



Final report on aircraft serious incident

Case no.: **24-045F014**

Date: **8. September 2024**

Location: **FL250, about 44 Nm south of BGNO**

Description: **Loss of cabin pressure**

Investigation per Icelandic Law on Transportation Accident Investigation, No. 18/2013 shall solely be used to determine the cause(s) and contributing factor(s) for transportation accidents and incidents, but not determine or divide blame or responsibility, to prevent further occurrences of similar cause(s). This report shall not be used as evidence in court.

1. FACTUAL INFORMATION

Location and time	
Location:	Climbing through FL250, about 44 Nm south of BGNO
Date:	8. September 2024
Time ¹ :	15:31

Aircraft	
Type:	Textron B200
Register:	TF-NLA
Year of manufacture:	1997
Serial number:	BB-1597
CoA:	Valid
Engines:	Two PT6A-42 turboprop engines

Other information	
Type of flight:	Passenger flight
Persons on board:	Two pilots and seven passengers
Injury:	None
Damage:	Fracture of the cabin door upper forward locking pin
Short description:	Loss of cabin pressure

Commander / Pilot Flying		
Certificate:	CPL issued by ICETRA	
Ratings:	SEP BE90/99/100/200 TRI FE TRE	
Medical Certificate:	Class 1	
Experience:	Total flight hours:	~6400 hours
	Total flight hours on type:	~4800 hours
	Last 90 days on type:	82:45 hours
	Last 24 hours on type:	5:34 hours

¹ All times in the report are UTC, unless otherwise stated.

First Officer / Pilot Monitoring			
Certificate:	CPL issued by ICETRA		
Ratings:	MEP BE90/99/100/200		
Medical Certificate:	Class 1		
Experience:	Total flight hours:	357.2 hours	
	Total flight hours on type:	141 hours	
	Last 90 days on type:	94:49 hours	
	Last 24 hours on type:	5:34 hours	

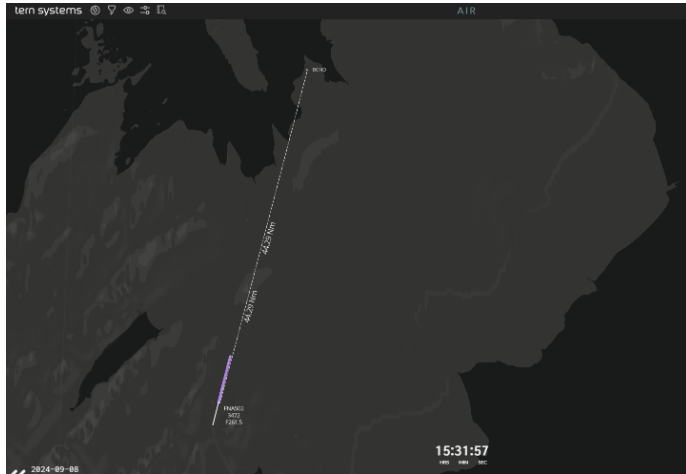
Aircraft TF-NLA was operating a contracted passenger flight from Station Nord (BGNO) to Mestersvig (BGMV) in Greenland under the callsign FNA502. The Commander was the Pilot Flying (PF).

During the climb from BGNO, when the aircraft was passing FL250 and climbing to FL280, there was a loud bang heard from within the aft cabin. The first officer could hear a rush of wind after the bang. The Commander immediately suspected the aircraft door, which is in the back of the aircraft. He looked at both cabin altitude gauges, which were rapidly rising. The PF initiated an emergency descent and followed the applicable procedure, which included reducing power to idle, select fine pitch angle for the propeller blades, select flaps to approach and select the wheels down.

The Commander then instructed the First Officer to call RVK Control via the SATCOM and declare emergency (Mayday – Mayday – Mayday), as well as squawking 7700, and advising that they were descending and returning to Station Nord (BGNO).

According to the Commander, the flight crew did not don the oxygen masks because the commander wanted to be able to communicate with the first officer, which he stated was easier without the oxygen masks. The Commander also stated that he was prepared to don it if the cabin pressure exceeded 12,500 feet.

According to the radar recordings, the highest altitude the aircraft reached was FL261.5 at 15:31:57 UTC, when the aircraft was located about 44 Nm south of BGNO (Figure 1).



The cabin depressurized at a rate of about 4-5000 FPM. About 2-3 minutes after the “bang”, when the aircraft was descending between FL170 and FL160, the cabin altitude briefly exceeded 12,500 feet, resulting in an “Altitude Warning” and an automatic deployment of the cabin oxygen masks.

Neither the Commander, nor the First Officer, donned the oxygen masks when the cabin pressure exceeded 12,500 feet. The cabin altitude rose highest to 14,000 – 14,500 feet for few seconds.

The Commander instructed the first officer to call Reykjavik Control using the Satcom and to advise that “Altitude Warning” had initiated and that they were descending and returning to Station Nord.

The emergency descent continued down to FL100, where the aircraft was leveled off and then continued its flight to Station Nord, after the landing gear and flaps had been retracted.

The aircraft returned to BGNO, where it landed safely at 15:57.

After landing the Commander briefed the passengers on what had occurred. When the cabin door in the aft cabin was opened, the forward upper cabin entry door hook fell down, as it was fractured (Figure 2).

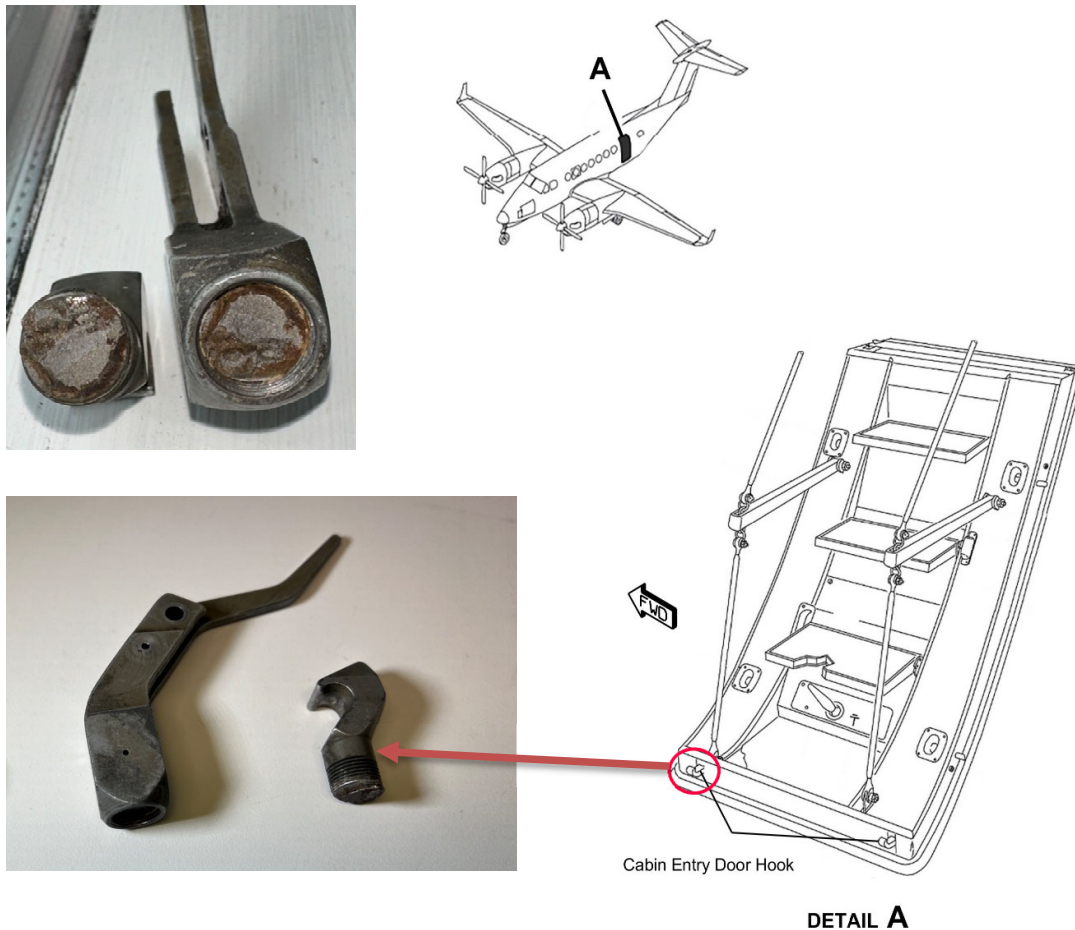


Figure 2: Location of the forward upper cabin entry door hook

The forward upper cabin entry door hook has the P/N 101-430029-1. According to the manufacturers documents², the forward upper cabin entry door hook is a 10,000 flight cycles Airworthiness Limitation Item, along with the rest of the cabin airstair door upper hook mechanism (including pins, brackets, spring, arm and hooks).

Review of the maintenance records of airplane TF-NLA revealed that the forward upper cabin entry door hook, P/N 101-430029-1, had accumulated 8585 cycles since the aircraft was new. This part had never been replaced, and it had accumulated close to 86% of its life limit. It had therefore not reached its airworthiness limit when it failed.

² B200 Aircraft Maintenance Manual, 200 Series Airworthiness Limitations Manual (rev F), chapter 04-00-00, page 3 of 13, B. Fuselage and Associated Structure.

2. ANALYSIS AND CONCLUSION

SIA-Iceland classified this as a serious incident, because the forward upper cabin entry door hook is an airworthiness limitation item that failed prior to reaching its life, resulting in a cabin depressurization at FL250 and an emergency being declared.

The First Officer was fairly new and flying for the first time in Greenland. The crew was not in VHF contact with ATC and was diverting back to Station Nord, descending from controlled airspace and into uncontrolled airspace. According to the Commander, they were aware of another flight that was planned for takeoff from Station Nord and on the same route after them. As the Commander had on multiple occasions performed emergency descent in a simulator, he knew that communication would be harder with the oxygen masks donned. He therefore prioritized communications over immediately donning the oxygen masks. He focused on flying the aircraft and descending to a safe altitude, while at the same time assisting the First Officer with his tasks.

The flight crew used the following check list:

EMERGENCY DESCENT	
1. POWER LEVERS.....	IDLE
2. PROP LEVERS.....	FULL FORWARD
3. FLAPS (200 KNOTS MAXIMUM).....	APPROACH
4. LANDING GEAR (181 KNOTS MAXIMUM).....	DN
5. AIRSPEED.....	181 KNOTS MAXIMUM

According to the Commander, if the cabin had depressurized at higher rate resulting in immediate loss of cabin pressure accompanied with the applicable warning, then the flight crew would have immediately donned the oxygen masks. In addition, having an open cockpit/cabin area the Commander did not want to cause panic among the passengers, as they had control of the situation and were monitoring the cabin pressure.

Time of useful consciousness can be found in Table 1.

Cabin Pressure Altitude (ft)	TUC
15,000	More than 30 min
18,000	20 – 30 min
22,000	10 min
25,000	3 – 5 min
28,000	2.5 – 3 min
30,000	1 – 2 min
35,000	30 sec – 1 min
40,000	15 – 20 sec

Table 1: Time of Useful Consciousness (TUC)³

SIA-Iceland launched an investigation into the failure of the forward upper cabin entry door hook. The fractured P/N 101-430029-1 hook was brought for detailed inspection at the manufacturer's site (Figure 3), along with the accompanying forward upper cabin entry door arm, P/N 101-430030-1, and the undamaged aft upper cabin entry door hook. The inspection was attended by representatives from SIA-Iceland, the aircraft manufacturer, the NTSB and the FAA.

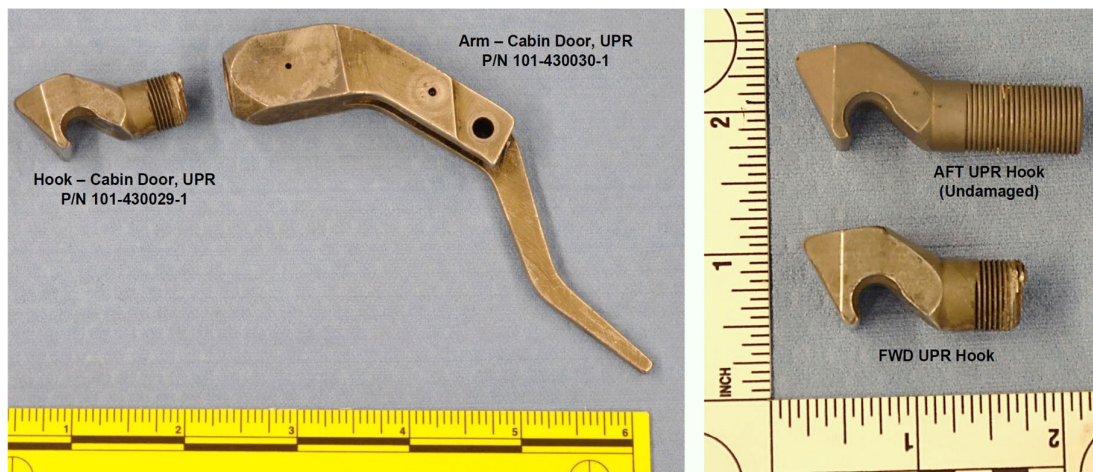


Figure 3: The fractured forward upper hook, the forward upper arm and the aft upper hook

³ Reinhart, R. O. (1996) Basic Flight Physiology (2nd ed). McGraw-Hill: New York.

The fracture in the forward upper cabin entry door hook was most likely caused by intergranular corrosion crack propagating from multiple planes at the threaded portion of the hook and growing inwards towards the center of the fracture surface. The outer slanted area of circular fracture surface was corroded, which indicates an aged fracture area event. The inner flat area was not corroded, which indicates a second fracture event most likely when the part failed.

The microstructure of the fractured hook was consistent with quenched and tempered 4340 high strength low alloy steel. The cadmium plate was visible on the surface of the part but due to the thinness of the plating layer it was impossible to verify its thickness.

The strength of the forward upper hook was approximated, using Rockwell hardness testing, to be 255 ksi which is marginally higher than the drawing requirement.

Detailed description of the findings of the investigation into the failure of the forward upper cabin entry door hook can be found in the appendix.

As the part most likely failed due to intergranular corrosion under normal operation loads, at about 86% of its life limit, while the microstructure of the fractured hook was consistent with quenched and tempered 4340 high strength low alloy steel, SIA-Iceland determined that the life limit of the part needs to be reconsidered (lowered), or a design change implemented.

3. SAFETY RECOMMENDATIONS

SIA-Iceland issues the following safety recommendations to Textron Aviation:

24-045F014 T01

SIA- Iceland recommends to Textron Aviation to reconsider (lower) the 10,000 flight cycles airworthiness life limit of the door hooks, or to perform design changes to improve its endurance.



The following board members approved the report:

- Guðmundur Freyr Úlfarsson
- Geirþrúður Alfreðsdóttir
- Bryndís Lára Torfadóttir
- Gestur Gunnarsson
- Hörður Arilússon
- Tómas Davíð Þorsteinsson

Reykjavík, 20. November 2025

On behalf of SIA-Iceland

Ragnar Guðmundsson
Investigator-In-Charge

4. APPENDIX

Manufacturing requirements

According to specifications, the forward upper cabin entry door hook, UPR, P/N 101-430029-1, is to be fabricated from 4340 low alloy steel bar and heat treated. The threads are to be machined after heat treatment. The hook is to have a vacuum deposited cadmium (cad) plating.

Examination

The forward upper cabin entry door hook was fractured approximately half-way through the threaded length. The remaining portion of the fractured hook was contained in the accompanying arm. The threads near the fracture location contained sealant residue and were affected by post-fracture mechanical damage. No plastic deformation of the hook (i.e., bending or necking) was noted. The fractured hook was marked with an inspection stamp (Figure 4).



Figure 4: The fractured forward upper hook

The fact that the fractured forward upper hook had an inspection stamp was important, because it indicated that it was not affected by Beechcraft Service Letter MTL-52-02. The fractured hook had therefore not required replacement prior to 12 January 2024 per Service Letter MTL-52-02. This service letter had been published because cabin entry door hooks may have been improperly CAD plated or improperly manufactured.

The fractured surface of the forward upper hook was inspected using an optical microscope. Oxidation products were observed around the edge of the fracture surface which indicated corrosion and that the crack was present for an extended period of time (Figure 5). The fracture initiated from multiple locations around the circumference of the part and propagated inwards.

High magnification SEM images of several locations on the fracture surface revealed that the features of the fracture surface at every imaged location were consistent with intergranular fracture. Small pockets of ductile dimples were located near the center of the fracture surface. Crack branching was also observed.

Intergranular fracture refers to the crack growth along the grain boundaries of a material, often occurring in metals with a high concentration of brittle particles at these boundaries, which facilitates crack propagation and reduces fracture toughness

The outer slanted and oxidized area of circular fracture surface (Figure 5) indicates an aged fracture area event, while the inner flat area indicates a second fracture event.

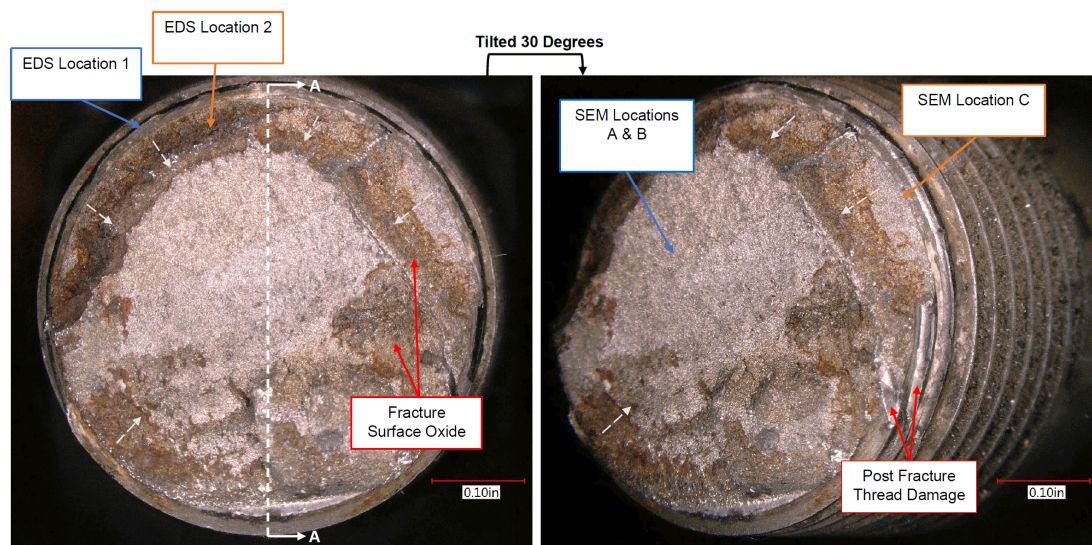


Figure 5: Optical microscope images of the forward upper hook fracture surface

Elemental analysis was performed of the thread surface adjacent to the fracture surface as well as the oxide product present on the fracture surface. Corrosive elements including

sodium (Na), and chlorine (Cl) were identified at both locations. The substantial concentrations of oxygen (O) and iron (Fe) indicate that the fracture surface oxide is iron oxide (i.e., rust). Cadmium (Cd) was also identified at both locations indicating that cadmium from the surface finish had been displaced to the fracture surface.

Cross-sectional examination of the forward upper hook was performed (Figure 6). The fracture exhibited significant crack branching. No additional cracking was observed at the neighboring threads. The microstructure of the hook was consistent with quenched and tempered low alloy steel. The lack of grain deformation around the threads indicates that threads were machined and not rolled. The grain direction orientation was consistent with the engineering drawing requirement. Due to the thin nature of the cadmium plating layer the thickness was not verifiable.

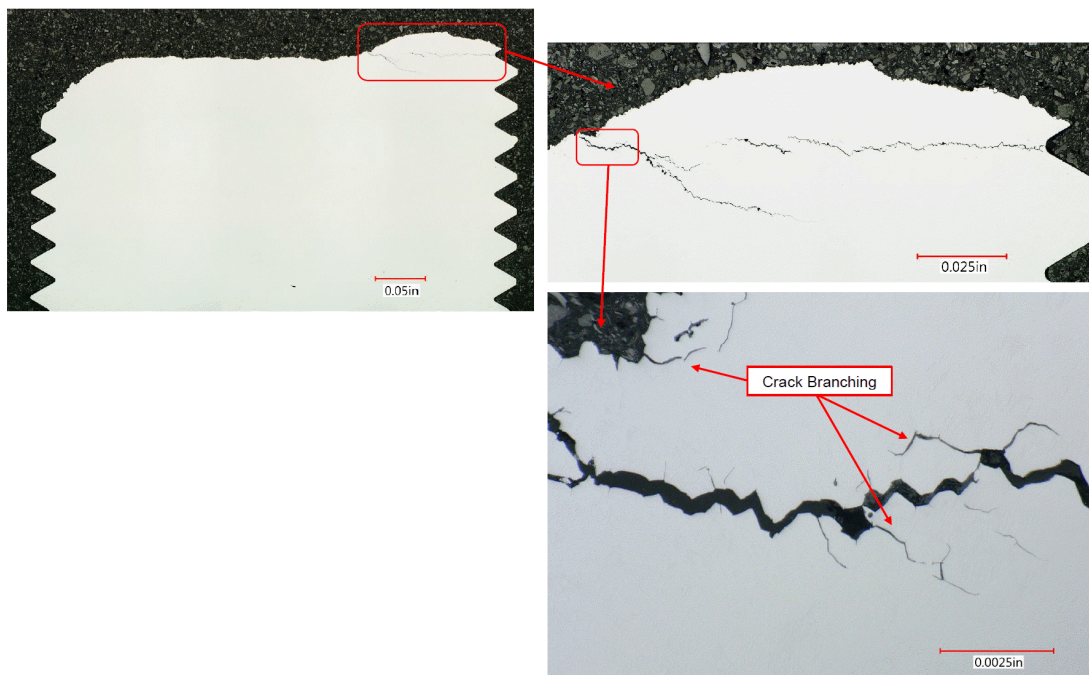


Figure 6: Cross-sectional examination of the fractured forward upper hook

Analysis of the thread sealant residue found in the threads adjacent to the fracture surface indicated that the residue was consistent with Loctite 222 which is the approved installation material. Additionally, the analysis indicated that the sealant contained some

contaminants most likely due to the migration of oxide particles from the rusted fracture surface.

Material Conformity

The strength of the fractured hook was approximated via Rockwell C hardness testing. The hardness of the hook ranged from 49.6 – 50.6 HRC with an average of 50.1 HRC. The average value can be approximated to 255 ksi using Table 2 in ASTM A370. This value is marginally above the drawing strength range.

A portion of the forward upper hook was submitted to a laboratory for chemical composition testing and the test results were acceptable for 4340 low alloy steel per composition limits.

Element	Arrow Lab Results P/N 101-430029-1 (wt. %)	Composition Limits (wt. %)
Carbon	0.41	0.38 – 0.43
Manganese	0.75	0.65 – 0.85
Phosphorus	0.007	0.025 Max
Sulfur	<0.005	0.025 Max
Silicon	0.29	0.15 – 0.35
Copper	0.20	0.35 Max
Nickel	1.73	1.65 – 2.00
Chromium	0.74	0.70 – 0.90
Molybdenum	0.25	0.20 – 0.30

Figure 7: The composition testing results of the fractured forward upper hook