

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



ERA23LA011

POWERPLANT EXAMINATION SUMMARY

November 9, 2022

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A. ACCIDENT

Location: Fort Myers, Florida
Date: October 8, 2022
Time: 1800 EST
2200 UTC
Helicopter: N5DF, Bell 505

B. POWERPLANT EXAMINATION SUMMARY

Participants:

FAA Sr. Investigator	Matthew Rigsby Federal Aviation Administration (AVP-100) Fort Worth, Texas
Technical Advisor	Gary Howe Bell Helicopter Textron Inc. Fort Worth, Texas
Technical Advisor	Bryan Larimore SAFRAN Helicopter Engines Grand Prairie, Texas

C. SUMMARY

On October 8, 2022, about 1800 eastern daylight time, a Bell 505 helicopter, N5DF, was substantially damaged when it was involved in an accident at Fort Myers, Florida. The private pilot and one passenger had serious injuries, and two passengers had minor injuries. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

D. DETAILS OF THE EXAMINATION

1.0 General

The SAFRAN Arrius 2R engine was examined on the airframe at the aircraft salvage facility (Florida Air Recovery, Jacksonville, Florida) on October 25-26, 2022. The results of that examination are detailed in the NTSB Wreckage Examination Summary in the public docket for this accident investigation.

The engine and digital engine control unit (DECU) was removed from the airframe and shipped to the SAFRAN HE USA facility in Grand Prairie, Texas for further examination.

2.0 Engine Examination at SAFRAN HE USA

The module 1 and 2 were separated. Continuity was confirmed through the entire gear train of the module 1 (MO1) and it was determined by the group that disassembly of the MO1 was not necessary.

The module 2 (gas generator) was disassembled down to the high pressure turbine. The free turbine blades had shed during overspeed protection and were contained by the shroud and protection ring. This blade shedding is by engine design to prevent the free turbine disk from bursting in the event of an overspeed as was the case in this event when the main rotor mast was sheared. The free turbine nozzle guide vane sustained damage during the blade shedding (Photo 1). The disk could still be rotated by hand. The rotating assembly of the gas generator could not be rotated by hand. The thermocouples were removed and all exhibited thermal damage. The high pressure turbine blades all exhibited extreme thermal damage and were partially consumed.



Photo 1: Free Turbine Blade Shedding (Overspeed Protection)

The engine was placed back into a sealed container and returned to the salvage facility at the request of the NTSB IIC.

3.0 DECU Examination

The 1-second interval continuous recording on the DECU dump file captured the accident flight. The information showed that during the entirety of the approximately 10-minute flight that engine operation was nominal until approximately 30 seconds prior to the end of the recording.

As collective was added (19:59:77) the gas generator reached the DECU max TOP (take off power) embedded limit of 101.29%. The collective continued to hold the high pitch demand and the N2/Nr (power turbine speed/main rotor speed) began to droop reaching 93.7513% by 20:03:77. The collective was lowered and the Nr began to recover at 96.68102% but in the next second, the collective was raised again and drooped to 87.8914% by 20:05:77.

At 20:06:77 the collective is completely lowered. This appeared to be the initial impact with the ground. The Nr was at 89.64968% and in the next second was at 102.5405% and the collective was raised again. At 20:08:77 the Nr sensor was most likely damaged as the reading went to zero; however, the NFFREQ2 (N2) read 91.40752%. Several faults began to appear on the DECU as it switched to degraded mode.

At 20:12:77 the NFFREQ (N2) was at 124.2205% consistent with the physical evidence of the power turbine overspeed protection blade shedding. This was most likely when the main rotor impacted the light pole and the main rotor mast was sheared.

In the next second 20:13:77 the NFFREQ2 was decelerating and the T4.5 left the normal range and raised to 1103.534°C and stayed there until the end of the recording at 20:30:77, consistent with thermal damage to the thermocouple harness and high pressure turbine (Table 1).

Parameters at accident sequence in 1 second intervals

Last 34 seconds:	Range 5 -95:	In %:	In %:	In %:	In °C:
DECU PO time:	Collective:	Gas generator:	Free turbine:	Main rotor:	temp t4 harm:
MM:SS:MS:	Potentiometer 1:	NGALT (N1):	NFFREQ2 (N2):	Nr helicopter:	T45 conformed:
19:57:77	48.04754	97.85291	103.7124	103.7124	742.9816
19:58:77	48.04754	98.43886	104.2983	104.2983	758.2162
19:59:77	48.04754	96.68102	104.2983	104.8843	737.9034
20:00:77	63.67275	100.7826	101.3686	103.1264	783.6073
20:01:77	65.62591	101.3686	97.85291	99.61076	798.8419
20:02:77	61.32897	100.7826	92.57941	94.33724	798.8419
20:03:77	23.04719	94.92319	97.85291	93.7513	763.2944
20:04:77	69.92284	100.1967	96.68102	96.68102	788.6855
20:05:77	84.37617	101.3686	86.134	87.89184	808.9983
20:06:77	7.421978	100.7826	96.09508	89.64968	803.9201
20:07:77	59.76645	96.09508	101.9545	102.5405	748.0599
20:08:77	46.48502	100.7826	91.40752	0	803.9201
20:09:77	55.07888	100.7826	90.23563	0	803.9201
20:10:77	7.421978	100.7826	96.09508	0	798.7419
20:11:77	76.56356	101.3686	53.32105	0	808.9983
20:12:77	76.56356	96.68102	124.2205	0	829.3111
20:13:77	31.25043	84.37617	53.907	0	1103.534
20:14:77	24.60971	77.93076	26.36755	0	1103.534
20:15:77	33.20358	73.82915	18.75026	0	1103.534
20:16:77	33.20358	70.31348	12.8908	0	1103.534
20:17:77	32.81295	65.62591	10.54702	0	1103.534
20:18:77	28.12539	60.93834	7.031347	0	1103.534
20:19:77	28.12539	56.25078	0	0	1103.534
20:20:77	28.12539	52.14916	0	0	1103.534
20:21:77	28.12539	47.46159	0	0	1103.534
20:22:77	28.12539	42.77403	0	0	1103.534
20:23:77	28.12539	38.08646	0	0	1103.534
20:24:77	30.07854	33.98484	0	0	1103.534
20:25:77	30.07854	26.9535	0	0	1103.534
20:26:77	26.17224	21.67999	0	0	1103.534
20:27:77	25.00035	16.99242	0	0	1103.534
20:28:77	24.21908	10.54702	0	0	1103.534
20:29:77	24.21908	5.27351	0	0	1103.534
20:30:77	24.60971	0	0	0	1103.534
End of recording:					

As a result of the blade shedding the gas generator T4 exceeds its limits resulting in thermal damage to the HP turbine.

Table 1: DECU Data (Last 34 Seconds)

Submitted by:

Ralph E Hicks
Senior Air Safety Investigator, NTSB