The sole purpose of safety investigations is the prevention of aviation accidents and incidents.

The Commission does not apportion blame or liability. The investigation is independent and separate from any judicial and administrative proceedings.

Any use of this Report for purposes other than prevention of accidents and occurrences may lead to wrong conclusions and interpretations.

# FINAL REPORT

**of the State Commission on Aircraft Accidents Investigation**

dated 11 June 2024

**from the investigation of an aviation incident**

# 2023-0061

OCCURRENCE NUMBER

Aeroplane, Extra NG, SP-HMM

4 August 2023; EPKP

SCF-NP: System/Component Failure or Malfunction (Non-Powerplant)

> This Final Report was issued by the State Commission on Aircraft Accidents Investigation on the basis of information available on the date of its issue.
>
> This Final Report presents the circumstances of the aviation occurrence concerned, as well as its causes, contributing factors and safety

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## 1. Course of the occurrence

On 4 August 2023, the pilot planned an aerobatic flight with a passenger. The aeroplane took off from the Pobiednik aerodrome near Krakow (EPKP) after 17:20[1]. At an altitude 1000 m AGL[2], the pilot performed several aileron rolls. After another roll was completed, the cockpit canopy opened during level flight. The opened and released canopy forcibly separated from its opening limit strap and hit the upper surface of the starboard wing.

In response to this occurrence, the pilot made an emergency landing on the same airfield. During the descent and landing, the cockpit canopy remained open and leaned on the wing.

Neither the pilot nor the passenger was harmed in the course of this occurrence. The aeroplane sustained damage.

## 2. Relevant information

### 2.1. Weather conditions

The meteorological conditions in the area of EPKP were suitable for VFR-compliant flight operations with VMC[3]. There was no air turbulence.

The weather had no effect on the occurrence.

### 2.2. Crew qualifications

The Pilot-in-Command (PIC[4]) was an aeroplane pilot, 49 years of age, held a valid PPL(A)[5] with SEP(L)[6] and “Aerobatics” rating, as well as a UACP[7] and a valid Class 2 aeromedical certificate and LAPL[8] issued unconditionally.

The pilot had an experience of more than 1000 hours flying general aviation aeroplanes (including ultralight aircraft). The pilot also had a considerable experience in flying the Extra NG, the type of which he was flying for aerobatics. The pilot was undergoing routine training at the time.

The passenger had no aircraft qualifications.

Rest during the last 48 h – the pilot was provided with an opportunity to rest for 24 h in home conditions.

The pilot knew EPKP well and had flown from it several times.

During the occurrence, the pilot occupied the rear seat in the cockpit.

[1] All time points in this Report are LMT. LMT=UTC+2.
[2] Above Ground Level.
[3] Visual Meteorological Conditions.
[4] Pilot-in-Command.
[5] Private Pilot Licence (Aeroplanes).
[6] Single Engine Piston Land.
[7] Certificate of Qualifications of the Ultralight Aircraft Pilot.
[8] Light Aircraft Pilot Licence.

## 2.3. Place of occurrence

The occurrence took place in the airspace above EPKP aerodrome (Fig. 1).

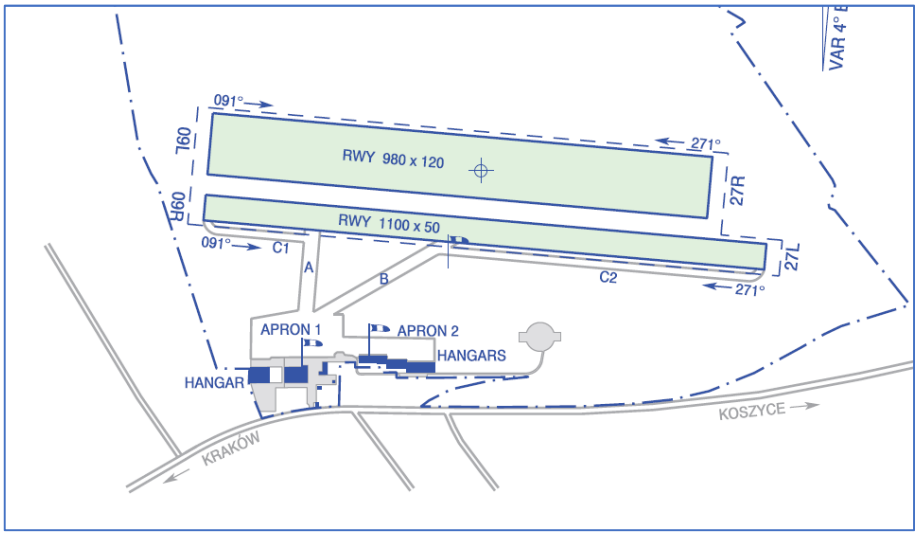


Fig. 1. EPKP aerodrome – section of the EPKP aerodrome map [source: AIP VFR Polska]

## 2.4. Aircraft

General information:

- The Extra NG is a two-seater aeroplane, CS-23 certified in aerobatics (A) and utility category (U), with an EASA[9] type certificate, ref. no. EASA.A.620:
- manufacturer – Extra Flugzeugproduktions und Vertriebs GmbH;
- factory designation (model) – Extra NG;
- serial number – NG026;
- year of manufacture – 2021;
- registration marks – SP-HMM;
- owner – Pekao Leasing sp. z o.o.;
- user – private individual;
- certificate of registration – date of entry 9 August 2021, registry no. 5501, valid on the day of occurrence;
- Certificate of Airworthiness (CofA) – issued on 7 September 2021, no limitations, valid on the day of occurrence;
- Airworthiness Review Certificate (ARC) – issued on 5 September 2022, valid on the day of occurrence.

[9] European Union Aviation Safety Agency.

### 2.5. Aircraft damage

During the flight, the cockpit canopy's pawls were released spontaneously, resulting in the opening of the canopy. While the hinges prevented the canopy from separating, the opening limit strap broke. The canopy hit the top surface of the starboard wing. The inner canopy frame at the front shoot bolt assembly as well as the adhesive bond between the hinge brackets and canopy frame were damaged.

The nature of damage required factory canopy replace with the modificated new one.

### 2.6. Survival aspects

During the occurrence, both the pilot and his passenger had the safety belts fastened. Neither wore any protective helmets, as none was required. Neither of the two suffered any injuries.

Had the canopy separated from the fuselage (fully or in part), the separated debris could have hit the aeroplane empennage, resulting in damage to tail control surfaces. Had the separated canopy fallen from height, it could have posed a hazard of injury and property damage on the ground.

### 2.7. Other information

In the occurrence disclosed herein, the pilot ruled out that he or his passenger could have inadvertently repositioned the canopy locks during the flight.

The occurrence reported here is the second of such nature on the same aircraft during the last 15 months. The prior "major incident" took place in March 2022 (Occurrence No. 2022/1097).

The most probable root cause of Occurrence No. 2022/1097 was specified as follows:

"(…) self-excited vibration of the cockpit canopy assembly caused by local loss of canopy frame stiffness, resulting in release of the pawls and separation of the canopy from the aeroplane."

The following contributing factors were identified for the said occurrence:

1. Probable fracture of the cockpit canopy frame during the flight before the occurrence (or an earlier flight);
2. Play in the aft retainer of the cockpit canopy lock hardware;
3. Acceleration of the aeroplane to a high speed that was close to $V_{NE}$.

In April 2022, in Great Britain, an Extra NG suffered an aviation accident which involved a spontaneous opening of the cockpit canopy in flight.

To summarise, having examined the circumstances of occurrence No. 2023-0061, including the pilot's statement, the PKBWL requested the German BFU to

include the manufacturer of the affected aeroplane, Extra Flugzeugproduktions und Vertriebs GmbH, which is also TCH, in the investigation.

Liaising with TCH, BFU conducted a number of discussions and analyses to determine the reasonably possible scenarios of the canopy opening during the flight of the Extra NG, SP-HMM. The manufacturer of the Extra NG performed engineering analysis of the cockpit canopy latching aboard the aeroplane involved in the occurrence and defined repair procedures.

TCH, by the agency of BFU, responded to a number of questions raised by PKBWL. TCH analysed the occurrence based on the verification of damage to the Extra NG, SP-HMM. The analysis results are shown in Section 3.1.

The operation of the mechanism locking and securing the canopy against spontaneous opening is shown below (Fig. 2).

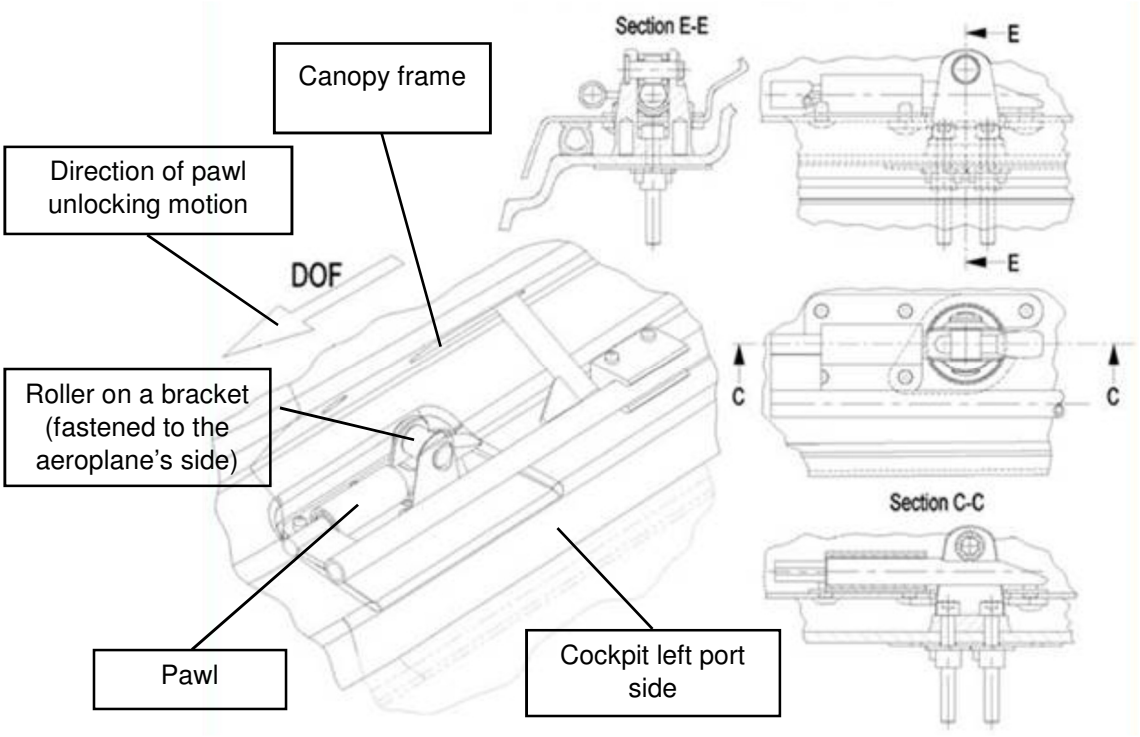


Fig. 2. Cockpit forward lock assembly fitting mechanism aboard the Extra NG [source: Extra GmbH/BFU]

## 2.8. Consultations of the draft Final Report

Before publication of the Final Report, PKBWL consulted its draft, requesting the following interested entities to submit their comments:

1) BFU (German Federal Bureau of Aircraft Accident Investigation), which did submit comments to the draft Final Report contents;
2) The pilot, who did not submit comments to the draft Final Report contents.

# 3. Conclusions

## 3.1. Findings

1) Despite the pilot's stated position that the canopy opened without his involvement (or any involvement of his passenger), BFU and the aeroplane manufacturer (being TCH) deemed that the cockpit canopy pawls were engaged only partially, which technically is not precluded by the cockpit latching system, in case the pilot has not made sure that he has locked the canopy completely (rear slider handle in max. aft locking position).
2) The cockpit locking mechanism was operating properly. The air flow around the cockpit in flight alone did not cause the mechanism to unlatch and unlock.
3) No pawl roller brackets were found to be damaged or loose.
4) The fractures of the canopy frame in the area of the canopy forward starboard hinge were a result of the impact of the opening canopy against the starboard wing.
5) The fractures of the canopy frame in the area of the forward port pawl were most likely a result of the canopy bouncing back loads.
6) All three roller brackets which fasten the canopy on the fuselage port side remained intact. The three pawls mating with the said roller brackets and installed on the canopy frame remained intact and in the "Locked" position. This precludes any reasonable spontaneous release of the canopy locks.
7) No evidences were identified on the cockpit frame to suggest that the locks had become loose.
8) All damage found was likely caused after the canopy opening limit strap broke, during the impact of the canopy against the starboard wing.
9) It was possible that the canopy locks were inadvertently loosened by the passenger during the flight, e.g. in a passenger's attempt to hold onto something while an aerobatic manoeuvre was in progress.
10) Prior to this occurrence, the cockpit canopy locking mechanism was not modified in any way.

## 3.2. Causes and contributing factors of the occurrence

1) The design of the cockpit canopy latching system technically did not preclude its partial engagement, in case the pilot has not made sure that rear slider handle is in the locked position which is indicated by a placard (max. aft locking position).
2) The canopy locks might not have been engaged and secured fully prior to the flight.
3) The action of aerodynamic forces drawing the canopy from the fuselage in high-velocity flight, coupled with canopy vibration, could have increased the load on each partially engaged canopy lock, thereby leading to the displacement of the locks towards their fully open position.

## 4. Safety recommendations

None.

## 5. Preventive action initiated and completed by TCH

Despite the results of the analyses pointing to the contribution of a human factor as the cause of the incident, TCH implemented the following actions to improve the performance of the cockpit canopy latching system in the Extra NG aeroplanes:

1) Revision #11 was made to the Extra NG POH[10] by refining and clarifying the pre-flight check procedure (Section 4) and rewording the description of the canopy closing and locking procedure (Section 7.7). The reworded description of the procedure now refers to a new in-cockpit legends for canopy lock handle positions (Fig. 3).

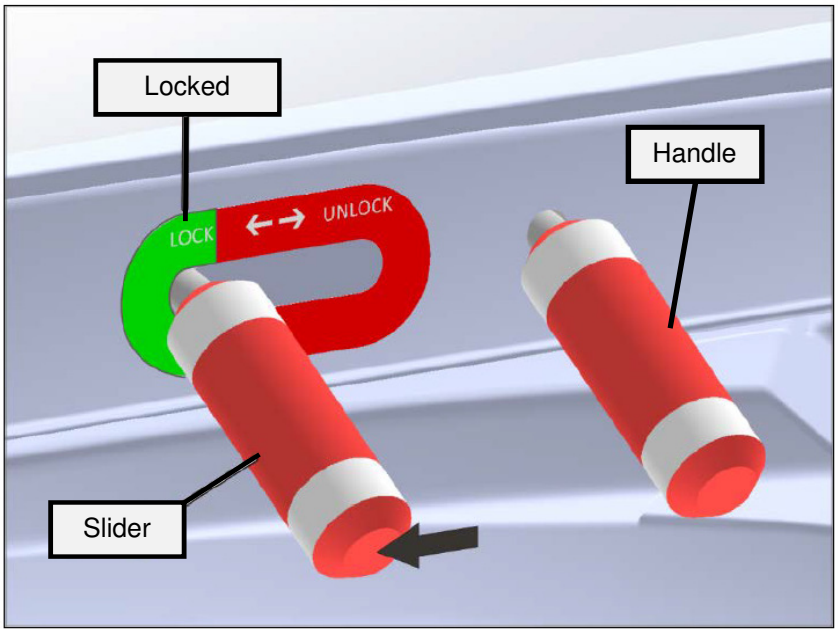


Fig. 3. "Lock" position legend for the canopy aft lock handle in the Extra NG aeroplane [source: POH Rev. 11, Extra Aircraft]

2) The cockpit canopy locking mechanism was modified on the Extra NG aeroplane, SP-HMM, S/N NG026, pursuant to Engineering Change ECO-NG-22-09 and ECO-NG-23-07. The modifications introduced, among others, a change in the shape (contour) of the pawls, which now results in additional retention of the latches in the locked position, combined with the installation of an additional spring which increases the hold-down force on the pawls in their locked position.

[10] Pilot's Operating Handbook.

3) TCH suggests that the users of the NG-series aeroplanes implement Service Bulletin SB-NG-2-22 “Canopy frame improvement” (published 23 December 2022) on the aeroplanes with the serial numbers (S/N) specified in it.
4) The aeroplane S/N NG061 and onwards will receive the modified/revised canopy locking system as standard equipment, conforming to Engineering Change ECO-NG-22-09 and ECO-NG-23-07.
5) Moreover, TCH issued an Assembly and Overhaul Manual (ref. AI-NG-02-23), which concerns preventive modification of the canopy locking system conforming to Engineering Change ECO-NG-22-09 and ECO-NG-23-07. TCH offers to implement the modifications free of charge at its manufacturing plant.

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