

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



ERA23FA138

WRECKAGE EXAMINATION SUMMARY

May 20, 2024

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A. ACCIDENT

Location: West Palm Beach, Florida
Date: March 5, 2023
Time: 2125 EST
0225 coordinated universal time (UTC)
Airplane: N804ER, Diamond DA-40

B. WRECKAGE EXAMINATION SUMMARY

IIC	Timothy W. Monville NTSB-OAS/ERA Washington, DC
Party Coordinator	Juan Garcia FAA Flight Standards District Office Miramar, Florida
Party Coordinator	Troy Helgeson Lycoming Williamsport, Pennsylvania

C. SUMMARY

On March 5, 2023, at 2125 EST, a Diamond DA-40, N804ER, was substantially damaged when it was involved in an accident near Palm Beach County Park (LNA), West Palm Beach, Florida. Both pilot-rated occupants were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations (CFR)* Part 91 personal flight.

The airplane was recently leased by and was being flown from Henderson City-County Airport (EHR), Henderson, Kentucky, to the operator's facility at Palm Beach County Park Airport (LNA), West Palm Beach, Florida, with a previous fuel stop at Williston Municipal Airport (X60), Williston, Florida.

According to Federal Aviation Administration (FAA) Automatic Dependent Surveillance - Broadcast (ADS-B) and air traffic control information, the flight departed from runway 23 at X60 at about 1923¹. After takeoff the flight proceeded in

¹ According to the US Navy Sun and Moon data, for that location (latitude and longitude), sunset was at 1832, or about 8 minutes before the flight landed there, and the end of civil twilight was at 1856, or about 27 minutes before the flight departed on the accident flight.

a south-southeasterly direction to about 14 nautical miles north-northwest of Southwest Florida International Airport (RSW), Fort Myers, Florida, then proceeded east towards LNA.

According to radio communication data provided by the FAA, which was correlated with ADS-B data, at 2100:43, when the flight was about 279° and 48 nautical miles from LNA. At that time an occupant of the airplane established contact with Palm Beach International Airport (PBI) departure control facility and advised that they were at 2,500 ft mean sea level (msl). The controller advised the flight to maintain visual flight rules at or above 2,600 ft msl, which an occupant acknowledged. The flight continued towards LNA, then at 2119:47, when the flight was about 7 nautical miles west of LNA, an occupant of the airplane advised the controller that the airport was in sight. Radar services were terminated, and the flight proceeded towards runway 10 at LNA for a straight-in visual approach, while the right seat occupant was making radio calls on the (recorded) common traffic advisory frequency (CTAF) announcing 7 miles, 3 miles, and 1 mile for a planned full-stop landing runway 10. The ADS-B data reflected the airplane being on runway centerline at the approach end of the runway. There was no radio call on the CTAF announcing a go-around.

Two witnesses, both of whom knew both occupants of the airplane, were waiting on the ramp at LNA for the airplane to arrive and this information was known by the left seat occupant via text messages in-flight². One of the witnesses held a private pilot certificate with about 60 hours total flight time and the other witness was a student pilot and a minor who had accrued about 40 hours total flight time. The pilot-rated witness reported seeing the airplane on a 10-mile final for runway 10. He reported that he planned to video record the airplane's arrival on short final but reported that at the intersection of runways 10/28 and 4/22, which was located about 800 ft from the approach end of runway 10, the airplane started to "go-around." It had descended no lower than 20 to 30 ft above ground level (agl) and did not touch down. He then began to record a video of the flight and reported that the engine was "constantly smooth" as the airplane flew over runway 10. He noted the airplane climbed no higher than between 200 ft and 250 ft agl, then when at or just past the departure end of the runway the airplane banked to the right, stalled, and rolled inverted (Figure 1).

The student pilot reported that when the flight was at the departure end of runway 10, it made a "sudden 45° right bank" which was not expected. It was at that point of the flight that he and the other witness began video recording with sound. He noted the airplane banked right, the nose leveled off, then entered a steep turn of 60°. When the nose of the airplane was pointed towards them, the right wing stalled,

² The witnesses were located at 26.589712°N latitude and -080.083888°W longitude. Refer to NTSB Record of Conversations contained in the NTSB public docket for the investigation. Both recorded video of the accident sequence which were provided to NTSB for analysis.

and the airplane became inverted. He also stated that to him it never sounded like full power, and from the point of landing he never heard a huge change in engine sound. He also added that the engine sounded ok during the turn to behind the hangars, then it went silent.



Figure 1: ScreenShot From Witness Video. Note the Inverted Airplane Just Above the Hangars.

The airplane impacted on airport property about 568 feet east from Palm Beach County Fire Rescue Station 35. Fire personnel extinguished the fire. First responders reported the right seat occupant was wearing the seatbelt and shoulder harness, which was cut.

The wreckage was recovered and retained for examination of the airframe and engine assembly.

D. DETAILS OF THE INVESTIGATION

1.0 General Airplane Information

1.1 Airplane Certification

The DA 40 airplane was originally type certified in accordance with the procedures established by Austrocontrol GmbH in Austria, and oversight

responsibility was later transferred to European Aviation Safety Agency (EASA) effective September 28, 2003. The airworthiness authority responsibilities for the DA 40 was transferred from EASA to Transport Canada Civil Aviation (TCCA) effective November 15, 2017. The certification basis is the Canadian Airworthiness Manual (AWM) Chapter 523 Change 523-4, Type Certificate No. A-224.

The FAA certification basis was equivalent to 14 *CFR* Part 23 effective February 1, 1965, including Amendments 23-1 through Amendment 23-51, Type Certificate No. A47CE. It was also certificated to 14 *CFR* Part 36 effective December 1, 1969, including Amendments 36-1 through Amendment 36-21, Special Condition 23-107-SC applicable to the Model DA 40 for Protection of Systems for High Intensity Radiated Fields, published on June 7, 2001. The equivalent Level of Safety ACE-03-01 to 14 *CFR* Part 23, § 23.1337(b), for auxiliary fuel level indication system is applicable to the Model DA40 equipped with long range fuel tanks per Optional Design Change OÄM 40-071c (ref. Note 7).

An export airworthiness certificate was issued on August 7, 2003, indicating that the airplane was manufactured in conformity with data forming the basis for Joint Aviation Authority (JAA) Type Certificate No. FZ021-JAA and FAA Type Certificate A47CE.

1.2 Airframe

The DA 40 is a single-engine, four seat, low-wing monoplane. It has a cantilever wing and a 'T' tail. The airplane structure is fiber-reinforced plastic composite. The semi-monocoque fuselage is a glass-fiber reinforced-plastic (GFRP) shell with GFRP bulkheads and stiffeners. Uni-directional carbon fiber bands give extra strength and stiffness in many areas. The cantilever wing is a semi-monocoque structure, and each wing attaches to the fuselage center section. The horizontal stabilizer is a semi-monocoque structure. The fixed tricycle landing gear has fairings attached to each leg. The main legs attach to the fuselage center-section, while the nose leg attaches to the forward fuselage.

It was manufactured in 2003 and assigned serial number 40.311.

The airplane was assigned United States registration N804ER.

1.3 Fuel Supply System

The airplane's fuel system consisted of tanks in each wing that was plumbed to a fuel tank selector valve, then forward to a fuel filter/strainer (gascolator), then forward to an electric fuel boost pump, then to an engine-driven fuel pump, forward to the fuel injection servo (fuel servo), then to the manifold valve or fuel flow divider then to a fuel injector nozzle installed in each cylinder.

1.4 Airplane Maintenance

The airplane was last inspected in accordance with an annual, in addition to 50/100/200/1000/2000 hour(s) inspections on February 24, 2023. The airplane total time and tachometer time on that date were the same value of 3,126.2.

2.0 General Engine And Propeller Information

2.1 Engine Description

The DA 40 was powered by a 180 horsepower, four-cylinder, direct drive, horizontally opposed Lycoming IO-360-M1A engine. It was equipped with a fuel injection system. According to the airplane's FAA Type Certificate Data Sheet, the maximum red line and the maximum continuous rpm were 2,700 and 2,400, respectively.

2.2 Engine Fuel Metering System

The engine's fuel injection system consisted in part of a fuel servo, a manifold valve with fuel injector lines and two-piece fuel injector nozzles installed in each cylinder. Flexible hoses connected the fuel servo to the manifold valve while stainless steel lines connected from the manifold valve to each two-piece fuel injector nozzle.

The fuel servo was controlled from the cockpit at an engine control assembly in the center console that holds in part the throttle and mixture control levers. The throttle control lever in the cockpit sets the position of the throttle control lever at the fuel servo and the two ends are mechanically connected by a Bowden cable. The throttle control cable has on the end in the engine compartment a cable eye, or rod end that attaches to the throttle control lever at the fuel servo. (Figure 2).

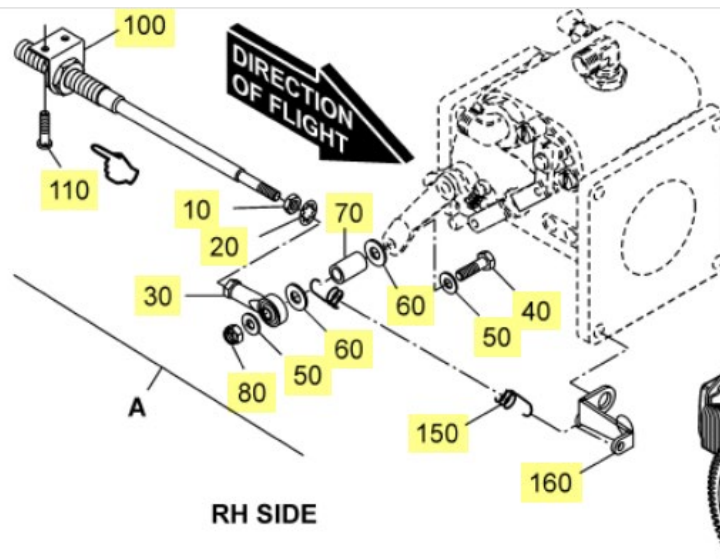


Figure 2: Throttle Control Attachment at Fuel Servo.

The throttle control cable attach hardware in the engine compartment was equipped with a spring, Part Number (P/N) RZ-063E-12X attached to the hardware securing the throttle cable to the throttle lever at the fuel servo and also to a Spring Anchor Bracket attached to the fuel servo. The spring was designed and part of the initial type certification so that if the throttle control separated at the engine fuel metering device, the tension spring was intended to drive the throttle control to full power.

2.3 Engine Maintenance

As part of the last airplane and engine inspection, the throttle cable was adjusted and secured (Figure 3).

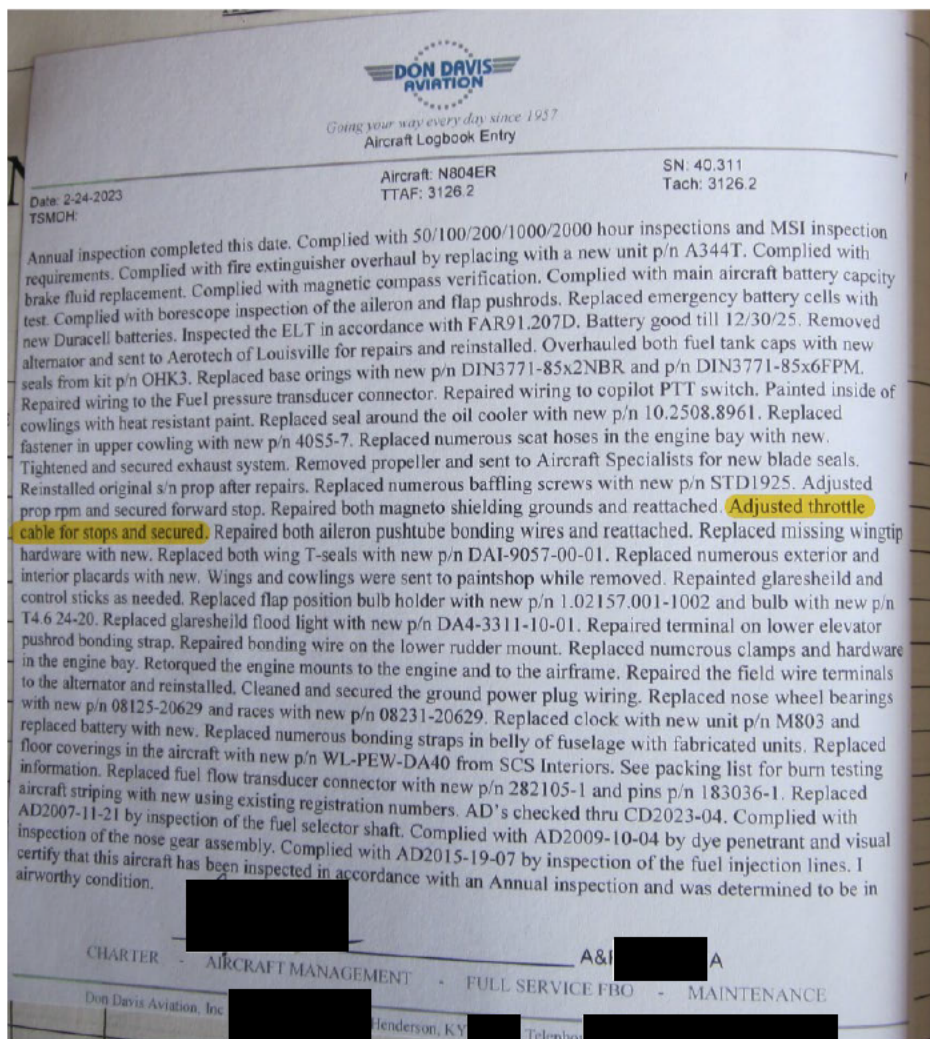


Figure 3: View of the Entry Showing Throttle Cable Adjustment.

2.4 Propeller

The airplane was equipped with a single acting, constant speed, two bladed Hartzell HC-C2YR-1BF propeller with F7495S blades installed in accordance with Supplemental Type Certificate SA01850CH.

3.0 On Scene Wreckage and Engine Documentation

3.1 Accident Site

The airplane crashed on airport property near the departure end of runway 10, south of hangars on the south end of the airport adjacent to Lantana Road (Figure 4). The accident site was located at 26.588181° north latitude and -

080.080998° west longitude, or about 1,030 ft and 191° from the departure end of runway 10.



Figure 4: View of the Wreckage at the Accident Site Location.

Examination of the accident site revealed a ground scar associated from the left wing consistent with the airplane being on a magnetic heading of 228°. The airplane was upright leaning on its right side on a magnetic heading of 221°. All components necessary to sustain flight remained attached or were found in close proximity to the main wreckage.

3.2 Airport Information

The LNA airport was equipped with runways 10/28, 16/34, and 04/22. Runway 10/28 was specified in the FAA Airport Facility Directory (AFD) to be an asphalt runway 3,498 ft long and 75 ft wide. The AFD also specified, "No touch and

go [landings] on [Runway] 10-28." The published CTAF frequency was 122.7 MHz. A partial transcription of communications of the CTAF was prepared by NTSB³.

Security cameras mounted on businesses at LNA Airport captured the go-around and accident sequence. Details about the camera locations are noted below⁴ –

Camera 1: Mounted on a soffit 8 ft 7 inches above ground level at Palm Beach Copters building at 26.588764° north and -080.084535° west. The camera had east and south views and sound. Video GLEU2498.

Camera 2: Mounted on a soffit 8 ft 7 inches above ground level at Palm Beach Copters building at 26.588779° north and -080.084556° west. The camera had north and west views and sound. Video YGQC7749.

Camera 3: Mounted on a soffit 9 ft 1 inches above ground level at 26.588761° north and -080.084155° west. The camera had north and east views but no sound. Video YIKR9654.

The KLNA airport was opened on March 6, 2023 at 0805 EST.

On March 7, 2023, multiple inspections, including a full-length inspection of runway 10/28 was performed by NTSB and the LNA Airport Manager. Those inspections did not detect any propeller slashes consistent with abnormal runway contact or no debris or parts consistent with the accident airplane.

3.3 Fuselage

The front portion of the fuselage to about the pilot and co-pilot seats was extensively impact damaged.

3.4 Empennage

The aft empennage was displaced to the left (Figure 5).

³ The partial transcription of communications will be part of the NTSB public docket for the investigation.

⁴ The videos were provided to a NTSB Subject Matter Expert (SME) for analysis.



Figure 5: View Showing the Aft Empennage Displaced to the Left.

3.5 Wings

Examination of the left wing (Figure 6) revealed it was fragmented which exposed the fuel tank which was impact damaged. The main spar was fractured. The flap was fragmented into 2 pieces but found in close proximity to the wing. The transfer pins of the transfer lever were nearly parallel to the longitudinal axis of the fuselage.

Examination of the right wing (Figure 7) revealed it was full span; the wingtip was in close proximity to the end of the wing. The flap appeared to be extended, but the transfer pins attached to the transfer lever appeared to be parallel to the longitudinal axis of the airplane⁵. About 6 gallons of fuel consistent with 100LL were drained from the fuel tank. The flap and aileron remained connected. The flap was separated at the inboard connection at the transfer lever/pins and the outboard hinges; the outboard hinge was displaced aft consistent with impact. All remaining flap hinges remained connected.

⁵ Refer to NTSB photograph IMG_2736.jpg.



Figure 6: View of the Reconstructed Left Wing.



Figure 7: View of the Right Wing.

3.6 Flight Controls

Examination of the elevator flight control system revealed continuity from the control surface to the idler lever where the threaded portion of the eye end fitting with spherical bearing exhibited bending overload. The rod was deformed

about 90° near the lower fin in the area where the aft empennage was displaced to the left.

Examination of the aileron flight control revealed continuity from each control surface to the forward bellcrank which exhibited overload failure.

Examination of the rudder flight control system revealed control cable continuity from the cockpit to the rudder lower mounting bracket except the 2 “fuselage” cables and the four “cockpit” cables were cut consistent with recovery.

Examination of the flap control system revealed no evidence of preimpact failure or malfunction. The flap actuator which remained structurally attached at the end adjacent to the motor but the structure in that area was fractured⁶ revealed the distance between the actuator attach point at the structure and the idler lever of the flap actuator measured 14.875 inches, which was within limits for flaps retracted.

3.7 Landing Gear

The nose landing gear was displaced from its normal position and the nose gear leg tubular strut exhibited extensive impact damage. The left main landing gear attach hardware and mounting block remained in position, but the adjacent structure was separated. The right main landing gear was displaced from its normal position.



Figure 8: Views of the Landing Gears.

3.8 Cockpit

Examination of the cockpit revealed extensive impact damage in addition to fire damage to the left front seat, the left side of the instrument panel, the

⁶ Refer to NTSB Digital Photograph IMG_2922.jpg

inboard edge of the right front seat, firewall, and slightly to the aft portion of the engine (Figure 9).



Figure 9: View Showing the Damage to the Cockpit.

Further examination of the cockpit revealed the following:

Throttle - Full forward

Propeller - Full forward

Mixture - Full rich

Fuel selector - Left tank free of obstructions. Some sediment and residual fuel. Screen clean.

Elevator Trim - Slightly more than ½ nose down

Hour Meter - 29.6

Altimeter - 740 ft and 30.10 inHg

VSI - 1700 fpm climb

Attitude Indicator - 20° Climb and 30° Right Bank

Pilot's Circuit Breaker Panel - 3 CB's left of starter CB in, all other tripped

Right Circuit Breaker Panel - The "ESS ASV." "Flaps", "Horizon", and "Pitot" CB's were tripped. The "Landing" CB was in. All other CB's were damaged/separated (NTSB Pic IMG_2726).

Magneto Switch-Both

Flap Selector-Down Position, but right side of the flap switch guard was pushed to the left.

Left Seat Control Stick- Not fractured but heat damaged
Right Seat Control Stick-Not fractured
Aspen Avionics Evolution-Installed on Pilot's Side
Vision MicroSystems, Inc. Engine Instrument-Faceplate Separated⁷.
Boost Pump-About 1 ounce of fuel drained from pump outlet, slight contaminant (particulates) noted.

3.9 Fuel/Fuel System

The left fuel tank was impact damaged (Figure 10), while the right fuel tank was drained and found to contain about 6 gallons of 100 low lead fuel.



Figure 10: Impact Damaged Left Fuel Tank.

3.10 Engine

While lifting the wreckage for recovery, the throttle control cable was not attached to the throttle control lever of the fuel servo (Figure 11).

⁷ Diamond Aircraft personnel reported it does not record and retain data.



Figure 11: View Showing Separated Throttle Control Cable.

Examination of the engine, serial number (S/N) L-31046-51A after recovery revealed the crankshaft flange was fractured but remained connected to the propeller flange. Rotation of the engine using a splined tool inserted at one of the accessory drives revealed crankshaft, camshaft, and valve train continuity. Thumb suction and compression was noted in each cylinder. Borescope inspection of each cylinder revealed no anomalies were noted.

Examination of the oil lubrication system components revealed the oil cooler was crushed. The oil suction screen was clean but the impact damaged oil filter could not be cut open using a standard tool and the oil filter element was not accessed.

Examination of the air induction system revealed the No. 2 cylinder (Left Forward Cylinder) induction pipe was crushed aft against the oil sump and was impact separated from the cylinder. No blockage or obstructions were noted or reported of the air induction system.

Examination of the exhaust system revealed the No. 2 cylinder exhaust was crushed aft and up. No blockage or obstructions were noted or reported of the exhaust system.

Examination of the ignition system revealed both magnetos were impact separated from the engine; pieces of magneto flange remained tightly secured under the hold-down clamp. The top case of the right magneto was displaced slightly and the cap was cracked and displaced; two towers of the cap was impact fractured. Both magnetos were rotated using an electric device and produced spark at all leads. Inspection of the ignition harness revealed impact damage. The harness was not tested using a high-tension tester.

Examination of the engine fuel metering system revealed the No. 2 cylinder injector line was separated from the injector nozzle, but the line was near the nozzle (Figure 12). All other lines remained tightly secured to their respective nozzles. The fuel servo remained attached to the oil sump and air plenum and the mixture control cable remained attached to the mixture control lever that was impact damaged, but as previously noted, the throttle control cable was not attached to the throttle control lever. The end of the throttle cable that would have contained a rod-end exhibited bending overload (Figure 13). A bolt that secured the throttle control to the throttle control lever was in-place at the lever, but a nut was not affixed to the bolt, and the nut and throttle control rod-end were not located⁸ (Figure 14). The flow divider was free of contaminant and the diaphragm was intact. Examination of the fuel servo inlet screen revealed it was clean; a slight amount of fuel consistent with 100 low-lead drained from the inlet when the fuel line was removed.

⁸ A search of the area by the Palm Beach Sheriff's Office was requested by NTSB. That search failed to locate the rod end or nut. Refer to NTSB Memorandum For Record in the NTSB public docket for this investigation.



Figure 12: View Showing the Separated Fuel Injector Line From the No. 2 Fuel Injector Nozzle.



Figure 13: Bent and Fractured Throttle Control Cable.

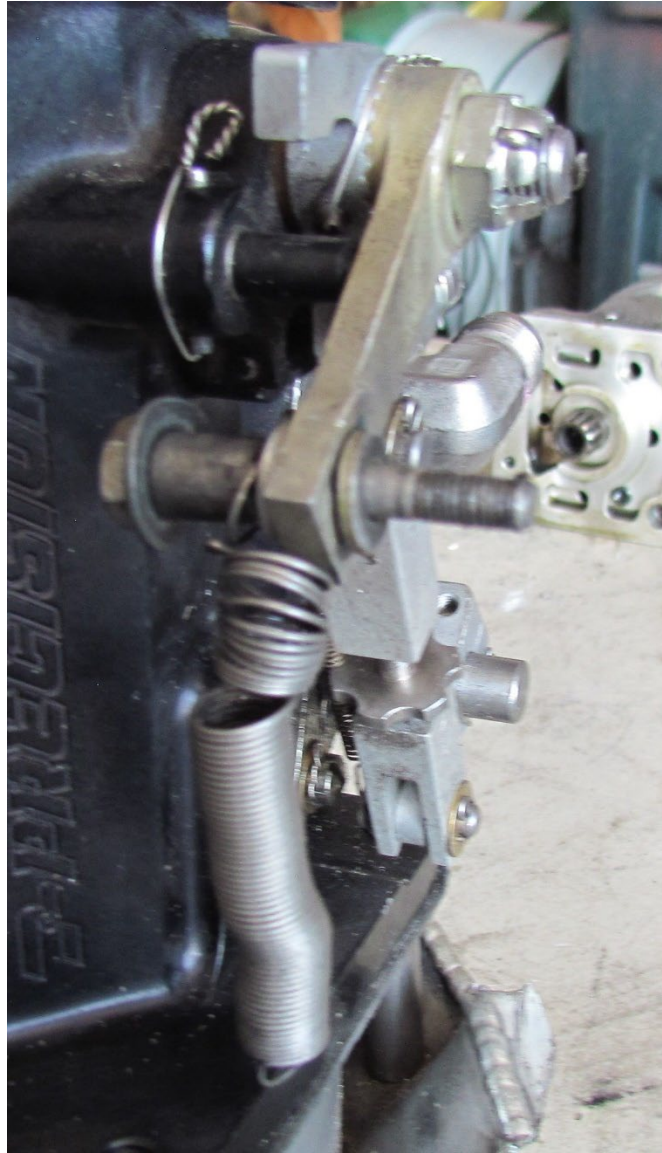


Figure 14: View of the Hardware Still Attached to the Throttle Control Lever at the Fuel Servo.

3.11 Propeller Examination

Examination of the Hartzell propeller, S/N CH39358B revealed both blades remained secured in the propeller hub and the crankshaft flange remained attached to the propeller flange (Figure 15). Blade marked "A" exhibited a slight aft bend about 10° and leading-edge twisting towards low pitch. The blade tip was curled aft about 90° beginning 3 inches from the tip. The leading edge of the blade was polished from about 1/3 span out to the tip. A section of blade was missing at the tip on the trailing edge. Blade marked "B" exhibited scratches on the cambered side of the blade, and a heavy gouge on the blade back about 5.5 inches from the hub.



Figure 15: View of the Propeller Assembly.

4.0 Retained Items

An Apple Watch Series 6 watch, Black Apple iPad, Apple iPhone 14 Pro (2), Apple iPad mini, and No. 2 fuel injector nozzle and line were retained for examination by NTSB Subject Matter Experts⁹.

Submitted by:

Timothy W. Monville
Sr. Air Safety Investigator

⁹ Refer to NTSB Evidence Control Forms and NTSB Reports contained in the public docket for the investigation.