Final Report

SERIOUS INCIDENT/2022/1097

STATE COMMISSION ON AIRCRAFT ACCIDENT INVESTIGATION

UL. CHAŁUBIŃSKIEGO 4/6, 00-928 WARSZAWA | EVENT NOTIFICATION + 48 500 233 233

FINAL REPORT

from investigation of the aviation occurrence of the aircraft below 2250 kg MTOM

SERIOUS INCIDENT

OCCURRENCE NO. – 2022/1097

AIRCRAFT – Extra NG, SP-HMM

DATE AND PLACE OF OCCURRENCE – 18 March 2022, EPKP

The Report is a document presenting the position of the State Commission on Aircraft Accidents Investigation concerning circumstances of the air occurrence, its causes and safety recommendations. The Report was drawn up on the basis of information available on the date of its completion.

The investigation may be reopened if new information becomes available or new investigation techniques are applied, which may affect the wording related to the causes, circumstances and safety recommendations contained in the Report.

Investigation into the air occurrence was carried out in accordance with the applicable international, European Union and domestic legal provisions for prevention purposes only. The investigation was carried out without application of the legal evidential procedure, applicable for proceedings of other authorities required to take action in connection with an air occurrence.

The Commission does not apportion blame or liability.

In accordance with Article 5 paragraph 6 of the Regulation (EU) No 996/2010 of the European Parliament and of the Council on the investigation and prevention of accidents and incidents in civil aviation […] and Article 134 of the Act – Aviation Law, the wording used in this Report may not be considered as an indication of the guilty or responsible for the occurrence.

For the above reasons, any use of this Report for any purpose other than air accidents and incidents prevention may lead to wrong conclusions and interpretations.

This Report was drawn up in the Polish language. Other language versions may be drawn up for information purposes only.

WARSAW 2022

Occurrence reference number	**2022/1097**			
Type of occurrence	SERIOUS INCIDENT			
Date of occurrence	18 March 2022			
Place of occurrence	Kraków-Pobiednik (EPKP)			
Type and model of aircraft	Extra NG			
Aircraft registration marks	SP-HMM			
Aircraft/User Operator	Private			
Pilot in Command	PPL(A)			
Number of victims/injuries	Fatal	Serious	Minor	None
	0	0	1	1
Domestic and international authorities informed about the occurrence	ULC, EASA			
Investigator-in-Charge	Michal Ombach			
Investigating Authority	State Commission on Aircraft Accidents Investigation (PKBWL)			
Accredited Representatives and their advisers	None			
Document containing results	Final Report			
Safety recommendations	None			
Addressees of the recommendations	Not applicable			
Date of completion of the investigation	22 August 2022			

1. Type of occurrence

Serious incident.

2. Investigating Authority

SCAAI (PKBWL).

3. Date and time of the occurrence

18 March 2022, 17:25[1] (16:25 UTC).

4. Place of the take-off and intended landing

Take-off from Kraków – Pobiednik aerodrome, EPKP (Fig.1).

[1] All times in Final Report are in LMT, LMT=UTC+1 h.

5. Place of occurrence information

Airspace above the EPKP.

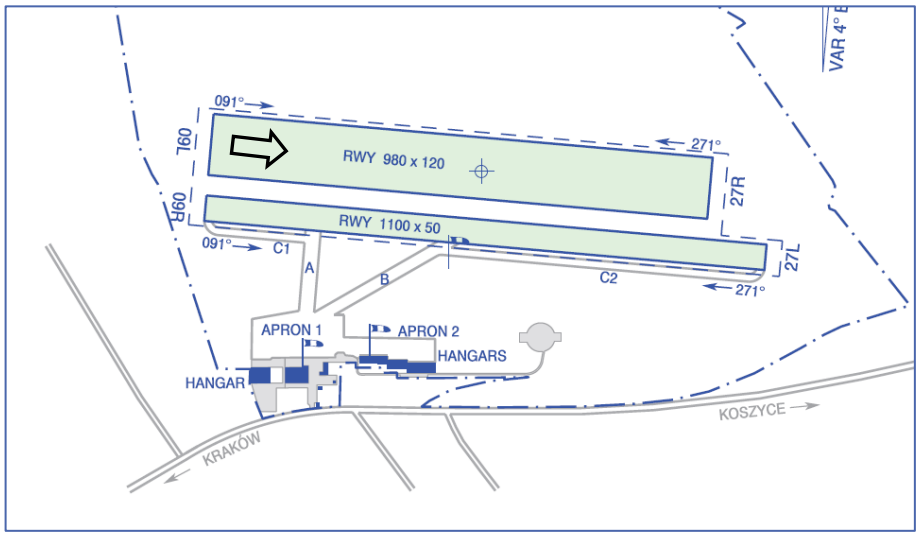

Fig. 1 EPKP – aerodrome infrastructure and landing strip marked by black arrow [source: AIP Polska]

6. Operation type

Aerobatic flight.

7. Flight phase

Acceleration, diving.

8. Flight conditions

Daylight, VMC.

9. Meteorological information

The following notifications were issued for Krakow-Balice (EPKK) airport, located about 10 km away:

METAR EPKK 181600Z 03009KT CAVOK 08/M09 Q1039=

METAR EPKK 181630Z 03008KT CAVOK 07/M08 Q1039=

Meteorological conditions had no impact on the occurrence.

10. Flight operator

Private.

11. Personnel information (crew data)

Pilot (PIC) – male, aged 48, valid PPL(A) with SEP(L), „Aerobatic" and UACP entries, medical certificate class II/LAPL with no limitation.

PIC proved his total flight time 140 FH 27 min. including 92 FH 33 min. as PIC. Additionally, he had above 900 FH on ultralight aircraft. He has collected more than 200 take-offs with the Extra aircraft. In the period of 03÷18.03.2022 he flew 15 take-

offs in 9 hrs 10 min. on Extra NG. The above data can confirm that the pilot was in current training.

The passenger, aged 47, holder of PPL(A), was occupying the front seat and – in accordance with his declaration – was not involved into aircraft control.

12. Injuries to persons

PIC suffered minor injuries, not to be qualified for advanced medical treatment. The passenger did not suffer any injuries.

13. Damage to aircraft

The aircraft sustained damage as shown in the Fig. 2.

During the flight the canopy released from its locks on the portside of the fuselage, turned on hinges, hit the right upper wing skin and broke. A part of the frame remained on the starboard, some debris detached from the aircraft and fell on the ground. Due to collision with canopy debris, the vertical fin, rudder as well as right side of horizontal stabilizer sustained minor damage (dents, scratches, paint chips).

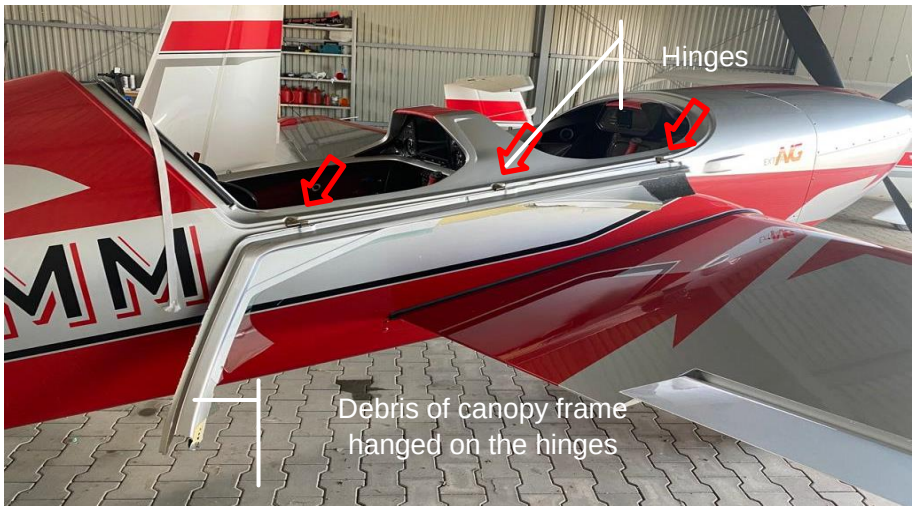

Fig. 2 Cockpit of the aircraft and a part of the broken canopy frame [source: SCAAI]

14. History of the flight and analysis

14.1. Description of occurrence

On 18 March 2022 the owner / pilot in command (PIC) of Extra NG[2] aircraft had planned aerobatic flights from EPKP airfield. After pre-flight inspection and main tank refuelling up to ca. 70 l, he flew a solo flight[3] - it was uneventfull. During the second flight with passenger on board[4], right after completing the sequence and joining the aerodrome circle, the passenger informed PIC about „unusual sounds and light

[2] Extra NG – two-seat aircraft, certified in accordance with CS-23 aerobatic (A) and (U), type certificate EASA.A.620. The company of Extra Flugzeugproduktions- und Vertriebs GmbH is Extra manufacturer.
[3] Pilot (PIC) is seating in the back, behind the passenger, the seats have been arranged in tandem configuration – one by one.
[4] On Extra NG aircraft the passenger occupies the front seat.

vibrations of the aircraft". Both men were convinced the sounds came from the engine, so after landing the PIC performed the engine test run, but no irregularities were found. After refuelling the main tank, the men checked the aircraft, looking for eventual loosened part causing noise and vibration observed during the second flight. The check did not reveal any failures, so the crew finally concluded, the vibration they heard and felt were an illusion only.

However, before the third take-off (the same crew), after starting-up the engine, the PIC performed additional engine check twice. No discrepancies were identified.

The take-off and climb up to 4000 ft AGL went in a standard way. PIC contacted APP Krakow (approach service) and got the clearance for entering to the control zone. After accelerating up to ca. 350 kph and levelling the flight, the canopy suddenly opened, broke and part of it detached from the aircraft. PIC immediately reduced the speed to approx. 200 kph, descended and landed uneventfully on EPKP with no radio contact. After gentle touch-down, the pilot taxied to the hangar. PIC, who was sitting in the back, suffered minor face cut, probably caused by the headset when the wind blew it away.

Most canopy parts was found in the airfield area (Fig. 3). They did not cause injuries to third parties or material losses.

Fig. 3 Piece of canopy frame found [source: SCAAI]

14.2. Analysis of occurrence

The analysis has been performed based on the information provided by the PIC, passenger (also the pilot) and the ground staff involved in aircraft maintenance. The pictures made by the occupants and whiteness were used. The aircraft was not equipped with any recording devices.

As per the PIC statement, before the third take-off, the canopy was closed and properly locked.

The Extra NG canopy is fixed on the three hinges located on the starboard and is opened in the right direction (Fig. 4).

Fig. 4 Location of canopy hinges on the aircraft starboard [źródło: PKBWL]

To lock the closed canopy, it is necessary to pull the sliding handle located on the left side of the pilot (Fig. 5). The handle is connected with two pawls getting in contact with appropriate fittings on the cockpit side and creating the locks. The mechanism works in unlocked/locked settings and has been equipped with a notch (dead point) activated after moving the handle to its locked position. Inside the cockpit, on the same pushrod, there are two handles available respectively from the rear and front seat. In flight, in case of unlocking (canopy jettisoning), the canopy moves automatically back on the hinge guides and detaches from an airplane.

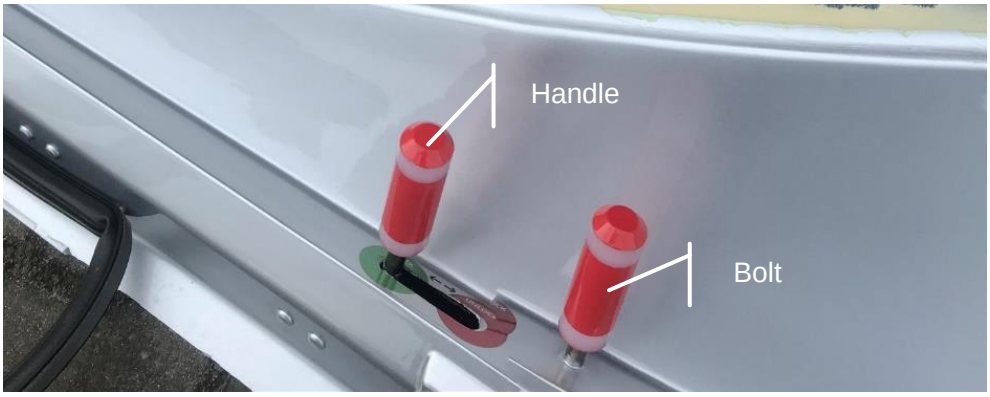

Fig. 5 Canopy locking mechanism located at the passenger seat, on the left side (portside). The fixed bolt allows to move the handle in case of high force required [source: SCAAI]

The visual inspection of fittings (Fig. 6) on the portside as well as corresponding pawls located on the same pushrod (Fig. 7) did not reveal their damage. Each fitting was screwed to the fuselage by two screws (Fig. 6). The screws of rear fitting were found loosened, causing that even if the pawl was tightly joined with its fitting, there was a clearance between the fitting and the portside. This clearance could have caused vibrations of the canopy.

Each fitting was equipped with a roll on its upper side, to decrease the resistance during opening and closing the canopy. This solution also allows to increase the force pressing the canopy frame to the fuselage, which combined with a rubber seal allows to eliminate vibration.

Fig. 6 Fittings for pawls on the portside [source: SCAAI]

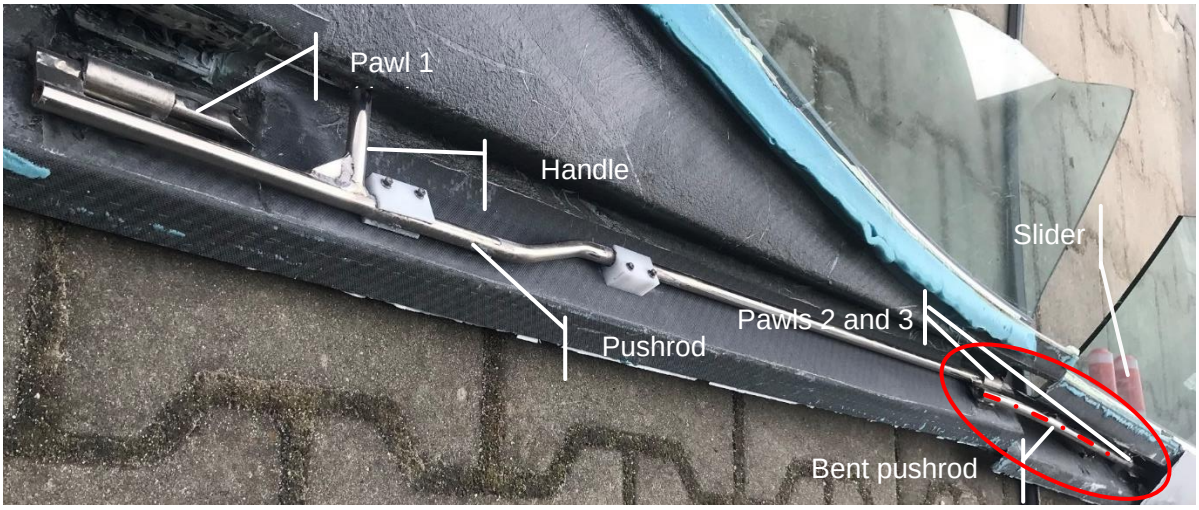

Fig. 7 Pawls on the common pushrod [source: SCAAI]

The pushrod with the pawls was found slightly bent, probably due to high stress over the material yield strength, occurred when the canopy was being destroyed – while detaching from the aircraft or/and while hitting the ground. The bent part of the pushrod was marked with the red ellipse (see Fig. 7).

The pawls on the detached part of the canopy were found in their locked settings (Fig. 7). It does not mean that the canopy was detached when the pawls were locked – this would not be possible. The pawls must have been opened prior to the detachment, and after the detachment the pushrod was displaced to the „locked" position of the pawls due to the force exerted by the spring, partially visible in Fig. 8.

The unintentional opening of pawls in flight should be excluded. PIC declared, that he had tightened them before the take-off by moving his handle to the „locked" position.

This declaration is considered credible because the cockpit canopy would have fallen off during the engine test run, taxiing or take-off if it had not been locked before.

The above leads to the conclusion, the most probable reason of displacement of the pawls from corresponding fittings (if an intended opening is excluded) were vibrations caused by loss of the canopy frame rigidity after its cracking. These vibrations occurred after loosening the rear fitting in the system of pawl locking, when the force pressing the frame to the cabin side decreased. The frame crack started the destruction process. The crack occurred probably in the area of stress concentration (notch), near the middle pawl (Fig. 8).

Fig. 8 Cracked canopy frame in the area of middle pawl location. A notch is present on the edge of fitting slot reinforcement [source: SCAAI]

Fig. 9 Handles and sliders locking the canopy: rear (on the left) and front (on the right) [source: SCAAI]

The damaged frame in the area of the rear slider (marked by a red circle in Fig. 9) proves high intensity of vibrations. A recess in the composite has been grooved by the handle of the slider.

The vibrations might have been caused by air pulsation around the aircraft flying with a high speed or by high RPM of the powerplant.

Having no opportunity to forecast the occurrence (it came suddenly), none of the pilots was able to prevent its outcome. In case of long-lasting vibrations, the immediate speed reduction would prevent them. In the circumstances of aerobatic flight at about 350 kph, it was practically impossible, the amplitude of vibrations increased rapidly and resulted in the above outcome.

The described behaviour of the airframe may be caused by the hidden mechanical failure, difficult to notice during pre or post flight inspection. The affected aircraft was new, with a very low flight time, so the assembly failures cannot be excluded (carbon-fibre canopy frame, sealing, soundproofing, fixing of particular elements, others). Loose screws of the rear pawl fitting could be one, but not the only reason of the occurrence.

Most probably, the noise heard by the occupants during the flight before the occurrence, came from the canopy – the aircraft element with lost stiffness due to cracked carbon-fibre frame but also the loosened rear fitting.

In case of carbon-fibre composite cracking, the loss of stiffness comes suddenly and usually the whole affected part is destroyed.

The aircraft was sent to the manufacturer for repair.

14.3. Commissions findings

1) The pilot had a valid ratings to perform the flight;
2) The aircraft airworthiness was properly documented;
3) Loading requirements for the take-off as well as centre of gravity location were met – the aircraft was properly configured, including aerobatic requirements (i. e. empty fuel tanks in the wings);
4) The fragments detached from the aircraft did not cause damage on the ground, all were found and identified;
5) The human factor was not a cause of the occurrence.

15. Cause of the occurrence

The probable cause of the occurrence was vibration of the canopy frame caused by the loss of its stiffness that led to pawls unlocking and detaching the canopy from the aircraft.

16. Factors contributing to the occurrence

1) Probable crack of canopy frame in the flight before the occurrence (or earlier);
2) Loosened rear fitting of the canopy locking system;
3) Accelerating the aircraft to a high speed, close to V_{NE}.

17. Safety recommendations

SCAAI has not proposed any safety recommendations.

18. Proposed systemic changes and/or other comments

None.

19. Annexes

None.

END

Investigator in-charge

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(Signature on original)