

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



WPR22LA114

INVESTIGATIVE SUPPLEMENTAL MATERIAL

ACCIDENT

Location: Oceanside, California
Date: February 24, 2022
Time: 1245 Pacific daylight time
Airplane: Cessna C208B Supervan 900

IIC Zoë Keliher
National Transportation Safety Board
Portland, Oregon

Party Members

Bobby Bishop
Texas Turbine Conversions Inc.
Celina, Texas

Casey Love
Textron Aviation (Cessna)
Wichita, Kansas

Jennifer McDuffie
Honeywell
Phoenix, Arizona

Les Doud
Hartzell Propellers Inc.
Piqua, Ohio

HISTORY OF FLIGHT

On February 24, 2022, at 1245, a Cessna C208B Supervan 900 airplane, N10JA, was substantially damaged when it was involved in an accident in Oceanside, California. The pilot and passenger were seriously injured. The airplane was operated as a Title 14 *Code of Federal Regulations* (CFR) Part 91 sky-diving flight.

The pilot stated that the pilot-rated passenger was spending the day observing the sky-diving operation. He had made three consecutive flights climbing to around 13,000 feet mean sea level (msl) to unload the skydivers. On the fourth flight, the airplane departed runway 25 and made a gradual climb to 12,700 ft msl as he circled back to the airport. The sky divers departed the airplane and the pilot initiated a steep, turning decent in excess of 6,400 ft per min (fpm) with the power at idle. The pilot stated that while the airplane was on the base leg of the traffic pattern to runway 25, at an altitude of about 4,000 ft msl, the pilot attempted to arrest the decent by adding power.

The pilot further stated that despite his attempts to add power, movement of the power lever was unresponsive. He moved the propeller speed lever, which was also unresponsive. The pilot presumed the engine flamed-out and attempted a restart. With the propeller still windmilling, he switched the ignition to “continuous” and turned the boost pump on. He observed the torque gauge increase from 0% to 20%, but the thrust lever was still unresponsive. He added full nose-up trim and the control yoke was full aft, against the stop, but the airplane could not maintain a level attitude. With the airplane in a nose-low attitude, it collided with terrain about 1,400 ft short of the runway. The pilot stated that he did not feather the propeller.

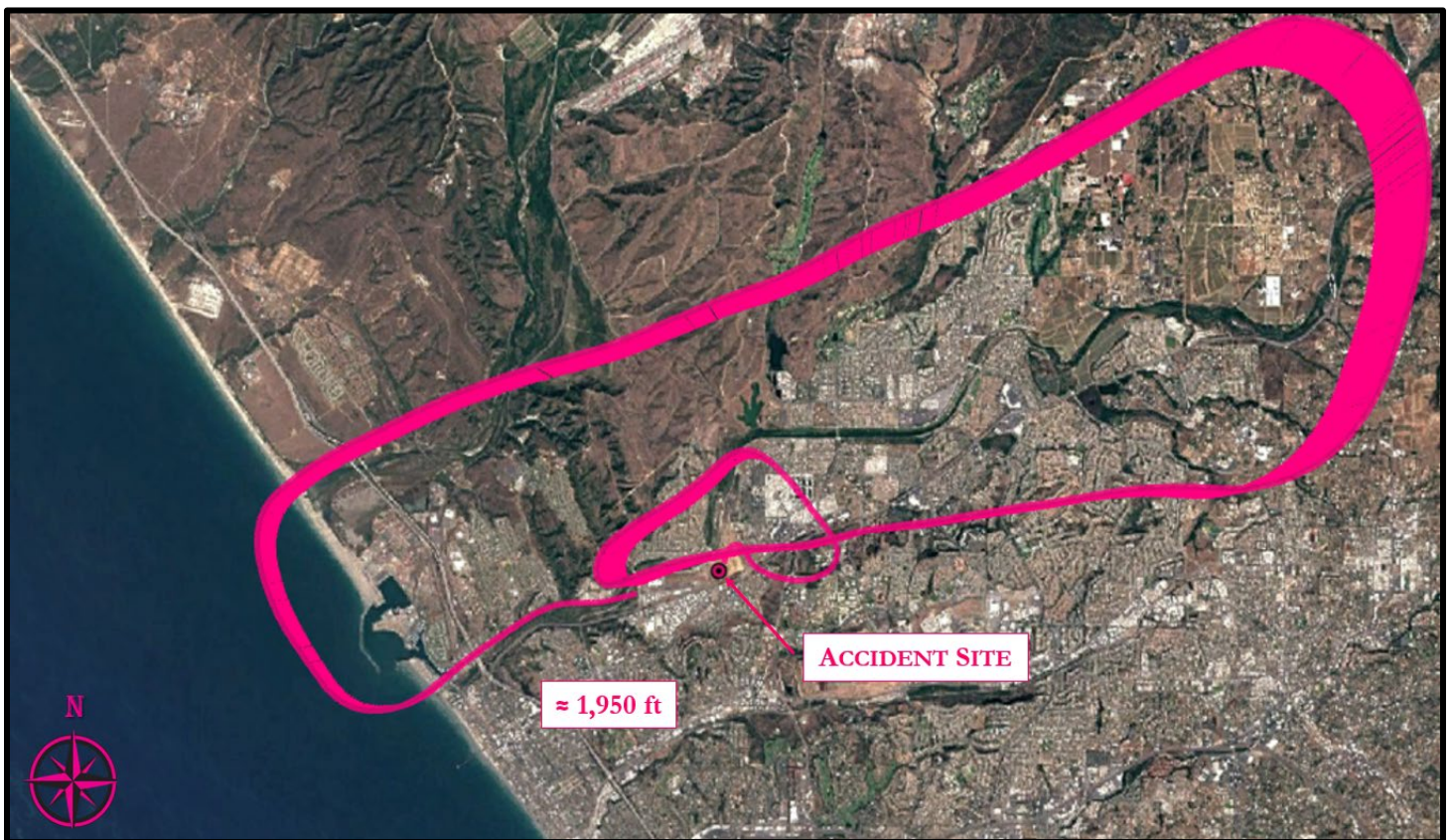


Figure 1: Flight Path

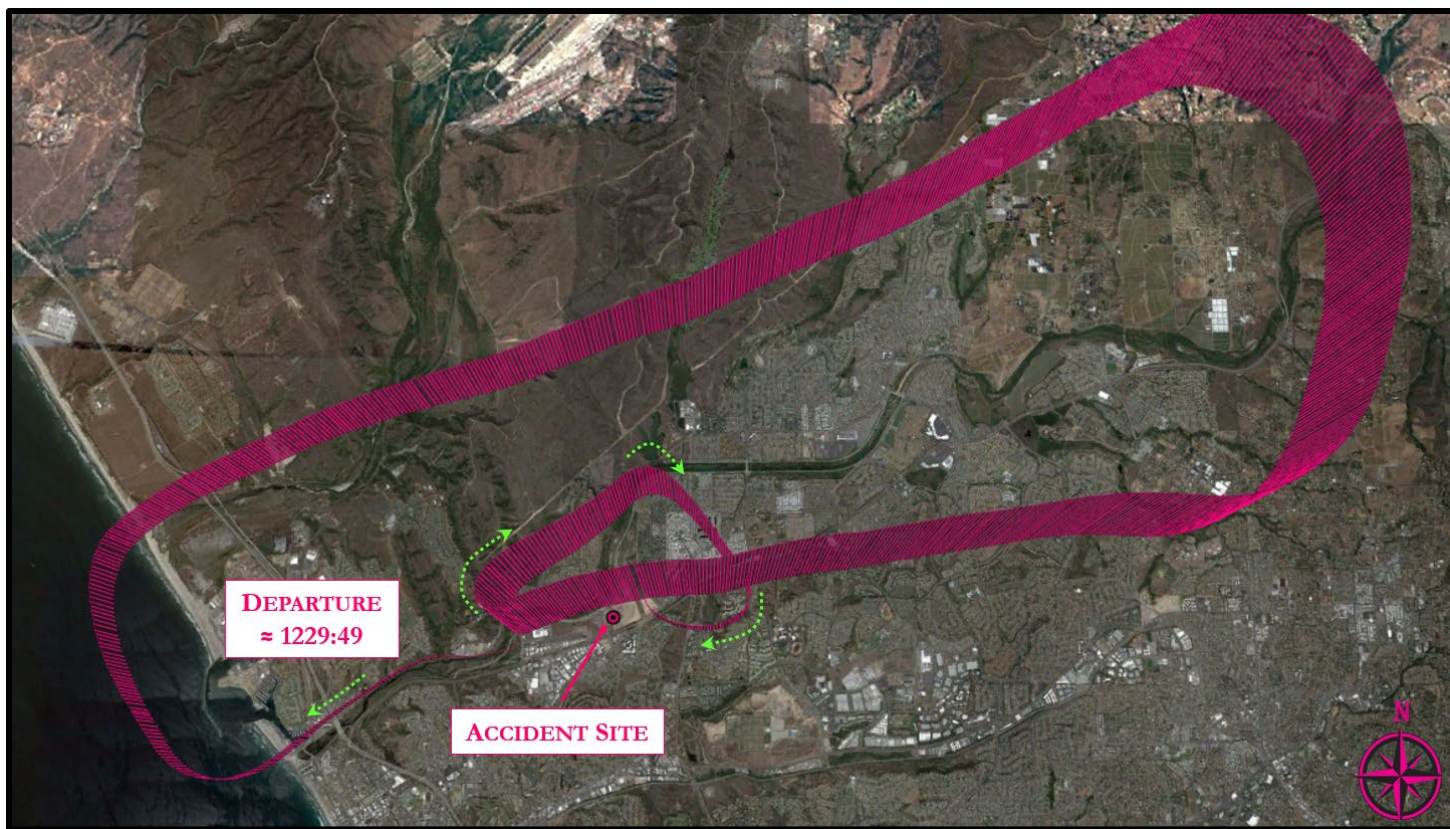


Figure 2: ADS-B Data for Accident Flight

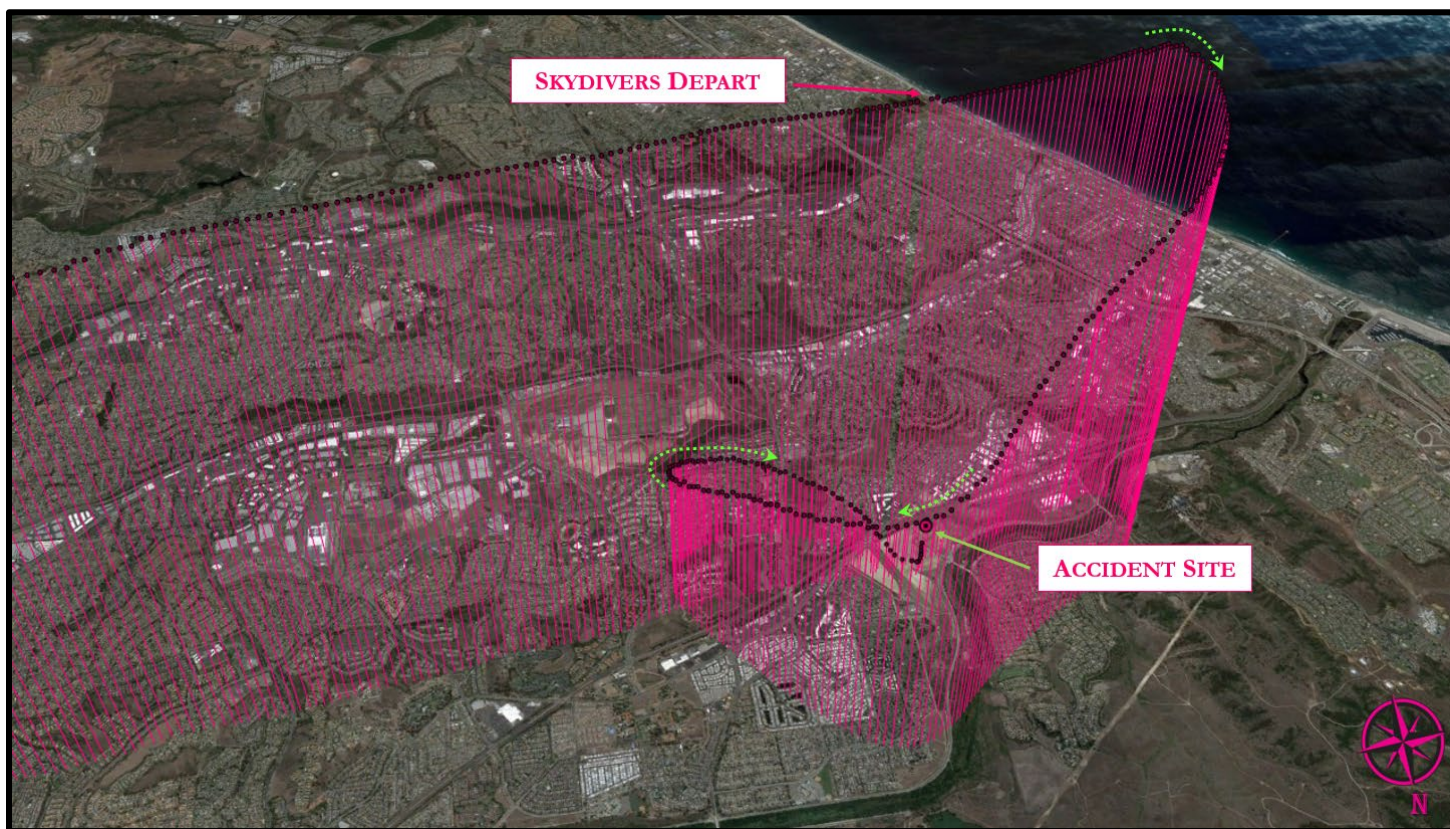


Figure 3: Last Portion of Flight

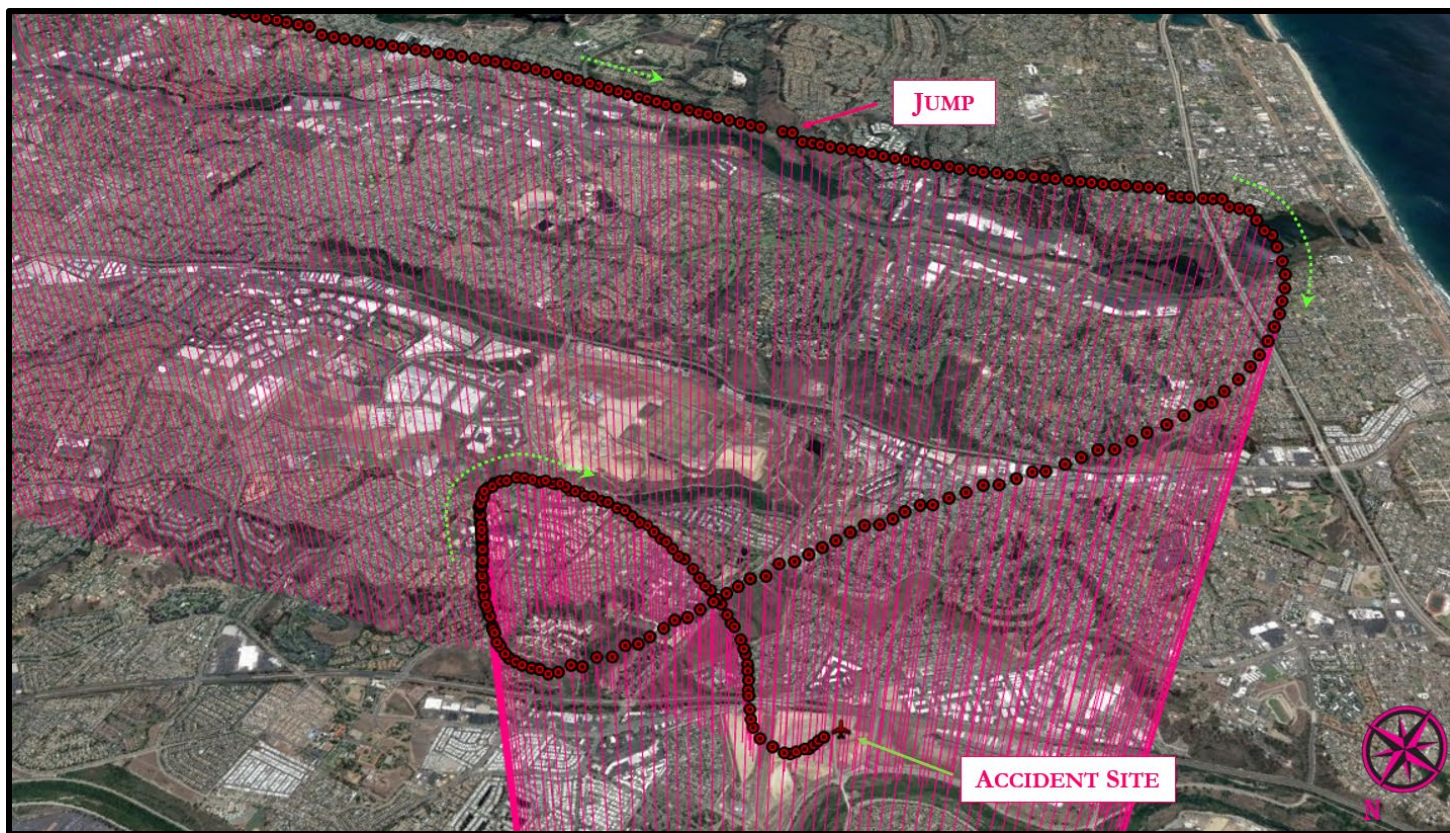


Figure 4: Final Portion of Accident Flight

The pilot-rated passenger stated that the pilot told him that during the sky-diving operations they sometimes a beta setting in flight. The pilot said that they would use beta to descend and race the skydivers to the ground. On the accident flight, after the skydivers were dropped, the pilot began a steep descent and retarded the thrust lever into beta. The fuel gauges showed zero, indicating that the fuel tanks were empty. After notifying the pilot of the fuel situation, he stated that they were inaccurate. While on the base leg, airplane was high and fast. The pilot stated that he was going to make a right turn without using any rudder.

The passenger further stated that the pilot initiated a steep right bank-turn for a few seconds and then a steep left bank turn. He recalled that the turns were all uncoordinated and the auxiliary fuel pump light was illuminated. The pilot began to move the power and propeller speed levers and stated that they “lost the engine.” The airplane impacted terrain in a nose-low attitude. The passenger took several videos of the flights from his cell phone. The clip from the accident flight showed that the fuel gauges were at empty, the propeller rpm was about 65% and the oil temperature and pressure were in the green arcs.

OPERATIONS

The engine is designed to operate in either of the two modes: propeller governing mode (flight mode) or beta mode. In propeller governing mode, the propeller governor meters oil to the propeller as a function of engine speed, power requirements, and pilot demand through the power lever. In beta mode, oil is metered to the propeller by the propeller pitch control and the propeller blade angle is controlled directly by the power lever movement. A pressure switch in the propeller hydraulic control system is used to power an indicator light on the instrument panel. The beta light is illuminated when the propeller is operating in beta mode.

The airplane’s engine is managed by the pilot through the power lever and speed lever located in the cockpit center console. The engine power lever (black) connects to the propeller pitch control and the manual fuel valve. The engine speed lever (blue) connects to the propeller governor and to the underspeed fuel governor (USFG).

The propeller-control system is designed to operate in either propeller-governing range or beta range. When the engine-power lever is forward of the flight-idle gate, the engine is in the propeller governing mode. As airspeed decays, the propeller governor outputs higher oil pressure until “beta pressure” is available, turning on the beta light

in the cockpit. The presence of beta pressure enables the engine to operate in the beta range once the power lever is pulled aft of the flight-idle gate. The gate is a mechanical detent in the engine control console that prevents inadvertent reduction of the power lever below the flight idle setting. Before the power lever can be reduced below the flight-idle setting, the pilot must lift a silver t-handle located under the power lever over the detent gate/ lock, which allows the power lever to be moved further aft.

In the propeller-governing range, the power lever controls the engine power by adjusting the fuel flow from the manual fuel valve. Engine rpm is selected using the speed lever, which varies the propeller blade angle using the propeller governor. In the beta range, the power lever varies the propeller blade angle using the propeller pitch control. To maintain the speed lever and engine rpm settings, the USFG varies the engine power by scheduling the fuel flow. The USFG controls the engine rpm settings between 68% and 96%.

FUEL SHUTOFF/FEATHER LEVER

The baseline condition lever has been re-designated as the FUEL SHUT-OFF/FEATHER lever. In the Pratt & Whitney configuration, the baseline condition lever mechanically turned the fuel on and off, determined the engine idle speed and was used to start and stop the engine. Because the TPE331 engine normally uses an electric fuel shutoff valve, the fuel SHUTOFF/FEATHER handle is locked in the forward "NORM" position for all normal operations. If the handle is moved to the aft fuel SHUTOFF/FEATHER position, the fuel shutoff valve is mechanically closed and the propeller feathering valve is mechanically actuated. If the propeller is off the start locks, it will go into the feather position. The handle locks in both the NORM and SHUTOFF/FEATHER position to prevent inadvertent operation.

BETA MODE

In beta mode, the pilot has manual control of the propeller load through the propeller pitch control. The manual fuel valve cam is cut where it will have no effect in beta mode. Speed control is a function of the underspeed governor. For beta operation, the effect of bringing the power lever behind flight idle is that fuel is reduced to the point that rpm drops below the setting of the propeller governor. The underspeed governor then assumes control of fuel to maintain the selected minimum rpm.

In beta mode, propeller control oil is metered by the propeller pitch control at the beta tube to maintain a selected propeller blade angle. The propeller pitch control sleeve is positioned by the power lever movement of the cam in the propeller pitch control. The sleeve meters oil pressure into the piston, via the beta tube, to position blade pitch angle.

AIRFRAME

Airframe: Cessna C208B (s/n 208B0961)

FUSELAGE

The removal of the wings and stabilizers facilitated their transportation to the storage facility. These components remained intact, with the flight controls still in place. Impact fractures occurred in multiple locations on the engine mount, yet the engine remained attached. The nose landing gear separated from the trunnion and became embedded in the lower portion of the forward fuselage. Upon impact, the cockpit floor structure experienced a displacement upward of approximately 10 inches.

The investigator established aileron flight control continuity by observing control surface movement while actuating the cables at the turnbuckle separations near the aileron sector in the cabin overhead. The low tension loop cable remained connected to both the aileron sector and the control columns. Due to the displacement of the structure, the control columns became wedged and could not be manually actuated. The pilot control wheel was separated from the control column mount location forward of the instrument panel due to an impact fracture. The copilot

control wheel had been removed for skydive operations. Elevator cables were attached to the elevator bellcrank in the aft fuselage and the forward bellcrank below the cockpit floorboards. The push/pull rod from the forward elevator bellcrank to the cockpit elevator control horn was fractured by the displaced nose landing gear. However, each end of the forward elevator push/pull rod remained connected to its respective control mechanism.

COCKPIT

An STC installed generator switch labeled START, OFF, GEN was installed. The switch was in the GEN position. A start mode switch was installed labeled PARALLEL, MOTOR, PARA/SERIES was in the PARALLEL position.

Placards installed below the autopilot controller read “AUTOPILOT DISABLED” and “ELECTRIC TRIM DISABLED”.

An annunciator panel from the accident aircraft was submitted to the Materials Laboratory for examination. The panel contained twenty-four (24) individual annunciators. Each annunciator contained two (2) bulbs. The panel was intact and visually appeared to have had limited impact-related damage. The individual annunciator lights were removed from the panel and x-rayed to determine the status of the filaments inside each of the bulbs. The status of each light is listed in the chart below.



Figure 5: Annunciator Panel

ENGINE FIRE	OIL PRESS LOW	GENERATOR OFF	SRL INOP	AUX FUEL PUMP ON	FUEL PRESS LOW	STARTER ENERGIZED	IGNITION ON
INS INS	INS INS	INS INS	INS INS	INS INS	INS BNS	INS INS	INS BNS
VOLTAGE LOW	VACUUM LOW	RESERVOIR FUEL LOW	LEFT FUEL LOW	RIGHT FUEL LOW	STBY ELEC PWR ON	BETA	FUEL SELECT OFF
INS INS	INS INS	INS INS	INS INS	INS INS	INS INS	BNS BNS	INS INS
DOOR WARNING			INLET ANTI-ICE	CHIP DETECTOR	STBY ELEC PWR INOP		
INS INS	INS INS	INS INS	INS INS	INS INS	INS INS	INS INS	Both Bulbs Missing

Figure 6:Diagram of Lights

Legend

INS-Intact, not stretched
BNS-Broken, not stretched

On-scene photographs provided by the FAA indicated that approximately 20 gallons of jet fuel was drained from the wing fuel-tanks after the accident (the exact quantity per tank is unknown).

Investigators found the fuel strainer bowl was separated from the strainer body consistent with impact forces; the screen remained attached to the strainer body, and the strainer appeared clean. Approximately 1.5 gallons of clean jet fuel were drained from the collector tank drain. Fuel was also present in the fuel line from the strainer to the engine-driven fuel pump.

ENGINE

Engine: Honeywell TPE331-12JR-704T[†] (s/n P123249)

The tachometer indicated 8,912.3 hours.

The engine was intact, with the engine mounting truss remaining attached although broken and deformed in multiple locations. The airframe exhaust was bent and crushed, remaining attached to the engine, while the secondary exhaust was crushed and located under the fuselage. The control units were observed at the following approximate positions:

FCU – 66°

PPC – 68°

Underspeed Governor – 18°

In the cockpit, when the power-lever angle (PLA) was positioned at Flight Idle (above the gate), the fuel control unit (FCU) was at approximately 46°, and the propeller pitch controller (PPC) was at approximately 46°. Moving the PLA all the way forward showed the PPC at 100° and the FCU at 102°, while moving it to reverse showed both at 0°. The underspeed governor was confirmed on the min stop when the speed lever was positioned to the low setting, and on the max stop when positioned to the high setting. However, the propeller governor moved toward the max stop but did not contact it. The feather valve could be actuated by hand.

The purge kit was dented, and the oil tank was crushed and punctured. The engine oil bypass indicator was not extruded, and the exhaust gas temperature (EGT) harness appeared deformed. Additionally, the aircraft oil cooler tubing was dented.

The airframe inlet was crushed and pushed into the engine inlet, along with earthen debris. Two impeller blades were bent opposite the direction of rotation and had material missing.

Removal of the magnetic chip decor revealed that it was clean of debris. The primary fuel manifold inlet was impacted by the crushed airframe exhaust. Upon turning the propeller flange, it was confirmed that the starter pad rotated. Additionally, the gearbox oil scavenge line was removed to inspect the oil pump gerotors, which turned when the power section was rotated. The propeller flange also rotated when the turbine was rotated.

The third-stage turbine rotor was intact, with some rubbing observed on the shroud. Earthen debris was discovered in the exhaust duct, while the third-stage stator exhibited metal spray. The FCU fuel filter was removed and found to be clean.

The first stage impeller shroud exhibited rubbing at the knee and exducer. Earthen debris was discovered in the engine combustor, visible after removing the plenum ignitor bore plug for borescope inspection. Additionally, earthen debris was found between the combustor lining and the plenum housing.

The first-stage turbine nozzle and first-stage turbine rotor appeared intact. Metal spray was observed on the third stage stator, which could not be removed by hand.

PROPELLER BLADES

Propeller: Hartzell HC-E4N-5KL/JNC10904/106500P (s/n SZ40)

The propeller on the accident airplane is a 110-inch diameter, 4-blade, single-acting, hydraulically operated constant speed model with feathering and reverse pitch capability. Oil pressure from the propeller governor is used to move the blades to the low pitch (blade angle) direction. A force from a feathering spring and centrifugal twisting moments from the blade counterweights are used to move the blades to the high pitch/feather direction in the absence of governor oil pressure. The propeller incorporates a Beta tube mechanism that provides blade angle information from the propeller pitch control when angles are lower than the flight idle position. The propeller utilizes an aluminum hub with composite blades. Rotation is counterclockwise as viewed from the rear.

The propeller converts the rotational energy of the engine output shaft into useable thrust to move the airplane. For turbine installations, the rpm of a fixed pitch propeller would vary greatly as a function of engine power and airspeed. Therefore, a variable blade pitch (or constant-speed) propeller is used in which the blade pitch or angle can be adjusted during flight in order to control the propeller rpm and to obtain the correct position for all phases of flight, such as takeoff, climb or cruise. It is also possible to feather the blades after an engine failure, to reduce the aerodynamic drag in an emergency.

In the TPE331 control system, if the pilot reduces the power lever to idle, the blade angle will lower to attempt to equal the demanded power, by a increase in pressure supplied from the propeller governor, until the blade angle cannot decrease due to the low pitch stop (5.5° in the accident airplane). Once it can't maintain 100% (1591 rpm), the rpm will drop until reaching 97% (1543 rpm). The underspeed governor then adds power/fuel as needed to maintain 97%.

The propeller governor assembly regulates propeller speed at different engine settings, controlled by the speed lever in the cockpit to adjust preload on the governor's speeder spring. In beta mode, the propeller governor supplies high pressure oil directed through the propeller pitch control to adjust blade angle manually. This control comprises a cam-driven ported sleeve housing a beta tube, which aligns oil supply holes to balance propeller pressure. In case of a negative torque sensor malfunction, the pilot can move the power lever forward to maximize blade angle for minimal drag, using the beta follow-up system. The propeller oil-transfer tube, extending from the propeller dome to the propeller pitch control, regulates oil pressure jointly with the control during beta mode, while serving as a conduit in governing mode.

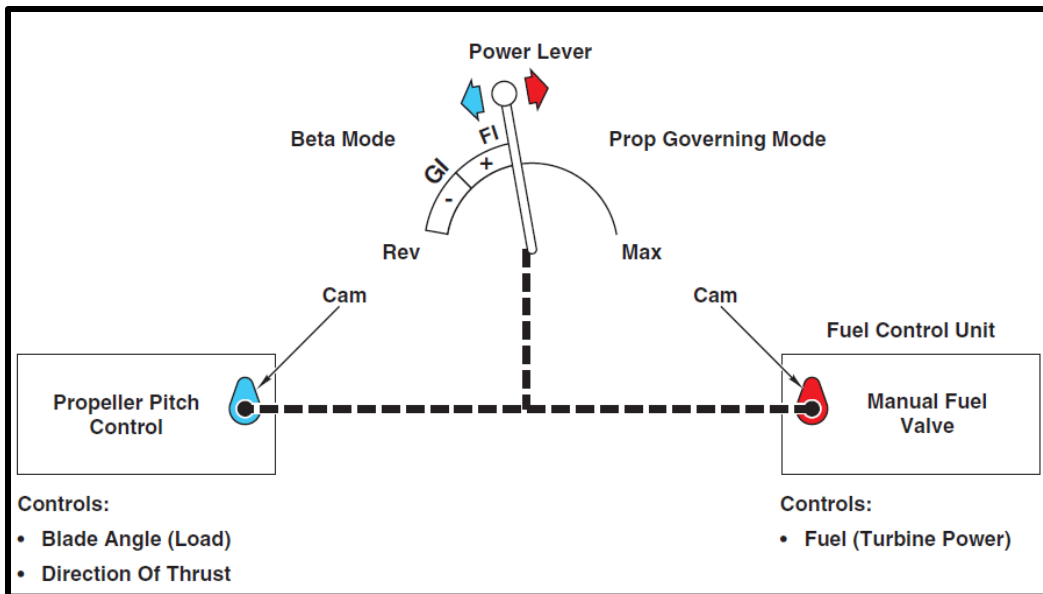


Figure 7: Diagram of Power Lever

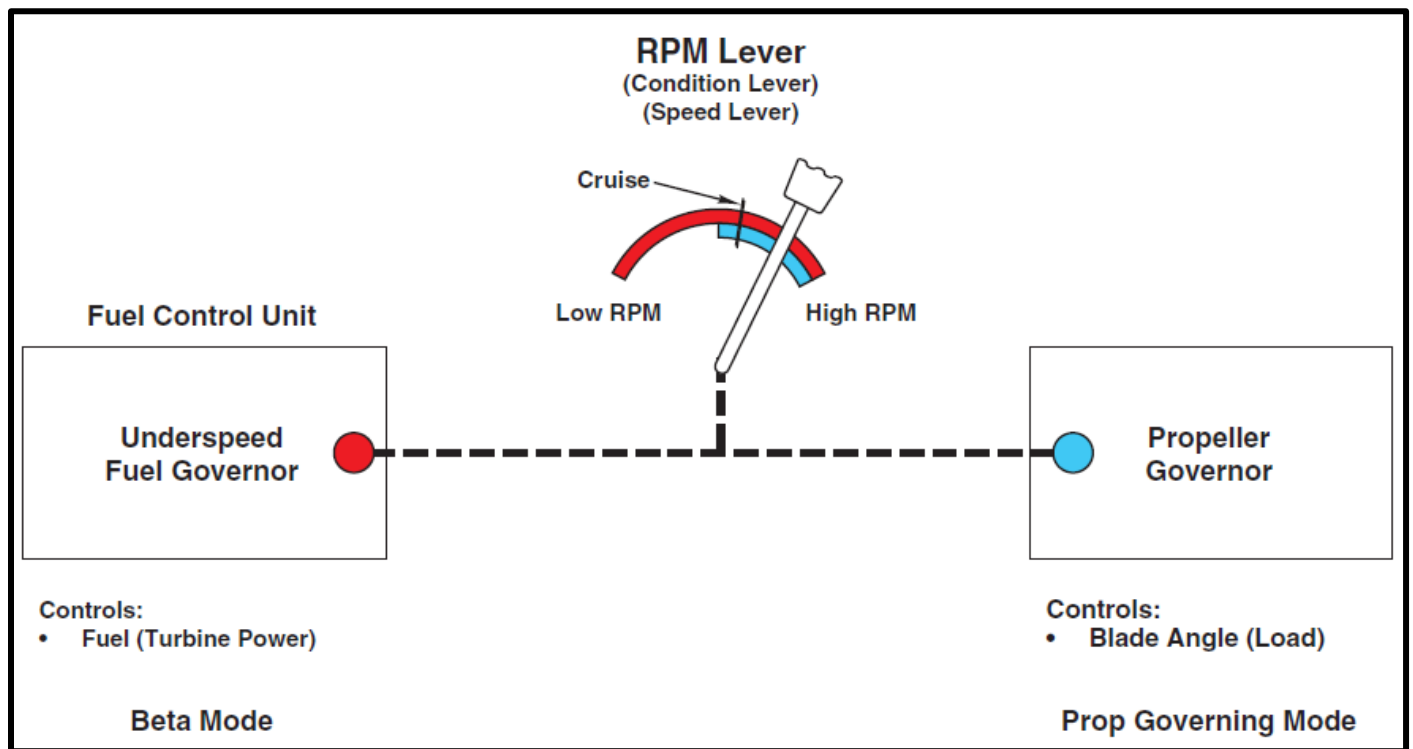


Figure 8: Diagram of Speed Lever

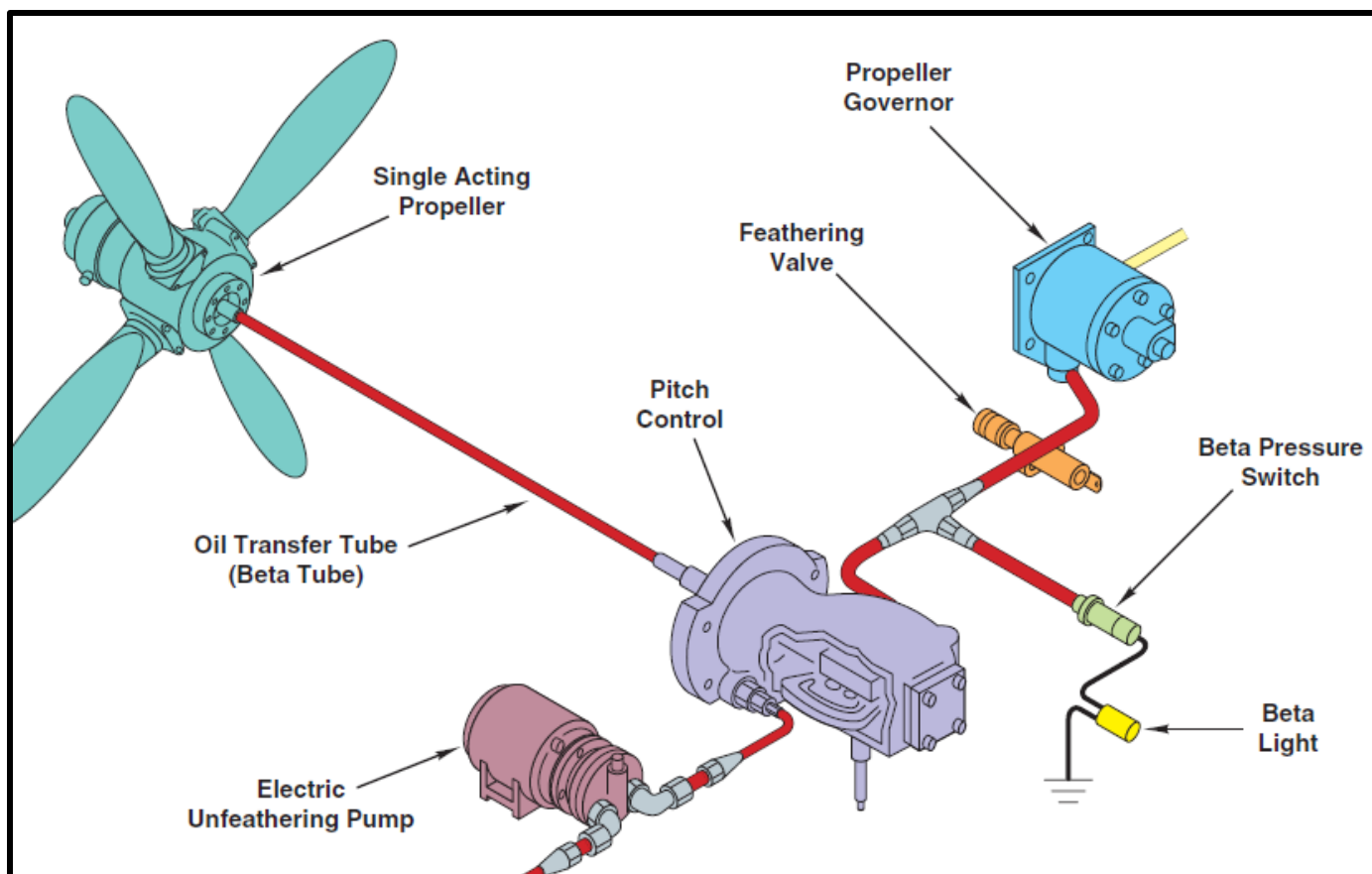


Figure 9: Diagram of Propeller Components

The aerodynamic forces acting on a propeller blade were contingent upon blade angle, aircraft speed, and rotational speed (rpm). During flight idle, the blade angle can become fixed aerodynamically, with the potential for complete locking to the reverse mechanical stop, due to the aerodynamic load on the propeller exceeding the forces of the propeller controls.. The prospect of decelerating the airplane towards stall at low altitude could pose a significant risk, exacerbated by diminished elevator control resulting from the low dynamic pressure within the propeller slipstream, which may impeded the pilot's ability to modulate airplane airspeed effectively.

Available recourse for the pilot involves reducing rpm beyond the transition from high to low on the speed lever. Under such conditions, the sole method to achieve this on the TPE331 engine is for the pilot to shut-down the engine completely (dumping all oil pressure). This action would provide a reduction in rpm, thereby diminishing the aerodynamic twisting moment and facilitating the "unlocking" of the propeller (override the twisting forces towards reverse).¹ Consequently, the forces of the feathering spring and counterweights would be greater than the aerodynamic forces and move the propeller blade angle towards feather. As long as the propeller is rotating and the blades are stuck in the reverse position, the drag on the propeller inhibits elevator control.

If the pilot were to shut-down the engine and were able to feather the propeller, this would yield a substantial reduction in drag generated by the powerplant, potentially approaching zero, thus enabling the airplane to potentially glide to a safe landing. Moreover, enhanced elevator pitch control would, at the very least, enable the pilot to decelerate and execute a proper flare during a forced landing scenario.

Examination of the propeller revealed that propeller remained attached to the engine propeller shaft flange, with all four blades separated at the shank. While three blades were fully recovered, only a tip fragment of the fourth blade

¹ There is no known supporting what the windmill speed would be if the engine were shut down or how slow would the windmill speed have to decrease to before the aerodynamic loads would decrease such that the propeller blades move towards feather (i.e. positive blade angle). Thus, if the windmilling speed would not decrease below that threshold, this statement may not be accurate.

was located. The spinner dome displayed spiral scoring and crushing, predominantly still attached to the spinner bulkhead, with no discernible counterweight impressions. Blades were numbered clockwise from No. 1 to No. 4. Blades No. 3 and No. 4 exhibited forcefully rotated counterweights towards low pitch, indicating damage to pitch change components. Upon actuation toward the feather stop, Blades No. 1 and No. 2 moved smoothly, while Blades No. 3 and No. 4 did not respond. Fractured blade segments were paired with their respective shanks based on matching fracture patterns.

Chordwise/rotational scoring was evident on the camber side of Blades No. 3 and No. 4, indicative of bending aft and twisting to low pitch. Similarly, Blade No. 1 displayed such scoring on its camber side, with no notable marks on the face side of any blades.

The propeller hydraulic unit, including the cylinder, piston, feathering spring, and pitch change rod, remained attached to the propeller hub and appeared undamaged, except for minor scratches and scoring near the forward spinner bulkhead area. One start lock pin showed a fractured ear, but both pins operated smoothly. The pitch change rod extended approximately 1.6" from the feather stop, with dirt packed into the threads. The beta adjust screw depth was 0.258", requiring 38.5 turns to remove, and the beta tube depth was 0.127", requiring an additional 17.9 turns for removal. The pitch change rod moved smoothly to feather once counterweight No. 3 was removed. Due to a lack of proper fixture, the cylinder, pitch change rod, piston, and feathering spring were not removed. However, both start lock pins were extracted, revealing an intact spring and retention cup. There was no evidence of forceful contact with the piston, suggesting the propeller was not on the start locks at impact.

The hub unit showed no visible fractures or cracks, with all thru-bolts secure. Rotational scoring marks were observed on the aft hub where the spinner bulkhead mounts, and the hub-side bearing race of Blade No. 1 displayed ball bearing impact imprints. All four preload plate shelves exhibited varying degrees of damage. Two forward tangs on the fork were fractured, cracked, or bent toward low pitch, with one tang fracture-separated. The pitch change knobs of Blades No. 3 and No. 4 were found underneath the pitch change fork due to forceful rotation to low pitch, leaving contact marks on the forward hub wall. All four pitch change knob assemblies remained intact and secured on the blade butt.

All four blades were fractured at the blade-shank interface. Chordwise/rotational scoring was evident on the camber side of all four blades, progressively moving to a lower radius in the sequence of rotation. Blade No. 1 and Blade No. 2 each fractured approximately 10-11 inches from the tip.

Additionally, all four blades displayed leading edge nicks, gouging, and some chunking, along with trailing edge compression delamination.

RECORDS

Maintenance record excerpts:

N10JA	2/16/2022	Hobbs 8898.6
TTSN 1192	TCSN 456	TLSN 3660
This date completed 100hr inspection IAW 14 CFR Part 43 Appendix D, Honeywell Engine Maintenance Manual 72-01-40 rev. 5 and Texas Turbine Supervan Instructions for Continued Airworthiness Doc. No. 9004-21 Rev. D. I certify this engine has been inspected in accordance with TPE-72-0476 and determined to be in airworthy condition. All AD's check until February 16th.		

N10JA	2/22/22	AFTT 9580.6	Hobbs 8911.4
Replaced starter generator with Freedom Aero Services repaired P/N 23079-000-1, S/N P1192. Replaced Tach Generator with new P/N 22A690, S/N 12429. Replaced left P/N 01-0790613-92 and right P/N 01-0790613-91 wingtip position/anti-collision strobe lights with new LED units.			

Figure 10: Excerpts of the Last Maintenance

VIDEOS

The passenger took three video clips on the day of the accident. Video 3 was during takeoff earlier in the day. Video 2 was taken on the flight prior to the accident. In that video, the camera showed the annunciator light panel, which showed both the right fuel-tank low-light and the beta light were illuminated. The video from the accident flight, Video 1, was taken about 2 minutes prior to impact. The video showed an airspeed of about 110-115 kts and a descent rate in excess of -3,000 feet per minute.

Video 1

2022:02:24 12:44:02-08:00 (10.7 secs)

33 deg 14' 13.20" N, 117 deg 18' 28.08" W, 2403.409 m Above Sea Level

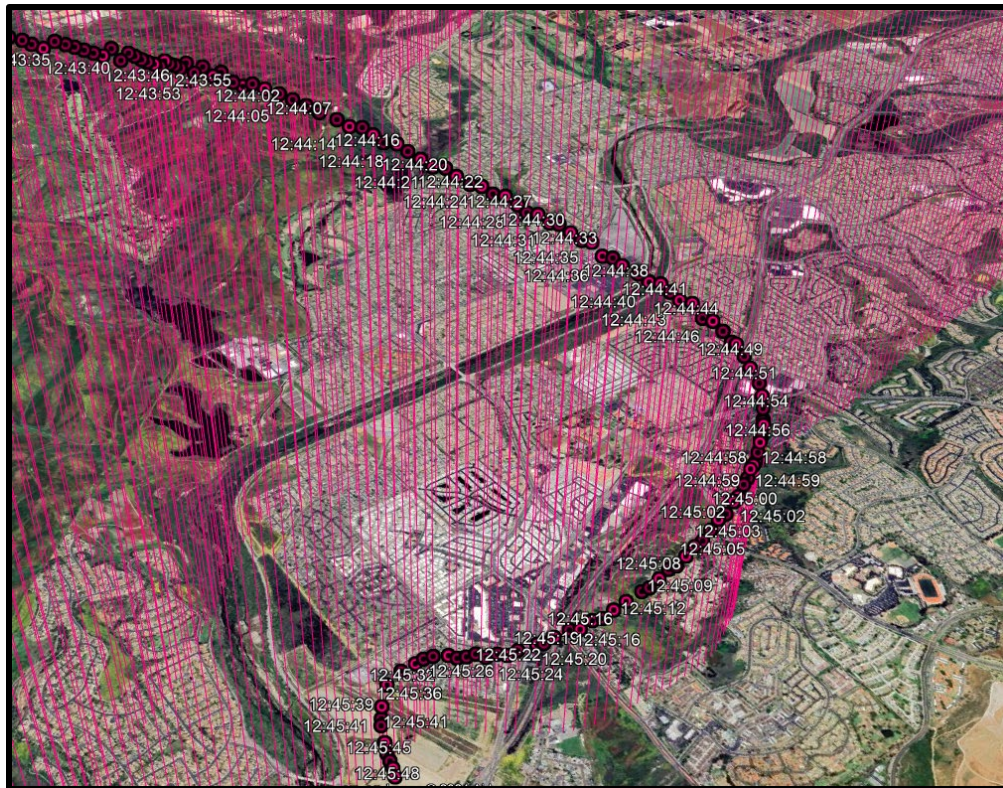


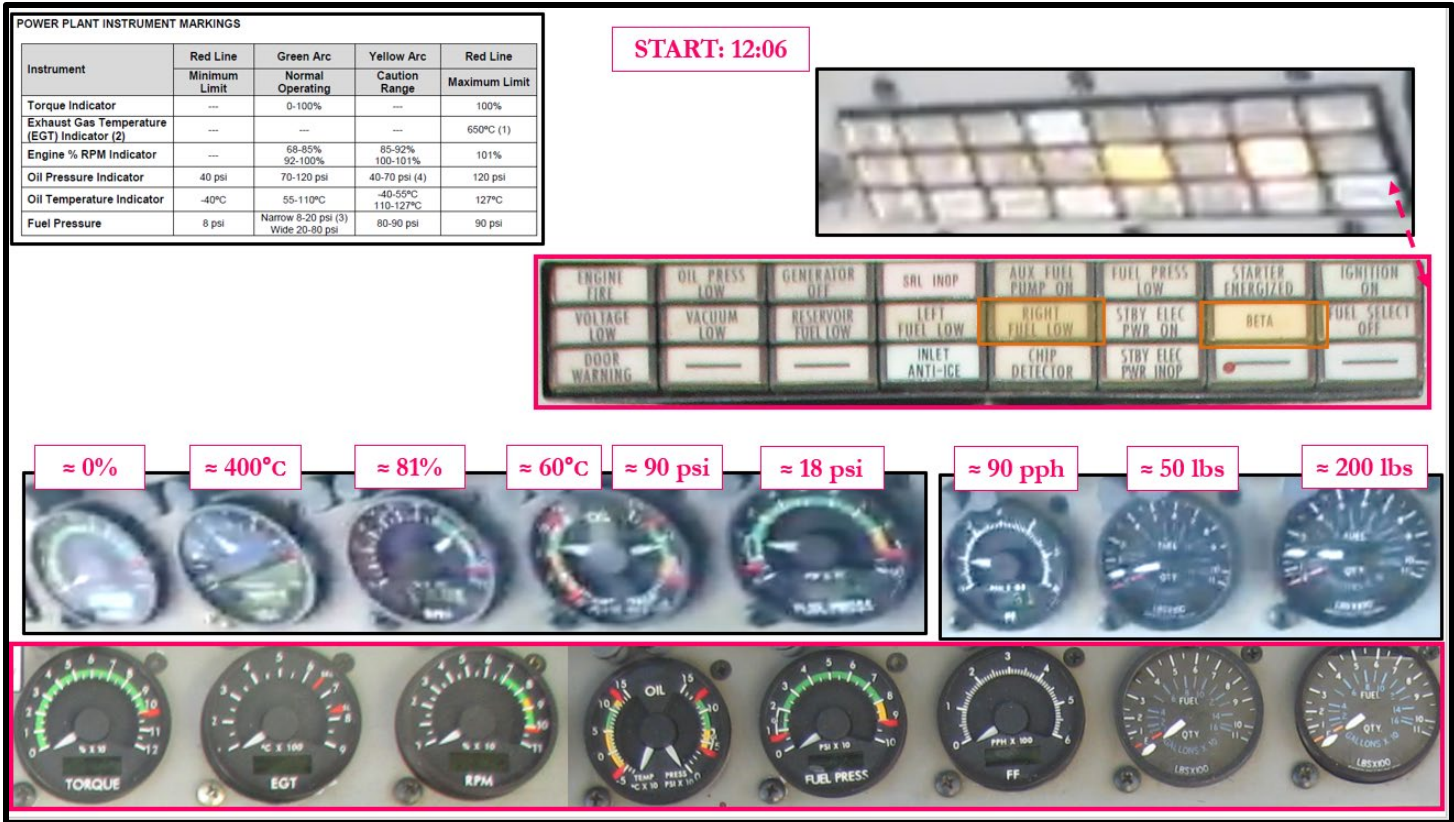
Figure 11: Last Leg of Accident Flight with Time Stamps



Figure 12: Excerpt of Video 3 Image with Exemplar

Video 2

2022:02:24 12:06:31-08:00 (12.66 secs)
33 deg 16' 18.48" N, 117 deg 16' 23.88" W, 1819.761 m Above Sea Level



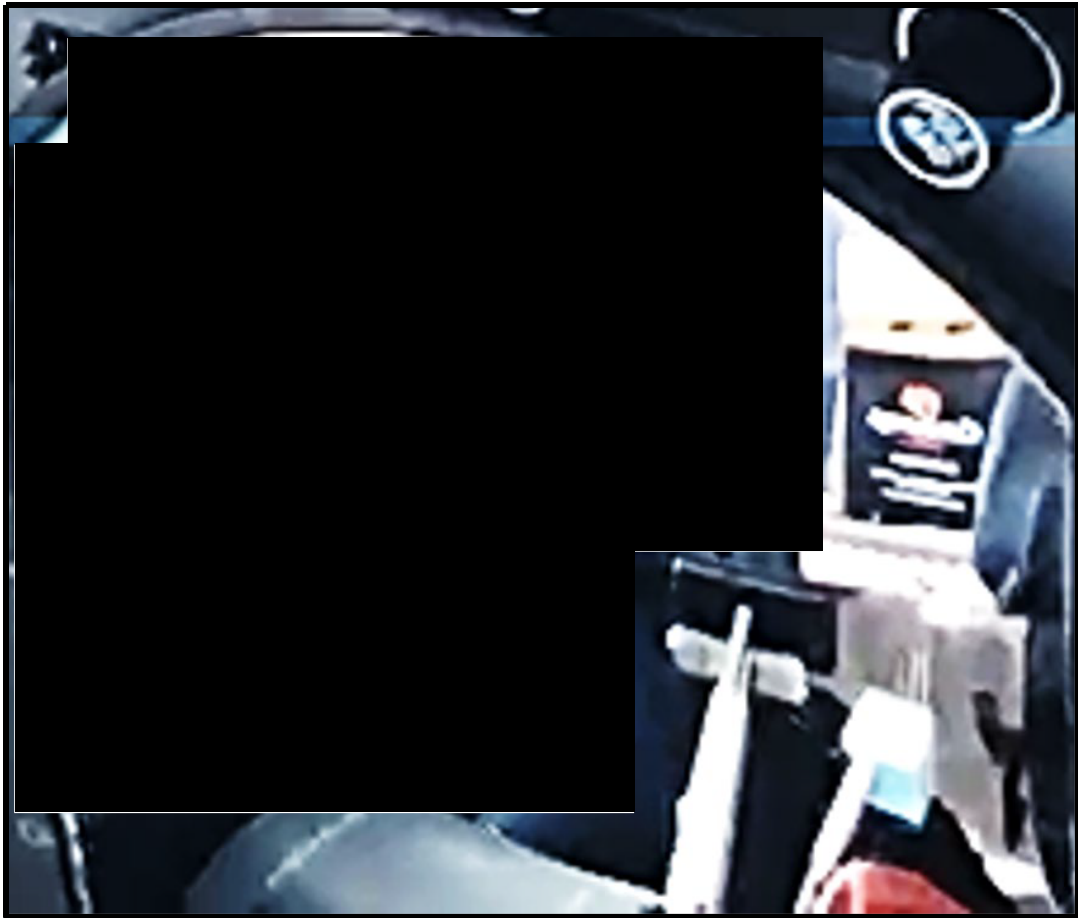


Figure 14: Image from Video 2 Showing Throttle Quadrant

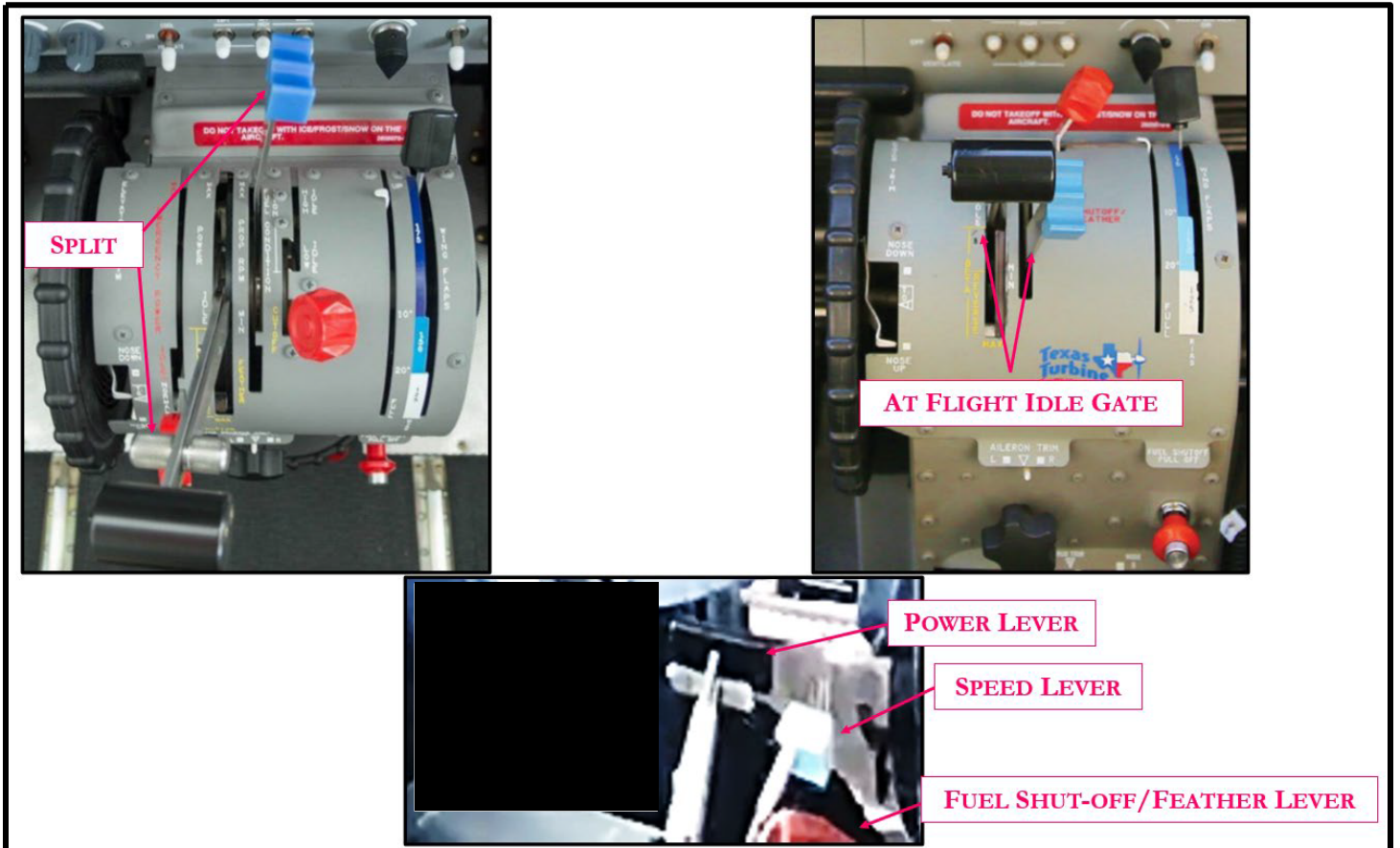


Figure 15: Throttle Quadrant Exemplars Compared to Image in Video

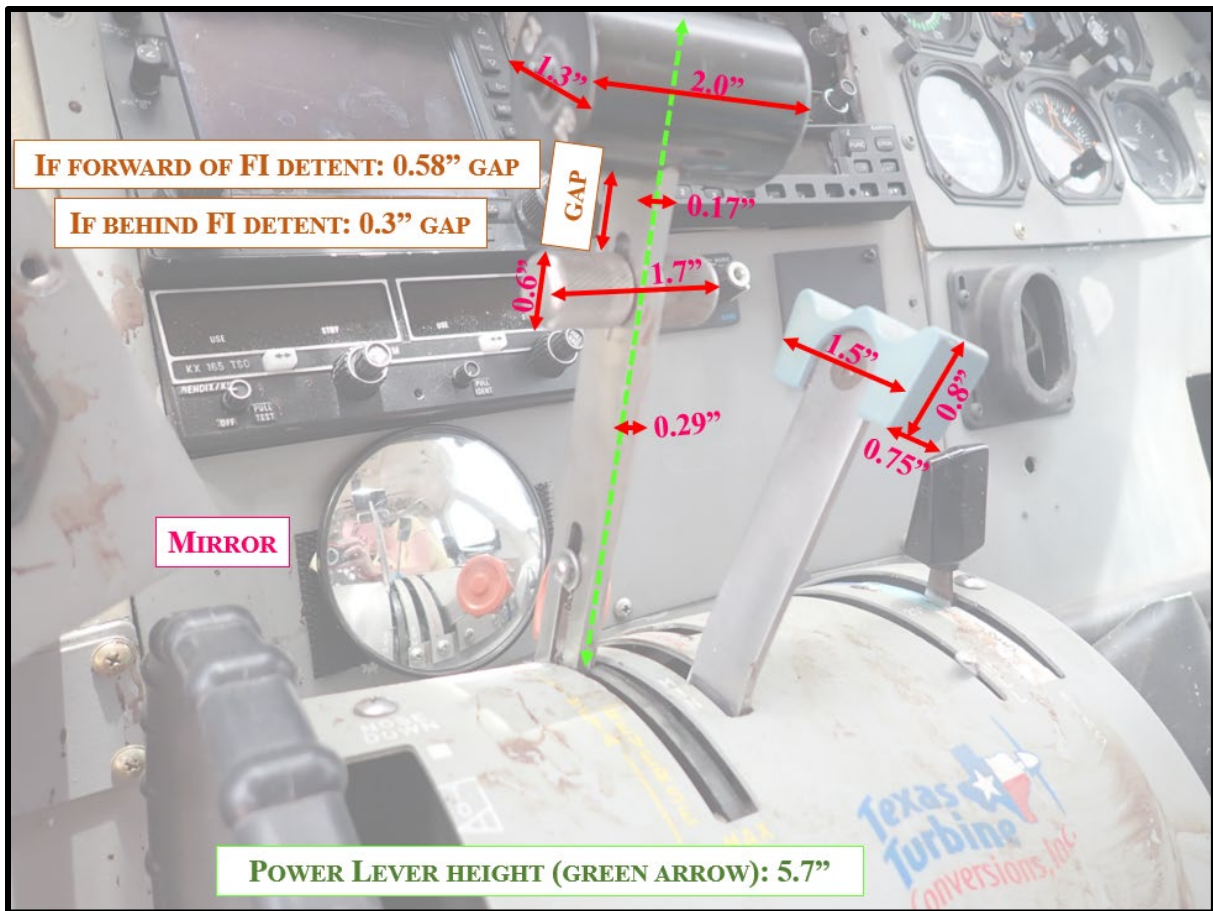


Figure 16: Throttle Quadrant with Power Lever forward of Flight Idle detent

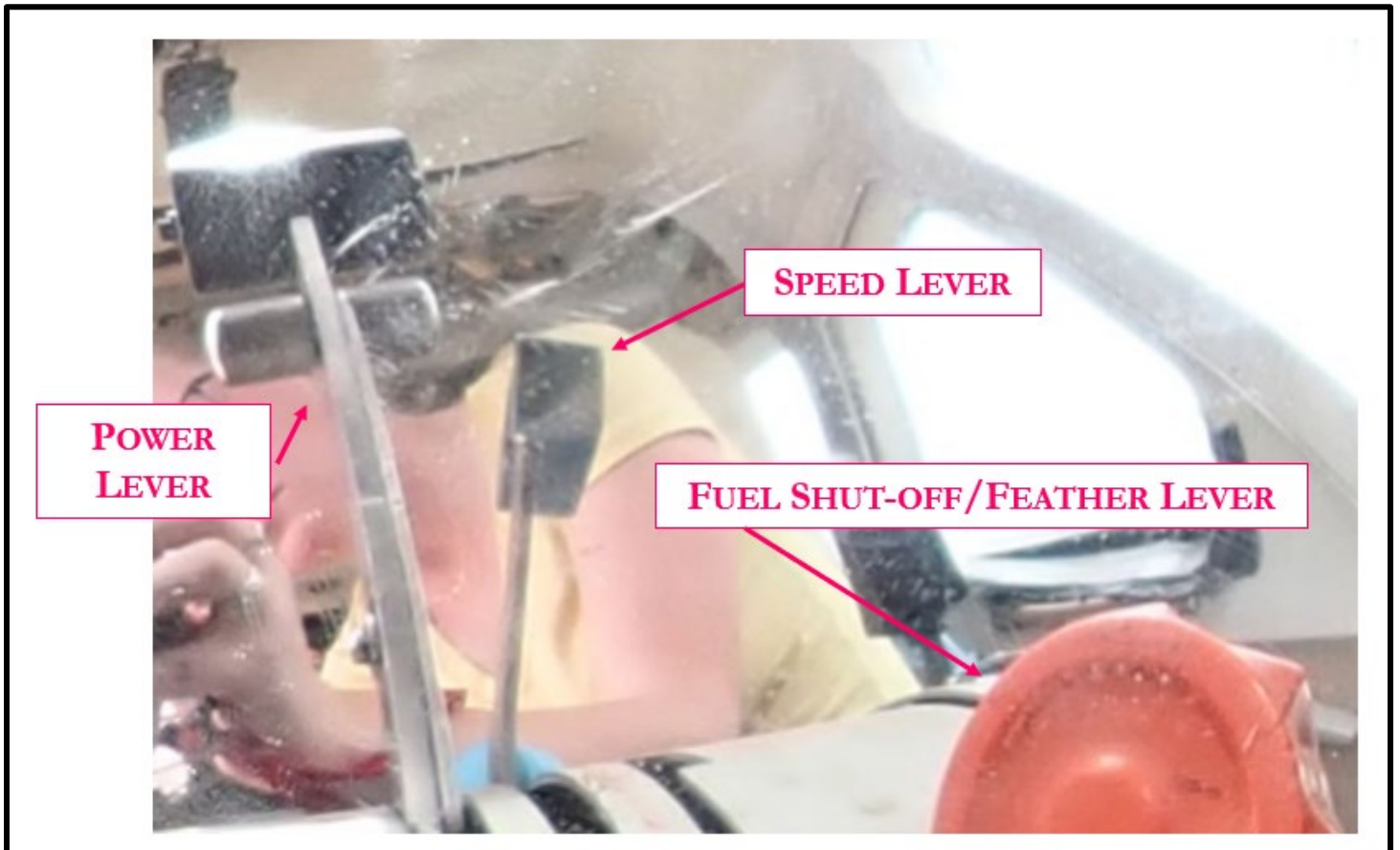


Figure 17: Simulation of the Levers' Positions (Close-up from the Exemplar Above)

PILOT INFORMATION

Pilot: Darren H. Mohle

A review of the operator's pilot schedules revealed that one pilot was assigned each day. In 2022 the accident pilot was scheduled for the following days:

- January 20
- January 22
- January 28
- February 11
- February 17
- February 24

MANUAL EXCERPTS

FLAMEOUT

ENGINE FLAMEOUT DURING FLIGHT

1. If Engine RPM Is Above **60%**:
 - a) Power Lever – ½ inch forward of FLIGHT IDLE
 - b) Ignition Switch – CONT
 - c) Power Lever – AS DESIRED after satisfactory relight as evidenced by normal EGT and RPM.
 - d) Ignition Switch – AUTO if cause of flameout has been corrected.
2. If Engine RPM is Below **60%**:
 - a) Fuel Valve Switch – OFF
 - b) Refer to Airstart checklists for engine restart.

FUEL SYSTEM MALFUNCTION

FUEL SYSTEM MALFUNCTION - INAVERTENT FUEL FLOW INTERRUPTION PROCEDURES

Fuel flows by gravity from the wing tanks, through fuel tank shutoff valves at the inboard end of each wing tank, and on to the reservoir located under the center cabin floorboard. After engine start, gravity provides fuel to the engine-driven fuel pump.

If the inter-stage fuel pressure drops between the low and high pressure engine driven fuel pumps, a pressure switch will activate the amber FUEL PRESS LOW annunciator as well as turn on the auxiliary boost pump (when the fuel boost switch is in the NORM position) and illuminate the AUX FUEL PUMP ON annunciator. This occurs anytime the fuel pressure drops below approximately 4.75 psi.

Anytime the level of fuel in the reservoir drops to approximately one-half full, the red RESERVOIR FUEL LOW annunciator will illuminate. If this occurs, the pilot should immediately verify that both fuel tank selectors (located in the overhead panel) are ON and turn the ignition to continuous and fuel boost pump on.

WARNING
THERE IS ONLY ENOUGH FUEL IN THE RESERVOIR FOR
APPROXIMATELY 1 MINUTE OF ENGINE OPERATION AT MAXIMUM
CONTINUOUS POWER AFTER ILLUMINATION OF THE RESERVOIR
FUEL LOW ANNUNCIATOR.

If the tank selectors have been left off, turning them on will quickly fill the reservoir and extinguish the RESERVOIR FUEL LOW annunciator. Once the cause of the RESERVOIR FUEL LOW condition has been determined and corrected (annunciator extinguished), the ignition switch can be moved to the AUTO position and the fuel boost switch can be returned to the NORM position.

A fuel selector off warning system advises the pilot if both fuel tank selectors are in the OFF position before engine start, if either fuel tank selector is OFF during engine start, or if one fuel tank selector is OFF and the fuel level in the tank being used drops below approximately 25 gallons. The warning system includes a red annunciator labeled FUEL SELECT OFF and two warning horns. If the FUEL SEL WARN circuit breaker has popped or the START CONT circuit breaker has been pulled (possibly for ground maintenance), the FUEL SELECT OFF annunciator will be illuminated even with both fuel tank selectors in the ON position. This is a warning to the pilot that the fuel selector off warning system has been deactivated. See Section 7 for further details on the fuel selector off warning system.

TOTAL FUEL

Both Tanks and Reservoir:339.1 U.S. Gallons (1283 l)
Both Tanks:335.6 U.S. Gallons (1270 l)
Each Tank:167.8 U.S. Gallons (635 l)

TOTAL USABLE FUEL

Both Tanks ON and Reservoir:335.3 U.S. Gallons (1268 l)
Both Tanks ON:332.0 U.S. Gallons (1256 l)
Single Tank ON:165.0 U.S. Gallons (624 l)

TOTAL UNUSABLE FUEL

Both Tanks ON:3.6 U.S. Gallons (13 l)
Single Tank ON:2.8 U.S. Gallons (10 l)

Maximum Fuel Imbalance:.....200 Pounds (90 kg)

NOTE

To achieve full fuel capacity, fill fuel tank to the top of the filler neck. Filling fuel tanks to the bottom of the fuel filler collar (level with flapper valve) allows space for thermal expansion and results in a decrease in fuel capacity of 4.0 U.S. gallons (15 l) per side (8.0 U.S. gallons (30 l) total).

The fuel quantity, fuel used and fuel remaining functions of the G1000 are supplemental information only and must be verified by the pilot.

Continuous uncoordinated flight is prohibited if L FUEL LOW, R FUEL LOW or L-R FUEL LOW annunciator is shown on PFD.

Unusable fuel quantity will continue to increase the longer a significant sideslip is maintained.

Due to possible fuel starvation, maximum full rudder sideslip duration is limited to a maximum of three minutes.