National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594

WPR23FA034

INVESTIGATIVE SUPPLEMENTAL MATERIAL

ACCIDENT

Location: Snohomish, Washington
Date: 11/18/2022
Time: 1019 Pacific standard time
Airplane: Cessna 208B EX Caravan

INVESTIGATIVE SUPPLEMENTAL MATERIAL

IIC

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HISTORY OF FLIGHT

On November 18, 2022, at 1019 Pacific standard time, a Cessna 208B EX Caravan, N2069B, was substantially damaged when it was involved in an accident near Snohomish, Washington. All four occupants were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 test flight.

The operator, Raisbeck Engineering, holds the Supplemental Type Certificate (STC) for an aerodynamic drag reduction system (DRS) on the Cessna 208B. The accident flight was part of the testing for Raisbeck to expand the applicability of that DRS to the Cessna 208B EX model[1]. QuickSilver Aero was contracted to provide instrumentation support for Raisbeck's flight test program.

The airplane began flights to support the flight-test three days before the accident. The flights on the first day, consisting of three flights, totaled 1.1 hours and included a pilot familiarity-flight and a ferry flight to have the airplane's weight and balance performed. Two days before the accident, the flight-test data-collection flights (establishing baseline data) began. Those included two flights, equating to 4.6 hours flight time, which were conducted to gather baseline data for both mid center-of-gravity (CG) cruise flight and forward CG stall speeds. The day prior to the accident, two test flights were performed with the accident test-pilot and the accident aft-seated testing personnel (different right-seated pilot). The first flight, totaling 1.2 hours, was testing aft CG static stability. The last flight that day ended short, totaling 1.4 hours, with only about half of the test card completed because an aft crewmember was feeling airsick.

The purpose of the accident flight was to complete that test card from the day prior, which was baseline testing of the airplane's aft CG stall characteristics. Witnesses reported that they observed the airplane break-up inflight and watched pieces floating down. The airplane then descended in a nose-low near-vertical corkscrew maneuver toward the ground (see Figure 1 below). Several witnesses reported seeing a white plume of smoke when they observed the airplane break into pieces.

A security camera recorded a poor-quality image of the airplane rotating about its longitudinal axis in nose-low attitude (see Figure 1 below). The video is consistent with showing the fuselage with an intact wing. The airplane is seen rotating about the pitch axis with the intact wing pointed up in trail. The nose is slightly low, the aft fuselage slightly high (see Figure 2 and 3 below) .

[1] The airplane was a Textron Aviation (Cessna) 208B EX model but this testing was not just for this model aircraft with no other modification installed. It was testing for this model with AeroAcoustics Aircraft Systems Inc. STC #SA01213SE - Aircraft Payload Extender (APE) III installed. This was for Raisbeck to expand the applicability of the DRS to the Cessna 208B EX with Aeroacoustics Aircraft Systems, Inc. Payload Extender (APE) III installed. The DRS system was not installed at the time of the accident.

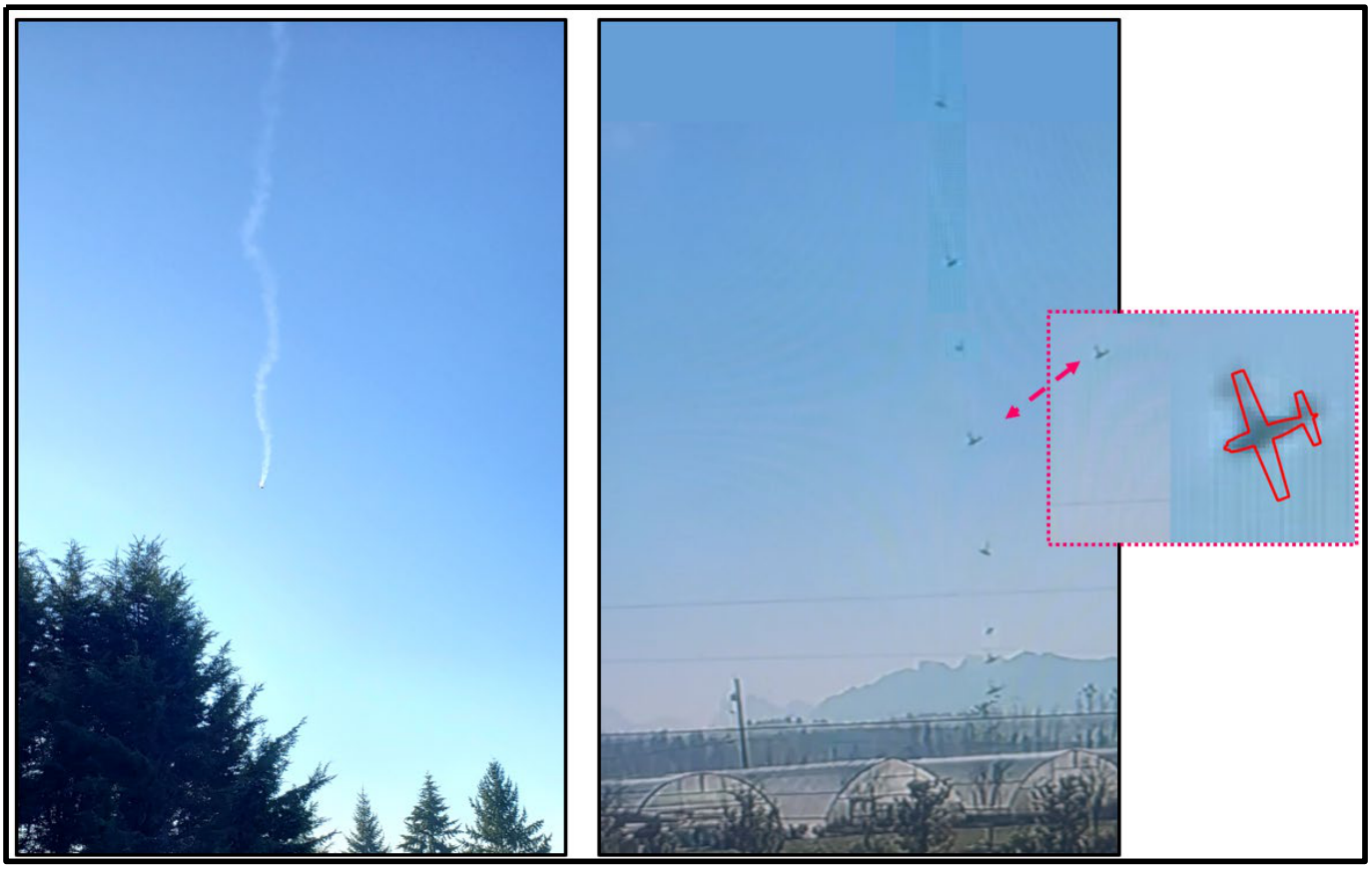


Figure 1: Picture from witness and video excerpt (provided by Mr. William Clark)

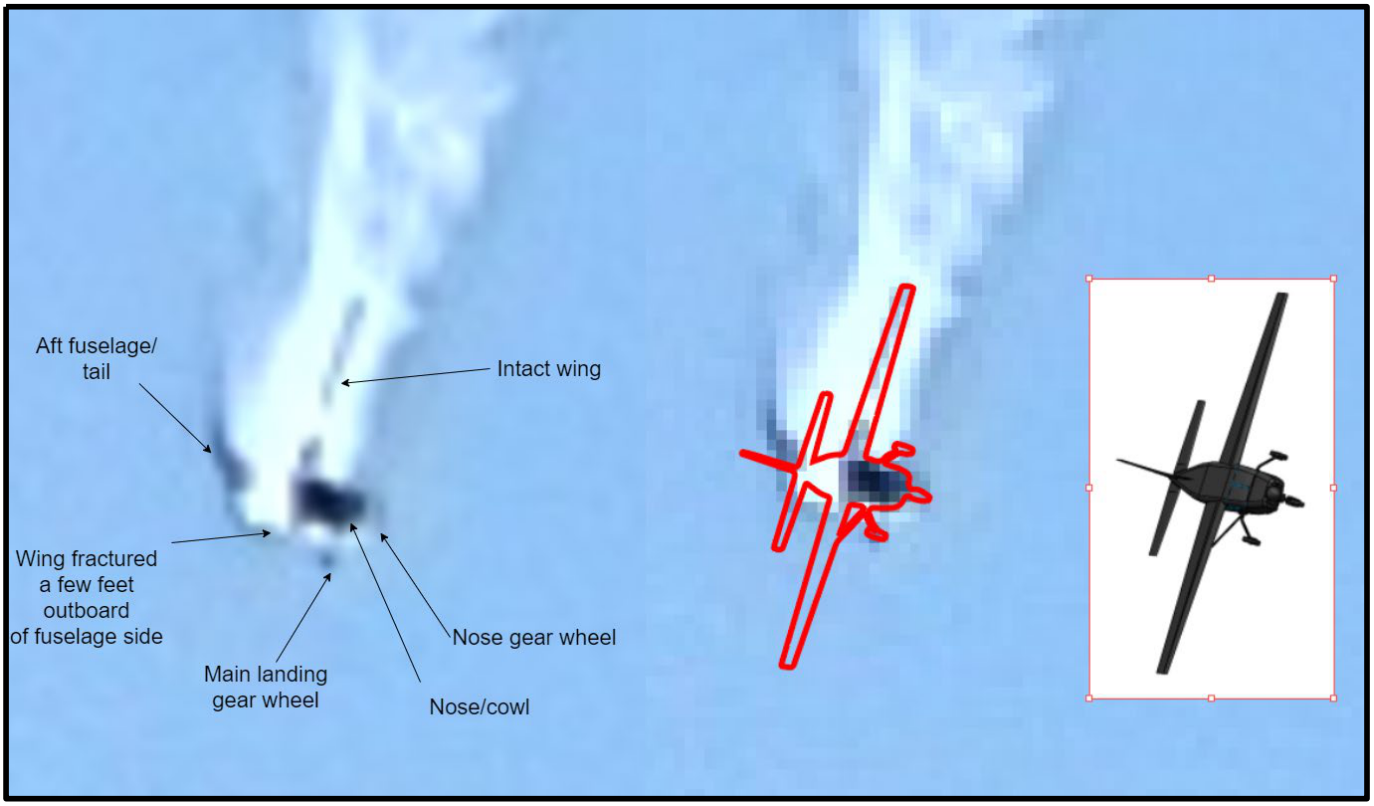


Figure 2: Image from video showing possible signatures of structures (provided by Mr. Gritter)

A review of the radar track data indicated that after departing Renton, Washington around 0925, the airplane continued to the north. The airplane continued in a gradual climb to about 9,500 ft mean sea level (msl) and began a series of turns/maneuvers. The airplane proceeded for about 45 minutes varying in altitude between about 6,500 ft to 10,275 ft msl. At 1017 the track data indicated the airplane was climbing to an altitude of 9,700 ft msl and turning to the left.

The radar data further shows that the track made a near 360° turn and then at 1019:06, there was a sharp 180° left-turn. The track continued west until the last recorded hit at 1019:18. During the last 12 seconds the track indicated that the airplane's descent rate exceeded 14,000 ft-per-minute (fpm) and gradually lessened to 8,700 fpm at the last hit. The main wreckage was located about 2,145 ft east of the last recorded track data. The right-seat pilot who flew on the day prior to the accident reviewed that track data. He thought that just prior to the accident, they were likely at the second to last maneuver on the card which specified: 96 kts indicated airspeed; flaps in landing configuration; 930 ft-lbs of torque; propeller rpm fully forward; and accelerated 30° bank to the left.

Figure 3: Radar data of maneuvers during flight (left) and last turns (right)

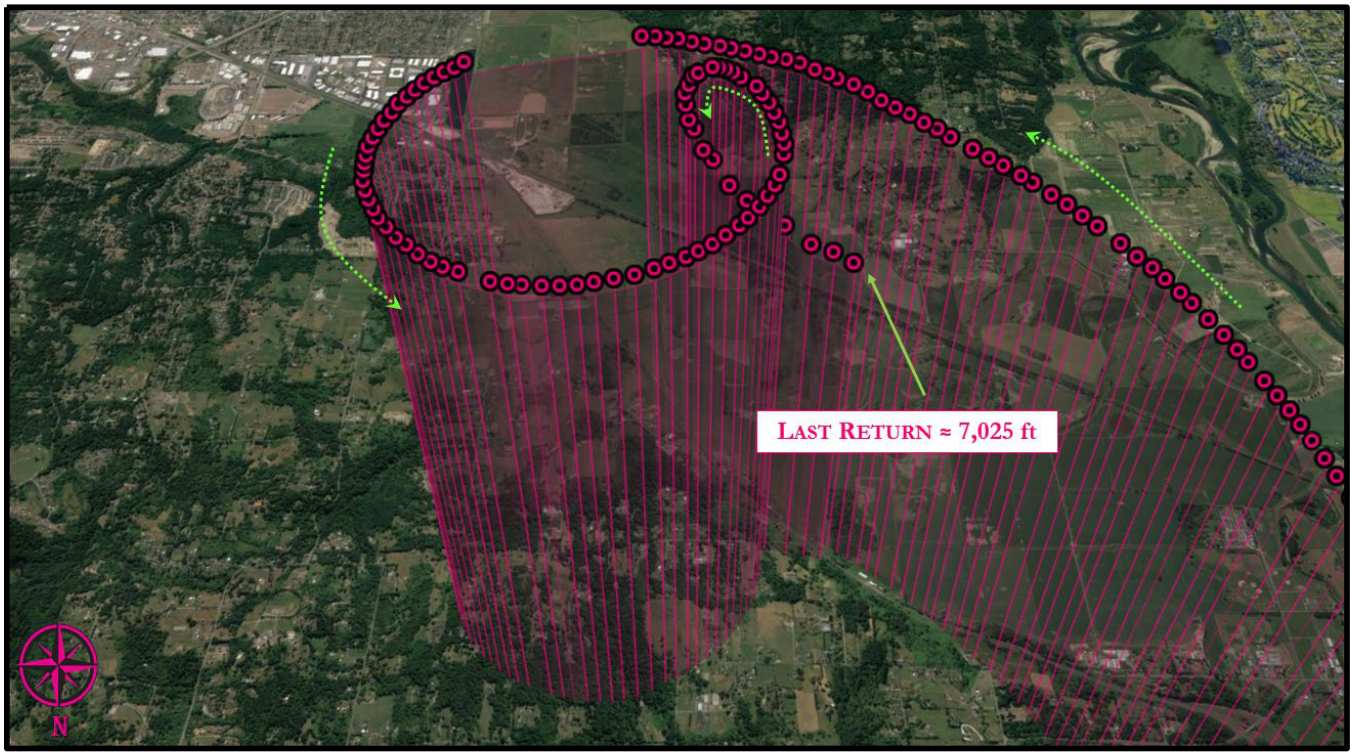


Figure 4: Last portion of flight

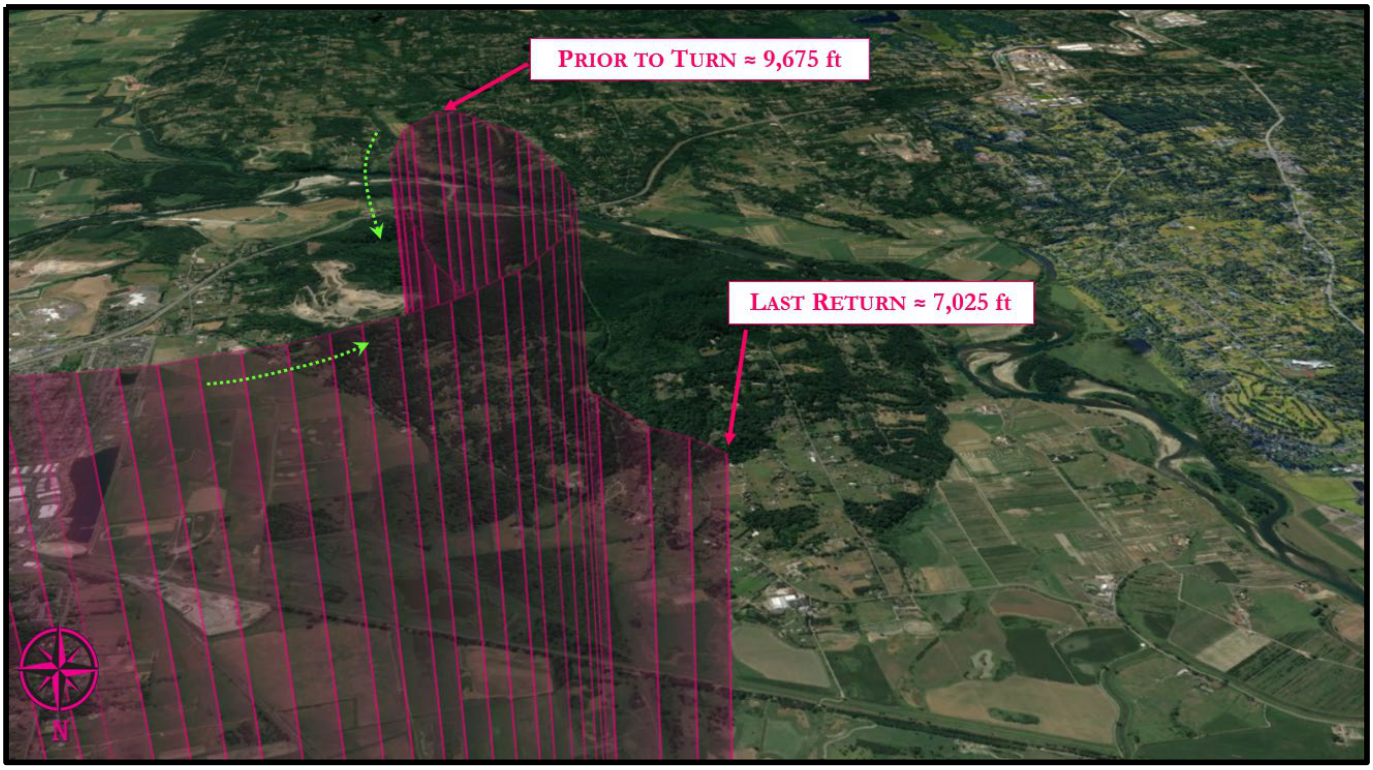


Figure 5: Last portion of flight track showing altitude

AIRPLANE INFORMATION

The airplane was a Textron Aviation Inc. 208B EX (serial number 208B5657), manufactured in 2021. It was equipped with a 867 shaft horsepower Pratt & Whitney PT6A-140 engine (s/n PCE-VA0763), and a McCauley 4HFR34C778/102BHA-0 propeller.

On November 14, 2022, the aircraft received a Special Airworthiness Certificate for Experimental Research and Development, with an expiration date of March 31, 2023. This certificate was signed by M.A. Bauermeister, DART [redacted] The most recent Phase Inspection, Phase #5, was completed on October 13, 2022. According to the last entry in the aircraft flight logbook, as of November 14, 2022, the aircraft had a total time of 921.5 hours, 1,101 cycles, and the hour meter also read 921.5 hours.

The airplane was configured with seating for the pilot, co-pilot, test director, and instrumentation lead. It also had test instrumentation equipment installed in the cabin and was equipped with a belly cargo pod. N2069B had been modified with AeroAcoustics Aircraft Systems Inc. STC #SA01213SE - Aircraft Payload Extender (APE) III, which added a stall fence on each wing leading edge, a scalloped gurney-type tab on each flap trailing edge, and high-cycle main landing gear axles. This STC increased the maximum landing and takeoff weights to 9,000 lbs. and 9,062 lbs., respectively.

The propeller blade serial numbers are as follows:
Blade #1 S/N: ALC30022
Blade #2 S/N: ALC30028
Blade #3 S/N: ALC30026
Blade #4 S/N: ALC30029

Instrumentation
As part of the Data Acquisition System (DAS) used for in-flight data gathering there was custom software and various hardware components. This includes computers for data acquisition, display, and cockpit monitoring, all running specialized software. The system also features a USB digitizer, a chassis with voltage and strain input modules, accelerometers, string potentiometers, strain gauges, force transducers, a cockpit display, a USB receiver, and a GPS receiver.

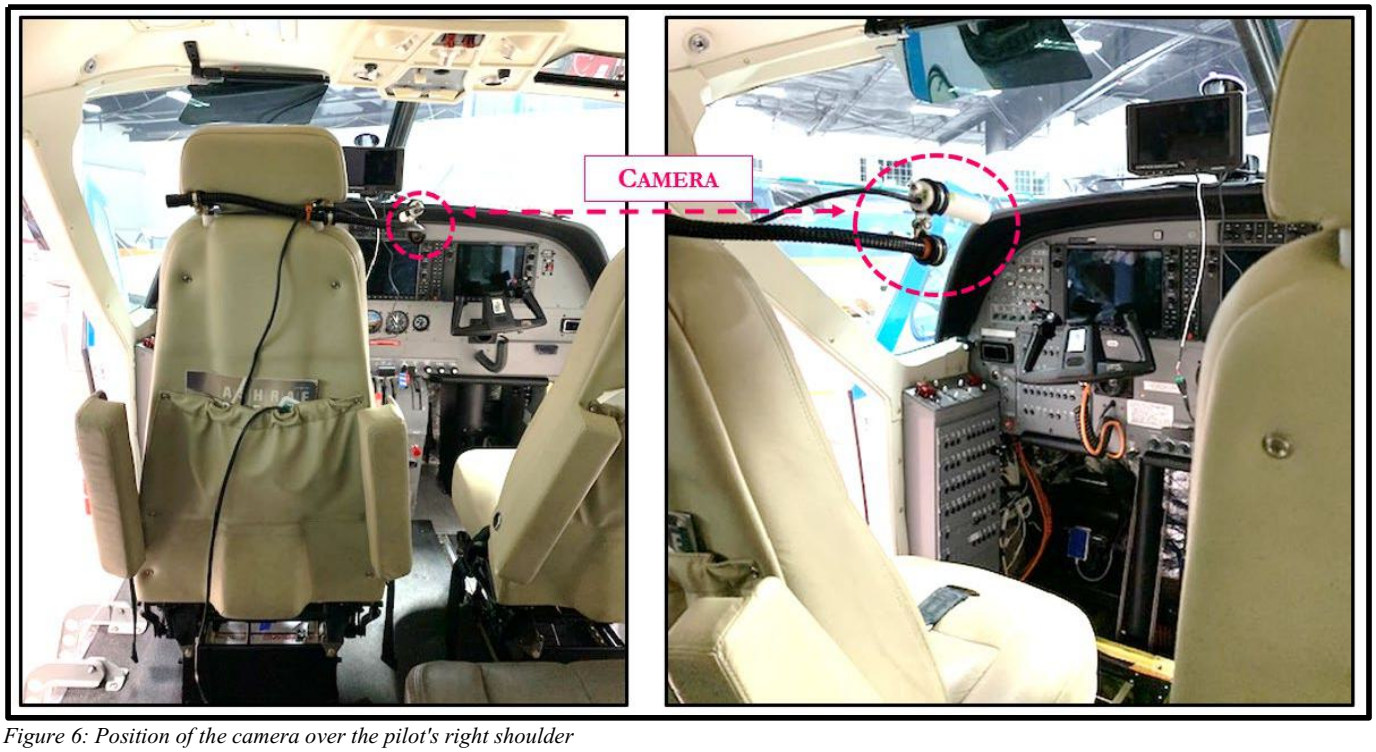


Figure 6: Position of the camera over the pilot's right shoulder

TEXTRON PILOT'S OPERATING HANDBOOK (POH)

Stalls
According to the POH, stall characteristics are conventional, with aural warning provided by a stall warning horn that activates between 5 and 10 knots above the stall speed in all configurations. The POH advises that stalls should be practiced conservatively and with sufficient altitude to ensure a safe recovery.

Spins

According to the airplane's POH, intentional spins are prohibited. The POH advises that, in the event of an inadvertent spin, the power lever should be set to idle, the ailerons should be placed in the neutral position, and full opposite rudder applied to the direction of rotation. It further instructs that, once the rudder reaches the stop, the control wheel should be pushed forward to break the stall, with full down elevator potentially needed for optimal recovery at aft center of gravity loadings. The POH cautions that these control inputs should be maintained until rotation stops, as premature relaxation may extend the recovery. After rotation ceases, the rudder should be neutralized, followed by a smooth recovery from the resulting dive.

WRECKAGE AND IMPACT

The accident site was located in a grass field in the rural farm land of Snohomish, about 2 nautical miles east of Harvey Airfield. In character, the open field was wet from both east-west and north-south oriented canals. The elevation of the main wreckage was about at sea level.

The wreckage was distributed over an approximate 1,830 ft distance on a median magnetic bearing of about 270°. The main wreckage and right wing were located at the beginning of the debris field and about 580 ft apart. The main wreckage, consisting of the engine, cockpit (and cargo pod), cabin, vertical stabilizer, and rudder, was partially consumed by fire. The right-wing strut separated from the fuselage attachment, but remained attached to the wing; the right flap was separated into numerous pieces and scattered among the debris field. The left-wing separated from the fuselage although was located adjacent to the main wreckage; the flap remained attached and was found in the retracted position.

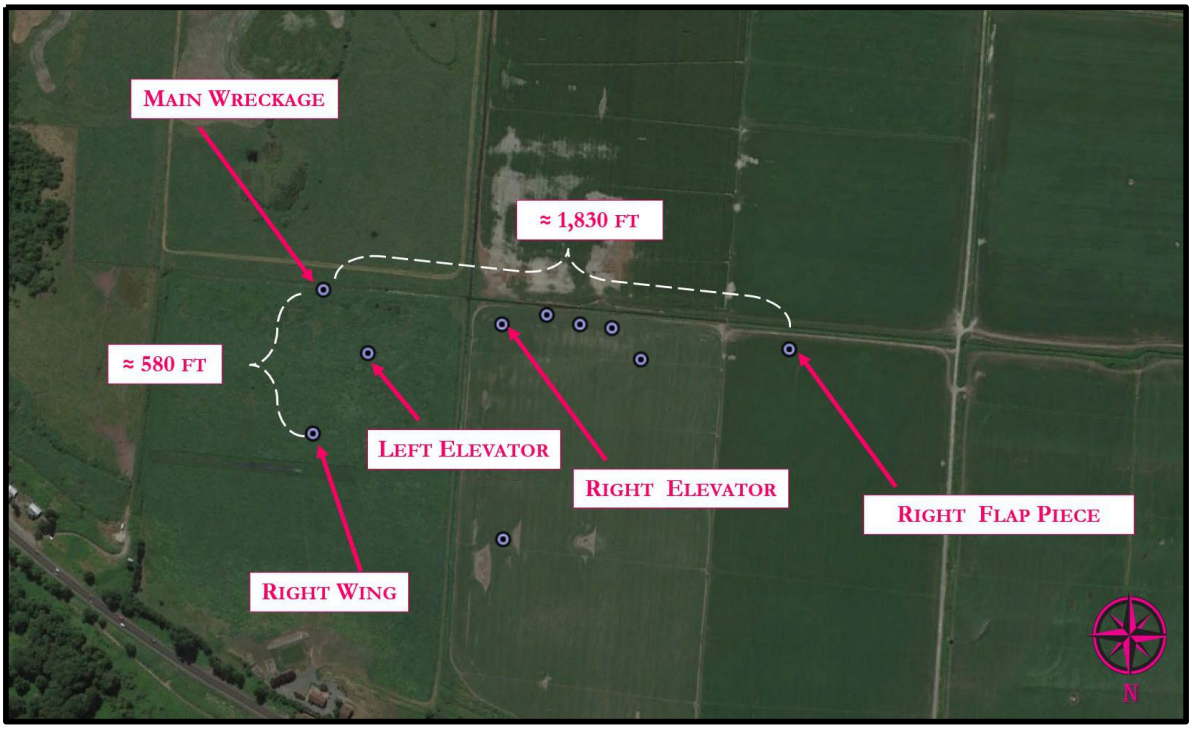


Figure 7: Wreckage Debris Field

COORDINATES OF WRECKAGE

- Main Wreckage – 47.9055777, -122.05879
- Left elevator – 47.906418, -122.053665
- Right Wing- 47.907318, -122.052879
- Engine cowling - 47.9082950, -122.0560460
- Inboard section of Right elevator - 47.9060050, -122.05577570

- Left horizontal - 47.9058700, -122.0564830
- Right horizontal - 47.9059450, -122.0570250
- Piece of Right flap - 47.9059590, -122.0575410
- Piece of right flap - 47.9062710, -122.0580410
- Furthest piece of right flap - 47.9060450, -122.0604030

AIRFRAME

FUSELAGE

The fuselage came to rest upright on its right side and was partially consumed by fire with a majority of the left side thermally consumed. The cargo pod was fragmented in numerous pieces and burned in the aft portion. There was about 6 feet intact from the forward section aft.

The cockpit pedestal was crushed to the right and trim chains were displaced; the aileron trim was nearly full left. The flap handle and indicator both showed the flaps were in the full down position. The throttle, condition, and mixture levers were all too deformed to determine a reliable position. The fuselage was broken in several sections and sustained right crush deformation. The left portion of the fuselage floor and side wall was consumed by fire.

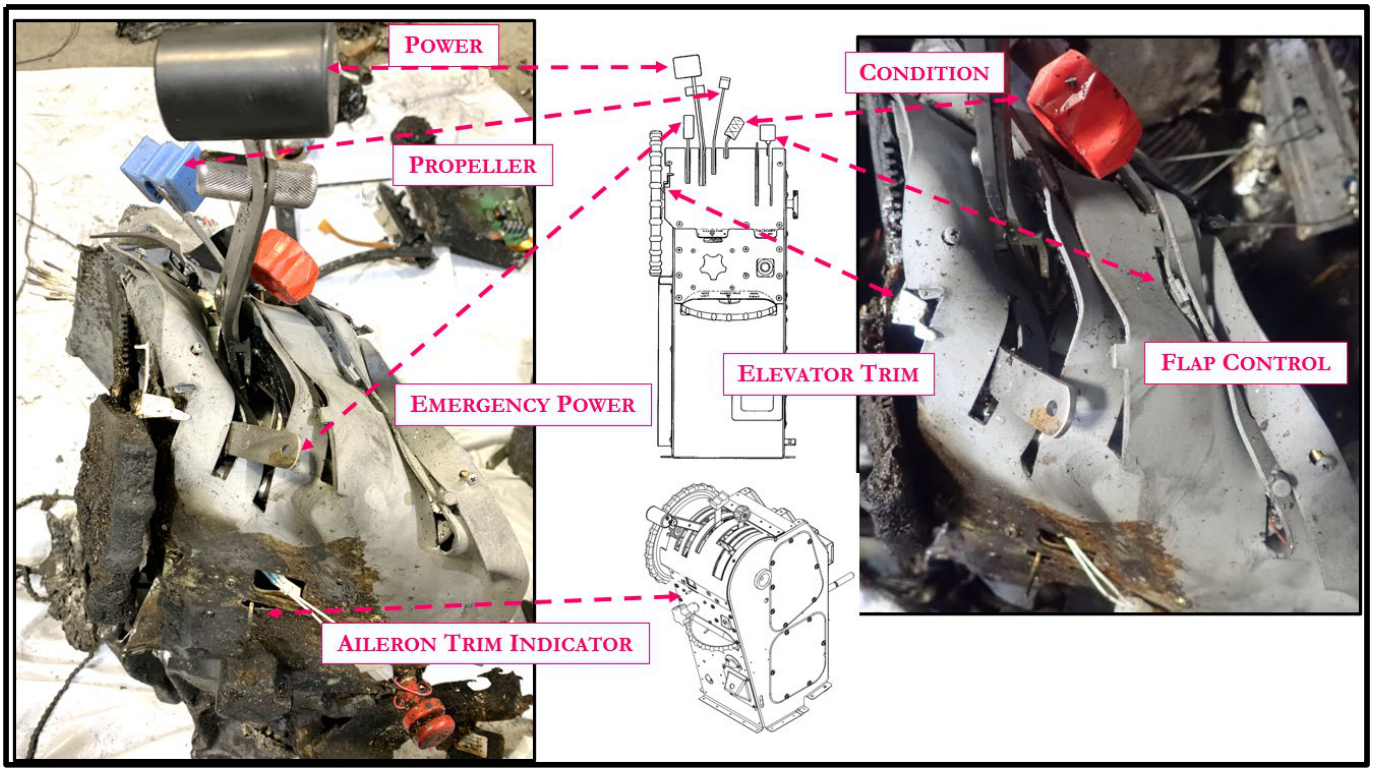


Figure 8: Cockpit pedestal

Of the 5 floor tracks, only portions of the right 3 were located. Those contained areas of molten material and cargo anchor attach fittings. Investigators found tracks with molten material consistent with where the operator reported the aft right seat, bench, and ballast anchors were located. All seats were consumed by fire. The pilot's seats were not attached to their respective seat tracks and were reportedly removed by first responders. The crush deformation was consistent with the airframe crush deformation of a downward right moment.

The fuel selector handles were unreliable. Numerous ratchet bodies were found within the molten ash of the wreckage and one appeared to be open. The flap standby switches were burned.

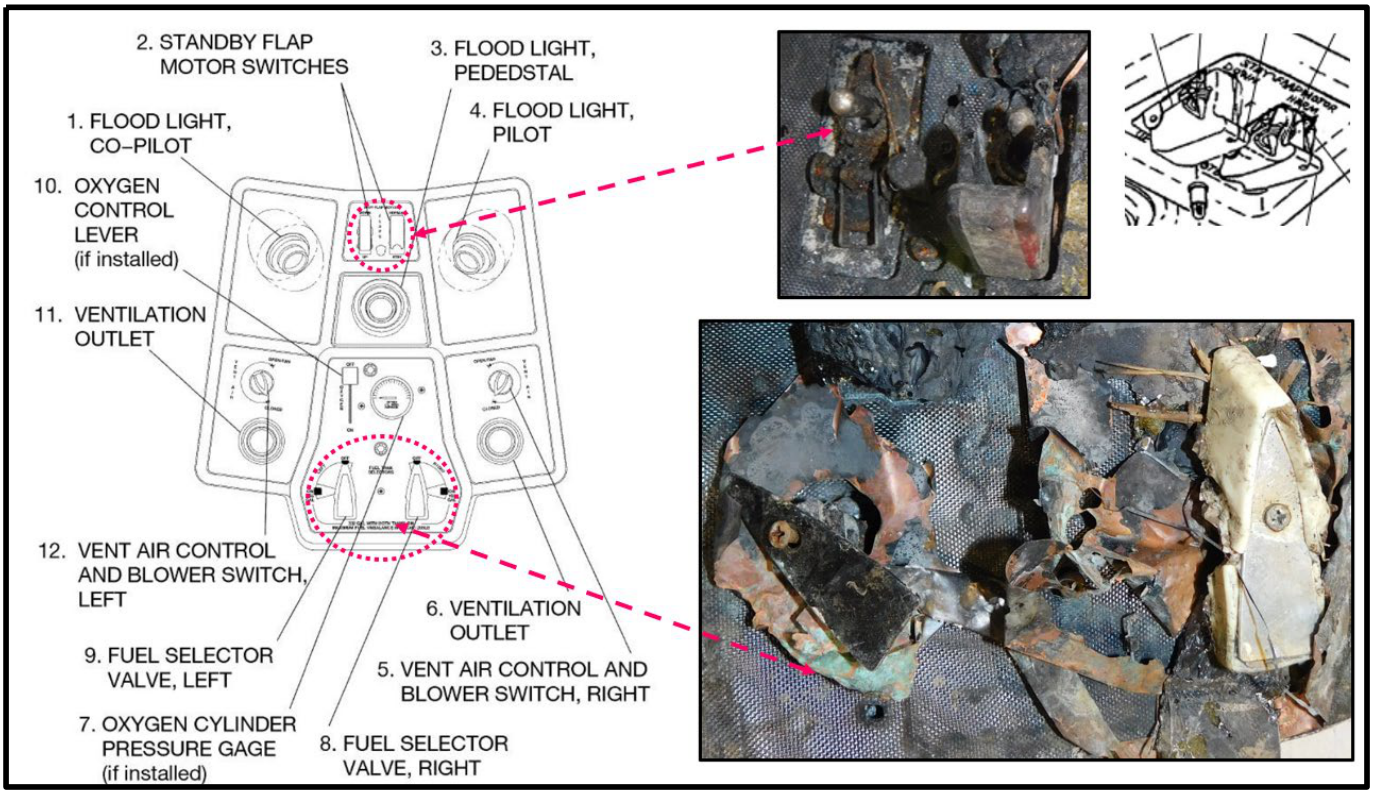


Figure 9: Fuel selectors and standby flap switches

The upper left and right cowling was relatively clean on the inside and the right nose cowling contained a divot about 12" that was oriented along the longitudinal axis.

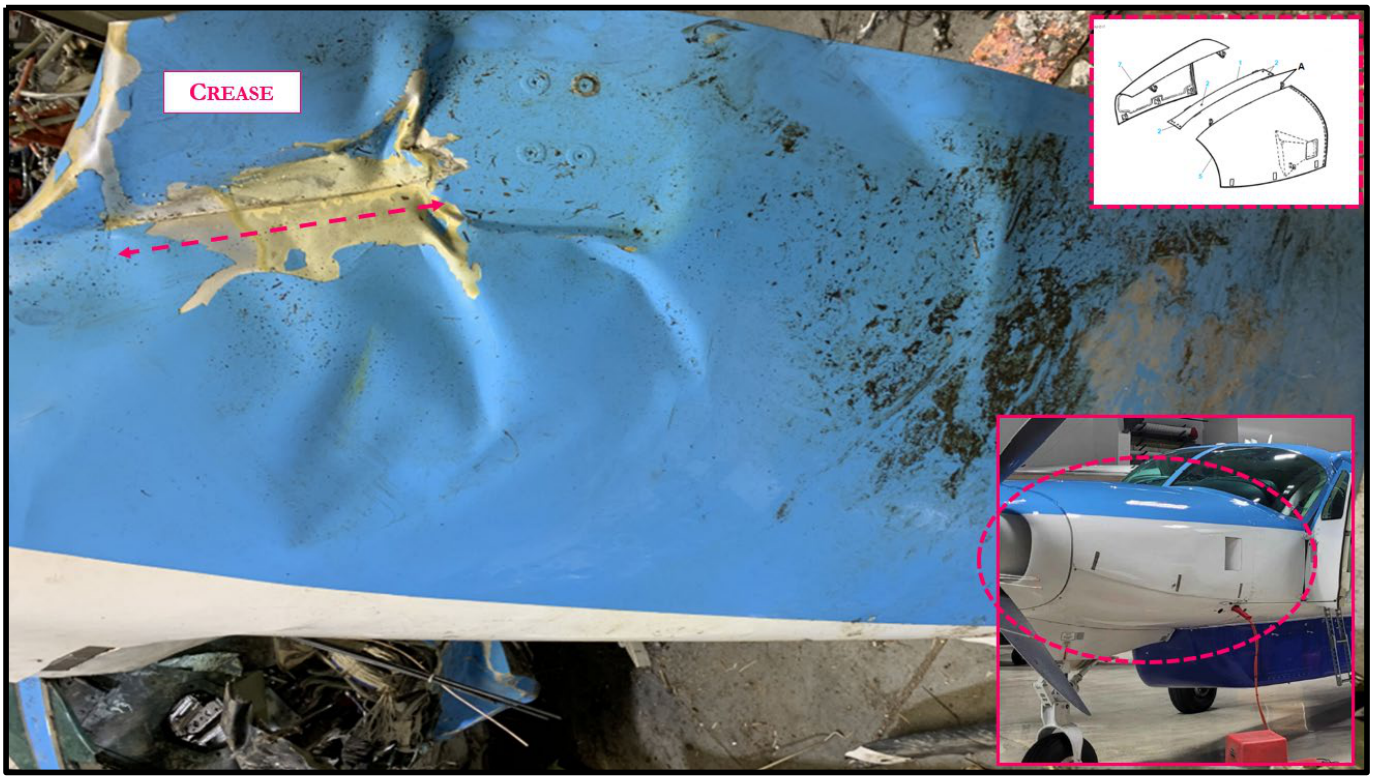


Figure 10: Left upper nose-cowling

Figure 11: Upper right nose-cowling (photo of the intact airplane provided by Robert Elkelenboom)

WINGS

The wing assembly consisted of all metal left and right removable panels, each braced by a lift strut and attached to the fuselage on each side with bolts through holes in attach fittings in both fuselage and inboard ends of wing spars. The structure of each wing panel was of conventional, semi-monocoque design employing a front and rear spar, ribs, stringers, and skins. Each wing panel also incorporated a sealed, integral fuel bay, a flap, a balanced aileron, and a slot-lip spoiler. The wing's main frame structure consisted of a front and rear spar assembly, center ribs, and upper and lower skins. The spars were of bonded and riveted construction and stringers between spars were bonded to interior wing skins. Spar caps were extruded angles riveted and bonded to sheet metal webs. The front spar incorporated a special forged fitting and formed channel assembly for lift strut attachment.

The wings and their respective fracture surfaces were thoroughly documented by the Structures Group.[2]

Examination

The right-wing forward and aft attach fittings separated from the wing but remained attached to the fuselage forward and aft spar. Both attached points were removed to reveal evidence of forward deformation. The forward spar showed overload deformation in upward and forward direction. The lower aft spar cap was deformed in compression folded upon itself.

[2] See Structures Group Chairman Report in the public docket.

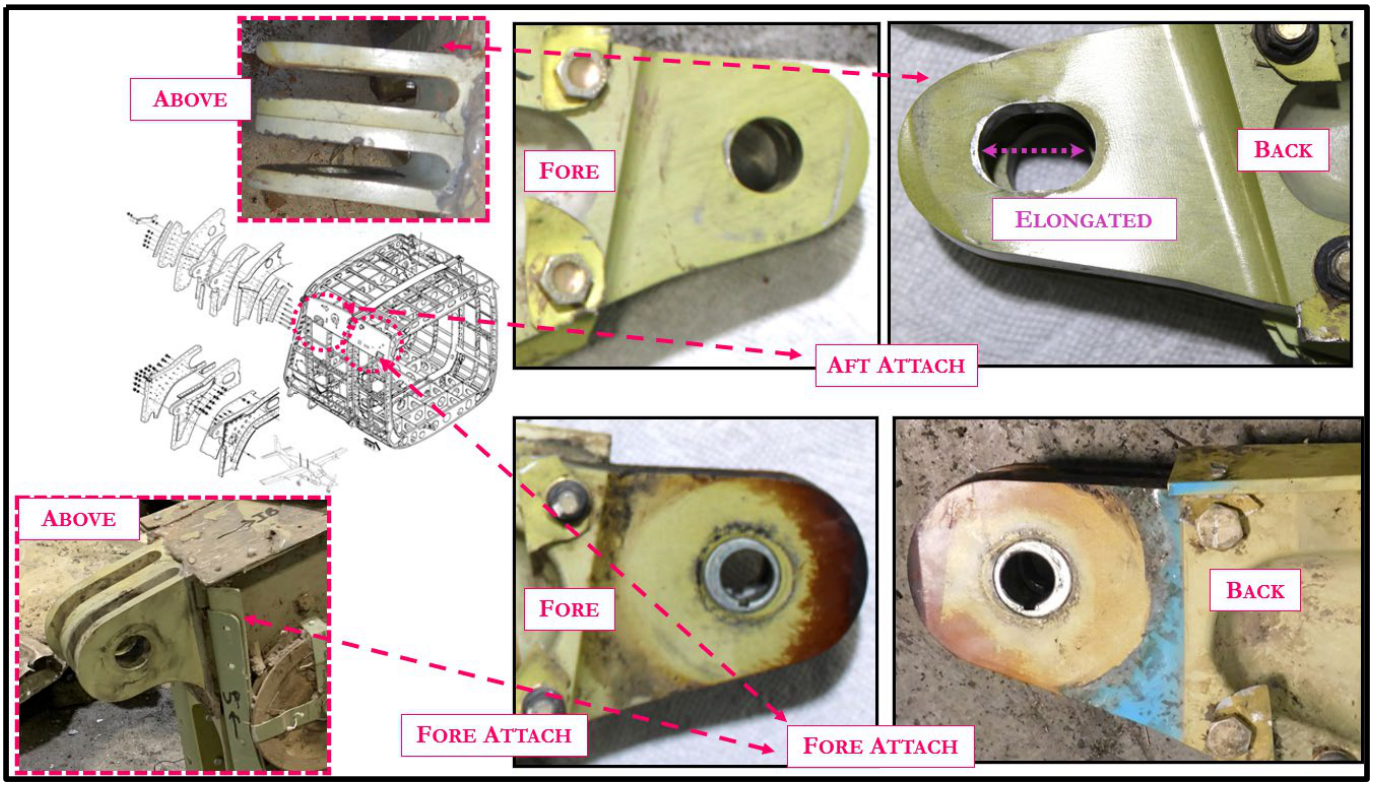


Figure 12: Right wing spar attach points

The right upper strut attach point remained affixed. The lower strut attach point was separated at the lower fuselage attach point. The strut trailing edge surface was deformed in a wavy pattern consistent with buckling. Inside the strut showed an appearance of aft deformation. The bottom strut attach point revealed the forward attach was bent forward.

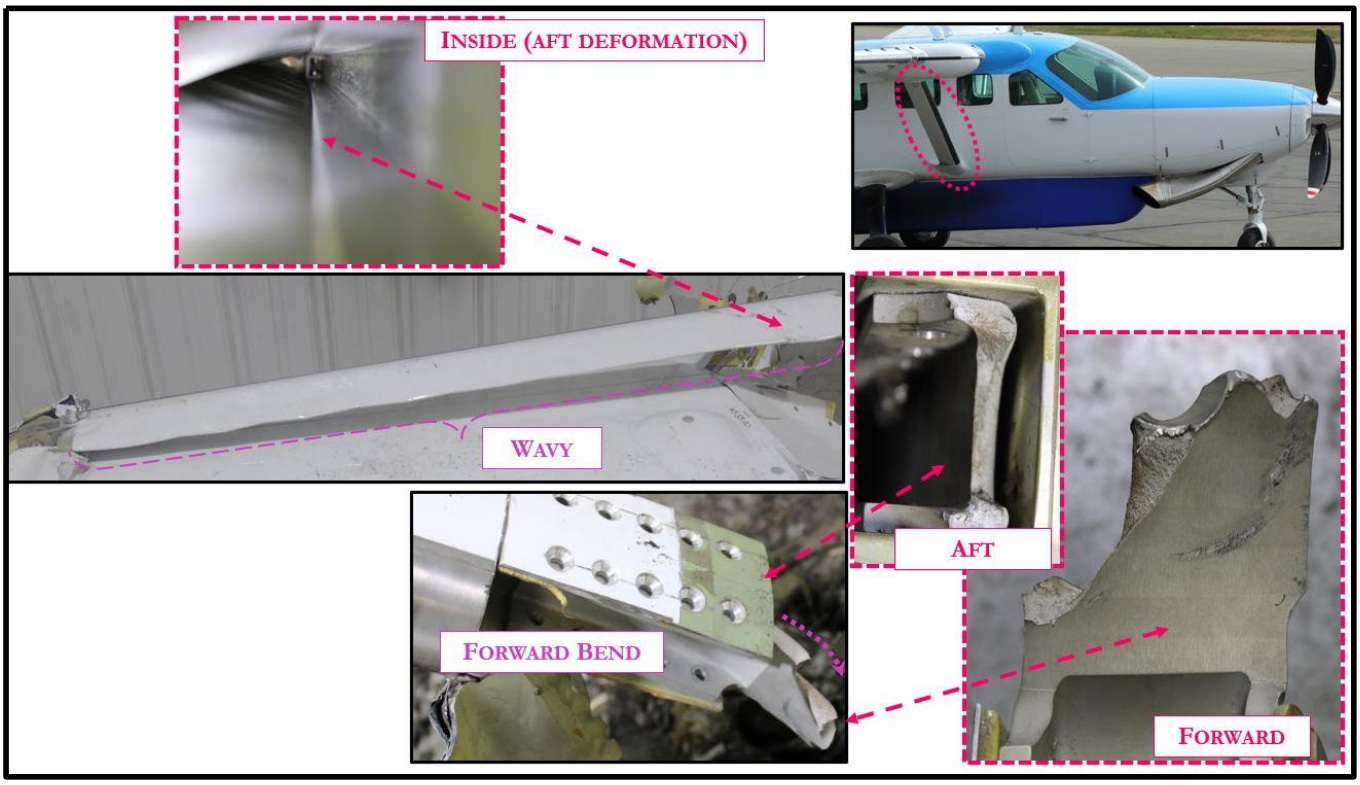


Figure 13: Right wing-strut (photo of the intact airplane provided by Robert EIkelenboom)

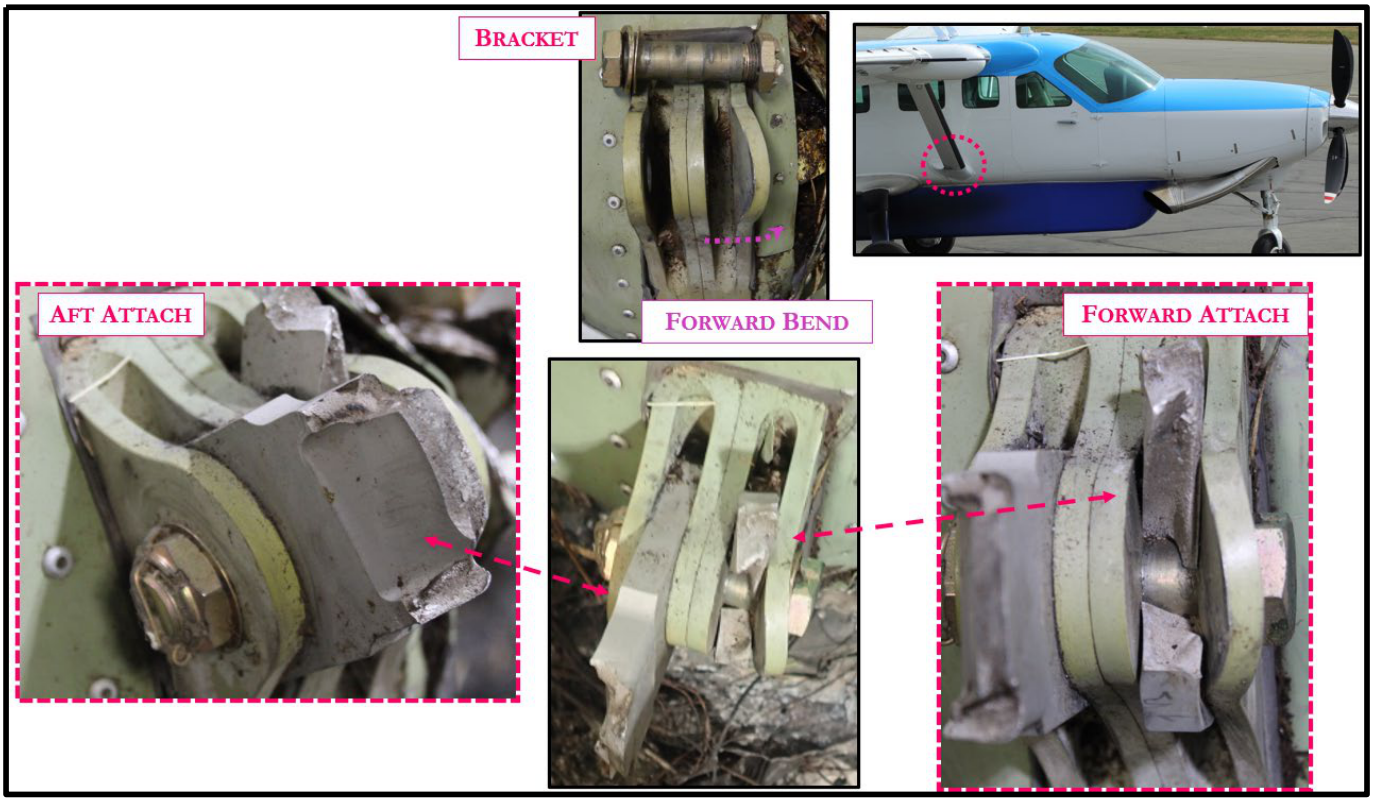


Figure 14: Right lower wing-strut attach point (photo of the intact airplane provided by Robert Elkelenboom)

The inboard section of the left wing was consumed by fire and the remainder of the wing came to rest adjacent to the fuselage. The left wing attach points and root area were thermally damaged and only melted pieces remained as identifiable by the robust fittings (e.g., bolt, nut and cotter pin, etc). The aft wing strut attach point was almost completely thermally consumed with melted metal surrounding the bolt.

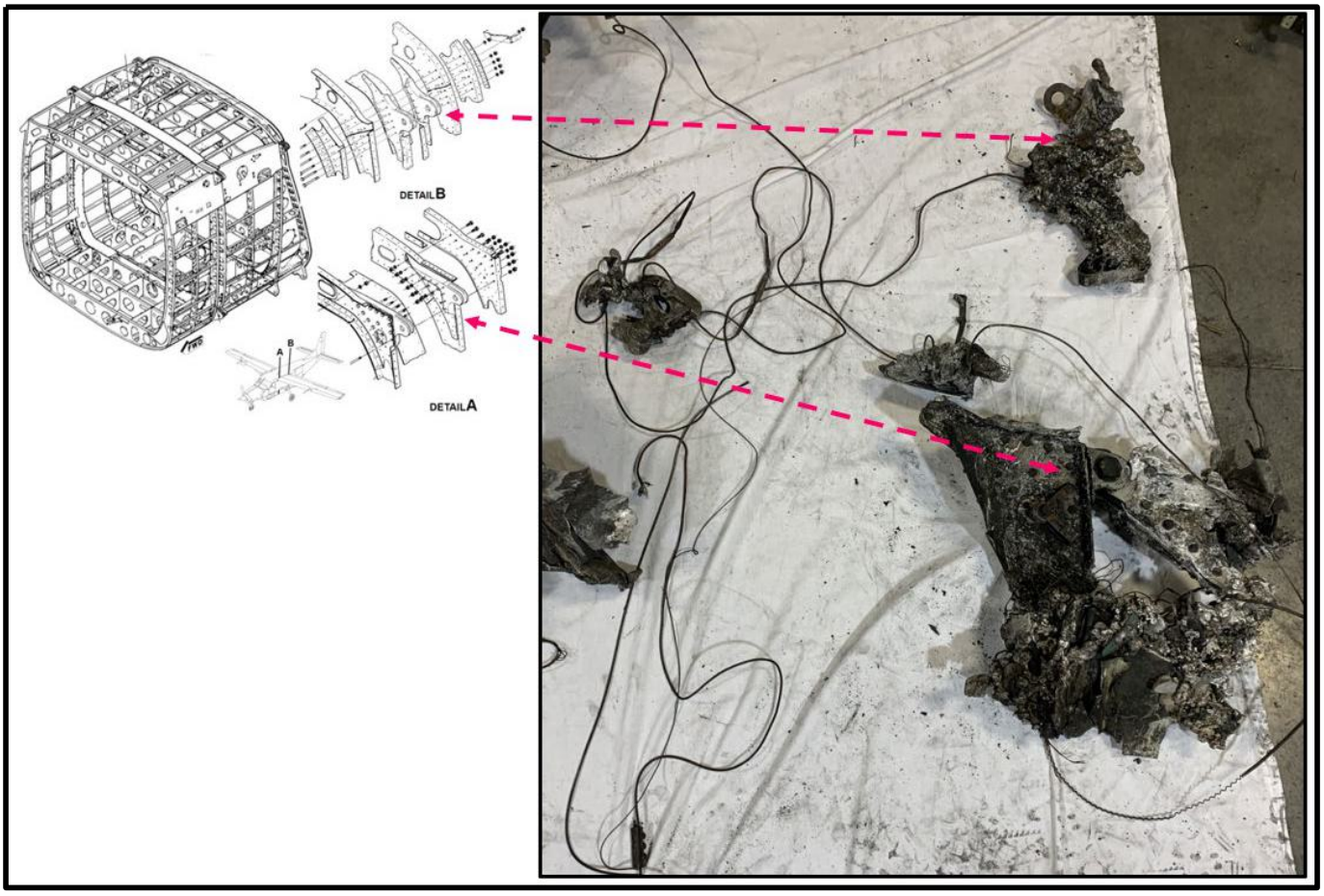


Figure 15: Left wing spar attach points

The right wing was relatively intact, with the aileron and trim tab both attached and undamaged. Diagonal buckling was observed on the upper wing skin, along with distinct parallel mechanical cuts displaying upward-curled edges and black paint transfer. Similar cuts were noted near the wing root, also exhibiting upward curling and paint transfer, consistent with mechanical impact. The most forward and outboard cuts were jagged and consistent in shape with the propeller blade tip.

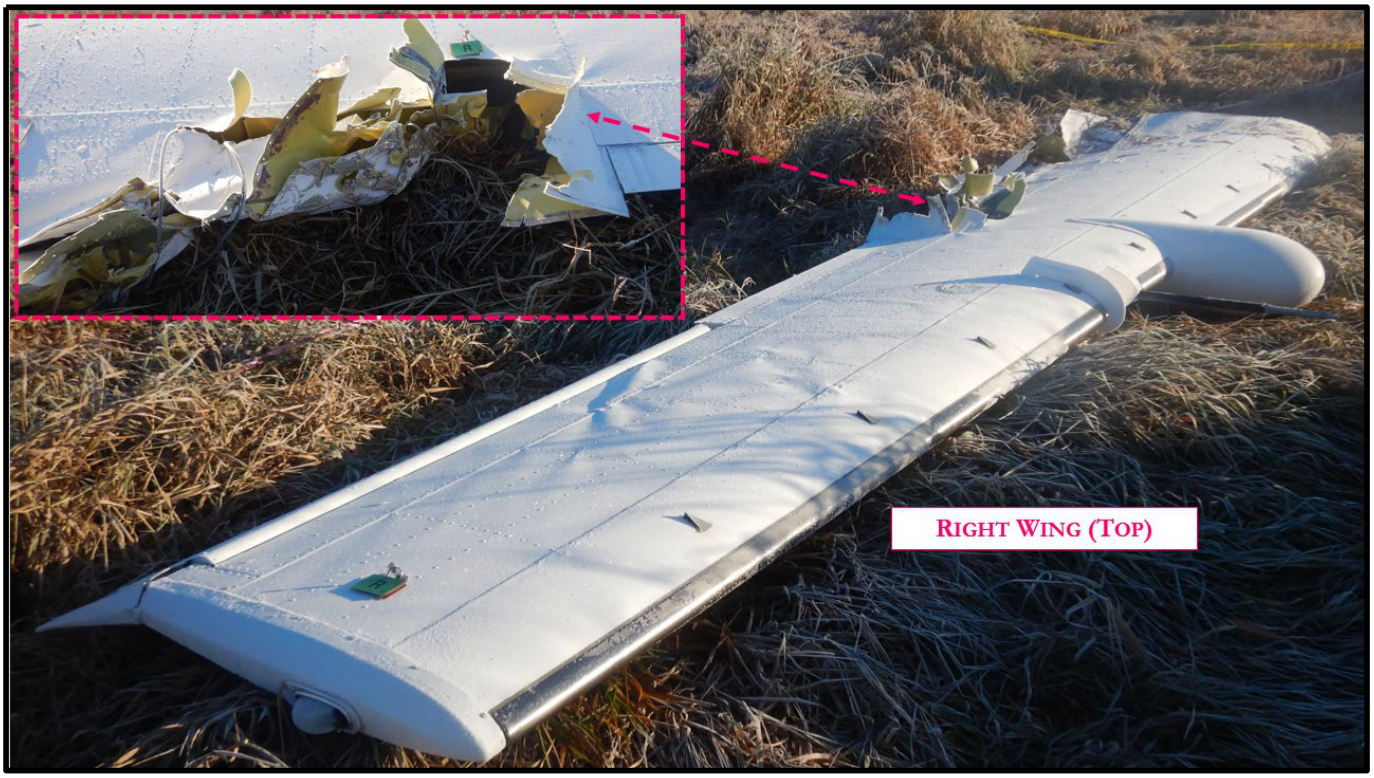


Figure 16: Right wing's upper surface

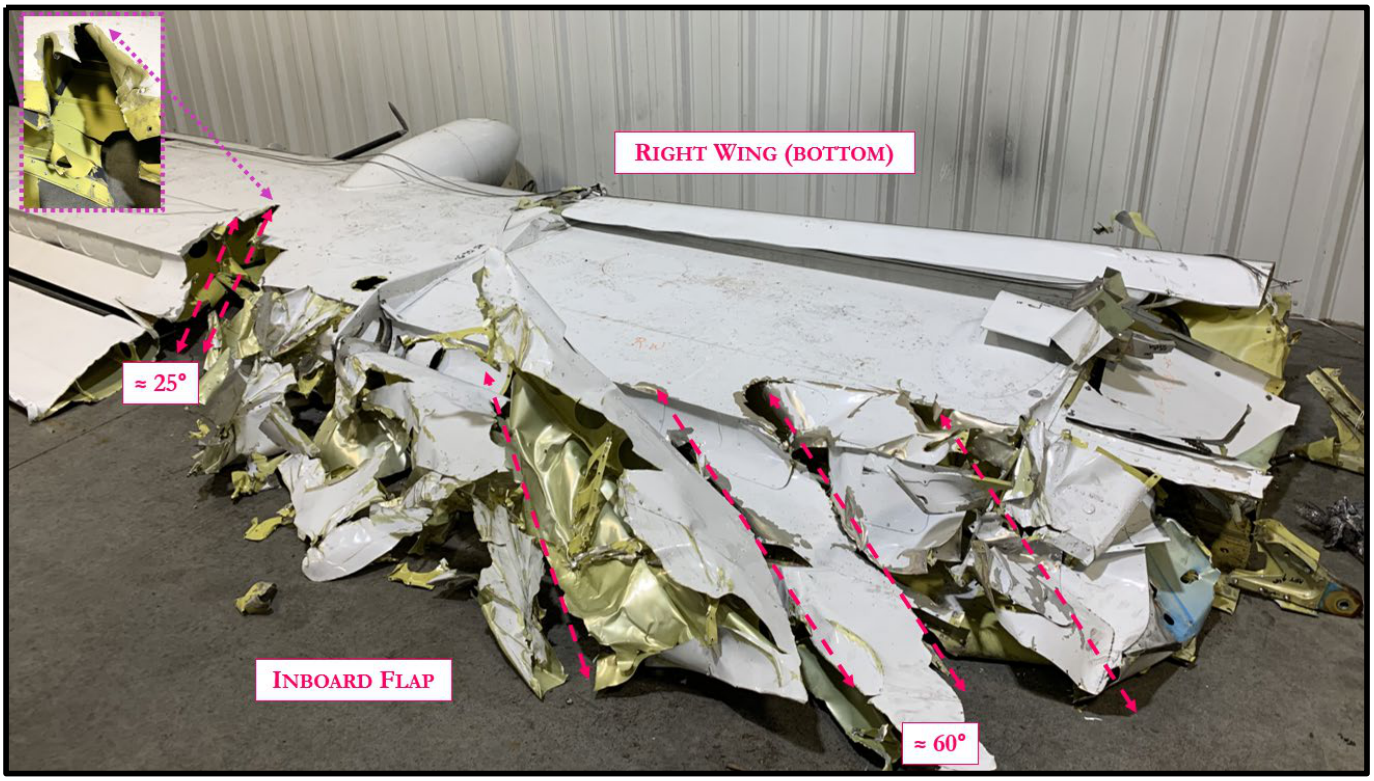


Figure 17: Right wing's bottom surface and flap

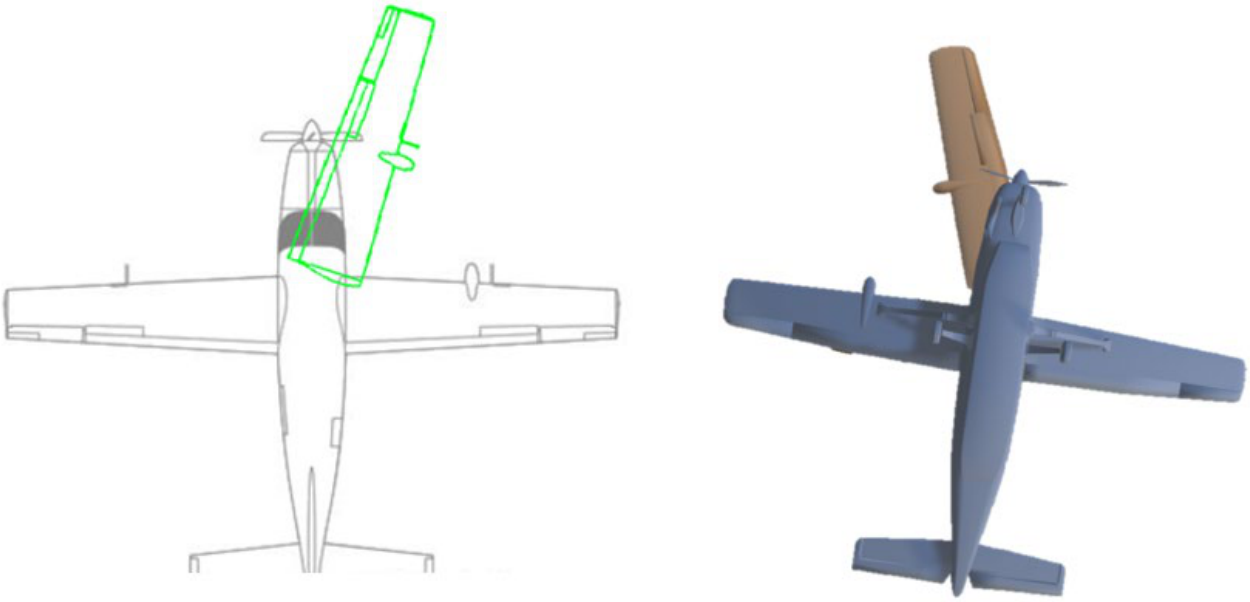


Figure 18: Left: top view; Right: bottom view (showing match with propeller slashes)

AILERONS/SPOILERS

The aileron and spoiler system included several components, such as the ailerons, a right aileron servo-operated trim tab, a left aileron servo tab, and the left and right spoilers. The system was equipped with a left and right control column, each containing a control wheel, control tube, bearings, and a quadrant. An interconnect cable connected the left control wheel to the right control wheel. The aileron control cable was divided into two loops. The low-tension loop, located in the fuselage, extended from the left quadrant under the floorboards, up the left sidewall to a bellcrank in the cabin top, across the cabin top to the right sidewall, down to the floor, and back to the left quadrant. The high-tension loop was located in the cabin top and extended into the left and right wings, where it interconnected with the left and right wing bellcranks. Aileron and spoiler pushrods connected the wing bellcranks to the ailerons and spoilers. During full aileron down travel, the spoiler moved down by three to four degrees, and during the first five degrees of up aileron travel, it moved up slightly, then increased proportionately as the aileron moved further up.

The aileron trim system was composed of several components. The trim wheel, located on the center pedestal, provided manual input to the trim system. From the trim wheel, sheathed cables were routed through the windshield center post and out to the right wing. These sheathed cables were connected to chains that wrapped around trim tab actuators, which were, in turn, connected by integral pushrods to the aileron trim tab. These actuators served to alter the trim tab position.

Examination

The left wing's aileron control surface remained attached, with the inboard aileron control tube still connected to both the control surface and the aileron bellcrank. The bellcrank had dislodged from the lower bearing and was loose in its housing, though the stop remained intact with no noted anomalies. The spoiler control rod end was attached to the bellcrank, and the control cables were connected to their respective bellcrank horns and remained continuous outboard to the root. The aileron system in the cabin experienced thermal damage at various points between the control column and the wings, resulting in fragments of control cable, turnbuckles, and pulley remnants that prevented continuity verification.

The left control column had separated due to thermal damage, though the bolts at the base remained intact. The control column held trapped swaged ends, and the control wheel tube had melted free from its rotating mount. Upon alignment of the melted surface fractures, investigators found the control yoke frozen in a near-vertical alignment, consistent with full left aileron deflection. The left fuselage pulley, attached to a melted piece of the airframe, suffered thermal damage, with no aileron cable present.

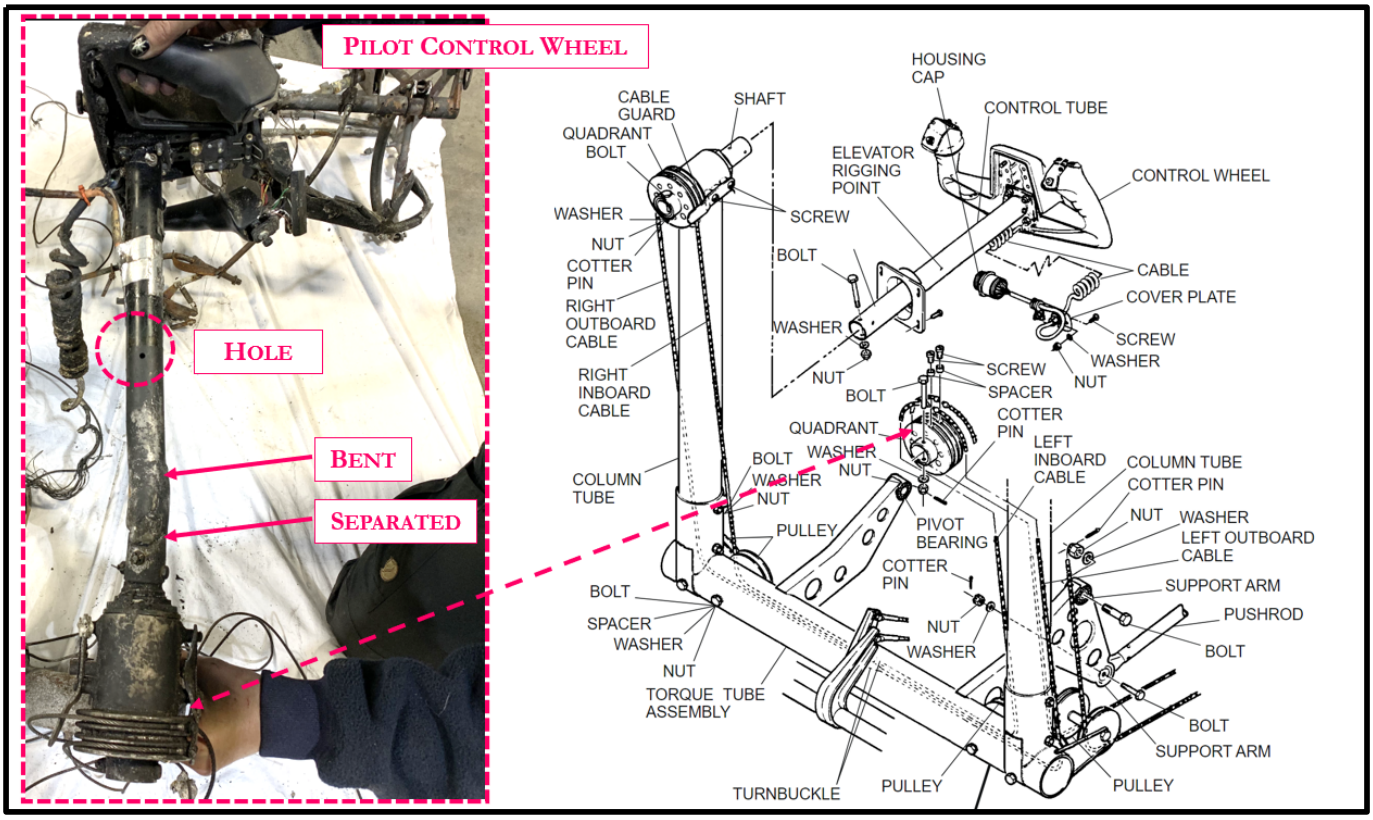


Figure 19: Left control column

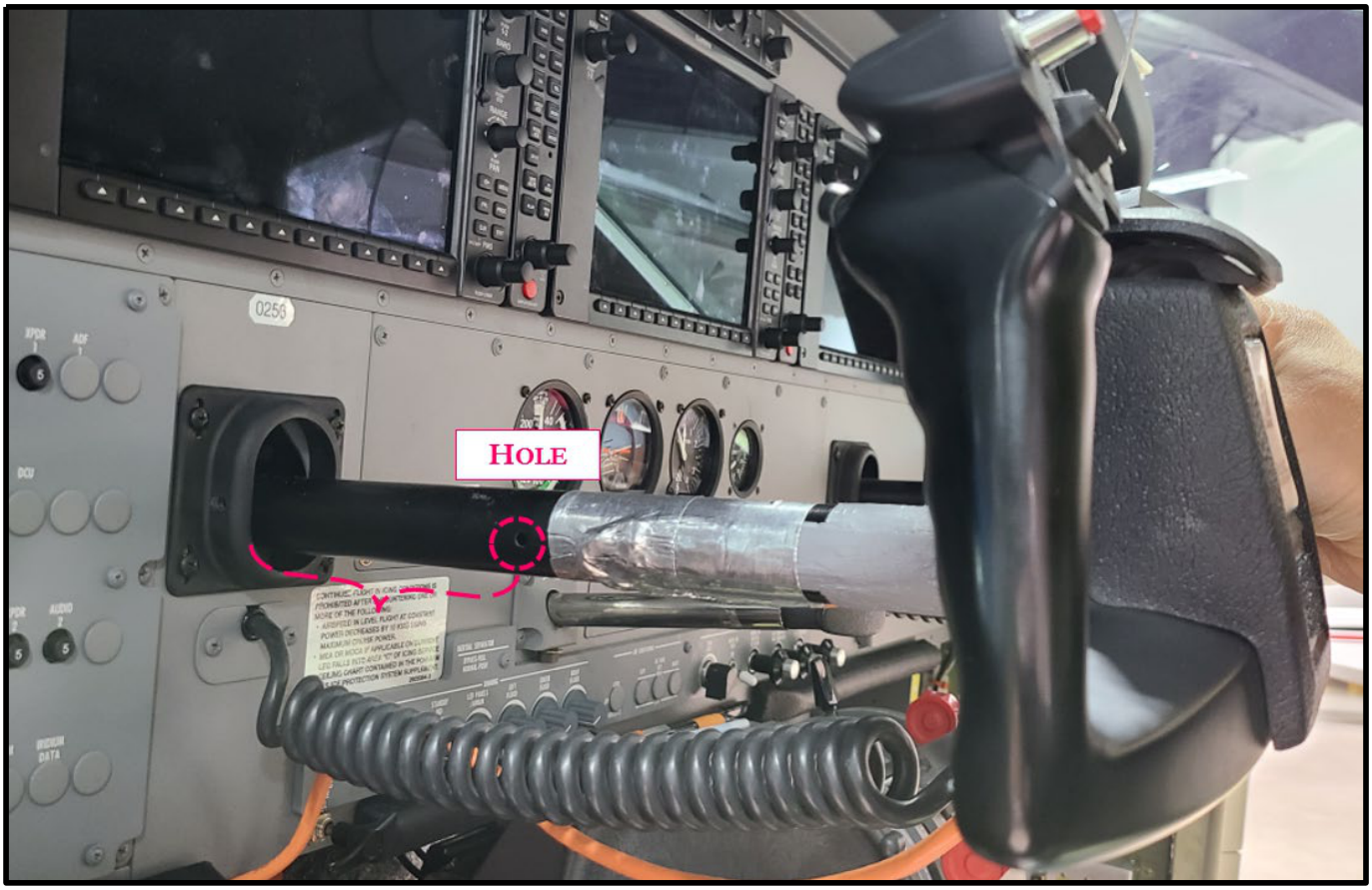


Figure 20: Control column in full aft position

The right control column remained attached, with the pulley unburned. One control cable with two ends was located in the aft channel, while the forward channel contained no control cables, and the screw appeared loose, showing signs of being pulled from the collar. The control yoke tube had broken from its rotating mount, and both control yoke horns were detached from their base. There was no evidence of frictional entrapment on the control yoke tubes, though slight bending was observed aft of the elevator rigging point hole (hole), consistent with the control yokes being fully aft during impact.

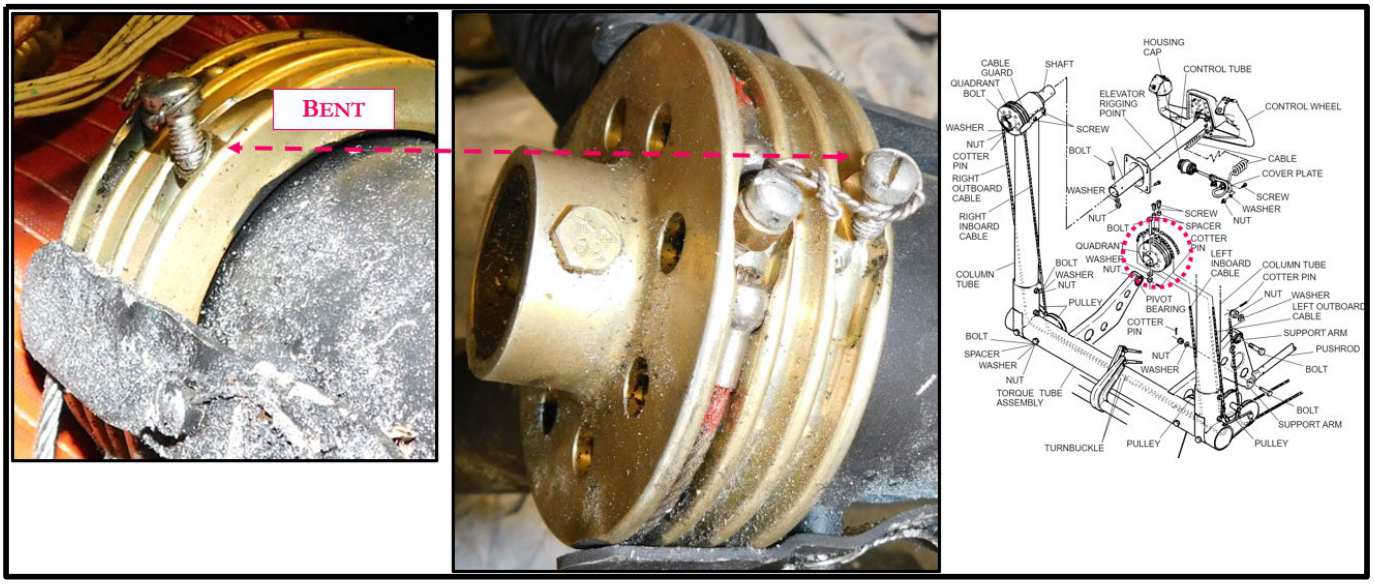


Figure 21: Right control column pulley

The right aileron remained attached at its fittings, with the trim tab measured at 1 7/8 inches, corresponding to a 5° tab-down position, as noted by a Cessna representative. The trim tab control cables were affixed to the chain ends, which were engaged on the sprockets in the actuator. The trim tab cables continued inboard for approximately 10 feet 11 inches until severed near gashes in the wing, consistent with propeller contact. The aileron trim selector position was in the full left position.

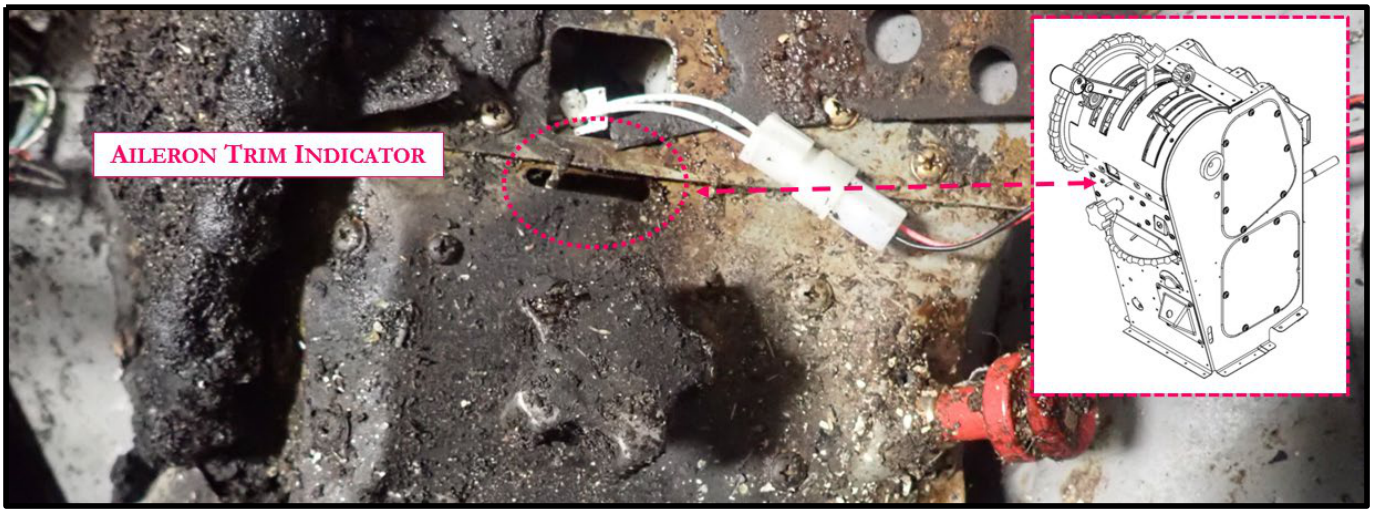


Figure 22: Aileron trim position indicator

The right aileron attach fittings were intact, and the aileron control tube was continuous to the bellcrank. The bellcrank's upward attach point remained affixed, while the bottom lobe had dislodged from the bearing on the bottom wing skin. The forward and aft aileron control cables were attached to the bellcrank, with the spoiler also attached. The aft bellcrank cable attach point had dislodged from the stop, which showed deformation in an aft direction. The bellcrank stop surface contained a divot consistent with wear from the stop. The aileron cables were continuous inboard to the wing root, where they were frayed and displayed a broom-straw appearance, consistent with overload.

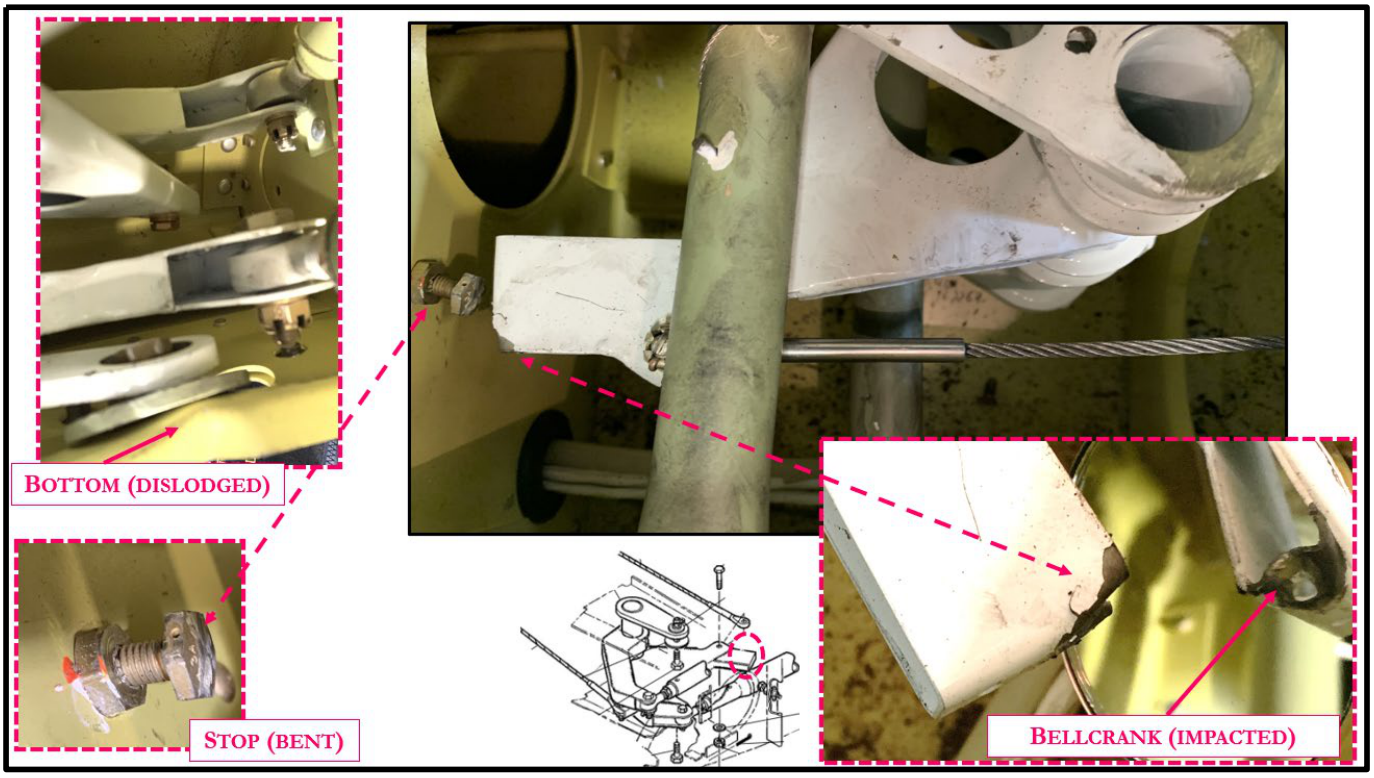


Figure 23: Right aileron bellcrank

FLAPS

The flap system in the aircraft consisted of both mechanical and electrical components. The flap control lever, located on the control pedestal, provided input to the flap switch actuator, which in turn controlled the primary flap motor. The flap actuator assembly drove a bell crank positioned in the root of the right wing. The flaps were connected to the right inboard forward bell crank through a series of pushrods, connecting rods, interconnecting rods, and additional bell cranks. The system also included a standby system, which consisted of an independent switch and motor.

The flap control lever allowed the pilot to select any flap position between 0 and 30 degrees, with detents at the UP, 10, 20, and FULL down settings. When there was a difference between the selected and actual flap positions, one of two micro switches located on the flap switch actuator closed. This closed micro switch actuated a relay, applying power to the primary motor and turning it in the proper direction. The motor then turned the actuator drive screw, moving the stop nut attached to a tube connected to the right inboard forward bell crank. As the tube moved, it rotated the right inboard forward bell crank, which in turn rotated the left inboard forward bell crank through the wing-to-wing interconnect rod. The inboard forward bell cranks rotated corresponding inboard aft bell cranks via interconnect rods. Connecting rods from the inboard aft bell cranks then rotated the outboard bell cranks. Pushrods connected the flaps to both the inboard and outboard bell cranks near the inboard and center flap tracks, respectively. The outboard flap travel was assisted by a cable attached to the inboard aft bell crank. When the flap position matched the selected position, the micro switch in the flap switch actuator opened, disengaging the corresponding relay and stopping both the motor and the flap movement. A follow-up cable provided a flap position indication through a pointer on the control pedestal. The flap system was also equipped with a standby motor, which could be used in the event of a failure in the primary system.

The standby system was controlled by two toggle switches mounted in the overhead console. Before using the standby UP/DOWN switch, the STBY FLAP MOTOR switch had to be set to the STBY position. When the STBY FLAP MOTOR switch was in the NORM position, the primary flap motor was connected and operational, while the standby flap motor was disconnected and non-operational. Conversely, when the STBY FLAP MOTOR switch was set to the STBY position, the standby flap motor was connected and could operate, while the primary flap motor was disconnected and could not operate.

Examination

The right wing flap was severely fragmented, exhibiting numerous diagonal cuts that created a saw-like pattern. The outboard flap attach point was deformed, and the corresponding flap surface remained intact for about 6 feet. The inboard portion of this section was cut diagonally, with a rough and jagged edge that extended up into the flap.

Five fences remained attached to that section of the flap. The mid-flap attach point remained affixed to a section of the control surface measuring approximately 3 feet. The control rod was bent inward and remained attached to the bell crank, with the control rod at the bell crank continuing inboard. The inboard flap attach point was deformed, and the control surface was not attached. The flap motor jackscrew, located in the upper cabin, was found flush, consistent with the flaps being fully down.

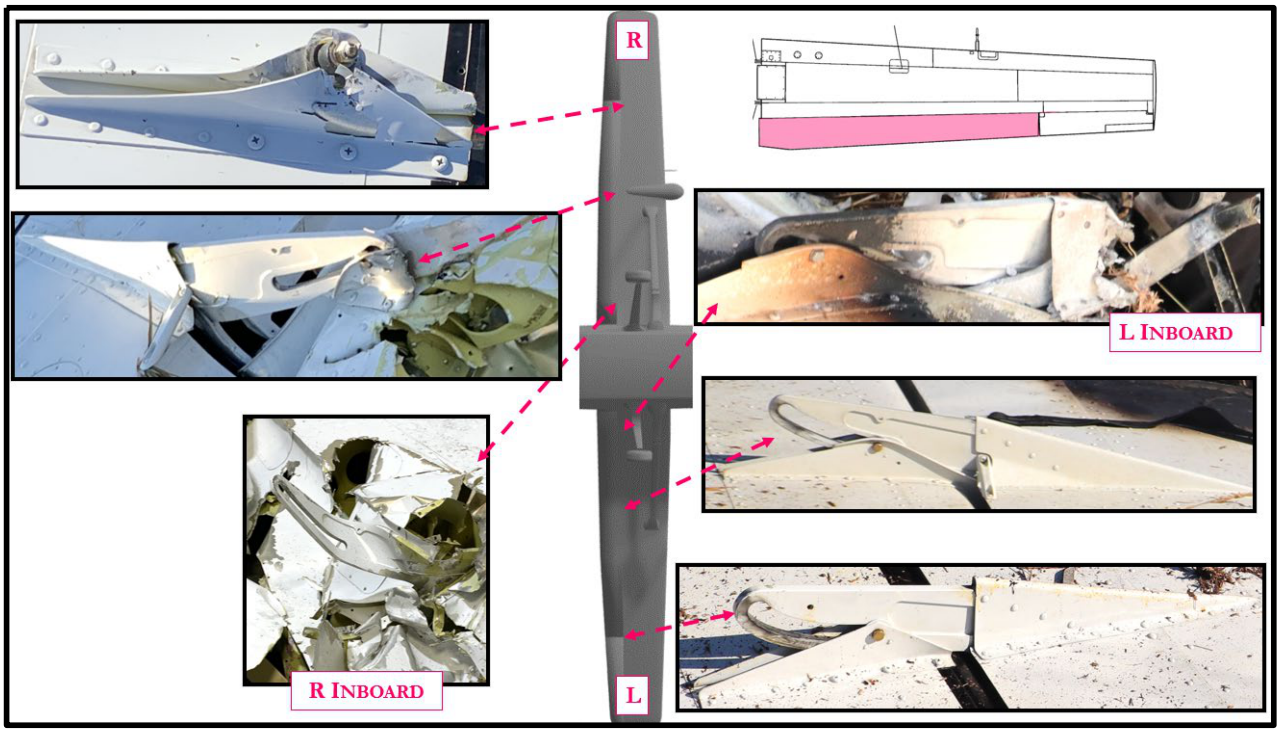


Figure 24: Flap attach points

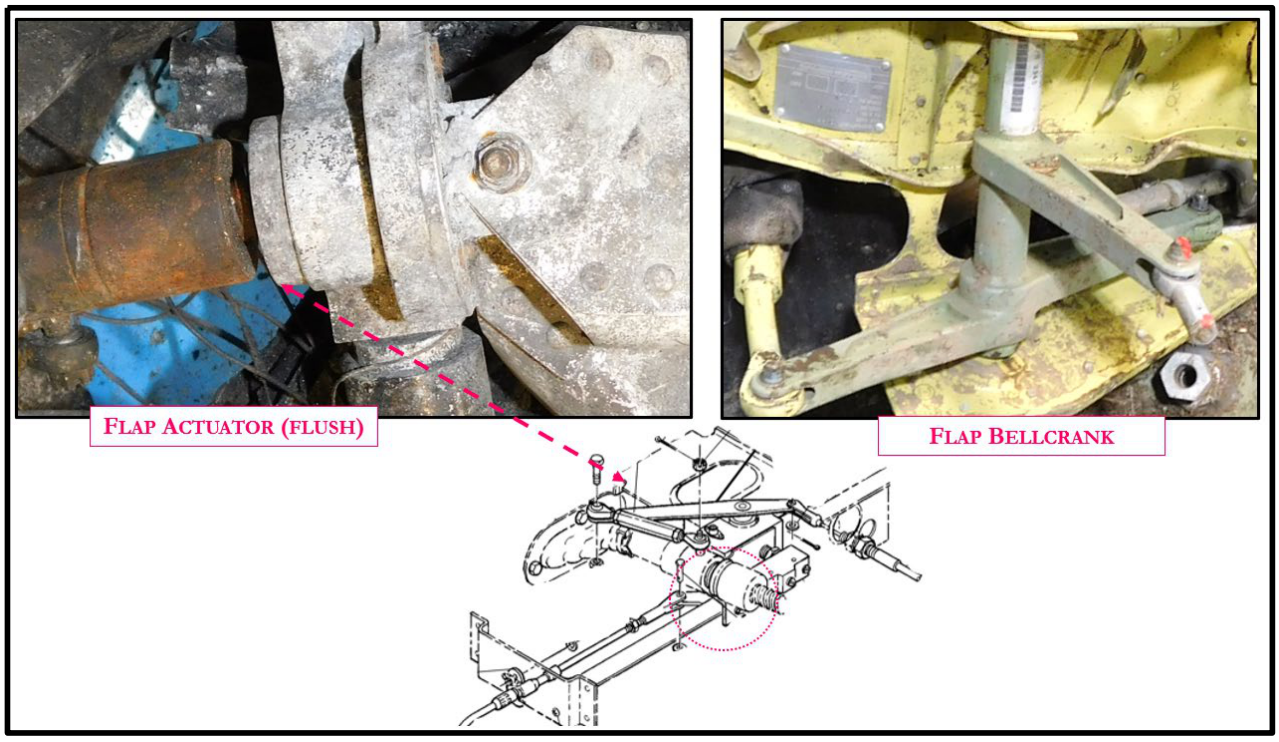


Figure 25: Flap actuator and bellcrank

HORIZONTAL STABILIZER/ ELEVATOR

The elevator was controlled by a control column support that connected to a pushrod, which in turn was connected to a bellcrank. The bellcrank had left and right arms, each equipped with links attached to cables. These left and right cables were routed under the floorboard and connected to turnbuckles in the tailcone. A second set of cables, also connected to turnbuckles, was routed to a bellcrank within the tailcone. A pushrod then connected the bellcrank to an elevator torque tube. The rest of the system comprised pulleys, cables, supports, and attaching hardware.

The elevator trim tab was located on the trailing edges of both the right and left elevators. The tabs were manually actuated by rotating a trim wheel, which was located on the left side of the control pedestal. The system consisted of a trim control wheel attached to a sprocket and a roller chain attached to up and down cables. These cables were routed under the floorboard, through pulleys, and into the tailcone of the airplane, where they were connected to roller chains attached to sprockets on the left and right trim tab actuators located in the horizontal stabilizers. Two pushrods connected the left and right actuators to the trim tabs.

Examination

The elevator control cables were attached at the mixing bar and continued aft to the empennage. The control tube was attached to the bellcrank but had separated at the aft bulkhead. The remaining section of the control tube was still attached to the aft elevator bellcrank. The elevators had separated from the circular tubing, with the rivets sheared and the right elevator control tube torn downward. Both elevator control surfaces were separated from the entirety of the control tube.

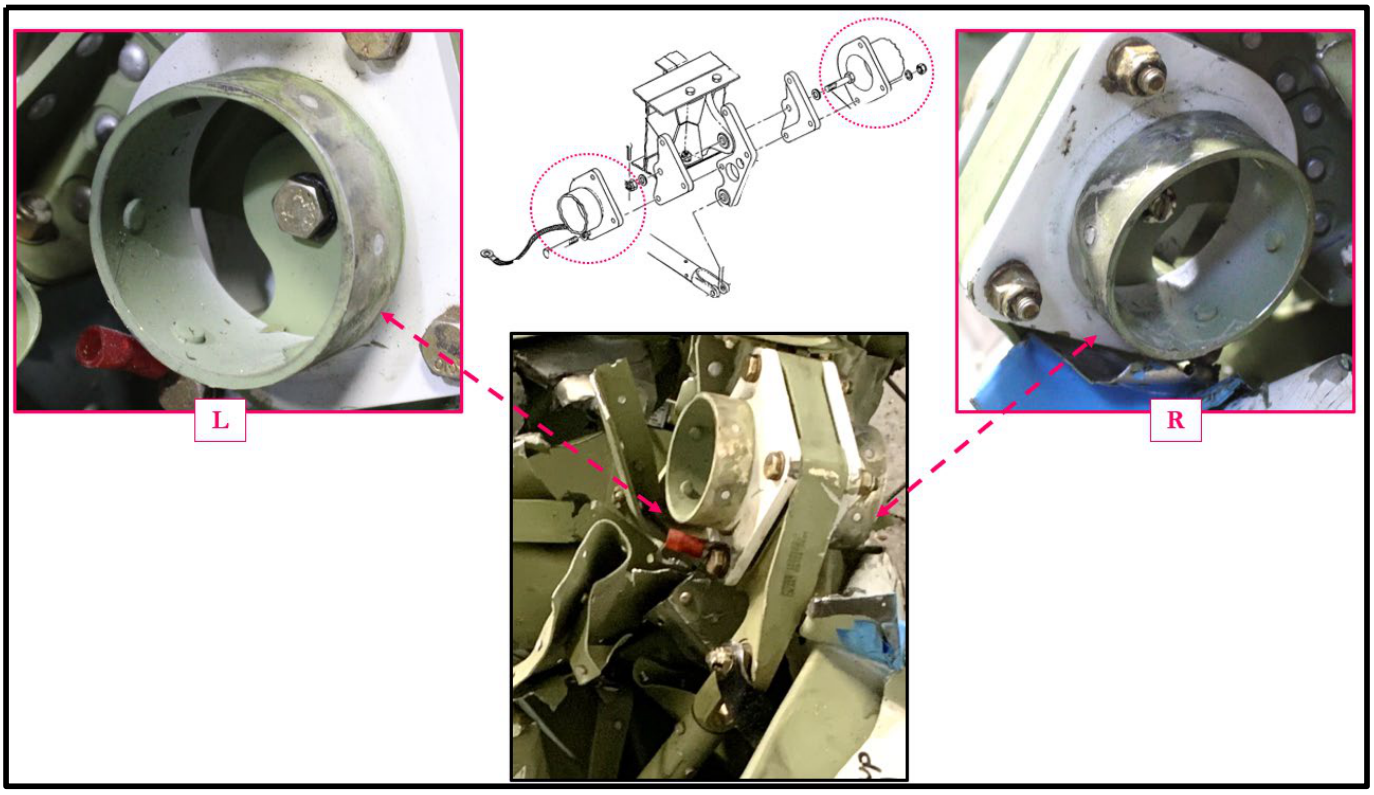


Figure 26: Elevator control tube center (showing push rod forward)

The left elevator remained intact but had torn at the mid and aft attach points. The left horizontal stabilizer contained the actuator, which Textron Aviation found the left elevator trim tab trailing edge down (airplane nose up). The inboard webbing and spars exhibited downward bending consistent with a negative load.

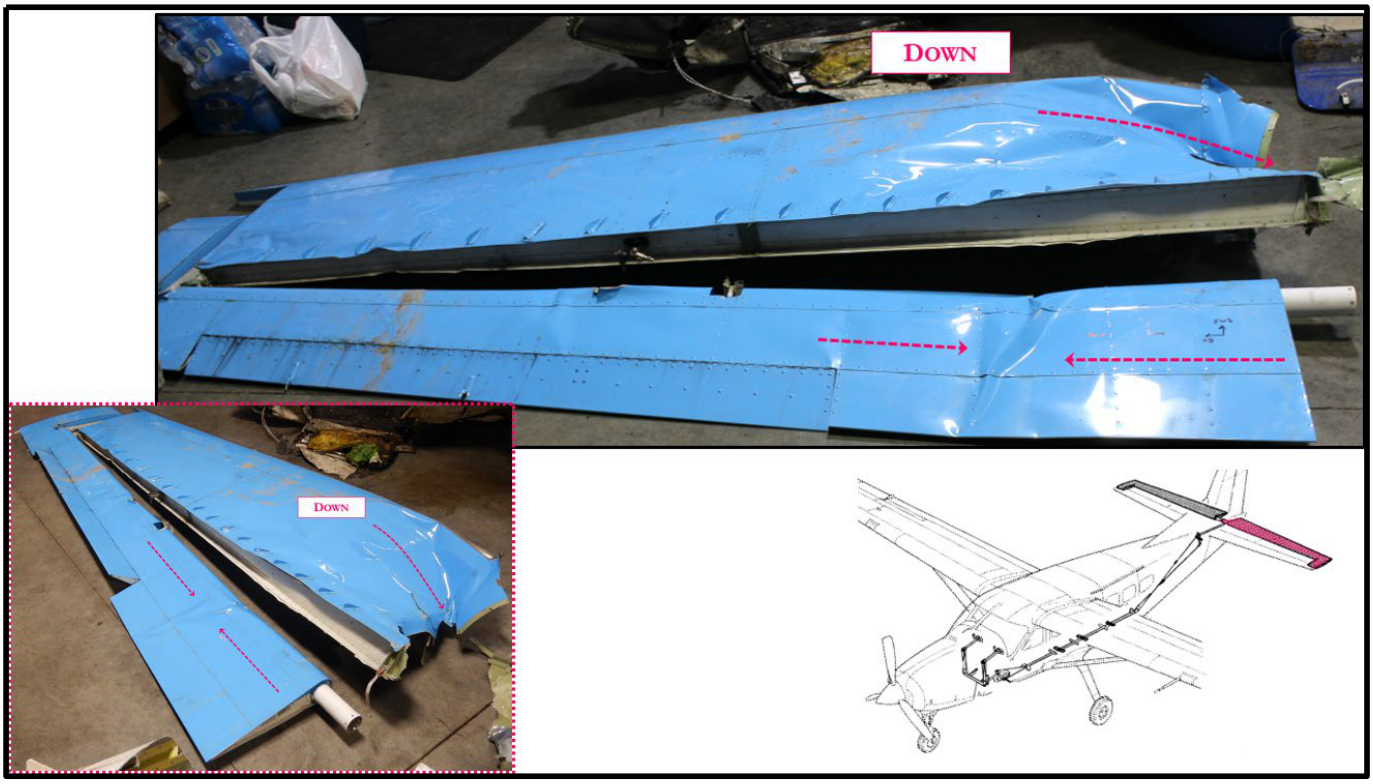


Figure 27: Left horizontal stabilizer and elevator (upper skin)

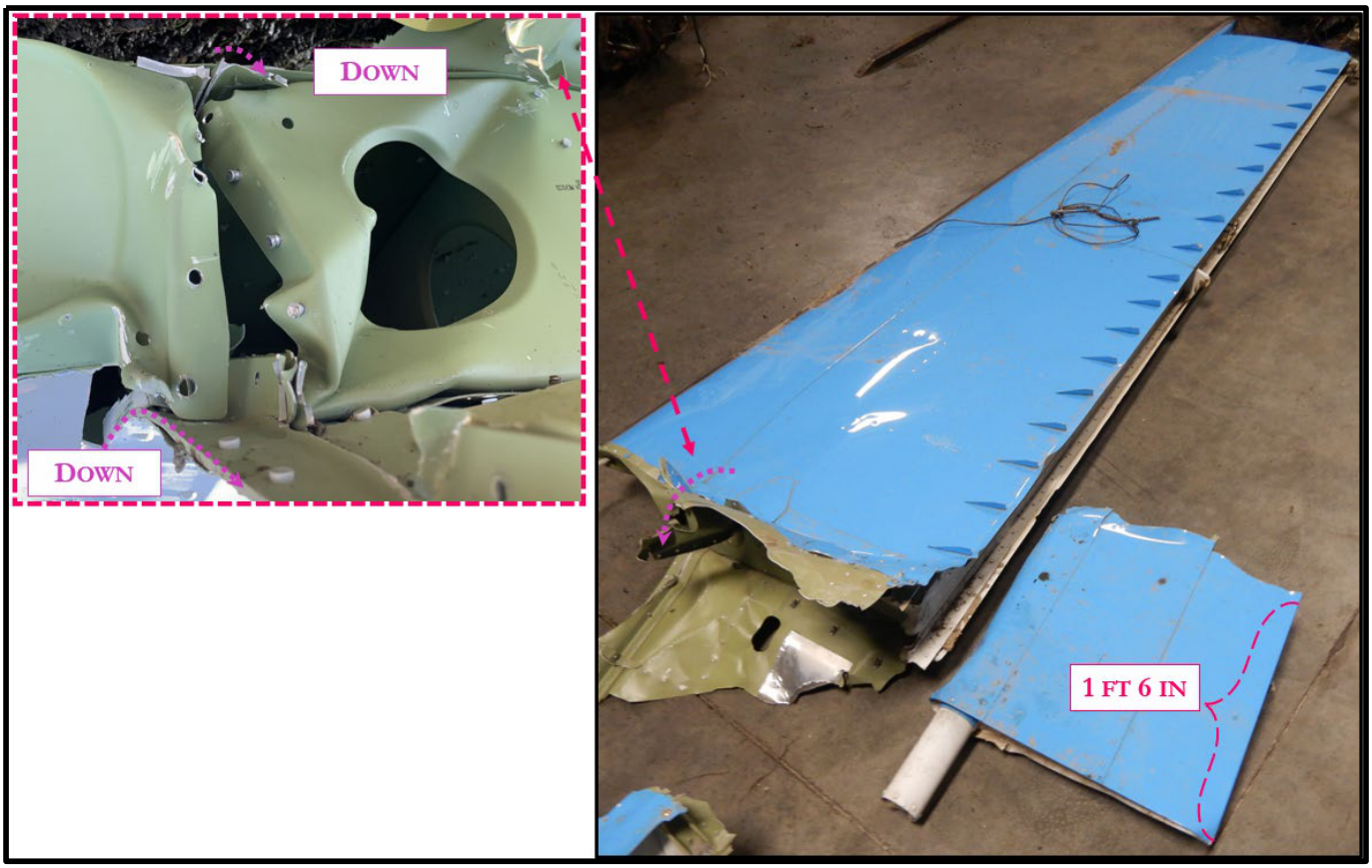


Figure 28: Right horizontal stabilizer and elevator (upper skin)

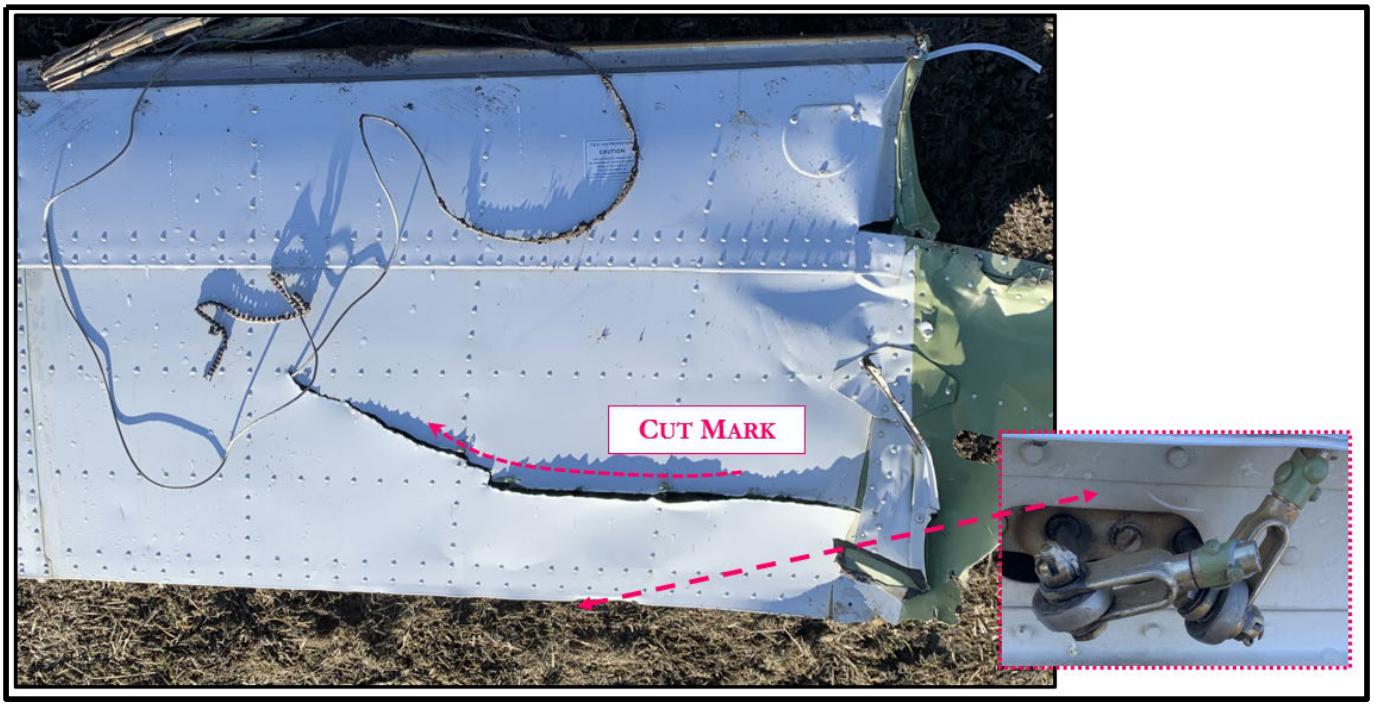


Figure 29: Right horizontal stabilizer (lower skin and elevator attach point)

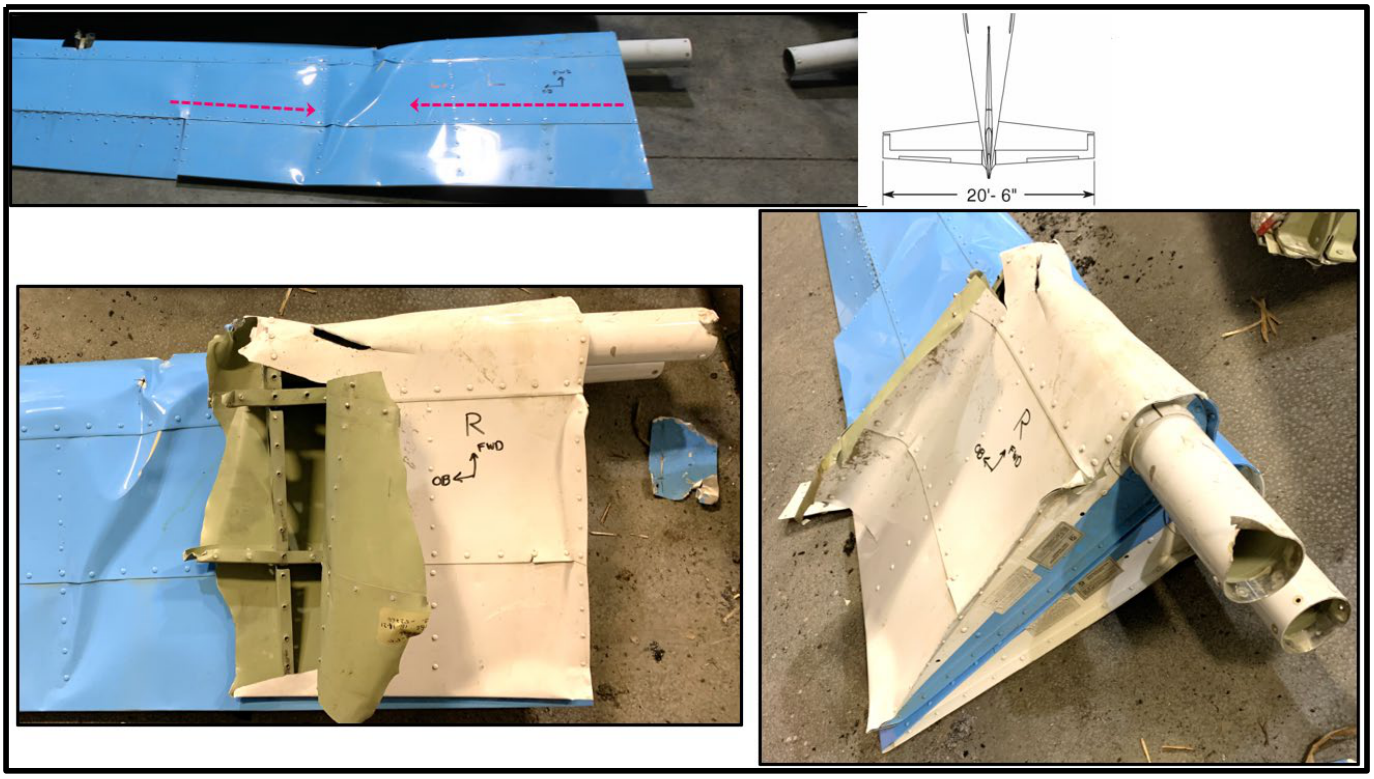


Figure 30: Comparison of the inboard right and left elevator bends (left upper elevator and bottom right elevator)

Only a portion of the right elevator, part number 2634000-70, was located, with the most inboard piece found measuring about 1 foot 6 inches. The left horizontal stabilizer remained intact, with the elevator attached at both the outboard and midsections. The trim cables were separated from the chain and displayed broomstrawing at the sprockets, which showed evidence of crush deformation. The control cable had sawed through the bottom of the right horizontal stabilizer to approximately 30 inches outboard.

The left elevator trim actuator extension was measured at approximately 1 1/2 inches, which, according to a Cessna representative, corresponded to approximately 17 degrees of trim tab trailing edge down (full travel). The right elevator trim actuator extension was measured at approximately 2 5/8 inches, which corresponded to approximately 17 degrees of trim tab trailing edge up (full travel).

VERTICAL STABILIZER/ RUDDER

The rudder system included the pilot's and copilot's rudder pedals, which were attached to torque tubes. Control cables were connected to arms on the torque tubes and routed under the floorboard through a series of pulleys to a rudder bellcrank located in the stinger of the airplane. The rudder was controlled by depressing either the left or right rudder pedal, corresponding to the desired direction of deflection.

Examination

The pilot's rudder pedals had been consumed by fire, with only the metal bases remaining. The right seat pedals were intact, though the outboard pedal showed deformation extending further outboard. The rudder control cables remained attached to the mixing bar and continued aft to the empennage. The cables were still connected to the aft bellcrank and showed no evidence of deformation. The cables continued further aft and were attached to the rudder control horn. The rudder control horn had separated at its pivot bearing, and there was evidence of rust and scraping on the control horn as well as wear on the respective stops.

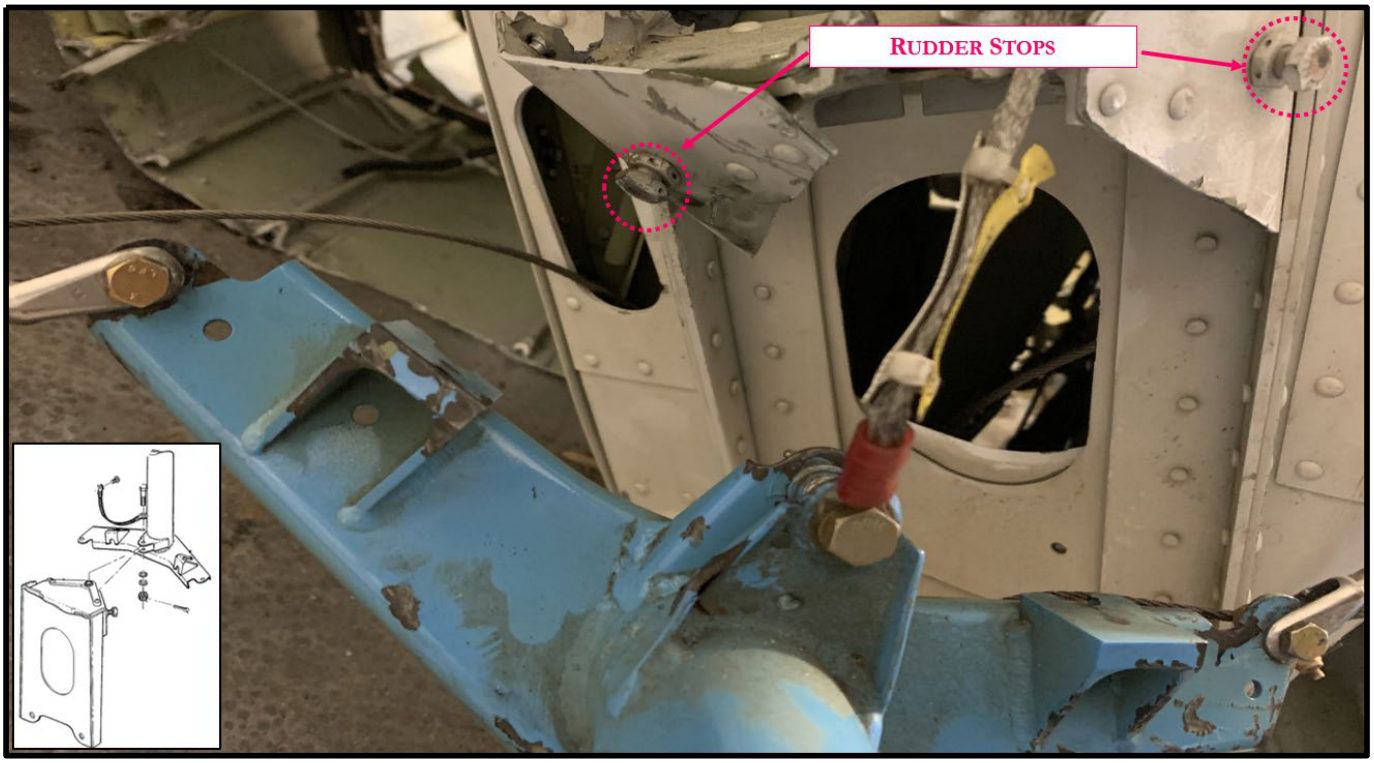


Figure 31: Rudder stops

TESTING

Raisbeck Engineering Inc. (REI) received Supplemental Type Certificate (STC No. SA02741SE) for installing an aerodynamic Drag Reduction System (DRS) on the Textron Aviation Inc. Cessna Model 208B aircraft, also known as the Grand Caravan, which was equipped with P&WC PT6A-114A engines producing 675 SHP. The DRS included a forward fairing installed in front of the belly cargo pod and a set of aft body strakes mounted under the tailcone, just behind the belly cargo pod.

REI worked on extending the DRS to the 208B Grand Caravan EX model (referred to as "208B EX") through an STC under ODA Project No. ADC-0112. This model, which featured PT6A-140 engines operating at 867 SHP, was aerodynamically similar to the non-EX 208B. Both models shared the same Type Certificate Data Sheet (TCDS) and were designated as 208B.

The purpose of these tests was to establish that the stall characteristics of the Raisbeck 208B EX DRS configuration met FAA requirements. These tests in the DRS configuration would support compliance with 14 CFR 23.201, 23.203, and 23.207. Prior

to the DRS modification however, the baseline aircraft was being evaluated to ensure aft c.g. stall characteristics were acceptable as a program risk reduction.

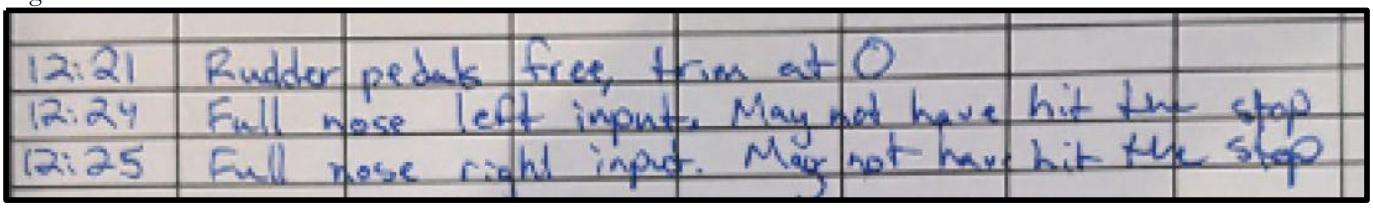
The airplane was weighed before testing, and the c.g. conditions were calculated based on the loading of fuel, ballast, and occupants. All critical loadings were weighed and confirmed after the aircraft was loaded, particularly those added to achieve the forward or aft c.g. limit or maximum weight condition.

QuickSilver Aerospace Instrumentation Specification for the testing was signed as reviewed by Raisbeck on October 4, 2022.

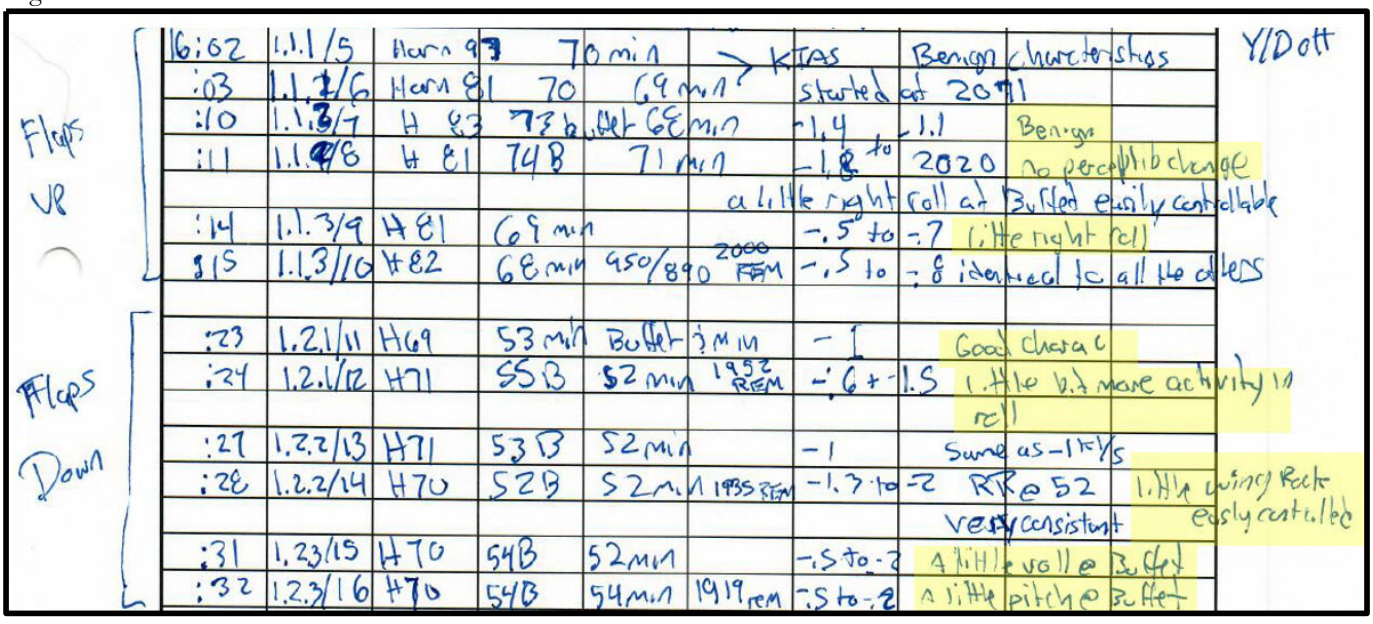
The stall procedures included a provision that the pilot uses the elevator to steadily decelerate the airplane into the stall at the target entry rate, calling out the initial buffet, stall warning, aft stop, and minimum speed. Recovery began after the aft elevator stop was reached for approximately 2 seconds. The pilot would then allow the airplane to stabilize between stalls and ensure that roll during the stall and recovery did not exceed a certain degree of bank. Finally, the pilot evaluated and commented on the airplane's handling characteristics.

TESTING NOTES ON THE AIRPLANE'S PERFORMANCE

Nov 15, 2022:
Flight 01:



November 16, 2022:
Flight 05:



November 17, 2022:
Flight 6 (both engineer's notes):

11:31	8	4.2L		102		75%	Limited by force
11:32	9	4.2R		102			Limited by roll
11:37	10	4.3L		94		50%	Reached 150 lb
11:38	11	4.3R		94			Reached 100 %
11:42	12	4.4L	6000	72	landing	50%	Reached 150 lb at 60%
11:43	13	4.4R					Reached 100% at 120 lb
11:55	14	Approach			10		

:31	4.2L/8	1797	[illegible]	Q ⇒ 1806	no mvs no fuss max rudder
:33	4.2R/9	1791			limited by aileron
:37	4.3L/10	1207		Full Rudder 150 lb Buffet	
:39	4.3R/11	1207		100% Rudder Buffet	
:42	4.4L/12		Much easier than 150 lbs		
:43	4.4R/13		Nice and steady 100%		

Flight 07 (both engineer's notes):

Flaps Up	:46	5.5L/11	idle ~132	H=	B=	min=	[illegible] entry rate does not work in turn
	:52	5.5L/12	idle	H=89	B=74	min=71	no roll off
	15 :00	5.5R/13	idle	H=86	B=77	min=71	no roll off
	:06	5.7L/14	930Q	H=78	B=72	min=64	slight tendency to roll out of turn
	:09	5.7R/15	930Q	H=85	B=72	min=69	" "
Flaps Dn	:14	5.6L/16	idle ~128	H=72	B=59	min=	roll off to left 50°
	:20	5.6R/17	idle ~132	H=73	B=58	min=57	roll out 20° to other direction
		5.8L	930Q				
				RTB	Finish rest of card Tomorrow		

15:00	13	5.5R	10000↓	126	Up	Idle
15:06	14	5.7L	10000↓	126	Up	930
15:08	15	5.7R		96	Down	Idle
15:13	16	5.6L				
		Pilot reports elevator doesn't →				
		column pos. string pot isn't working.				

PILOT INFORMATION

DAVID (DAVE) W. NEWTON : TEST PILOT[3]

[3] In the weight and balance forms, Mr. Newton is labeled as the Pilot, and Ken VanWinkle (the right-seated pilot on Flight 07) is labeled as the Co-Pilot. However, according to available post-flight audio debriefs for Flight #1, 4, 5, 6, 7, "onboard was test pilot Dave Newton, PIC Ken VanWinkle."

The test pilot, was positioned in the front left seat. He was contracted by Raisbeck through the Organization Designation Authorization (ODA) company. On August 1, 2022 he completed the FAA recurrent training for a Flight Test Engineering Designee (DER). He was an FAA Flight Test Designee

A review of Federal Aviation Administration (FAA) airman and medical certification records revealed that the 67-year-old pilot held an airline transport pilot certificate with category ratings for multi-engine and single-engine land airplanes. He was also type-rated in the following airplanes: BE-1900, BE-300, BE-400, CE-500, CE-525S, CE-650, DHC-8, HS-125, LR-60, LR-JET, MU-300, RA-390S. Additionally, the pilot held a flight instructor certificate. His most recent second-class medical certificate was issued in March 2022, with the limitation he must wear corrective lenses.

The pilot's personal flight records were not recovered, but in his last application for a medical certificate, he reported a total flight time of 11,659 hours.

LOGGED PILOT HOURS					
	Hours		Hours		Hours
Total Logged All Aircraft	11720	Retractable Gear	9091	Insured Make & Model	232
Multi- Engine	7557	Helicopter	0		
Turbo- Propeller	901	Jet	6471		
Tall Wheel	0	Seaplane	0		
Glider	0	Instructor	2897		
Amphibious	0	Other			

SCOTT A. BRENNEMAN : RIGHT-SEATED PILOT

The second pilot, was positioned in the front right seat.

A review of FAA airman and medical certification records revealed that the 52-year-old pilot held an airline transport pilot certificate with category ratings for multi-engine and single-engine land airplanes. He was also type-rated in the following airplanes: BE-1900, BE-300, BE-400, CE-500, CE-525S, CE-650, DHC-8, HS-125, LR-60, LR-JET, MU-300, RA-390S. Additionally, the pilot held a flight instructor certificate. His most recent second-class medical certificate was issued in March 2022, with the limitation he must wear corrective lenses for near/intermediate vision.

The pilot's personal flight records were not recovered, but in his last application for a medical certificate, he reported a total flight time of 10,600 hours.

LOGGED PILOT HOURS					
	Hours		Hours		Hours
Total Logged All Aircraft	10,900	Retractable Gear	3500	Insured Make & Model	5000
Multi- Engine	3500	Helicopter	0		
Turbo- Propeller	9000	Jet	1000		
Tall Wheel	0	Seaplane	7		
Glider	0	Instructor	300		
Amphibious	0	Other			

ENGINEERS

The Test Director Nate Lachendro was in the aft left-seat and the Instrument Lead, Nathan Precup was in the aft right-seat.

WEATHER INFORMATION

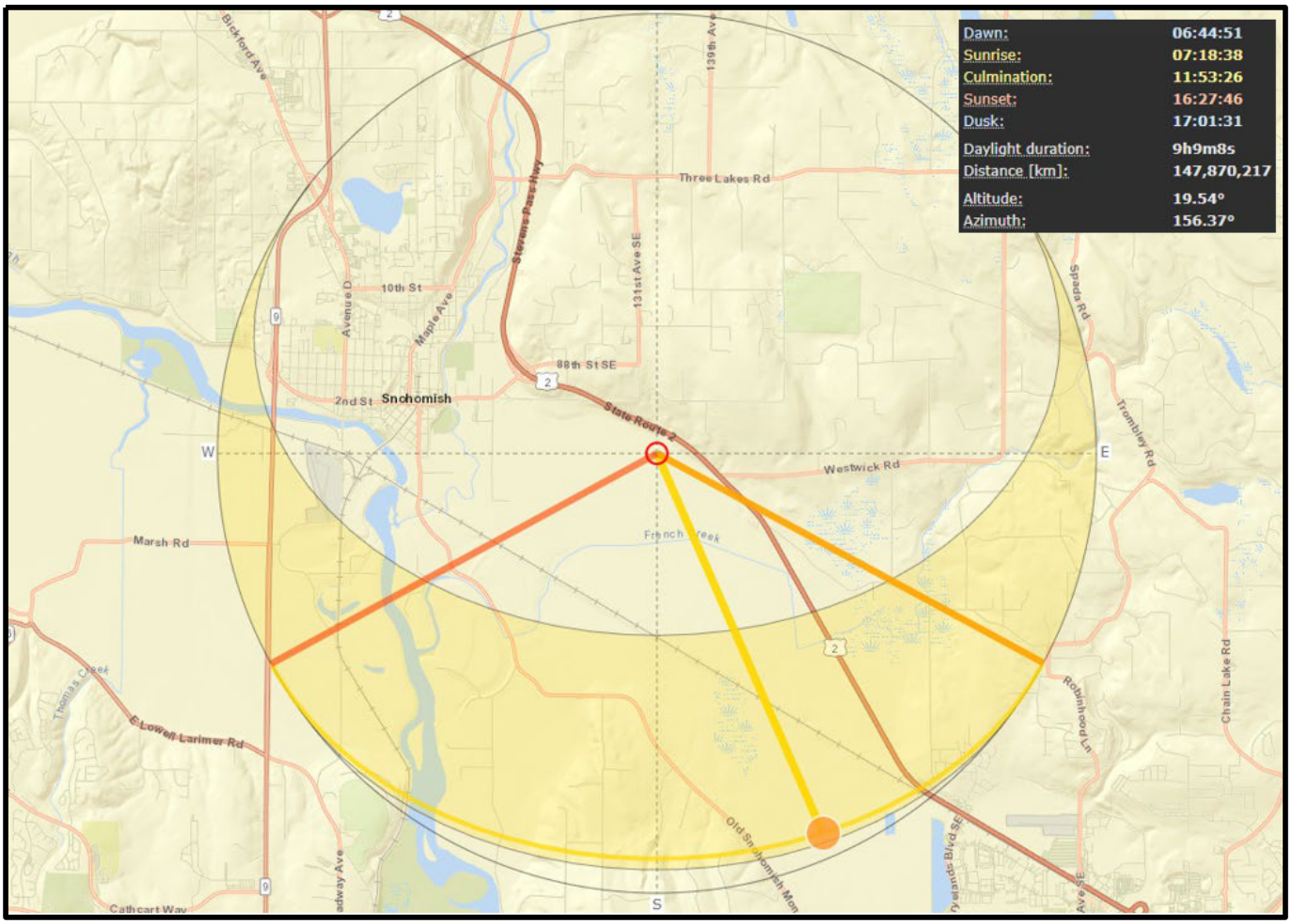


Figure 32: Sun position information at the time of the accident (courtesy of www.suncalc.com)