THE REPUBLIC OF CROATIA

Air, Maritime and Railway Traffic Accident Investigation Agency
Air Traffic Accident Investigation Department

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Zagreb, 31 December 2019

F I N A L R E P O R T

ON ACCIDENT OF THE DRONE UAVISION - WINGO OGASSA tail number 18106

Brač Airport, 20 November 2018

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CONTENT

OCCURENCE INFORMATION

Type of the occurrence:	Accident
Date:	20 November 2018
Time:	12:35 LT
Place:	Brač Airport (LDSB)
Type of the aircraft:	Drone
Registration (Tail Number):	18106 (tail number)
Manufacturer / model:	Uavision / Wingo Ogassa
Operator:	Portuguese Air Force
Damage to the aircraft:	Destroyed

INVESTIGATION

The Air, Maritime and Railway Traffic Accident Investigation Agency received information on the accident from the Brač Airport and employees of the Ministry of Sea, Transport and Infrastructure.

With the approval and in cooperation with the Ministry of Defence, which is responsible for investigating military aircraft accidents on the territory of the Republic of Croatia, AIA conducted the investigation of this accident and issued this Final Report.

SUMMARY

On 20 November 2018, the drone was returning from flight. In the approach to the runway 22 of Brač Airport, in the left turn for the final approach, the aircraft crashed near the threshold of the runway.

The take-off and landing operations were performed by the so-called 'external pilot' who was located on the airport surfaces and by remote control visually steered the aircraft.

During the crash, the aircraft was destroyed, while there was no other damage, nor injured persons.

By the investigation it was established that the cause of the crash was stalling during the approach of the aircraft due to a low speed in the turn and the gust of wind from the rear of the aircraft.

AIA issued two safety recommendations.

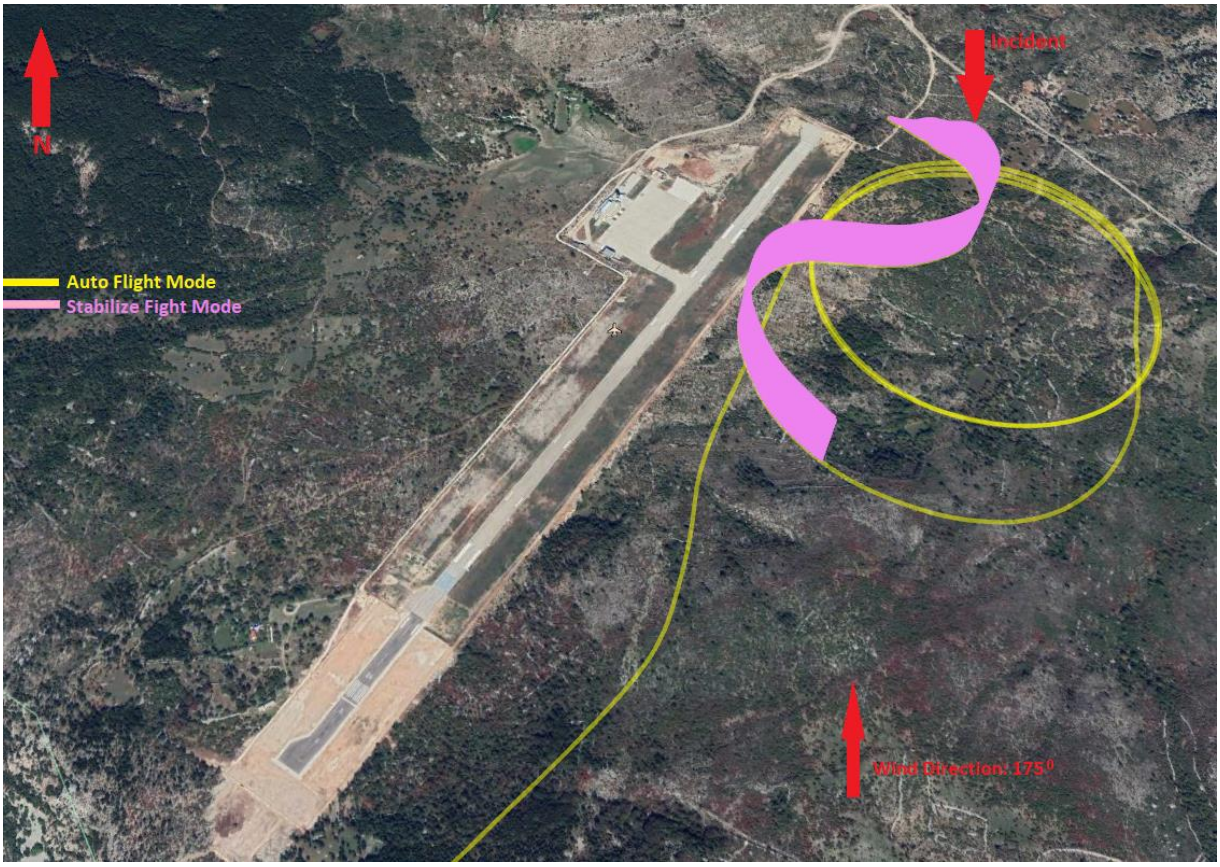
1. FACTS AND INFORMATION

1.1. FLIGHT INFORMATION

On 20 November 2018, the subject drone made a flight within EMSA's RPASMAR marine surveillance program. It departed from the Brač Airport at 10:00 LT (10:00 local time). The flight took place in the zone north of the island of Hvar and lasted for 2 hours and 40 minutes.

Towards the end of the flight, during the approach for landing, the aircraft operation was taken over by an external pilot, who visually operated the drone from the ground.

After the descent, the aircraft uncontrollably began to lose altitude in the left turn and crashed to the ground about 150 m east of the threshold of runway 22 of the Brač Airport.



Picture 1 – Brač Airport and flight path of the drone in approach

1.2. DAMAGE TO THE AIRCRAFT

The aircraft was destroyed in this accident.

1.3. OTHER DAMAGE

At the accident site there were no other damages.

1.4. PERSONAL INFORMATION

1.4.1. External pilot

Male person, Portuguese citizen, member of the Portuguese Air Force. He has 105:50 hours on take-offs and landings of drones as an external pilot, in total of 467 operations.

He also has 128:50 hours as drone operator.

1.4.2. Operator (UAV internal operator)

Male person, Portuguese citizen, member of the Portuguese Air Force. He has 116:30 hours as drone operator.

He also has 26:25 hours on take-offs and landings of drones as an external pilot, in total of 170 operations.

1.5. AIRCRAFT INFORMATION

1.5.1. General information

Manufacturer:	UAVISION
Type:	Wingo – Ogassa
Tail Number:	18106
Operator:	Portoguese Air Force
Cruise speed:	51 kt
Maximum speed:	70 kt
Stall speed:	42 kt with weight of 38 kg
MTOW:	38 kg
Payload:	5 kg

1.5.2. Aircraft description

The manufacturer of the subject aircraft is the Portuguese company 'UAVISION'.

This aircraft is specially designed for long-term operations at sea. It is intended for border and coast surveillance, vessel tracking and identification, search and rescue, detection of illegal fishing and illegal migration, remote recording and pipeline control.

The aircraft is powered by a propeller driven by a piston engine. It can spend 10 hours in the air at altitudes of up to 8000 ft, with an operating radius of 100 km. It needs a runway for takeoff and landing. Take off distance is 150 m. The maximum wind speed at which this aircraft can perform operations is 35 kt.

Picture 2 – Drone Uavision Wingo - Ogassa

1.6. METEOROLOGICAL INFORMATION

For the purposes of the investigation, an analysis of meteorological conditions at the time of the accident was obtained, within which a numerical reanalysis of the meteorological situation at the time of the accident was performed.

Meteorological situation

Weather conditions over the Mediterranean and Southeastern Europe were affected by a low-pressure air whose centre during 20 and 21 November moved from the Tyrrhenian Sea over the Otranto to the Aegean Sea. In these circumstances, an unstable and variable weather, with moderate and strong winds mainly in the south, and occasional rain, was prevailing in the Adriatic.

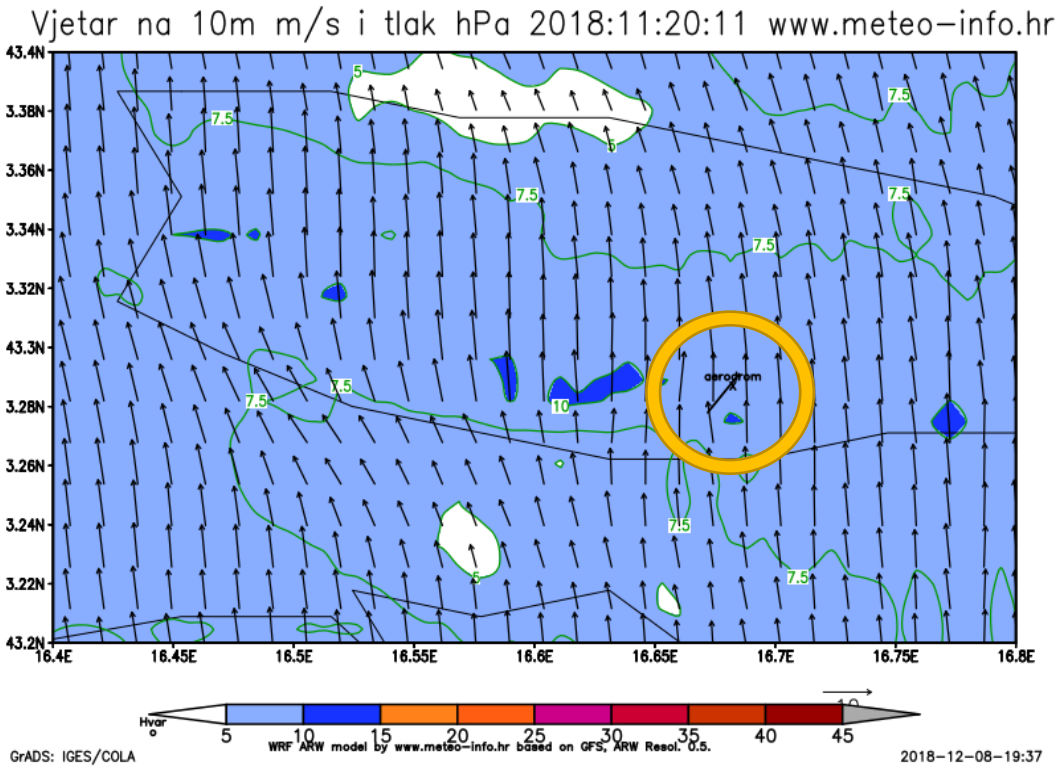
There were no precipitations at the Brač Airport at the time of the accident and the visibility was good.

Wind - speed and direction

At the time of the accident at the meteorological station Split - Marijan, winds of south and south-east directions of speeds of 4 to 9 m/s were measured. At meteorological station Hvar, the south-east wind of speed of 4 m/s was measured.

For the purposes of take-off and landing operations, the drone operator measured the wind speed at the position of the external pilot using a manual anemometer and monitored the wind direction by

observing the wind indicator. Thereby, at the time of the accident, the wind of the direction of 175° and speeds of up to 14 kt was established.

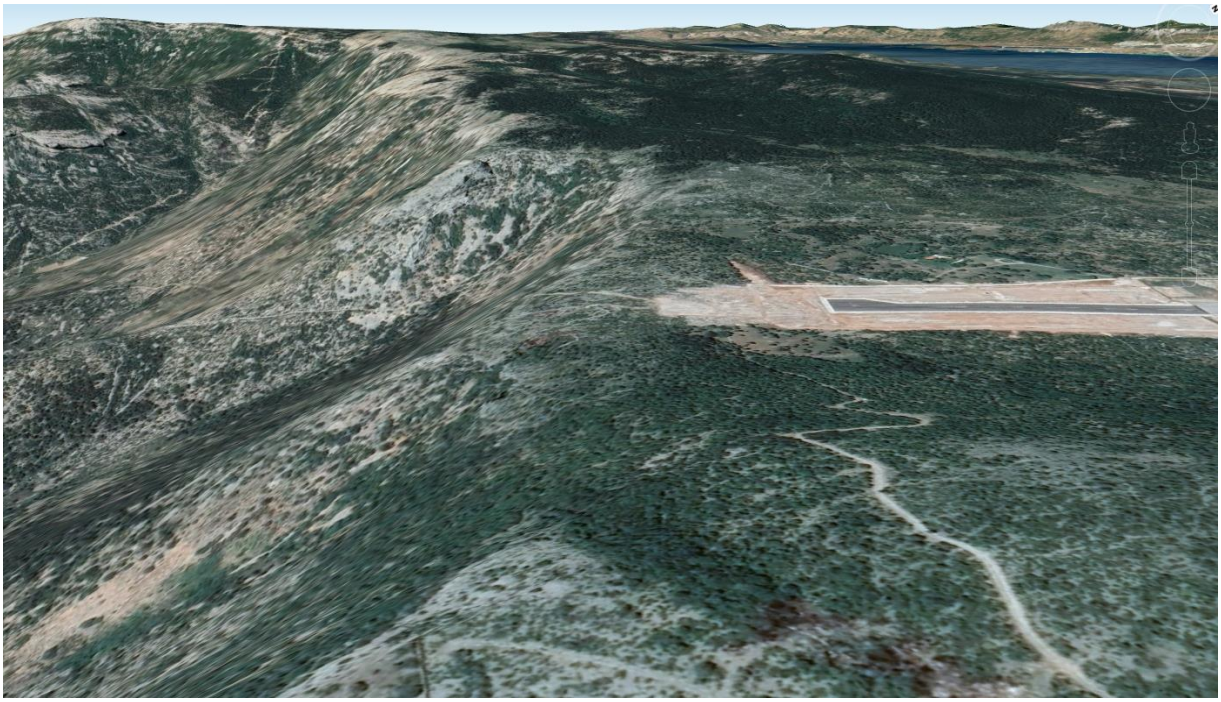


Picture 3 – Wind at 10m, direction and speed, 12:00 LT

Picture 3 shows wind direction and speed at 10 m above the ground obtained by numerical analysis. This data is fully consistent with the wind data measured at the surrounding weather stations. The Brač Airport is located in the place marked with a yellow circle.

Influence of relief on air currents

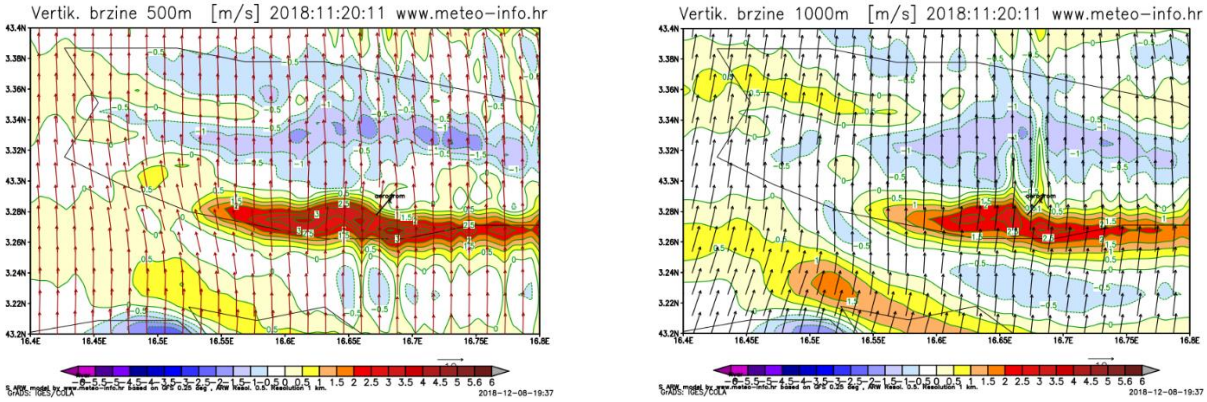
The airport is located on a natural plateau at an altitude of just over 500 m. On the south side of the plateau there is a slope which descends to sea level. The threshold of the runway 04 is almost at the edge of the mentioned slope (Picture 4) and is about 2 km away from the coastline. The distance from the threshold of the runway to the edge of the slope is about 250 m.



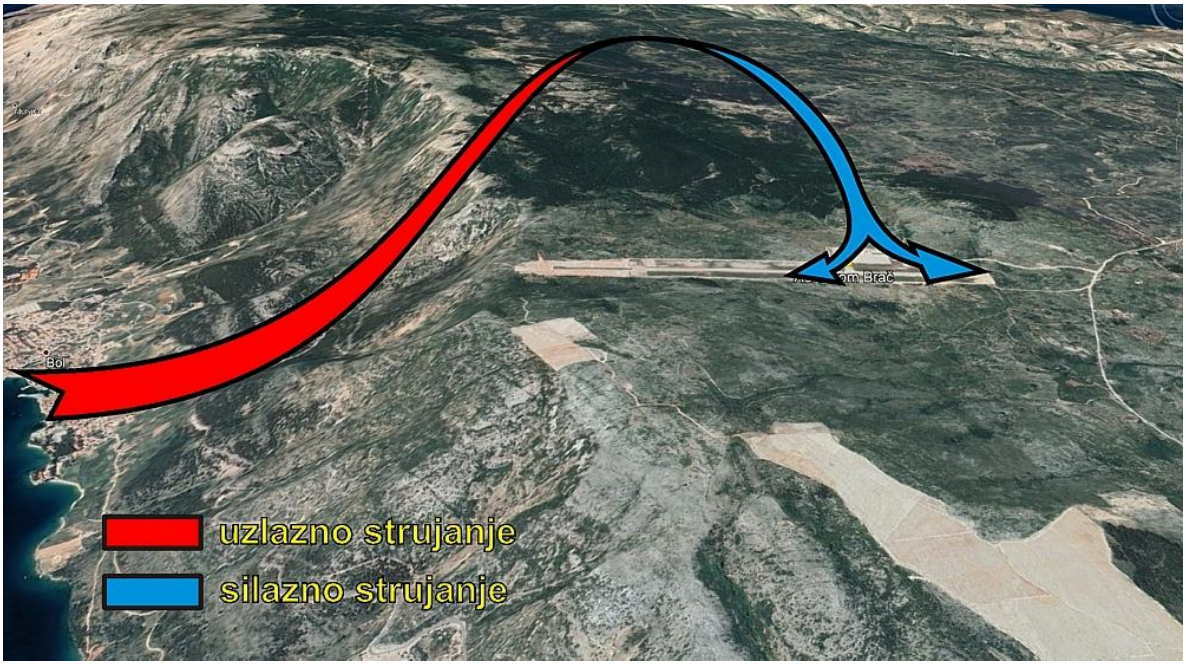
Picture 4 – Presentation of the relief in the area of the Brač Airport

In situations where stronger winds are blowing from the south directions, the air will flow uphill on the slope, and on the plateau behind the edge of the slope, the flow will be descending and accompanied by turbulence.

By numerical analysis a simulation of vertical air flow in the area of the island of Brač during the accident was made (Picture 5), and Picture 6 shows the air flow in the area of the Brač Airport.



Picture 5 –Presentation of vertical wind speeds at 500 m of altitude (left picture) and at 1000 m of altitude (right picture) at the time of the accident



Picture 6 –presentation of the air flow in the area of the Brač Airport at the time of the accident

It can be seen from Picture 6 that the relief of the south part of the island can, with moderate and strong winds from the southern quadrant, create a downward airflow just behind the edge of the slope. In the area of the runway, especially its northern part, in such situation, descending air currents which "spread" upon impact to the ground can be expected.

1.7. AIRPORT INFORMATION - BRAČ AIRPORT (LDSB)

It is located on the island of Brač above Bol, at an altitude of 541 m. It is equipped for the receiving and dispatching of smaller commercial aircrafts with up to 100 seats during daylight and night. Commercial flights mostly take place only during the summer season.

Brač Airport is open all year round; however, the flight control is only present at certain periods. During the absence of flight control at Brač Airport, communication takes place with the flight control of Split Airport.

The runway is asphalted, with length of 1760 m and orientation 04/22. During 2018, 30170 passengers passed through Brač Airport.

1.8. FLIGHT DATA RECORDERS

The flight and flight parameters data of the subject aircraft were recorded and stored in the memory of the respective device and were read after the accident.

1.9. IMPACT AND WRECKAGE INFORMATION

The aircraft hit the ground on a steep path at a speed of about 100 km/h and was completely destroyed. The impact site was about 150 m east of the threshold of runway 22 of Brač Airport.

Picture 7 – Remains of the drone at the impact site

1.10. ADDITIONAL INFORMATION

1.10.1. Flight parameters data

The flight and flight parameters data of the subject aircraft were read from the memory of the respective device after the accident. The aforementioned data showed the following:

- The speed of the aircraft in the approach, ten seconds before the crash, was 43 kt. The minimum speed specified by the manufacturer for this type of aircraft is 42 kt.
- The flight path of the aircraft in the approach was not like the usual optimal route for aircrafts in approach: - downwind - base - final.

2. ANALIZA

2.1. CIRCUMSTANCES

The analysis of the meteorological situation shows that the relief of the area where the airport is located affects the air currents in presence of south winds. In such situation, the threshold of the runway 22 of the Brač Airport is the zone of descending air current that 'spreads' when approaching the ground. In the area of the 'spread' of the air current, the wind direction is not stable but varies. An aircraft approaching the runway 22 'upwind' in such a situation can easily at some point get struck by a gust of wind from another direction. In case the speed is low (close to stall speed) and the gust of wind is in the rear of the aircraft, the flight performance of the aircraft may be significantly impaired.

2.2. APPROACH FOR LANDING

From the data read from the aircraft memory, it can be seen that the speed of the aircraft in the approach was low. Also, the flight path in the approach for landing was not optimal, that is, the approach did not go as usual (school circle: downwind-base-final). Therefore, the path of the aircraft in the approach for landing was such that the ability to control the flight parameters and stability of the aircraft was significantly lower than when approaching in the usual optimal path.

2.3. CRASH OF THE AIRCRAFT

The stall of the wings of the aircraft occurred when the aircraft entered the left turn. The flight speed before entering the turn was barely slightly higher than the stall speed, and the wind was of variable direction. It is highly likely that the gust of wind to the rear of the aircraft further reduced the flight speed, and the lateral tilt in the turn further contributed to the stall.

When the stall occurred, the aircraft began to decline suddenly, and the altitude above ground was too low for the aircraft to regain the required speed and to recover. Namely, the recovery of aircraft from stalling is possible only at the expense of additional loss of altitude. If the aircraft is low above ground, there is not enough altitude for recovery and return to normal flight. In such case, the impact of the aircraft to the ground is inevitable.

3. CONCLUSION

3.1. FINDINGS

Meteorological conditions

- Meteorological conditions were a factor in this accident,
- At the time of the landing of the subject aircraft, the wind was blowing from the south directions, and the threshold of the runway 22 in such situation is in the zone where the wind direction is variable,

Approach

- The speed of the aircraft in the approach, before the crash, was almost equal to the stall speed,
- Just before the beginning of the fall, the aircraft was in the left turn and laterally rolled,
- The approach did not take place according to the usual optimal pattern: downwind-base-final,

Crash of the aircraft

- The aircraft began to lose altitude while turning to the left,
- The loss of altitude occurred due to the stall for either both or one of the following two reasons:
    - Entering the turn at too low flight speed,
    - Gust of wind to the rear part of the aircraft, also at too low flight speed,

External pilot, aircraft and airport

- The pilot was eligible to operate the subject aircraft and had certain experience,
- By its characteristics, the aircraft fulfilled the necessary requirements for flying in the present conditions,
- No technical defects of the aircraft that could have contributed to the crash of the subject aircraft were established by the investigation,
- The Brač Airport fulfilled the necessary conditions for performing the operations of the subject

aircraft.

3.2. CAUSE

The cause of this accident was stalling at a low altitude occurred due to one of the following two reasons or combination of both:

- Entering the turn at too low flight speed (close to the stall speed),
- Gust of wind to the rear part of the aircraft in a situation when the flight speed was too low (close to the stall speed).

3.2.1. Contributing factors

The factors that contributed to the crash of the subject aircraft:

- Approach at the path that did not allow optimal control of flight parameters and stabilization of the aircraft,
- The wind that was blowing in the approach zone with a variable direction.

4. SAFETY RECOMMENDATIONS

Considering the findings of this investigation, AIA issues the following general recommendations:

AIN04-SR-15/2019

The speed of the aircraft during the approach for landing should always be sufficiently high, i.e. so much higher than the stall speed so as to prevent the gusts of wind to compromise the speed required for flying of the aircraft.

AIN04-SR-16/2019

The approach of the aircraft should take place along the path that is common in aviation (downwind - base - final) and which at the same time allows for the optimal control and stabilization of the aircraft in approach.

Investigator in Charge

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