



Memorandum For Record

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Eastern Region

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On March 16, 2021, at 1138 EDT, Mr. Freddy Hernandez of Broward County Aviation Department, North Perry Airport, sent NTSB an e-mail with the following information that was copied in its entirety:

“This is the NOTAM log for the last two weeks. Runway 10R was closed as part of a planned construction project.

59970509 03/029 !HWO 03/029 HWO RWY 10R/28L CLSD DLY SR-2230 2103151100-2103192230 HWO F Hernandez fhernandez@broward.org 3/15/2021 11:00 3/19/2021 22:30 Active

If you need additional information please contact me.”

According to the Federal Aviation Administration (FAA) airworthiness file for the airplane, it was manufactured in 1996 and remained briefly in the U.S. as N1088A, then in June 1996 it was de-registered and exported to South Africa.

According to the FAA Type Certificate Data Sheet (TCDS), the maximum specified engine limits are “*Engine Limits Takeoff and maximum continuous power 2700 rpm (36 in. Hg. MAP) (300 hp).”

According to the “Before Takeoff Checklist in the Pilot’s Operating Handbook and FAA Approved Airplane Flight Manual (POH/AFM), the Auxiliary Fuel Pump is specified to be “OFF” (Figure 1). A note in the “Takeoff” checklist associated with the propeller indicates that the engine rpm between 2,600 and 2,650 will increase to 2,700 during the takeoff roll (Figure 2). Another note in the takeoff checklist indicated, “DO NOT TAKE OFF WITH THE AUXILIARY FUEL PUMP ON HI. EXCESSIVELY HIGH FUEL FLOWS CAN CAUSE

ENGINE COMBUSTION TO CEASE DURING THE TAKE-OFF ROLL. If fuel flow exceeds the red line (34.2 gph), manually lean to 33.2 GPH prior to takeoff (Figure 2).

The POH/AFM also indicated in the systems description pertaining to the auxiliary fuel pump, “The auxiliary fuel pump is a single-speed, dual-pressure, electrically- driven, vane-type pump. The pump, located below the pilot's seat, is controlled by a single three-position switch. The switch is located on the pilot's subpanel to the left of the landing gear handle. The pump is used to perform the following functions:

1. Purge fuel vapors and prime the engine prior to start.
2. Provide a low boost to the fuel flow for all flight conditions.
3. Provide an alternate source of fuel pressure to the engine in the event the engine-driven fuel pump fails.”

The airplane crashed in a densely populated area east of HWO. The main wreckage without the engine and separated propeller came to rest adjacent to the airport perimeter fence at 25.998414° North and -080.231454° West longitude, which was about 1,831 ft and 138° from the departure end of runway 10L. The airplane was upright on a magnetic heading of 150°. The vehicle that was impacted came to rest heading 180° on the west edge of SW 72nd Avenue at 25.998687° North and -080.231423° West. The separated propeller came to rest near the front of the car on the passenger side.

Further examination of the accident site revealed 2 broken powerlines. The first broken powerline along the route of flight was a 7,620-volt line that was oriented east and west located north of the accident site; the line was installed about 35 ft above ground level. The second impacted powerline along the route of flight was a 120-volt insulated line that was located on the east side of SW 72nd Avenue which was a north/south road on the east perimeter of the airport. The powerline was installed about 23.5 ft above ground level.

A ground scar on the grass associated with the right wingtip was located at 25.998719° North and -080.231296° West or about 80 ft from the 7,620-volt powerline. Ground scars associated with the airplane across SW 72nd Avenue were oriented on a magnetic heading of 217°. The separated engine assembly was located to the right of the energy path about 60 ft from the initial ground scar while the main wreckage came to rest about 124 ft from the initial ground scar.

Examination of the wreckage revealed the cockpit and cabin exhibited extensive heat damage. The right wing was nearly consumed by fire while the left wing exhibited fire damage but still resembled a wing.

Examination of the elevator primary flight control cables revealed one cable remained connected at the bellcrank in the cockpit while the other had a section of bellcrank attached; both cables were cut near the aft cabin consistent with recovery. Both elevator push/pull rods remained connected at the elevator horn but were impact/fire damaged forward of the attachment. Examination of the pitch trim system revealed both cables were attached to chain in the cockpit, but the chain was not on the sprocket. The cables

were continuous to the aft cabin where one cable was pulled through and one was cut consistent with recovery. The left chain of the elevator trim tab actuator was around the sprocket. The left elevator trim tab actuator was extended 1.35 inches which equated to between neutral and 5° tab trailing edge down (nose-up).

Examination of the aileron primary flight control system revealed both cables remained connected to the chains in the cockpit. The right direct cable was continuous from the cockpit to the bellcrank near the control surface; a section of fractured bellcrank remained attached to the direct cable. The left direct cable was pinched by the impacted structure and could not be accessed. With the exception of where cut for recovery or tension overload at the left wing root, the left direct and balance cables were continuous from the left wing root to the left aileron bellcrank. The aileron balance cable was continuous from the left wing root to the right wing bellcrank; a section of fractured bellcrank remained attached to the balance cable near the right control surface. Both turnbuckles of the right aileron control cables were fractured consistent with heat. The aileron trim control cable ends were attached to the chains near the actuator but 1 trim cable was cut near the wing root for recovery and the other exhibited tension overload. The aileron trim actuator chain was off the sprocket; the actuator was extended 1.4 inches which equated to 2.25° tab trailing edge up (wing down). The aileron trim range is 12.5° 6 to 12.5°. In the cockpit, one aileron trim cable was cut consistent with recovery and 1 exhibited tension overload. The cable was separated from the chain which was around the sprocket.

Examination of the rudder control cables revealed both had sections of bellcrank attached to the ends in the cockpit. Both were continuous to where cut about 2 ft forward of the rear rudder bellcrank consistent with recovery. The rudder torque tube remained attached to the bellcrank, and sections of cables remained attached to the rear rudder bellcrank.

Examination of the cockpit revealed the fuel selector was positioned to the left fuel tank. The fuel supply and return lines were connected to the fuel selector valve, and the fuel supply lines were connected to the adjacent auxiliary fuel pump; all were tightly secured. No obstructions were noted of the fuel selector, and the screen had slight contamination. The auxiliary fuel pump was heat damaged which precluded operational testing. The left fuel supply line was crimped at the wing root area consistent with recovery while the right fuel supply line was heat damaged in the middle of the cockpit. The fuel supply B-nut at the firewall remained connected and tightly secured but the hose was pulled from the fitting during separation of the engine. No obstructions were noted from the outboard fuel tank to the firewall fitting then forward to the engine-driven fuel pump inlet. The three-position auxiliary fuel pump switch was retained for examination by the NTSB Materials Laboratory.

Examination of the left wing revealed the bladder of the inboard (40-gallon) fuel tank was heat damage and compromised. The landing gear was in the wheel well, the aileron remained attached and section of heat damaged flap was visible. The fuel cap was installed and secure. The anti-siphon valve operated OK. The stall vane moved freely. There was no evidence of wire strike on the leading edge of the wing. Some liquid consistent with fuel admixed with a foamy material

was noted in the 14-gallon outboard fuel tank, while no fuel was noted in the inboard 40-gallon fuel tank. The fuel tank indicator was heat damaged. Stall strips on the leading edge near the wing root and a vortex generator on the leading edge on the outer portion of the wing were noted. The aileron trim tab hinge was in place, but the trim tab was heat damaged. The fuel supply from the inboard (40-gallon fuel tank) was free of obstructions from the sump assembly to the wing root fitting, which was cut for recovery. The flexible fuel hose from the fuel tank strainer to the outlet fitting was tightly secured. The fuel system interconnect between the inboard (40-gallon) and outboard (14-gallon) fuel tank and the anti-surge valve were free of obstructions and operated freely, respectively. Examination of the fuel vent system revealed multiple separations of the flexible hoses and also a heat fracture of an aluminum line; however, all separated flexible hoses had 2 clamps. There were no obstructions of any fuel vent line or component. During examination, the heat damaged flexible hose from the flame arrestor to the external vent broke. The flap actuator was extended 1.85 inches which equated to flaps retracted.

Examination of the outboard section of right wing which separated during the ground impact sequence revealed the fuel cap was in-place and closed. The flap actuator was located but the housing was melted; therefore, extension could not be determined.

Examination of the propeller revealed all three blades remained in the hub. For the examination the blades were marked "1", "2" and "3". Blade marked "1" exhibited a slight aft bend beginning at the blade root, and a gouge on the leading edge midspan. The cambered side of the blade also exhibited scratches. Blade "2" was at a higher blade angle, and exhibited a leading edge gouge at the blade root. Blade "3" was loose in the hub. The blade was bent aft about 110° near the tip and a gentle radius aft bend from the root outward. Heave/coarse chordwise scratches were noted on the cambered side of the blade. There were no leading edge gouges.

Examination of the impacted car revealed the entire right side, hood, and portion of the roof were impact damaged. A car seat was located on the right side of the car in the rear seat. A crease in the front door was noted consistent with propeller contact.

Examination of the aircraft's engine revealed a section of insulated electrical powerline about 3/16 inch in diameter was wrapped about 4 times around the crankshaft aft of the crankshaft flange. The exhaust system components were crushed and the outlet of the turbocharger was partially separated. The induction pipes at the flanges of the Nos. 2,4, and 6 cylinders were broken. The No. 2 cylinder rocker cover was impact damaged. Several ignition leads were impact damaged. The alternator which was impact damaged was removed and it would not rotate. The gear was intact. The manifold valve cover was not safety wired and the lead seal was not present. The manifold valve cover was removed and the diaphragm and spring were intact. The diaphragm was stamped 4th quarter 2010 (indicating it has been changed since engine manufacture). No contamination was noted following removal of the screen which was clean. Residual fuel was noted which when tested with water finding paste did not contain water. The piston moved freely. The oil filter was removed and when drained the oil was clean with no signs of metal. All b-nuts of the fuel supply hoses were check by hand and were tightly installed. The throttle cable was connected at the controller but was severed consistent with impact. The linkage to turbo control was intact and working, with no binding. The turbo bracket was impact

damaged. The waste gate to controller oil line fitting was loose, most likely from impact, no oil residue until unscrewed completely. The turbocharger rotated freely with no bending of the blades. A flexible oil carrying line for the turbocharger and wastegate was broke off at a fitting near the bottom of the oil cooler; the B-nut remained on the fitting. A small-diameter hole was noted in the oil sump.

Impact damaged components on the aircraft's engine were replaced and the engine was placed in a test stand with a test three-bladed propeller that was shimmed to account for the bent crankshaft flange; the test propeller was pitched to 23.5°. For safety concerns because of the cracks in the crankshaft aft of the flange, excessive crankshaft run-out, excessive crankshaft deflection, and reduced crankshaft end play, the engine was limited to about 3 minutes at each of the key rpm settings, including wide open throttle and mixture full rich. With full throttle applied the maximum rpm and manifold pressure attained were 2,451 and 32.9 inHg, respectively. The maximum recorded fuel flow was 144 PPH.

The engine-driven fuel pump, part number (PN) 649368-9, serial number I209502B19 was placed on the test stand for testing to production acceptance test procedure (ATP) standards. Because of the age of the pump, it was flowed to the superseded PN 649368-60A7. During the start of initial testing, leakage was noted from the mixture shaft. At Test point 3 (pump operating at 600 rpm, 30 inHg, and the fuel flow set), the pump discharge pressure was 5.56 psi (specification was 6.5 psi to 7.0 psi). At Test Point 4 (pump operating at 2,700 rpm, 36 inHg applied, and the fuel flow set), the pump discharge pressure was 54.58 psi (specification was 32.18 psi to 32.82 psi). At Test Point 5 (pump operating at 2,700 rpm, 30 inHg, and the fuel flow set), the pump discharge pressure was 25.68 psi (specification was 15.5 psi to 22.0 psi). At Test Point 6 (pump operating at 600 rpm, 30 inHg, and fuel flow set), the discharge pressure was 5.57 psi (specification was 6.5 psi to 7.0 psi).

Following the engine run, the turbocharger was examined at the manufacturer's facility which revealed no evidence of preimpact failure or malfunction. Also following the engine run, operational testing of the controller, wastegate, and pressure relief valve were performed as received without adjustment. The pressure relief valve tested within limits for the "crack" pressure, while examination of the wastegate revealed the cylinder was about 8° out of alignment with the valve housing assembly consistent with impact damage. Operational testing of the wastegate revealed that it tested within limits at the fully open and start to close tests but was out of limits at the start to open and closed positions. Following testing, the turnbuckle of the valve housing assembly was separated from the shaft of the cylinder, and the tests were repeated, passing all tests. Inspection of the controller revealed it tested within limits at all test points.

Postaccident, an inspector with the Federal Aviation Administration (FAA) inspected the #2 Truck that fueled the accident airplane. The inspector took a sample of fuel from the sump drain valve and noted no contaminants. He also reported the fuel was blue in color, clear, and consistent with 100 Low Lead.

(feel for detent and visually check)
21. Aux Fuel Pump OFF

Figure 1: Excerpt from Before Takeoff Checklist From Pilot’s Operating Handbook and FAA Approved Airplane Flight Manual.

Raytheon Aircraft Company

Model B36TC

TAKEOFF

Section 4

Normal Procedures

Take-Off Power 36.0 in. Hg, 2700 RPM

Minimum Recommended Oil Temperature 38°C

1. Power..... SET

a. Manifold Pressure36.0 in. Hg

b. PropellerHIGH RPM

(2600-2650 rpm will increase to 2700 during take-off roll)

c. Fuel Flow.....33.2 GPH

(will increase up to 1 gph as rpm increases during take-off roll)

WARNING

DO NOT TAKE OFF WITH THE AUXILIARY FUEL PUMP ON HI. EXCESSIVELY HIGH FUEL FLOWS CAN CAUSE ENGINE COMBUSTION TO CEASE DURING THE TAKE-OFF ROLL. If fuel flow exceeds the red line (34.2 gph), manually lean to 33.2 GPH prior to takeoff.

Figure 2: Excerpt from Takeoff Checklist From Pilot’s Operating Handbook and FAA Approved Airplane Flight Manual.