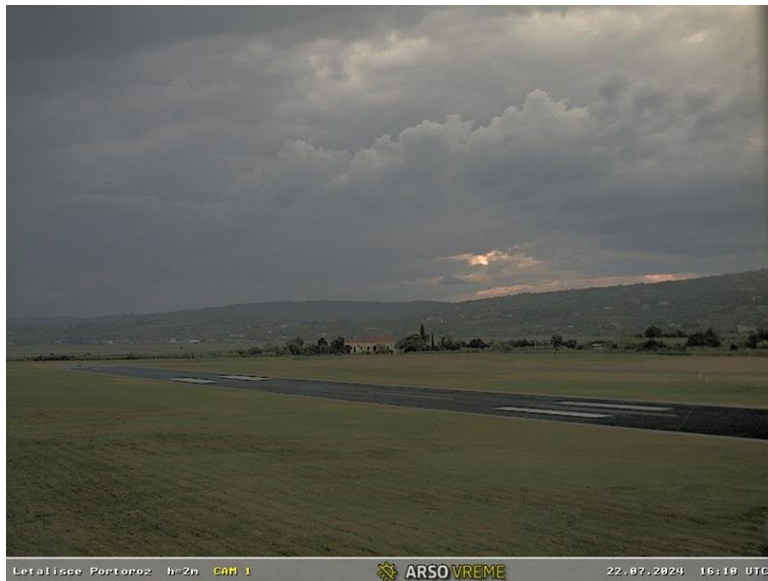
Slika 4: Rainfall at the LJPZ airport started before the landing of the S5-BZR aircraft



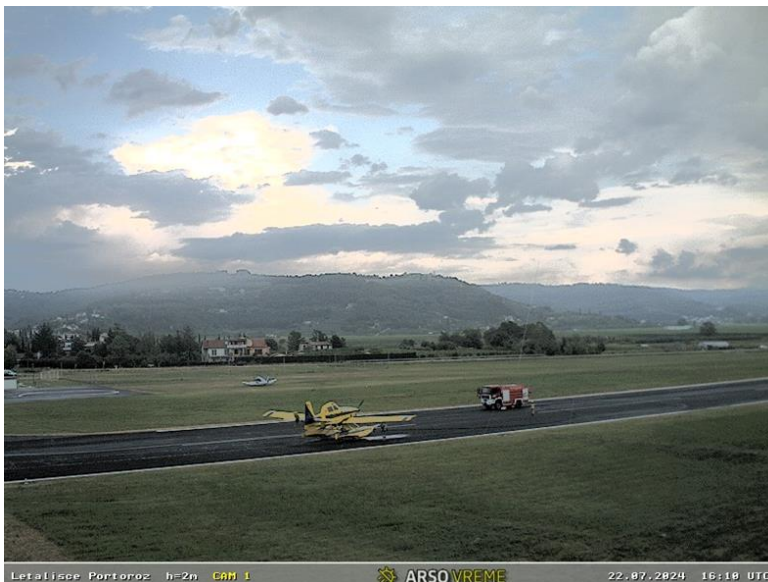
Slika 5: Precipitation in Ilirska Bistrica according to local time



Slika 6: Wind measurements at LJPZ airport according to local time in km/h



Slika 7: RWY view to the north at 18:10 LT



Slika 8: RWY view to the east at 18:10 LT

2.5.2 METAR reports

METAR LJPZ 221400Z 12014G25KT 090V160 9999 FEW030 FEW040CB SCT080 28/18 Q1011=
 METAR LJPZ 221430Z 12009KT 090V160 9999 FEW030 FEW040CB SCT080 29/18 Q1011=
 METAR LJPZ 221500Z 16008KT 110V190 9999 FEW040CB 29/18 Q1012=
 METAR LJPZ 221530Z 13008KT 100V200 9999 FEW040CB SCT060 29/20 Q1012=
METAR LJPZ 221600Z 09009KT 060V120 9999 VCSH FEW030 FEW040CB SCT050 28/20 Q1012=
 METAR LJPZ 221630Z 12007KT 9999 FEW020 FEW040TCU SCT060 BKN100 26/21 Q1012=

2.5.3 Weather Summary

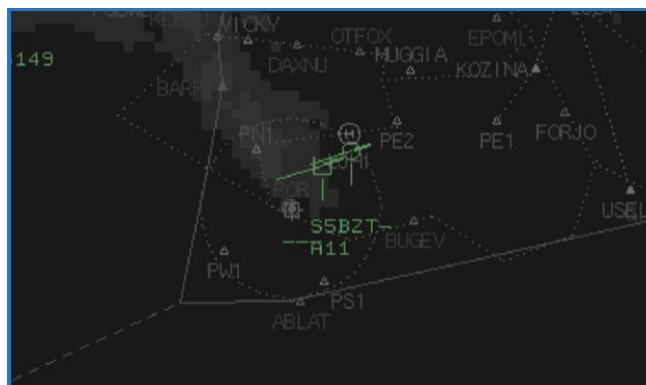
On July 22, 2024, between 14:00 and 16:30 UTC, the following weather conditions prevailed at the airport and in the surrounding area:

- Air temperature around 28 °C; visibility over 10 km;
- Southeast winds with speeds up to 9 knots;
- The cloud base was at 3000 feet AGL (Above Ground Level);
- **Occasional thunderstorms were observed to the north and east/southeast of the airport, while light rain showers occurred at the airport;**
- No other significant weather phenomena were reported;

2.6 ATS (Air Traffic Services) Data

At the time of the event, radio communication with the Portorož APP/TWR controller was established on the frequency 124.880 MHz. Before the aircraft's arrival, the controller provided the necessary arrival and landing information to the pilots for landing at Portorož Airport. The voice communication analysis indicates that the pilot of aircraft S5-BZT was conducting the communication with the controller.

Due to flying in formation, one of the aircraft had its radar transponder turned off (otherwise, a continuous TCAS alert would have been triggered due to their proximity). Aircraft S5-BZT had its transponder on and was visible on the radar screen. Aircraft S5-BZR was visible on the radar screen only as a primary return. The last visible position of S5-BZR on the radar screen was one minute before landing.



Slika 9: Radar response of two aircraft in formation before landing

2.6.1 Voice Communication Transcript

A few minutes before the arrival of the aircraft, the FIS (Flight Information Service) notified the Portorož controller about the planned arrival of two Air Tractor aircraft. The controller immediately relayed this information to the airport services at LJPZ to ensure airport services were available.

In the following transcript, two messages from the pilot of S5-BZR involved in the event are highlighted in blue. All other communication with the controller was conducted by the pilot of S5-BZT. During the arrival, there were no other aircraft in the airport's vicinity, and there were no other communications with the Portorož controller. The transcript is provided in UTC time..

16:02:45	LJPZ	S-ZT formation light shower at aerodrome Portorož.
	S5-BZTf	Say again for S-ZT formation.
	LJPZ	Starting to rain at Portorož.
	S5-BZTf	Yeah, we see the rain we still have 10km or more, we will be there in a couple of minutes. We got your airfield in-sight already.
	LJPZ	S-ZT formation report on final RWY15.
	S5-BZTf	We'll report final 15 S-ZT formation
16:04:56	S5-BZTf	Portorož RWY in-sight we'll proceed to Portorož bay to drop the water then we will proceed direct to final 15
	LJPZ	S-ZT roger, maintain own separation for landing and no other traffic reported.
	S5-BZTf	Own separation, no traffic reported BZT.
16:06:01	S5-BZR	BZR first aircraft proceeding right base RWY15
		Noise on freq for several seconds (probably still BZR transmitting)
16:06:16	LJPZ	S-ZT formation RWY15 cleared to land wind 110/7 max 11kts
	S5-BZR	Copied cleared for landing RWY15 BZR
16:07:15		Aerodrome - Control, it's sliding on the ground.
		Aerodrome - Control, he didn't put the wheels out..
		LJPZ – I see.
16:07:20	LJPZ	Second aircraft make go-around RWY is blocked.
16:07:39	LJPZ	Second aircraft do you read?
	S5-BZT	That is copied. I am okay, I got it, I got it.

Activation time of the airport fire department

16:12:06		Aerodrome	Control, the airport is closed.	
		LJPZ	Understood, the airport is closed	Time of NOTAM issuance about the airport closure
		Dispeč?	Acknowledged, I will issue a NOTAM, yes.	

2.6.2 Summary of the ATS Controller's Statement

...The aircraft were arriving in formation... I also activated the lights for RWY 15, PAPI, and Kalvert. As soon as I spotted the first aircraft, S5-BZR, it started to rain heavily. As we prepared for landing, I gave them instructions to maintain a safe distance between the two aircraft. The first aircraft, S5-BZR, came in from Left Base for RWY 15, flew over the final approach, and then turned left to re-enter the landing pattern. I tracked the aircraft on the runway, and, based on its speed and position, I anticipated that it would not be able to exit the runway via TWY B, so I immediately began searching for the second aircraft to inform it that the first aircraft was still on the runway. At that point, visibility toward Piran was very poor. Upon a second look at the runway, I saw smoke from the landing gear and the sparks of aircraft S5-BZR near TWY B. Simultaneously, a comment from the airport personnel (firefighters) was heard over the Motorola radio. The aircraft was stuck on the runway, skewed to the left, approximately 10-20 meters beyond TWY B. The time of the incident was 16:09 UTC. I observed the pilot through binoculars and could see that he was unharmed in the cockpit. The second aircraft in the formation, S5-BZT, was informed that the runway was blocked. The pilot acknowledged the situation and continued the flight towards Ljubljana, with a possibility for landing at LIPQ. A NOTAM was issued regarding the closure of the airport.

2.7 Investigation Data

Upon the arrival of the chief investigator, the incident site was secured by the police. The site inspection was conducted in the presence of representatives from LJPZ airport and the SKP PU Koper police. After the inspection, the aircraft was handed over to the Administration of the Republic of Slovenia for Civil Protection and Disaster Relief operator. Further inquiries were conducted to obtain data from the Administration of the Republic of Slovenia for Civil Protection and Disaster Relief operator, the maintenance and CAMO organizations, ATS, LJPZ airport, the CAA, and the aviation sector at the Ministry of Infrastructure. Additional information for the investigation was obtained from the investigating authorities of the aircraft manufacturer's country (NTSB USA) and from the country of the pilot involved in the incident (CIAIAC Spain). The operational documents were reviewed, and discussions were held with the responsible personnel from the Administration of the Republic of Slovenia for Civil Protection and Disaster Relief operator. Subsequently, at the request of the investigative authority, further details about the pilot were obtained and provided by the Spanish aviation investigative authority. Before the conclusion of the investigation, the draft final report was

submitted to the aviation operator, NTSB (USA), CIAIAC (Spain), CAA, and the Ministry of Infrastructure (MZI) for review and to provide comments and suggestions. The coordination and verification of data within the draft report were conducted with the operator on October 24, 2024. All recipients of the draft final report responded within the allotted 30-day period without comments, except for one recipient, who is also the addressee of a safety recommendation and did not respond to the draft. The final report was prepared for publication in January 2025.

2.8 Operator Data

Administration of the Republic of Slovenia for Civil Protection and Disaster Relief began preparations for aerial firefighting operations in 2023 and started practical firefighting operations from the air in May 2024 after registering the aircraft with the CAA. The operator entered into a master agreement with the aircraft supplier Air Tractor Europe S.L. for the purpose of providing training for pilots and aircraft maintenance for firefighting. Under this agreement, the operator secured experienced pilots from the Spanish aerial firefighting operator Titan Aerial Firefighting, a subcontractor of Air Tractor Europe S.L. From May 15, 2024, to September 15, 2024, the operator assigned these three experienced pilots to firefighting operations. Two trained pilots operate amphibious aircraft equipped with floats, and one pilot flies the land-based version.

- The operator secured three aircraft for firefighting purposes, two of which are amphibious and capable of water pickup from standing bodies of water. These are complex aircraft, which were registered by Administration of the Republic of Slovenia for Civil Protection and Disaster Relief as the aviation operator in the Slovenian civil registry with the CAA. The aircraft have valid certificates of airworthiness in accordance with EASA regulations⁵.
- The operator ensures regular maintenance of the aircraft with an approved maintenance organization in compliance with EASA Part-145 regulations⁶. The operator also contracted the inclusion of the aircraft in an organization authorized to manage the ongoing airworthiness of the aircraft in accordance with Part-CAMO regulations.

⁵ ARC - Airworthiness Review Certificate in accordance with M.A.901 Annex I Vb (Part M) to EU Regulation no. 1321/2014

⁶ <https://www.caa.si/del145-organizacija.html>

- Before starting firefighting operations, the operator ensured the development of the Operational Manual and appointed responsible persons from the State Aerial Firefighting Unit of the Administration of the Republic of Slovenia for Civil Protection and Disaster Relief (hereinafter DEGZ) in accordance with the Operational Manual, which describes the principles, rules, and procedures for conducting aviation activities..

3 ANALYSIS

3.1 General

The flight analysis shows that both pilots were conducting terrain observation on the day of the incident before being activated for firefighting in the Ilirska Bistrica area. The observation flight route was from Brnik–Portorož–Sežana–Portorož–Brnik. The flight lasted 2 hours and 30 minutes and concluded at 16:00 with a landing at Brnik Airport. Shortly after landing, at 16:24, the activation for firefighting in the Ilirska Bistrica area was initiated. Aircraft S5-BZR and S5-BZT departed from LJLJ airport again at 17:10. While fighting the fire, the aircraft encountered a storm front, causing them to abort the firefighting mission and, after dumping water in the Piran Bay, head toward the pre-designated alternate airport, Portorož, for a landing. In formation, the first aircraft, S5-BZR, landed with the landing gear retracted and came to a stop on the runway approximately 10 meters ahead of the TWY B intersection. Since the runway was closed, the second aircraft, S5-BZT, continued its flight toward LJLJ airport, where it later landed safely.

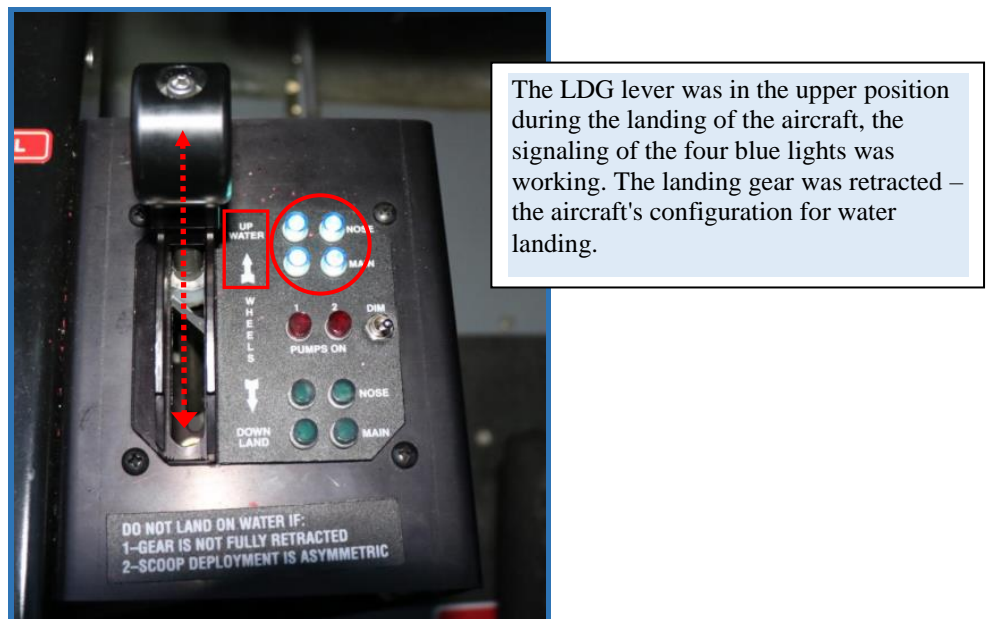
3.2 Landing Gear Operation Analysis

As outlined in the manufacturer's instructions, specifically described in the Aircraft Flight Manual (AFM) regarding aircraft operation, the pilot must select the landing gear configuration by adjusting the LDG lever in the aircraft's cockpit. When the lever is in the upper position, the landing gear is retracted into the float structure, and four blue lights illuminate, indicating the gear configuration for water landing (the LDG position is marked as "UP WATER"). When the lever is moved to the lower position, two red lights illuminate, signaling that the hydraulic pumps are active. When the landing gear is fully extended, four green lights illuminate,

indicating that the gear is fully deployed, with all wheels outside, and the aircraft is ready for landing on the runway (the LDG position is marked as "DOWN LAND").

Upon inspecting the aircraft immediately after the incident, it was found that the LDG lever was in the retracted position, indicating that the landing gear configuration was set for a water landing.

Analysis of the operation of the LDG lever revealed no malfunction in its operation. The mechanism for deploying the landing gear worked correctly. Additionally, a review of the aircraft's maintenance documentation found no comments or indications of technical issues with the retractable landing gear system.



Slika 10: The position of the LDG lever in the cabin of the S5-BZR aircraft immediately after the event

3.3 Analysis of Operational Procedures for the Contracted Operator

Pilots involved in firefighting operations with the operator Titan Aerial Firefighting are required to follow the standard operating procedures (SOP) outlined in the operator's manual "SOP (FF) - AIRCRAFT WATER DROP, STANDARD OPERATING PROCEDURES" (latest revision on February 1, 2024). The operator's instructions for firefighting procedures, including water retrieval and landing on the runway, mandate the use of a "checklist" at all points, without exception. When conducting a joint operation with two aircraft, the "Checklist" must be executed via radio communication between the two aircraft. In this process, one pilot reads out the checklist elements, and the other pilot performs them, with the roles then

switched. The operator emphasizes the mandatory cross-checking of the checklist via radio communication between pilots flying in formation.

12.7. Scooping Procedure:

- Approach (11.500 Pounds)
- Downwind – 100 / 110 knots – flaps 10°. Confirm – **FOUR BLUES**
- 80/85 knots – 20° flaps. Confirm – **FOUR BLUES**
- Scooping – 50 to 55 KTS GS

12.8. Return to Base – Approach for Landing on Land

- **At 6 NM** on approach to the aerodrome, landing gear down and confirm – **FOUR GREEN lights**
- Approach (11.500 Pounds)
- Downwind – 100 / 110 knots – flaps 10°
- Final – 80 / 85 kts – flaps 20° to 30°.
- Prop - Forward
- Confirm – **FOUR GREENS**

Slika 11: Titan Aerial firefighting instructions (page no. 36/84) of the SOP operational manual

For returning to base and landing on the runway, the procedure specifies that the landing gear must be lowered 6 nautical miles from the airport, and the pilot must verify that all 4 GREEN lights are on. The procedure must be confirmed through communication between pilots in formation to ensure that the landing gear is properly deployed for runway landing.

The audible signals indicating the position of the landing gear should only be turned off once the position of the landing gear has been confirmed as "LOWER GEAR FOR LANDING ON RUNWAY" (male voice). For water landings, the signal should be "PREPARE FOR WATER LANDING" (female voice).

3.4 Influence of Human Factors

An analysis of such incidents, which in some cases resulted in significant aircraft damage and even pilot injuries, reveals that the common denominator in most identical cases is the influence of human factors. Statistically, the investigative authority has recorded more than 10 such incidents over the past decade involving incorrect configurations for landing on water or runways with the same type of aircraft (Fire Boss) manufactured by Air Tractor.

This operation is subject to stress and pressure and requires a high level of physical preparedness and intense concentration. It involves close coordination between ground and air personnel, heightened situational awareness, and precise execution of challenging maneuvers at low altitudes. Firefighting operations are particularly complex due to time constraints, rapid

planning, constantly changing scenarios, swift coordination, and the high focus required to operate in the presence of other aircraft. The very nature of firefighting—water scoops, drops, constant maneuvering, flight interruptions, and shifting priorities—significantly impacts the physical and mental fatigue of the crew. Throughout all phases of the operation, the aircraft crew must strictly adhere to all checklists outlined in the Aircraft Flight Manual (AFM) provided by the manufacturer, as well as all prescribed procedures in the Standard Operating Procedures (SOP) of the aviation operator.

In this particular case, the pilot stated that he expedited the landing maneuver to ensure a safe landing for another aircraft in formation behind him before weather conditions could deteriorate. He was also aware that after landing on Runway 15, he would need to taxi back to the runway exit to clear the path for the approaching aircraft. According to the pilot, this significantly contributed to his partial completion of the pre-landing checklist, ultimately resulting in the landing gear remaining retracted, a configuration intended for water landings.

It is worth noting that under conditions of strong ambient light, it can be more challenging during flight to distinguish whether the landing gear position indicators display green or blue lights in the cockpit. Although green and blue are within the same color spectrum, the contrast may be subtle and could lead to confusion. In this case, the pilot did not confirm whether the blue lights were illuminated, indicating retracted landing gear. However, this omission cannot be attributed to color perception issues or light intensity problems.

An additional cockpit warning system, the "Amphibian Landing Gear Position Advisory System," provides an auditory alert. This system was functioning correctly before the landing, and the pilot heard the voice message, repeated every 3.5 seconds, warning that the landing gear was retracted. However, the pilot misinterpreted the landing gear lever's position (LDG), primarily because the landing gear control panel in this aircraft is designed with the lever in a horizontal forward-backward orientation, unlike other aircraft with a vertical lever configuration marked with "UP" and "DOWN." The pilot noted that it would be logical for the aircraft designer to adopt a vertical lever orientation, where:

- Lever up »UP« – Gear retracted.
- Lever down »DOWN« – Gear deployed.

Investigations of similar incidents have documented the following:

The fact that the system issues a warning regardless of whether the landing gear is extended or retracted, and that these messages are repetitive, can negatively impact the pilot's attention. Over time, the pilot may unconsciously perceive it as normal for the warning to

occur in all scenarios. Furthermore, if the warning is in English, the reaction time of a pilot whose native language is different can be slower, as the brain must first translate the information and then process it for full comprehension. Additionally, during the landing or separation maneuver, the pilot's workload increases, requiring divided attention to perform multiple tasks simultaneously. It is assessed that these factors could contribute to the pilot's reduced concentration, as he did not fully register the landing gear's position despite receiving indications.

It is therefore important to emphasize the critical role of proper initial and recurrent training in ensuring discipline in the application of procedures and the execution of checklists tailored to each phase of flight. Distinction training is particularly necessary for pilots with ingrained habits from similar aircraft types.

It has been observed that Titan Aerial Firefighting, the operator employing pilots contracted by the Slovenian Administration for Civil Protection and Disaster Relief, is aware of the influence of human factors. The operator conducts periodic training sessions aimed at raising awareness, identifying, and assessing risks to prevent the recurrence of such incidents. Their operational manual includes the following reminder:

"We all make mistakes; what matters is establishing routines that allow us to recognize and correct them before they lead to potentially hazardous situations. The safety of pilots and ground personnel is the absolute priority in this type of operation."

3.5 Analysis of Regulations

The Slovenian Administration for Civil Protection and Disaster Relief was designated as the operator of aerial firefighting operations in accordance with the Regulation on the Implementation of Protection, Rescue, and Assistance Using Aircraft (as amended, Official Gazette of the Republic of Slovenia, No. 21/16, dated March 18, 2016). Before commencing aerial firefighting operations, the operator entered into a contract with Air Tractor Europe S.L., the aircraft supplier, to provide pilot training and aircraft maintenance for firefighting purposes. Within the contract, experienced pilots from the Spanish aviation operator Titan Aerial Firefighting, a subcontractor of Air Tractor Europe S.L., were provided. The operator established operational documentation and appointed responsible personnel for the National Aerial Firefighting Unit (DEGZ) under the Administration of the Republic of Slovenia for Civil

Protection and Disaster Relief, in accordance with the Operational Manual, which outlines the principles, rules, and procedures for aerial activities.

An analysis of the existing regulation—the Regulation on the Implementation of Protection, Rescue, and Assistance Using Aircraft—revealed inconsistencies. On one hand, it mandates cooperation with other national security authorities under relevant ministries, yet this is not reflected in practice. Additionally, the regulation imposes obligations on the operator that conflict with international aviation regulations and established practices for conducting aerial operations. A systemic flaw in the regulation is the absence of a defined administrative oversight authority for operators assuming the role of an aviation operator. The investigative commission deemed this inconsistency a significant risk, potentially impacting the expected level of aviation safety in Slovenia.

It is evident that Administration of the Republic of Slovenia for Civil Protection and Disaster Relief, in its role as an aviation operator, assumed tasks and responsibilities requiring extensive and challenging preparations to establish a safe management system. According to the commission, the time and human resources available for such preparations were and remain limited. Moreover, since the inception of these operations, Administration of the Republic of Slovenia for Civil Protection and Disaster Relief has lacked expert support from both national aviation oversight authorities, the Ministry of Defense Aviation Authority (MAA MoD) and the Civil Aviation Agency (CAA).

The investigation also uncovered shortcomings in the training of pilots—candidates for independently conducting aerial firefighting operations. Practical training is conducted as part of maintaining qualifications for contracted foreign pilots, but without a predetermined training program. Consequently, it remains unclear who is responsible for theoretical and practical pilot training, which program is being followed, and who the accountable personnel within the aviation entity providing the training are.

Regarding the analysis of the regulation, the following is stated:

"For civil aircraft, the aviation operator must, in accordance with the regulations, include in its operational manual training programs for personnel participating in aviation operations and ensure that such training is conducted based on these programs, maintaining the required documentation. Compliance with programs and training is verified by a commission appointed

by the Director of the Civil Aviation Agency of the Republic of Slovenia, which is responsible for inspecting the aviation operator."

According to the Aviation Act, as amended, the oversight authority is the "Civil Aviation Agency of the Republic of Slovenia" (CAA), which has not fulfilled this role in practice.

The investigation identified the following:

- The Administration of the Republic of Slovenia for Civil Protection and Disaster Relief Operational Manual, in its role as the operator, does not reflect the actual state of aerial firefighting operations. In practice, firefighting is conducted according to the subcontractor's operational procedures manual, which is understandable, rather than the Administration of the Republic of Slovenia for Civil Protection and Disaster Relief manual, which was issued for the initial operations without coordination with other safety authorities.
- The operator has established an internal oversight system, but it does not include experienced aviation experts to ensure the effectiveness of the Safety Management System (SMS). This internal oversight represents a systemic safety risk, given that the aviation operator lacks a designated aviation oversight authority, except for airworthiness matters related to aircraft registered in the civil registry under CAA oversight.

At the time of the investigation and before publishing this final report, the commission noted the following:

- The national legislation does not systemically define which authority is responsible for administrative and professional oversight of aerial firefighting support activities.
- During the investigation, the Government of the Republic of Slovenia issued a resolution declaring that aerial firefighting support activities, under the National Aerial Firefighting Unit of the Administration of the Republic of Slovenia for Civil Protection and Disaster Relief and all associated activities, are activities of public interest conducted as state aviation operations.

- To comply with international aviation standards and established practices governing civil aviation, the Government of the Republic of Slovenia decided to organize oversight within the Ministry of Defense.

During the investigation, the Government of the Republic of Slovenia issued a resolution that specifies the organization of the safety authority responsible for continuous oversight of the aviation operator (Administration of the Republic of Slovenia for Civil Protection and Disaster Relief) within the Ministry of Defense (MoD). The commission views this resolution as a timely and appropriate plan to address the inconsistencies identified in Section 3.1 of this report. However, the outdated Regulation on the Implementation of Protection, Rescue, and Assistance Using Aircraft remains in effect and requires amendment. The commission also recommends the appointment of an interim oversight authority (MAA MoD or CAA) to supervise the operator until the safety authority within MoD is fully established..

4 SAFETY RECOMMENDATIONS

The commission assesses that the existing Regulation on the Implementation of Protection, Rescue, and Assistance Using Aircraft is outdated, inadequate, and fails to align with international aviation regulations, EU regulations, and other applicable legal acts in the Republic of Slovenia in the field of civil aviation. The regulation does not specify which of the two national aviation oversight authorities (MAA MoD or CAA) is responsible for supervising the implementation of aviation regulations applicable in Slovenia, conducting misdemeanor proceedings related to these regulations, and performing other administrative and inspection tasks as defined by ICAO international aviation regulations, EU regulations, government directives, and the regulations of both relevant ministries.

Therefore, the Safety Investigation Authority for Aviation, Maritime, and Railway Accidents and Incidents issues the following safety recommendation:

SI-SR001-2025

The Ministry of Infrastructure, in cooperation with the Ministry of Defence, should initiate the revision process of the Regulation on the Implementation of Protection, Rescue, and Assistance Operations Using Aircraft, or prepare a new regulation that governs this area. This regulation should specify in detail the methods for conducting firefighting operations using complex aircraft registered in the civil aircraft register. The Ministry of Infrastructure should ensure that the regulation is published no later than May 15, 2025.

SI-SR002-2025

The Ministry of Infrastructure should, within the framework of implementing the State Safety Program (SSP), continuously ensure that all aviation operations conducted within the country are properly certified and supervised. Clear responsibilities and legal bases for oversight and certification should be established. This applies to aviation operations covered under Regulation (EU) 2018/1139, as well as those excluded from its scope and governed by national regulations. Member States must ensure that activities involving state aircraft excluded from EU legislation are conducted with due consideration for the safety objectives of Regulation (EU) 2018/1139.

Toni Stojčevski
Head of Unit
Cheif Investigator