NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

April 10, 2020

SYSTEMS AND STRUCTURES GROUP CHAIRMAN'S FACTUAL REPORT

A. ACCIDENT: WPR19MA177

LOCATION: Dillingham Airfield, Mokuleia, Hawaii

DATE: June 21, 2019, at 1822 Hawaii-Aleutian standard time

AIRCRAFT: 1967 Beechcraft 65-A90 King Air, N256TA, (LJ-256)
Operated by Oahu Parachute Center

B. GROUP MEMBERS:

Group Chairman:	Robert L. Swaim Washington, DC
	Scott Warren Washington, DC
Member:	Peter Basile Textron Aircraft Company Wichita, Kansas

C. SUMMARY:

On June 21, 2019, at 1822 Hawaii-Aleutian standard time, a Beech 65-A90, N256TA, collided with terrain after takeoff from Dillingham Airfield (HDH), Mokuleia, Hawaii. The commercial pilot and ten passengers sustained fatal injuries, and the airplane was destroyed. The airplane was owned by N80896 LLC, and was being operated by Oahu Parachute Center (OPC) under the provisions of Title 14 Code of Federal Regulations Part 91 as a local sky-diving flight. Visual meteorological conditions prevailed, and no flight plan had been filed.

A combined Systems/Structures Group examined the aircraft debris on June 24 and 25, 2019. The group recovered and documented parts related to the systems and

structure of the airplane. Photographs of the airplane provided by the public and found online were examined, as were records resulting from the horizontal stabilizer separating from the airplane in 2016.

D. DETAILS OF THE INVESTIGATION:

1.0 PRIOR ACCIDENT:

The right horizontal stabilizer and elevator separated during flight on July 23, 2016 and the event was partially recorded by one of the skydivers.[1] (See Figures 1- 3)

Figure 1. Still image from skydiver Achal Asawa 2016 video while he departed the airplane shows a lack of right horizontal stabilizer and elevator assembly.

[1] Still images from video posted to Youtube by Achal Asawa as https://www.youtube.com/watch?v=Qi83pFqAxOc

Figure 2. Still image from skydiver Achal Asawa video during freefall shows missing right horizontal stabilizer and elevator assembly (arrow) and another skydiver.

Figure 3. Still image from skydiver Achal Asawa video while under canopy shows right horizontal stabilizer and elevator assembly falling past him. (arrow)

The NTSB Narrative for the accident stated:[2]

> On July 23, 2016, about 1900 Pacific daylight time, a Beech 65-A90, N256TA, sustained substantial damage following a loss of control while climbing out near the Byron Airport (C83) Byron, California. The commercial pilot and the 14 passengers were not

[2] NTSB accident number WPR16LA150

injured. The airplane was registered to N80896 LLC, and operated by Bay Area Skydiving under the provisions of 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed and no flight plan was filed for the sky-diving flight. The local flight departed C83 about 1851.

According to the pilot, as the airplane neared the planned jump area and altitude, about 12,500 ft, mean sea level, he initiated a left turn to line up for the drop zone. He stated the airplane's airspeed was a little slow and then "suddenly the airplane abruptly stalled, rolled off to the left, and began rotating nose-down." He stated that the airplane "did a couple of downward barrel rolls."

One of the jumpers, seated in the co-pilots seat, heard a "loud bang" during the recovery sequence and stated that "the pilot did not retard the throttles during the recovery, causing the airplane to develop too much speed." The jumper further stated that during the recovery he felt the g-force on his stomach. The pilot said that he temporarily recovered the airplane to a wings level attitude for a few seconds and observed that the airplane was about 90° off the planned heading, and slow in airspeed.

Subsequently, the pilot stated there was a "shock" to the controls and "simultaneous the airplane suddenly broke hard to the left," stalled a second time, and began to rotate downward. The pilot told the sky-divers to jump out of the airplane. The parachutists complied, and all of them successfully exited the airplane during this second spin event. The pilot then initiated the spin recovery procedures to no apparent effect through about 9 rotations and stated that the roll rate was a lot more rapid than the first spin event. He then pulled both propeller controls levers to the feather position and was able to get out the spin.

He recovered the airplane to a wings and pitch level attitude, but shortly thereafter, the airplane "broke left" and stalled for a third time. The pilot recovered the airplane again by lowering the pitch attitude and increasing the airspeed.

The pilot turned back towards the airport and since the airplane was handling abnormally, he adjusted the elevator trim to its full nose up position to help him maintain straight and level flight. He stated that the full nose up trim setting was used on the approach. In addition, the pilot flew the approach 15 knots faster than required, in order to compensate for the control issue of a marked decrease in elevator performance.

> The pilot described the landing as being nose low relative to a normal landing. After landing at C83, a witness observed that the airplane's right horizontal stabilizer, with the attached elevator, was missing. The separated airplane parts were subsequently located in a field a few miles south of the airport.

Photos were taken during the examination of the airplane after loss of the right horizontal stabilizer (HSTAB). The rear bulkhead on the right was found damaged where the horizontal stabilizer spar stub had attached. The fuselage skin and forward bulkhead also had damage. (See Figures 4 - 7)

Figure 4. The rear tail bulkhead with the tail cone fairing removed. (Photo from: Textron Report ASI-16-CF, taken August 11, 2016)

Figure 5. The right rear fuselage with a bend in the bulkhead which the right HSTAB attached to. (Photo from: Textron Report ASI-16-CF, taken August 11, 2016)

Figure 6. Closer view of the bent attachment which the right HSTAB attached to. (Photo from: Textron Report ASI-16-CF, taken August 11, 2016)

Figure 7. The damaged right HSTAB. (Photo from: Textron Report ASI-16-CF, taken August 11, 2016)

The horizontal stabilizer and elevator were replaced with parts from a 1965 KingAir Model 90,[3] registered as N98B and built as serial LJ-87.[4] The manufacturer's Illustrated Parts Catalog (IPC) does not show the Model 90 stabilizer as applicable to the Model A90 accident airplane (LJ-256). Figure 48, Item -11 of the IPC shows the effective right horizontal stabilizer part numbers for each airplane to be:

LJ-1 thru LJ-183. Part Number 50-600001-662
LJ-184 thru LJ-317. Part Number 50-600001-612

IPC Figure 49 shows that the –662 part had a beaded skin, and -612 a smooth skin.

The IPC shows that one of a range of parts had a common part number for the different airplane models. The IPC indicated that airframe serial numbers LJ-87 and -256 share the same elevator assembly.

Insufficient wreckage existed to determine the part numbers on the airplane at the time of the June 21, 2019 accident or if differences existed between the left and right tail surfaces.

[3] The range of Model 90 serial numbers was LJ-1 through LJ-75, LJ-77 through LJ-113. The Model A90 serial range was LJ-76, LJ-114 through LJ-317.
[4] See Maintenance Records Factual Report for the logbook entries and further details about this repair and subsequent movements of the airplane.

The group examined photo and video evidence about the airplane condition before the 2016 accident and the condition of the airplane after the accident. Two photos from the public showed the airplane as viewed almost directly at the nose. For each photo, NTSB image analysis experts reviewed the position of the aircraft left and right stabilizer tips. In each, the outboard tip of the left horizontal stabilizer was found lower (less dihedral) than the replacement right horizontal stabilizer. The details of their study were as follows:

The Beech 65-A90 stabilizer tip-to-tip span is about 12 feet. In the photograph, this measured 112 mm tip-to-tip. The white rectangle (see figure 8) is used to align the image based on the wingtip-to-wingtip line (bottom of the white rectangle). The stabilizer tip height difference is measured relative to the top of the white rectangle. This was estimated to be about 1 mm. Based on these measurements and the 12 ft stabilizer tip-to-tip span, the estimated stabilizer tip height difference is (1mm/112mm)x12ft = 0.11 ft = 1.3 inches.

An accurate estimate based on this approach would require accurate alignment of the camera axis along the longitudinal axis of symmetry of the airplane. This alignment was evaluated by measuring the distances from the vertical axis of symmetry to the wingtips. The distances were 211 mm and 219 mm, indicating that the camera axis was not aligned exactly with the longitudinal axis of the airplane. Since the left wing looks longer in the photograph, it was closer to the camera. This means that the airplane was yawed slightly clockwise (in top view) with respect to what would have been a perfect camera alignment. This moved the left wingtip closer to the camera and made the left wing look longer in the photograph. Similar analysis of the stabilizers indicates the same degree of yaw misalignment because (57-55)/(55+57)≅(219-211)/(211+219). This misalignment does have a small effect on the estimated stabilizer tip height difference.

A similar analysis was performed on the other photograph, shown in figure 9. It does not show the wingtips and, therefore, the bottom of the engines was used as a height reference and the white rectangle was used for alignment. The estimated stabilizer tip height difference was 1.2 inches, in close agreement with the above 1.3 inches estimate.

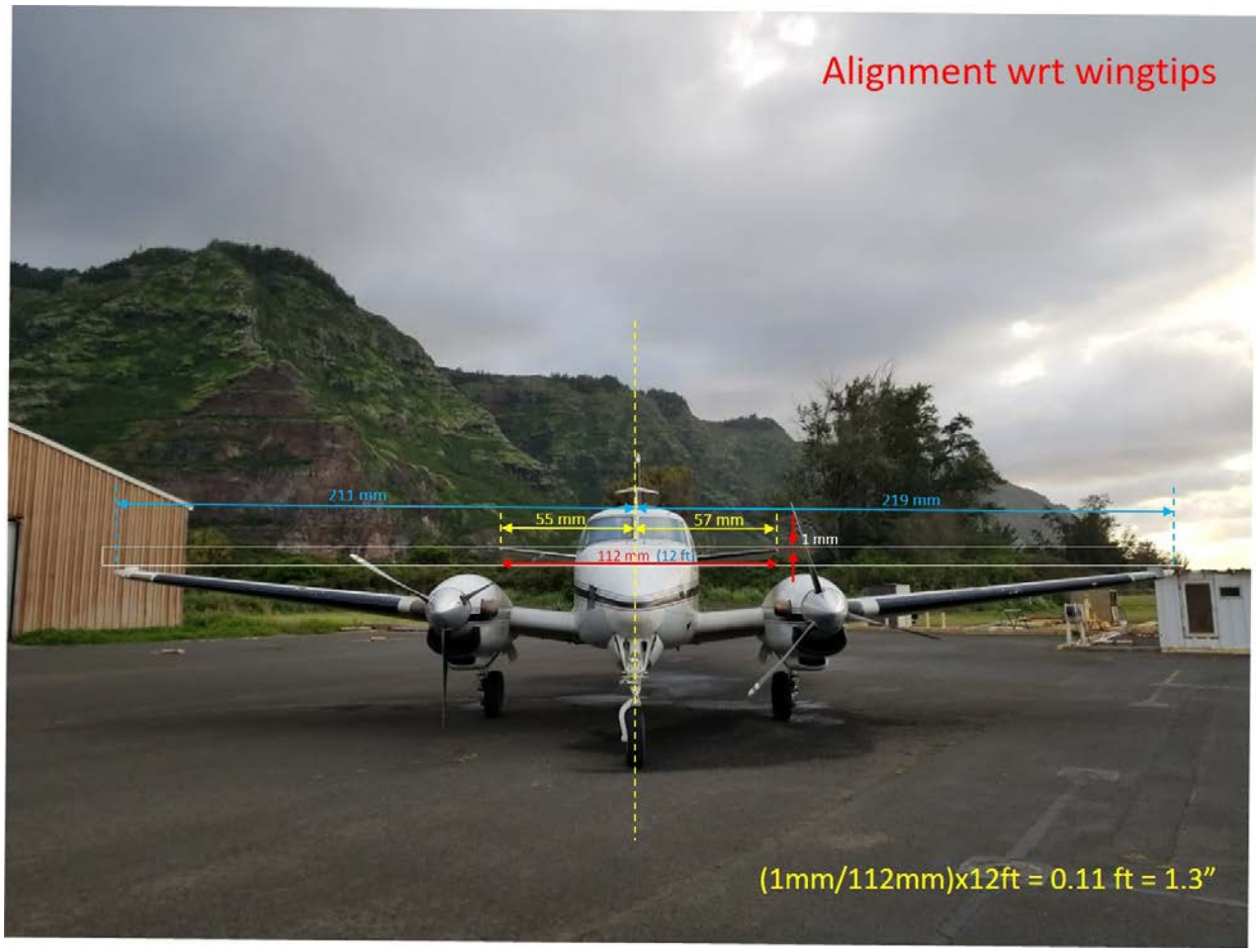

Figure 8. Front view of airplane, showing alignment measurements. (Photo from: Skinner)

Figure 9. Front view of airplane, showing alignment measurements. (Photo from: Skinner)

Videos and photographs of the airplane from prior to the 2016 accident were found on parachute jumping websites. The left wing appeared to be undamaged, without wrinkles and the trim tab on the left aileron was close to the faired position. (See Figures 10 and 11)

Figure 10. This 2011 photo is an example of pre-2016 accident photos that show the aileron trim tab faired to the aileron. (Still image from video posted to: www.Gurustunts.com)

Figure 11. Pre-2016 accident photo showing lack of wrinkles and smooth transition across the outboard section of the forward wing spar. (Still image from video posted to: www.Gurustunts.com)

Wrinkles and other damage to the left wing were present in a series of photographs taken immediately after the 2016 tail separation and from subsequent flights through to the Dillingham accident.[5] The direction of twist indicated by the wrinkles was leading edge up for the wing tip. The top of the

[5] These photographs include ones submitted by parachute jumpers and from the pilot of the ferry flight who moved the airplane to Hawaii. For further information about dates and locations for movement of the airplane see the Maintenance Group Chairman's Factual Report of Investigation.

wing also had a raised ridge aft of the forward wing spar in the outboard wing panel in the photographs. A small fairing panel which covered the top rear spar attachment for the left wing was photographed in 2016 with an upward buckle in compression. (See Figures 12 - 14)

Figure 12. Wrinkles in the top skin of the left wing, immediately outboard of the engine and aft of the forward spar. The arrows indicate skin raised as a ridge aft of the outboard section of the forward wing spar. (Also visible in photos from the delivery flight to Hawaii in Figure 18) (Photo from: Textron Report ASI-16-CF, taken August 11, 2016)

Figure 13. Close view of wrinkles in the top skin of the left wing, immediately outboard of the engine and aft of the forward spar, (Photo from: Textron Report ASI-16-CF, taken August 11, 2016)

Figure 14. Compression buckle of thin aluminum fairing over rear wing attach fitting. (Photo from: Textron Report ASI-16-CF, taken August 11, 2016)

The upper wing surface of the right wing was not a single smooth continuous plane across the joint of the outboard wing panel. (See Figure 15)

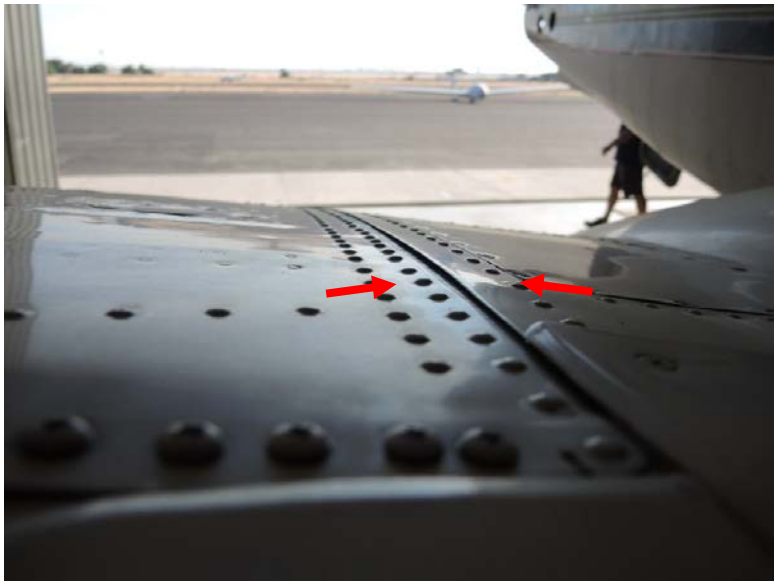

Figure 15. The right wing root joint not in plane with the surface of the outer panel, immediately outboard of the right engine. (Photo from: Textron Report ASI-16-CF, taken August 11, 2016)

A difference existed in the gaps between the engine cowlings to the left and right propeller spinners. The gap for the left propeller was not parallel and the propeller appeared to be oriented slightly downward. (See Figures 16A and 16B)

Figure 16A. Gap between left spinner and cowl, showing edges not parallel with propeller oriented downward. (Photo from: Textron Report ASI-16-CF, taken August 11, 2016)

Figure 16B. Gap between right spinner and cowl, showing parallel edges. (Photo from: Textron Report ASI-16-CF, taken August 11, 2016)

A difference existed between the photos before the 2016 accident and those taken after. The photos from immediately after the 2016 accident show the left aileron trim tab with a further downward deflection (see Figure 17 and 18) than photos taken before the horizontal stabilizer separation (see Figure 10).

Figure 17. Deflection of aileron trim tab on left wing photographed during inspection after 2016 loss of horizontal stabilizer. (Photo from: Textron Report ASI-16-CF, taken August 11, 2016)

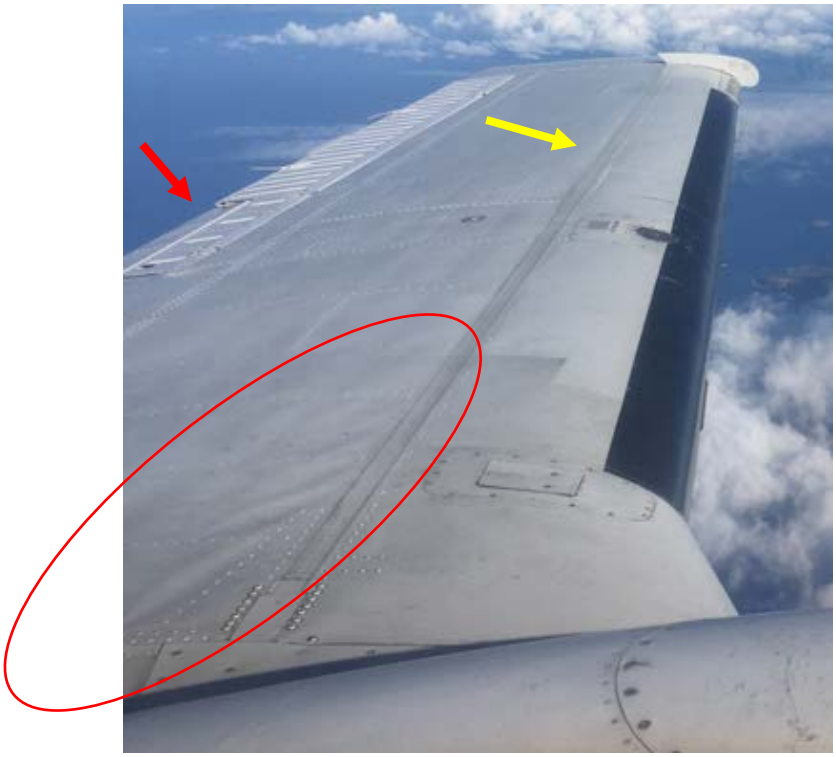

Figure 18. Inflight during 2017 delivery to Hawaii, the left/red arrow shows the trim tab deflection. The right/yellow arrow shows the non-smooth skin transition aft of the outboard section of the forward wing spar and the oval shows the wrinkled upper wing skin. (Photo from: Adam Townley Wren)

Responding to the NTSB request for images from the public, the following email transmitted a video. A still image from the video shows the deflection of the trim tab on the left aileron at a time that was reported to be just prior to the accident flight. (See Figure 19)

From: [redacted]
Sent: Wednesday, August 21, 2019 2:36 AM
To: eyewitnessreport <eyewitnessreport@ntsb.gov>
Subject: N256TA

To Whom it May Concern:
This video was taken about 30 minutes previous to the crash. The last successful flight of N256TA.
I don't know if you have this video. I am a skydiver. I work at Dillingham Airfield. I am often on the property in the evenings just as I was that day. I have witnessed this pilot taking off aggressively banking low to the ground many times. I feared the worst and it happened. I hope you find out why.
Regards
[redacted]

Figure 19. The extent of left aileron trim tab deflection is clearly visible between the arrows while loading for the flight prior to the accident. (Video from: Public)

A post-accident 2016 inspection photo also shows the roll trim knob set to full left wing down. (See Figure 20)

Figure 20. As-found position of aileron trim (left knob) in full left wing down orientation after the 2016 accident and of the rudder trim knob (right). The center of graduated adjustment scales in each have rectangular markings which are circled, with five lines to either side. The last adjustment marking from the right can be seen at the top of the aileron knob. A corresponding arrow shows the equivalent mark on the rudder knob as an example. (Photo from: Textron Report ASI-16-CF, taken August 11, 2016)

A 2018 photo of a pilot seated in the accident airplane showed the roll trim knob deflected fully to the left, and the knob was found in the same position in the wreckage. (See Figures 21A and 21B)

Figure 21A. This March 7, 2018 photo of a pilot recorded the aileron trim (left knob) in full left wing down orientation. (Photo from: Skinner)

Figure 21B. Close-up of above photo of aileron trim knob shows it turned to the extent that the five lines are not visible on the right side of the scale. Arrows point to three visible markings. (Photo cropped from Figure 21A with altered contrast and lighting.)

2.0 WRECKAGE EXAMINATION:

2.1 STRUCTURE, GENERAL:

Video evidence showed the airplane struck the ground inverted, consistent with the debris distribution and wing dihedral shape imprinted in the displaced grass. The path of debris ended at the airport perimeter fence, with a few items caught in the fence or thrown beyond. The center of the site had been cleared of debris to facilitate victim recovery by the time NTSB investigators arrived. An FAA inspector who initially responded to the scene provided photos which showed a mound of debris prior to victim recovery. (See Figures 22 and 23)

Figure 22. First known photo of accident site, taken prior to victim recovery. The orientation is roughly in the direction of travel of the airplane. Note mound of debris in the middle area which had been pulled apart and distributed by the time the daylight photos were taken later. (Photo from: FAA)

Figure 23. Left outboard wing, leading edge down. (Photo from: FAA)

The impact was nose down on a magnetic heading of 011 degrees at GPS position of N21.5807000 and W-158.188611, where fragments of windshield were found with an initial ground cut corresponding to the top of the vertical stabilizer. The path of the general disturbance to the ground slightly pivoted around the initial contact of the left wing on the right side of the travel path. For example, although the vertical stabilizer and rudder were found in the daylight far from the fence, the ground cut of the vertical stabilizer continued in a curving path consistent with rotation around the left wing. The fence posts were spaced 10 feet apart which indicated that nearly all debris was within about 40 feet along the fence and within about 40 feet of the fence. (See Figures 24 and 25)

Figure 24. Initial daylight view of impact site in direction of travel, prior to placement of tarps on fence. Right wing is against fence in upper left of photo with the right nacelle and engine to the right of it. The left wing is at upper right, with nacelle and cockpit area closest to fence. Note mound of debris has been pulled apart for victim recovery. (Photo from: Textron)

Figure 25. Windshield fragment at initial impact location. (Photo from: Swaim)

2.2 STRUCTURE, FUSELAGE:

Due to the extent of how much of the airframe had been consumed by the post-crash fire and disrupted by victim recovery, only small fragments of the fuselage were identifiable. The nose landing gear and a gear door were the largest of what was found from forward of the cockpit. An unburned nose landing gear door was found with several other light fragments on the other side of the perimeter fence. (See Figure 26)

Figure 26. The unburned nose landing gear door was found on the street side of airport perimeter fence, visible beneath the KEEP OUT sign. A heat exchanger, portion of a main landing gear, and other debris is visible in background, farther away from the photographer. (Photo from: Textron)

Nearly the entire fuselage was consumed by fire. One of the largest sections of fuselage was an eight-foot-long by five-foot-wide roof section from above and forward of the emergency exit.[6] It was identified by the remaining antennas and unique frame of the exit door. This top of the cabin had been accordion folded with scrapes on the exterior surface. (See Figures 27 and 28)

[6] The emergency exit had been the last window on the right, opposite of the jump door.

Figure 27. Arrow points to antenna shown in following photo. Oval denotes emergency exit. (Photo from: Textron Report ASI-16-CF, taken August 11, 2016)

Figure 28. Arrow points to base of antenna shown in previous photo. (Green item is a parachute.)

The other largest piece of fuselage was from beneath the cockpit and wing center section and was approximately five feet long by the width of the fuselage. This large fragment did not have the accordion folding found to the top of the cabin. (See Figure 29)

Figure 29. Fuselage from bottom of airplane.

Numerous small fragments were found of the floor and lower fuselage structure without recognizable features to locate them in the original airplane.

2.3 STRUCTURE, WINGS:

The complete span of the wings was identified in broken sections. The attachment points were found for the upper and lower forward spar fragments on both sides. The left wing tip contacted the ground before the right tip, and to the right of the path of movement. A line between wingtip impacts was measured to be 136/316 magnetic degrees. (See Figure 30)

Figure 30. The dashed lines show the ground scars of the wing leading edges as viewed from impact point of right wing tip toward the left. The center of the V created by dihedral is in the direction of movement, consistent with an inverted airplane attitude at contact. The airplane arrived from the runway, to the right of this photo, traveling toward the left. (Photo from: Swaim)

The left wing tip was away (South) from the fence with the leading edge down in initial night and subsequent daylight photos. The wing remnants outboard of the left engine pylon twisted so that the outboard end was on a diagonal with the leading edge down. The outboard portion of the wing had been extensively crushed along the chord line (fore/aft). The accordion-pleated end of the outboard wing measured 14 inches from the leading edge to rear spar. The wing outboard of the fuel tank and flap and the inboard half of the aileron were accounted for. The left wingtip was found separated in a pile of loose debris with crush and fire damage but was essentially complete. (See Figures 31 - 34)

Figure 31. Left wing in initial night photo, seen oriented with the leading edge downward prior to victim recovery. (Photo from: FAA)

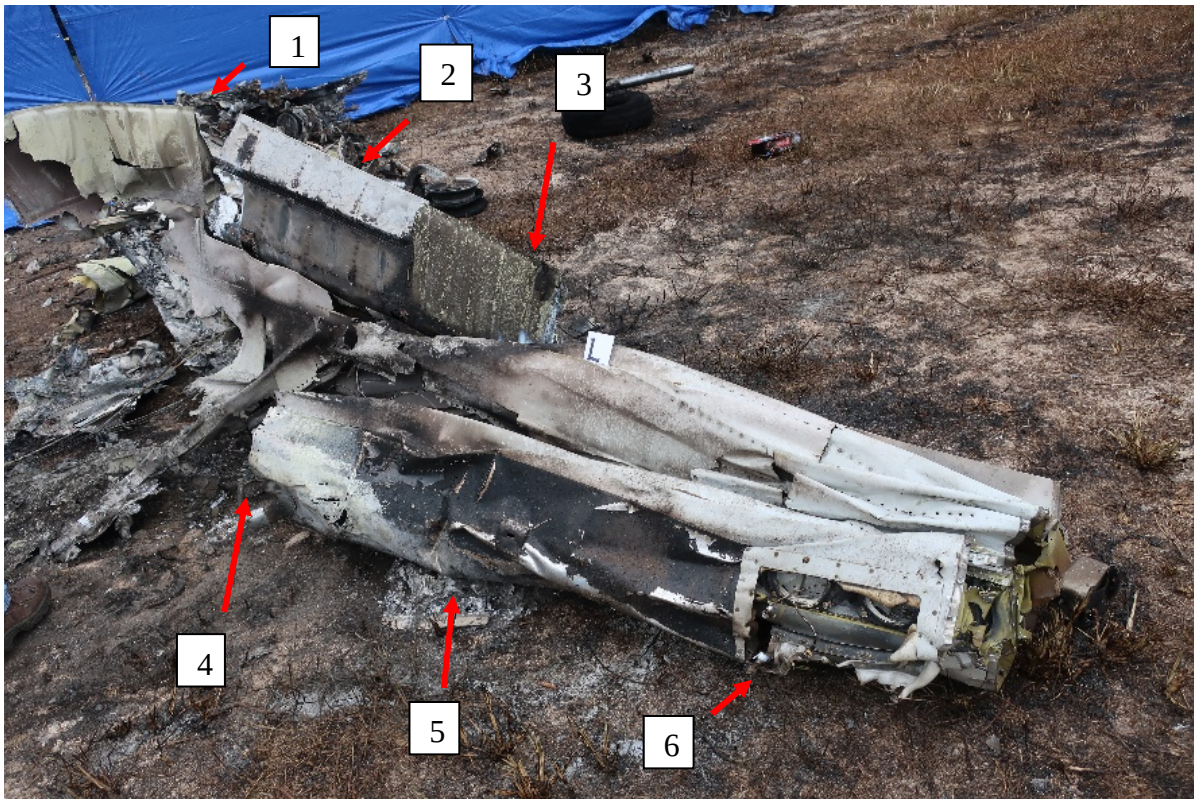

Figure 32. Outboard left wing in initial daylight photos, top surface. Item 1 denotes fire-damaged outboard tip of remaining wing flap. Item 2 points to the left aileron trim tab. Item 3 points to the outboard side of the remaining portion of left aileron. Item 4 points to the pitot tube. Item 5 points to the stall warning lift transducer. Item 6 points to the landing light. (Photo from: Textron)

Figure 33. Bottom surface of remaining left aileron and wing. (Photo from: Swaim)

Figure 34. Burned and crushed left wing tip placed next to the tip of the right wing. (Photo from: Swaim)

The pitot tube on the bottom of the leading edge was found intact with a slight bend toward the wing. (See Figure 35) The flattened area of left wing crush

was nearly flat across the opening for the stall warning lift transducer and about 29 degrees from the vertical spar. (See Figure 36)

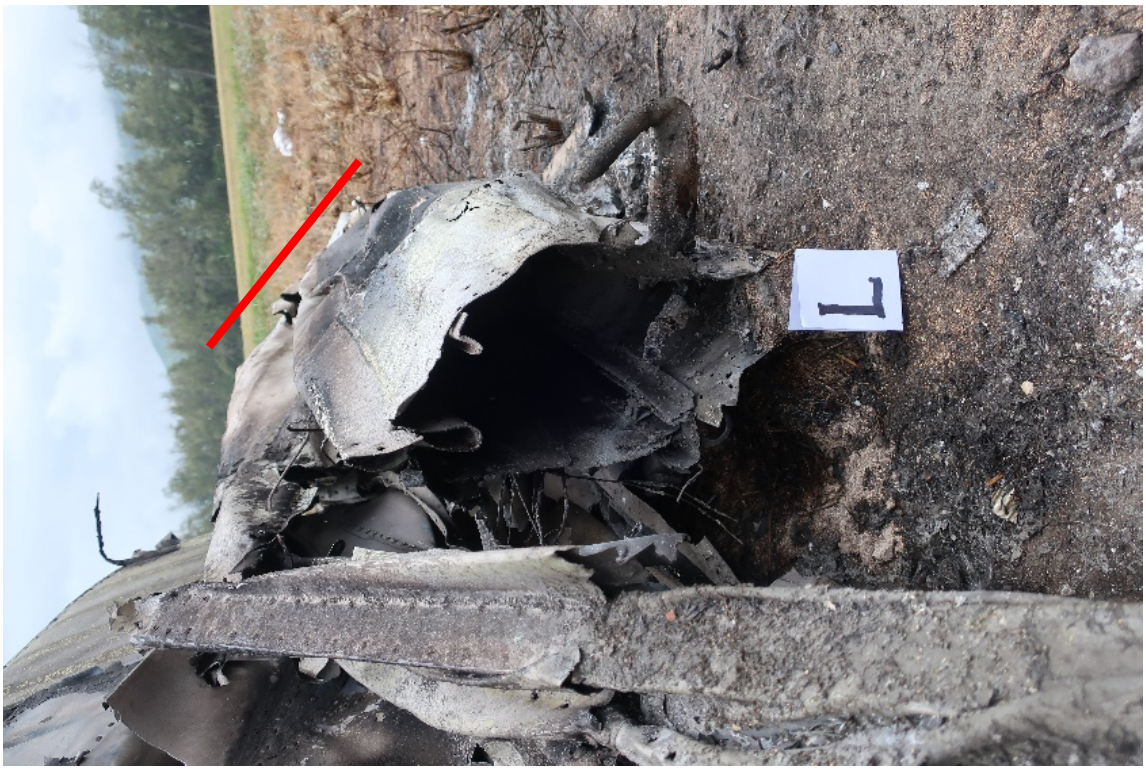

Figure 35. Pitot tube on bottom of outboard wing leading edge. The flat surface denoted by the red line is approximately the same as the upper line in next photo. (Photo from: Swaim)

Figure 36. Crush line (upper red line) of the upper leading edge as measured to the vertical center of the wing spar (lower red line) at wing tip. (Photo from: Swaim)

The structure between the left aileron and nacelle had been almost completely consumed by fire aft of the wing spar. Inboard of the engine pylon was more extensively fire damaged and little remained. The area of the engine pylon and outboard fuel tank had been consumed by fire, with remnants of the rear spar and surface stretched toward the location of the left engine. (See Figures 37 - 39)

Figure 37. The consumed wing, flap, and fuel tank area which had been outboard of the left nacelle. (Photo from: Swaim)

Figure 38. Arrows show remnants of left wing rear spar between wing at right and nacelle at upper left, where engine was found. (Photo from: Swaim)

Figure 39. The remaining portion of the inboard left wing leading edge, from between the nacelle and fuselage. (Photo from: Swaim)

The right wing outboard of the pylon was found relatively intact on the top surface with the leading edge at the airport perimeter fence. A crush line of about 30 ° at the tip and leading edge was further along the top surface than the crush features observed on the left wing. (See Figures 40 - 42)

Figure 40. Right outboard wing laying inverted at airport perimeter fence, prior to victim recovery. At left edge of photo are the nacelle remnants. A main landing gear is partially under fence. Compare with the initial daylight photo below. (Photo from: FAA)

Figure 41. Right wing bottom surface prior to erecting tarps on the fence. Note the complete aileron, servo tab, and outboard flap. (Photo from: Textron)

Figure 42. Right wing tip with added crush line. (Photo from: Swaim)

The inboard end of the outboard right wing panel remained loosely next to the nacelle, with much of the material consumed by fire. (See Figure 43) The wing panel was moved away from the nacelle to flip the wing over and further examine components in each. (See Figures 44 - 46)

Figure 43. Right nacelle with outboard wing panel beyond. The main landing gear strut cylinder is the horizontal tube extending from the "R" to the person's foot. The inner portion of the landing gear strut with the tire was partially beneath the airport perimeter fence. (Photo from: Swaim)

Figure 44. Right wing top surface. (Photo from: Textron)

Figure 45. Right wing top surface. (Photo from: Textron)

Figure 46. Right wing top surface. (Photo from: Textron)

2.4 HORIZONTAL TAIL SURFACES:

Portions of both horizontal stabilizers and elevators were found at the site of the accident. The left horizontal stabilizer had been folded upward about mid-span.[7] The left side was extensively more consumed by fire than the right had been. The outboard right elevator remained with the horizontal stabilizer and most of the inboard right elevator had been consumed by fire. An extensively burned and relatively small section of material which resembled the inboard portion of an elevator was found. Because a right elevator remnant already had a portion which was similar, elimination was used to place the burned fragment on the left side of the reconstruction. (See Figures 47 and 48)

[7] The term “upward” is used to mean relative to the normal configuration of the airplane. The horizontal stabilizer folding direction would have been consistent with a downward folding direction at impact when an inverted airplane impacted the ground.

Figure 47. Partial reconstruction of horizontal stabilizers and elevators, with left toward the left and right toward the right. The yellow lines denote the relative sides of the fuselage. The aft left spar stub fragment (Figure 50) is not in this photo. (Photo from: Swaim)

Figure 48. Partial reconstruction as seen from the front right. The yellow line denotes the centerline of the tail of the fuselage. The aft left spar stub fragment (Figure 50) is not in this photo. (Photo from: Swaim)

The horizontal stabilizers had been attached to the rear two bulkheads in the tail cone of the fuselage. Remnants for three of the four attachment points extended from inside the fuselage into the remnants of the horizontal stabilizers. Both the left front and left rear horizontal stabilizer spar fragments

remained bolted to fragments of their respective fuselage bulkheads, as did the forward right horizontal spar fragment. (See Figures 49 - 51)

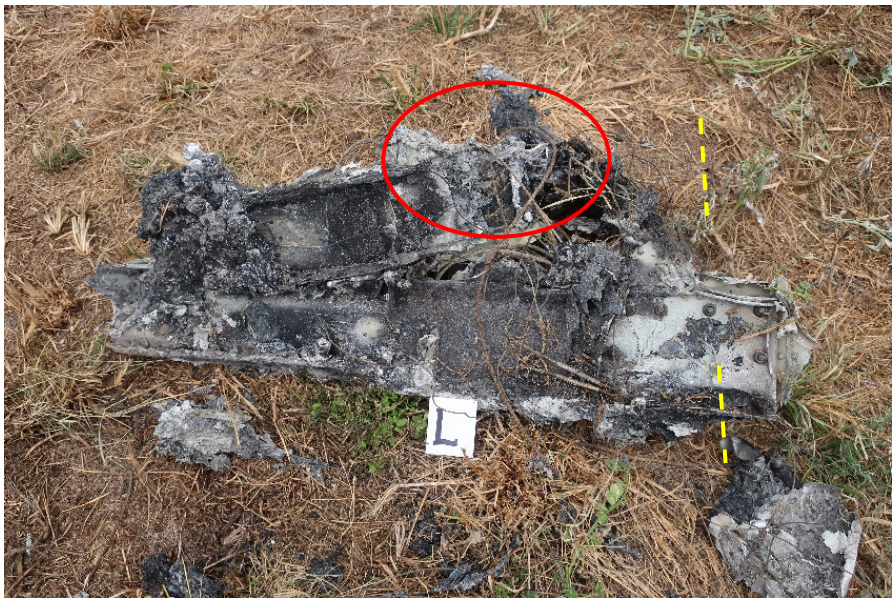

Figure 49. Left horizontal stabilizer bent in half with the oval denoting the forward spar stub bolted to a remnant of the aft fuselage bulkhead. The yellow lines denote the side of the aft fuselage, showing small amounts of the bulkhead remaining attached to the spar stub. (Photo from: Swaim)

Figure 50. Left horizontal stabilizer aft spar stub remnant bolts which remained attached to a fragment of the bulkhead. (Photo from: Swaim)

Figure 51. Right horizontal stabilizer forward spar stub bolted to a remnant of the aft fuselage bulkhead. (Photo from: Swaim)

The right rear horizontal stabilizer stub had broken at the skin of the fuselage and the inboard portion remained bolted to the bulkhead. The horizontal stabilizer in general from the area had been consumed by fire. (See Figure 52)

Figure 52. Attachment of right horizontal stabilizer rear spar stub to airplane bulkhead. (Photo from: Swaim)

2.5 VERTICAL STABILIZER:

Portions of the vertical stabilizer and rudder from the fuselage bulkhead to the cap of each were found in small fragments. The top of the stabilizer and rudder were crushed together and broken to the side. (See Figures 53 and 54)

Figure 53. Fragments of the rear spar from the fuselage bulkhead (oval) to the caps of the vertical stabilizer and rudder (arrow).

Figure 54. Tops of rudder and vertical stabilizer. (Photo from: Textron)

2.6 LANDING GEAR:

The main landing gear were designed to retract forward and up into the nacelles, behind each engine, with the wheels oriented forward. The left and right main landing gear housing cylinders were found in the area of the associated engine nacelles and each was found in the retracted orientations. Each of the main landing gear inner strut and wheel assemblies had been ejected from the cylinders. The left wheel and inner strut assembly was found to the east of the majority of debris and from the surrounding fire patterns on the ground, they appeared to have been there during the fire. The right wheel and strut assembly was found partially past the bottom of the perimeter fence. The down-locks of each had separated and there were no scars or other damage consistent with the landing gear not having been in the retracted orientation. (See Figures 55 - 57)

Figure 55. Left main landing gear strut and lock assembly. (Photo from: Swaim)

Figure 56. Left main landing gear with inner strut, separated from outer strut and found to east of the majority of the debris. (Photo from: Swaim)

Figure 57. Right main landing gear strut and lock assembly. (Photo from: Swaim)

The nose landing gear was designed to retract aft, with the top forward and tire aft. In one large wreckage fragment were the complete nose landing gear assembly with portions of the forward and top of the landing gear well. Sheet metal from the front and top of the gear well were bent around the nose gear toward the tire, in the retracted orientation. (See Figure 58)

Figure 58. Top of the nose landing gear assembly with the box fragments bent aft toward the tire.

2.7 FUEL SYSTEM:

The fuel system components were in areas of extensive fire damage. A left wing fuel shutoff valve was found with the valve in the open position. (See Figure 59)

Figure 59. Fuel shutoff valve found in open position. (Photo from: Swaim)

The right wing leading edge fuel cap was found in the closed position at the filler neck. Upon removing the cap, fire residue was evenly distributed on the interior surfaces of the cap and tank area. (See Figures 60 and 61)

Figure 60. Right wing fuel cap with fire residue. (Photo from: Textron)

Figure 61. Interior of right fuel tank after removal of cap. (Photo from: Textron)

2.8 AIRPLANE INTERIOR:

Cabin interior features were compared with the photographs taken following the 2016 accident. (See Figures 62 and 63)

Figure 62. Aircraft interior looking forward. (Photo from: Textron Report ASI-16-CF, taken August 11, 2016)

Figure 63. Aircraft interior looking aft. (Photo from: Textron Report ASI-16-CF, taken August 11, 2016)

Only a small fragment of one of the foam covered benches was found and most of the pilot and front passenger seats had been consumed by fire. (See Figure 64)

Figure 64. Remnants of pilot seat. The circular item below the seat is the left propeller hub. (Photo from: Swaim)

2.9 COCKPIT INSTRUMENTS:

The instrument panel was found as a collection of debris in a small area, facing back toward the runway. [8] The public had been requested to provide photographs and videos of the airplane and some of those from previous passengers were used to identify the locations and features of the instruments. (Example: Figure 65)

Figure 65. Example photograph of the N256TA engine instrument display. (Photo from Schenfeld)

Annunciators can be seen illuminated in some images and one annunciator appeared to be missing. Four items were noted in the following image. (See Figure 66)

[8] The NTSB policy is not to display photographs containing potentially disturbing images and the instrument panels were extensively contaminated with biologic material. Photographs in this report are provided when no biologic remnants are visible. Details about examinations of individual instruments are contained in Attachment A. Original or cropped photographs which possibly show biologic remnants are in the Official Use Only portion of the docket for this accident.

Figure 66. Annunciator panel during the landing approach on a previous flight obtained from public response to a request for photos and videos. (Photo of video from Kade)

Closer examination of the image found the following items from left to right and the Airplane Flight Manual provided the indented probable causes for illumination.

- PROP REV NOT READY (Amber)
  - Propeller levers are not in the high rpm, low pitch position.
- CABIN DOOR (Red)
  - Cabin door open or not secure. (Open for parachute operation.)
- ALT WARN (Missing annunciator) (Amber)
  - Cabin altitude exceeds 10,000 ft. (Pressurization system components were removed per FAA form 337 – System inoperative for parachute operations.)
- RH IGN IND (Amber)
  - Right ignition and start switch are in the ignition and start mode or the right auto-ignition is activated.

Photographs from the 2016 examination provided orientation for flight instrumentation when items were found. (See Figure 67)

Figure 67. Flight instruments in 2016. (Photo from: Textron Report ASI-16-CF, taken August 11, 2016)

2.9.1 INSTRUMENTS AS FOUND:

Attitude Indicator: Pitch -45 degrees, Roll 142 degrees left (See Figure 68)

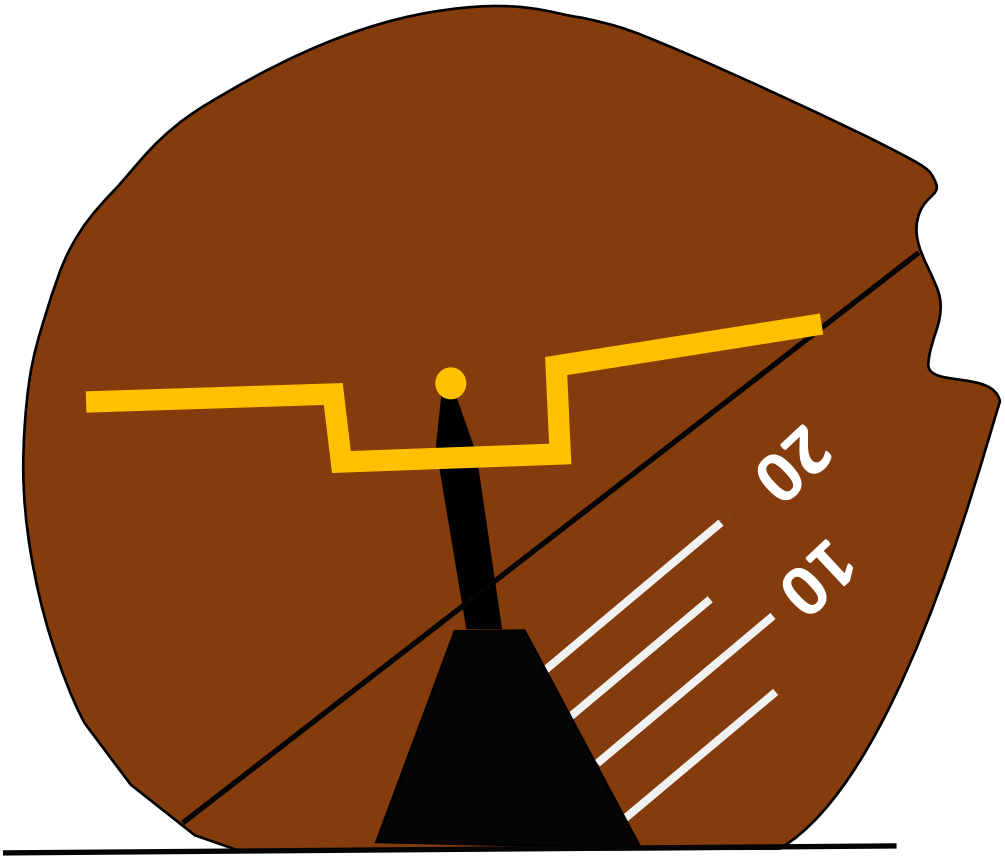

Figure 68. Tracing of displayed orientation of attitude indicator. The right and upper right irregular shapes are due to obscuration by debris.[9]

Altimeter: 29.925 in Hg

The face of a flight instrument with a single center hole was recovered and the face was too extensively fire damaged to determine which instrument it was from.

Fuel Quantity (from the panel located on the left cockpit wall): About 10% or Full (See Figures 69A and 69B)

[9] The graphic is shown due to visible biological material on photographs.

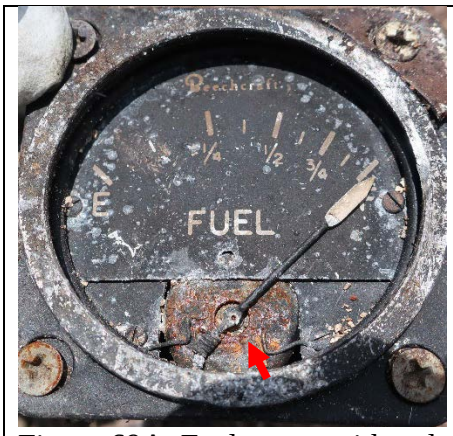

Figure 69A. Fuel gauge with red arrow denoting mark which aligns with the distance and orientation of the counterbalance on the needle. (Photo from: Swaim)

Figure 69B. Graphic added to show shape of needle over collection of damage points in face.

Textron provided the following statement about the fuel quantity indication system:

> The Nacelle tank is considered the main tank. Per the manual, "Fuel level in the nacelle tank is automatically maintained at nearly full capacity during normal operation…" The recovered gauge was a nacelle tank gauge based on the needle style seen in photographs from the accident in 2016. It could not be determined if it was for the left or right tank.

The engine instruments were also visible in photos and videos obtained from the 2016 examination, and from the public, for comparison with what was found in the wreckage remnants. (See Figures 70 - 72)

Figure 70. Engine displays (Photo from: Textron Report ASI-16-CF, taken August 11, 2016)

Figure 71. Enhanced view of engine displays in image from public

Figure 72. Enhanced view of engine displays in image from public.

The engine instruments were found with the panel fragment which carried them. Most of the engine instruments were found packed with biological material that hydroformed the faces into the internal mechanisms. Numerous witness marks were found in each, as listed in the Attachment A description for each instrument. The majority had been immobilized at displays consistent with impact values. Neither the annunciator panel nor any of its associated lamps could be located in the wreckage.

The results of examining the engine gauges are shown below from left to right across the lower row and then left to right across the upper row.[10]

Left Engine core: 95%

Right Engine core: 114%

Left Prop Tachometer: 2,540 rpm

Right Prop Tachometer: 2,450 rpm

Left Fuel Flow: 360 PPH

Right Fuel Flow: Not discernable

- The facial display was not found.

[10] Due to NTSB policy restricting publication of images showing biological remains, no illustrations are shown. Descriptions are contained in Attachment A.

Left Oil Temp: 98 Degrees

Right Oil Temperature: 85 Degrees

Left Interstage Turbine Temperature: 720 °C

Right Interstage Turbine Temperature: 700 °C

Left Prop Torque: 625 LB.FT.

Right Prop Torque: 660 LB.FT.

Left Fuel Pressure: 28 psi

Right Fuel Pressure: 28 psi

Left Oil Pressure: 68 psi

Right Oil Pressure: 72 psi

A composite illustration was created to depict the collection of impact marks on the engine displays shown above. (See Figure 73)

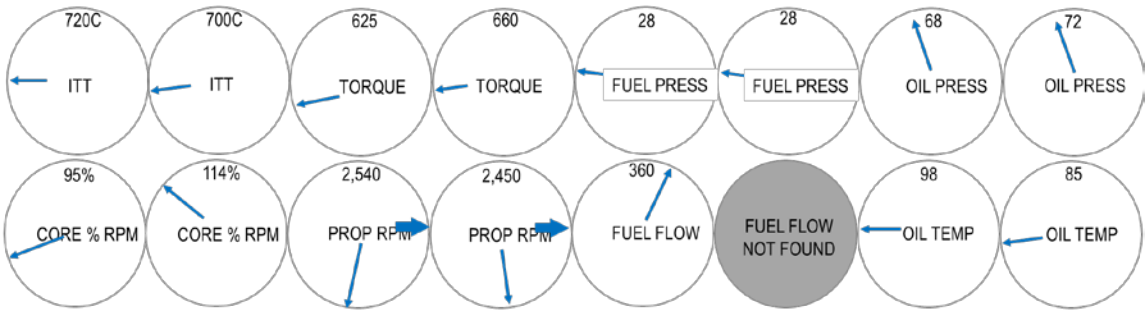

Figure 73. Collected values and approximate needle displays from examination of engine instruments.

2.10 ELECTRICAL:

Little remained of the airplane electrical system and most of the wiring which did remain was bare copper. After the post-crash fire, the steel generator housings from the engines were identifiable only by shape and location, and the circuit breaker panel from the cockpit was found to be missing numerous circuit breakers.

2.11 FLIGHT CONTROLS, GENERAL:

Fragments of each flight control surface and their associated trim tabs were identified, except for most of the left elevator and elevator trim tab. The missing areas of each were material which had been consumed by fire.

Control continuity could not be established due to the post-impact, fire, and human recovery damage. The lengths of steel flight control cables from within the aluminum fuselage were laying on the ground and many had been cut during victim recovery. A variety of kinks were in the cables, consistent with impact damage.

2.11.1 PITCH CONTROL AND TRIM SYSTEM[11]

The airplane had been equipped with a mechanically (no hydraulic assist) operated pitch control system. Trim inputs were provided directly by the pilot, and there was no electric trim or autopilot.

Each horizontal stabilizer had an elevator attached and each elevator had a single partial-span trim tab. The forward outboard corner of each elevator had a balance weight.

The two pitch trim actuator drums were connected by a 1/16-inch diameter pitch trim control cable that was routed to a drum beneath the cockpit control pedestal. The drum beneath the pedestal was connected by a link-chain to a rotating wheel, located on the left side of the pedestal.

The steel cockpit control column was the largest part of the pitch control system recovered from the cockpit. The forward cable bellcrank section from beneath the floor was in an area which had been consumed by fire. A section of the control column-to-bellcrank pushrod remained attached at the base of the column; the remaining section had been consumed by fire. The right side of the horizontal upper section of the control column was missing, the left side remained attached to the wheel shaft assembly; the control wheel had detached from the shaft (See Figure 74). The area of the aft fuselage bulkheads which had mounted the aft bellcrank were also consumed by fire and impact forces.

[11] See Attachment B, figures B3 and B4 for system descriptions.

Figure 74. Cockpit control column. (Photo from: Swaim)

As shown in previous figures, the right elevator remained from outboard of the trim tab and little was found of the left elevator. The right pitch trim drum and actuator rod were found and the extension from the actuator face to the center of the rod bolt was 1.06 inches. According to Textron, this actuator extension was consistent with a pitch trim position of 5 degrees tab trailing edge down. The full range of the elevator trim tab was 10 degrees tab trailing edge up to 21 degrees tab trailing edge down. (See Figures 75 and 76)

Figure 75. Right pitch control trim drum on fragment of horizontal stabilizer spar. (Photo from: Textron)

Figure 76. Right pitch control trim extension. (Photo from: Textron)

2.11.2 STALL WARNING SYSTEM

According to Textron, as designed, the stall warning/safe flight system consisted of a stall warning light on the upper LH corner of the instrument panel, a circuit breaker on the RH subpanel, a transistor switch mounted behind the instrument panel, and a lift transducer on the leading edge of the left wing. A safe flight indicator could be mounted on the glareshield above the LH instrument panel just to the left of the annunciator panel as an optional equipment on LJ-76 and LJ-114 thru LJ-1062[12], the safe flight indicator was not installed on LJ-1063 and After. When aerodynamic pressure on the lift transducer vane indicated that a stall was imminent, the transistor switch was actuated to complete the circuit to the red stall warning light. No provisions for an audible stall warning horn were installed on the accident aircraft and were not incorporated into the type until serial number LJ-357.

On the accident aircraft, the area of the wing containing the lift transducer was damaged during the accident impact (see figure 32), and the stall warning light could not be located.

2.11.3 AILERONS AND AILERON TRIM [13]

The right wing aileron control cables and a flap Teleflex cable were found cut consistent with victim recovery. (See Figure 77)

Figure 77. Post fire cut right wing aileron control cables. (Photo from: Textron)

[12] There was no indication that the accident airplane had the safe flight indicator installed.
[13] See Attachment B5 for system descriptions.

The aileron control stops in the left wing were found intact and unbent. The aft stop was found adjusted so that the bolt was almost fully seated and the forward stop bolt was fully extended (see Figures 78 and 79). The left forward aileron stop bolt would have been contacted when the left aileron was moving trailing edge up.

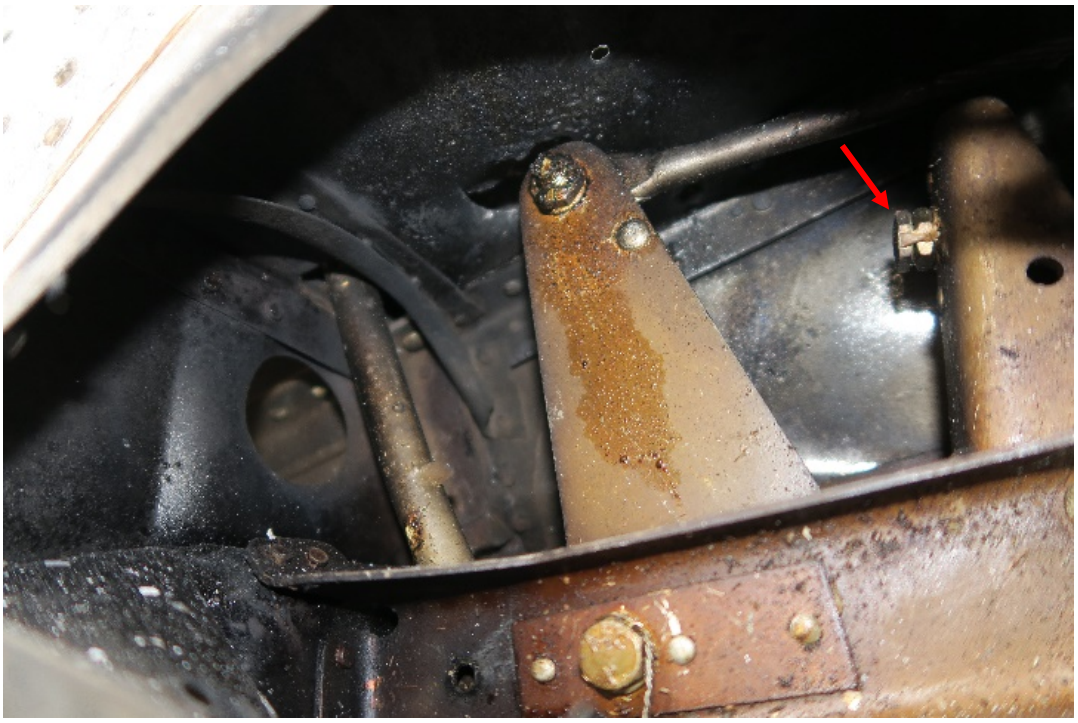

Figure 78. Left wing aileron control aft stop bolt found adjusted to seat. (Photo from: Textron)

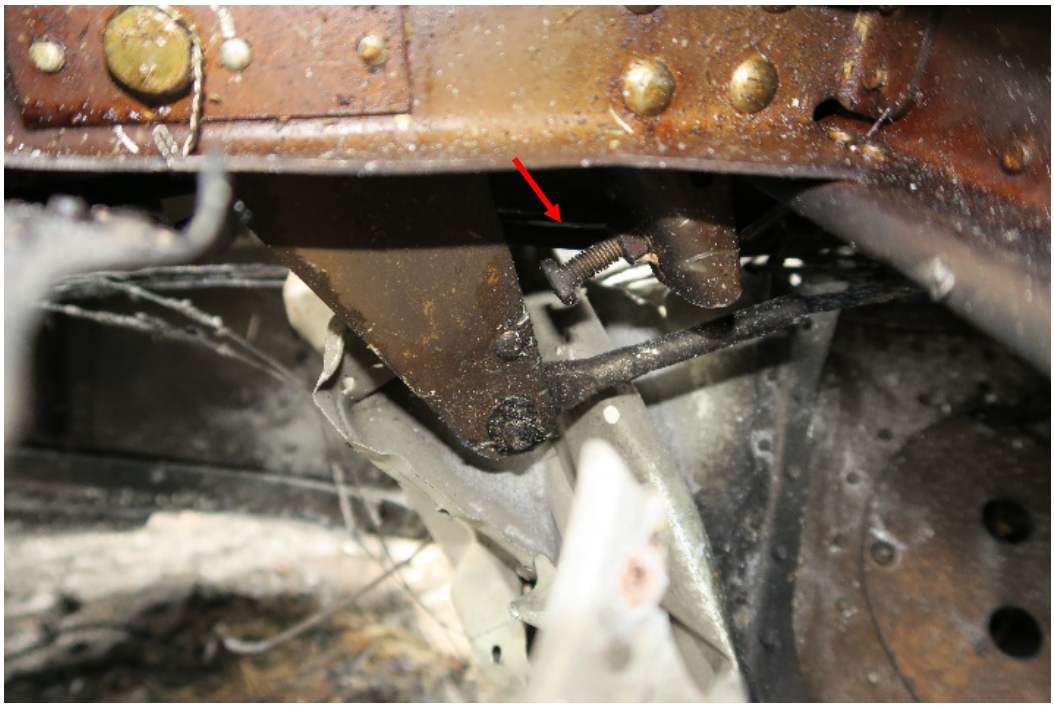

Figure 79. Left wing aileron control forward stop bolt found fully extended. (Photo from: Textron)

The aileron control stops in the right wing were also found intact and unbent in the mid-ranges of adjustment, unlike the ends of the adjustment limits found in the left wing. (See Figure 80)

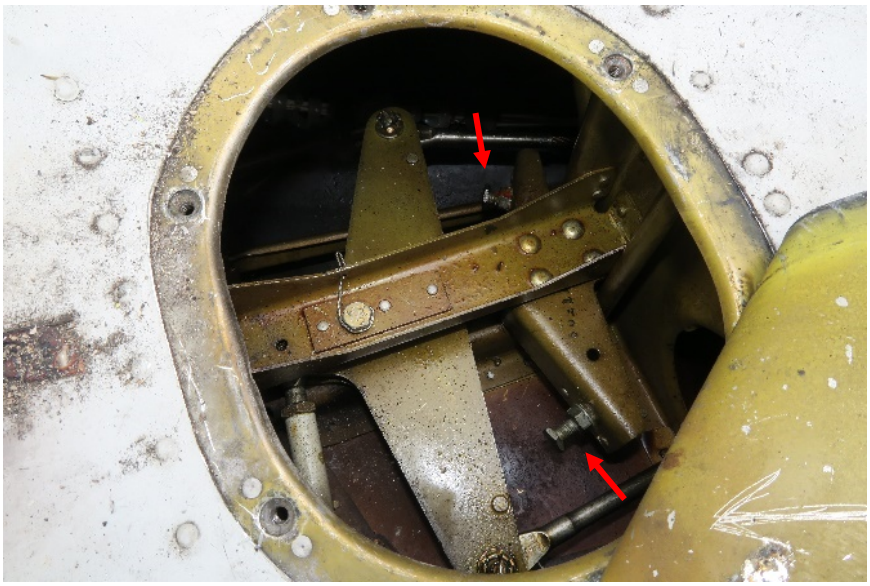

Figure 80. Right aileron control stops. (Photo from: Textron)

The right wing aileron tab anti-servo rod assembly was found broken and the fracture was covered with fire residue. (See Figure 81)

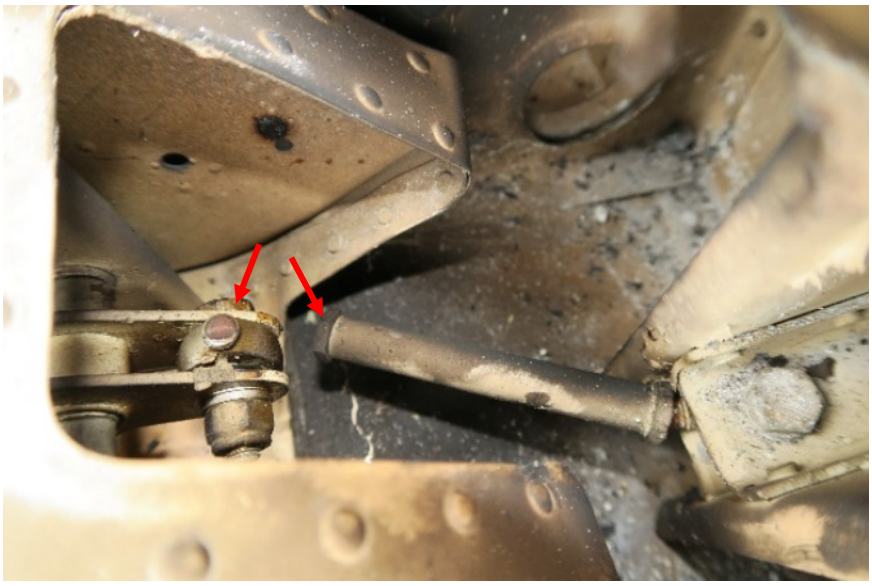

Figure 81. Right aileron tab anti-servo rod assembly with red arrows indicating the fracture surfaces (Photo from: Textron)

The AMM contained the trim tab and anti-servo tab values for travel.[14] (See Figure 82)

EFFECTIVITY	AILERON TRIM TAB TRAVEL	ANTI-SERVO TAB TRAVEL
PRIOR TO LJ-318	7.5° ± 1.5° UP 7.5° ± 1.5° DOWN	14° +2°/ -1° UP 8° +2°/ -1° DOWN
LJ-318 AND AFTER LW-1 AND AFTER	15° ± 1.5° UP 15° ± 1.5° DOWN	

Figure 82. Aileron trim tab travel values shown in AMM.

The aileron trim knob in the cockpit was found adjusted to the full left wing down position. This was the same position photographed after landing when the right horizontal stabilizer separated in 2016 and in a pilot photo of 2018. (See Figures 83 and 84)

[14] The adjustable trim tab was on the left wing and the right wing contained an anti-servo tab.

Figure 83. Cockpit control pedestal with aileron trim knob to left and rudder trim knob to right. Arrow points to flap handle in up/retracted position. (Photo from: Swaim)

Figure 84. Closer view of aileron trim knob with center "0" marking circled. (Photo from: Textron)

In wreckage from the left wing, the aileron trim actuator extension was found to be 0.65 inches from the face of the actuator to the center of the actuator rod bolt (See Figure 85). According to Textron, this actuator rod extension equates to a trim tab position of 7.5 deg trim tab trailing edge down. As noted in Figure 82, the aileron trim tab travel limit is 7.5 deg up or down (+/- 1.5 deg). Full deflection of the aileron trim tab downward would cause the left aileron to move upward and the corresponding right aileron to move downward causing the aircraft to roll to the left.

Figure 85. The aileron trim mechanism in the left wing was found extended 0.65 inches, corresponding with the position of the cockpit knob. (Photo from: Textron)

The outboard half (approximately) of the fire damaged left aileron was missing.

2.11.4 RUDDER AND RUDDER TRIM

Insufficient fragments of rudder control system components were found to determine pre-impact condition, damage, or positions.

The rudder trim control knob in the pedestal was found fixed in place and near center. (See Figure 86)

Figure 86. Rudder trim control knob with center “0” marking circled. (Photo from: Textron)

The rudder trim actuator extension was found to be 8.65 inches from the face of the actuator to the center of the actuator rod bolt. According to Textron, this actuator rod extension equates to a trim tab position of 5 deg trim tab trailing edge right (See Figures 87 and 88)

Figure 87. Rudder and trim remnants with exposed trim actuator. (Photo from: Textron)

Figure 88. Rudder trim measurement. (Photo from: Textron)

2.11.5 FLAPS

The flap handle was found in the UP position and the position indicator was not found (See Figure 89)

Figure 89. Arrow points to remnant of flap handle.

Remnants of the flap flex shafts were found twisted in the wreckage and heavily rusted from the post-crash fire. The left flap actuators were found loose in the wreckage. Both of the left flap actuators were in a position consistent with the flaps being in the up position (See figure 90).

Figure 90. Left side flap actuators

The outboard right flap actuator was found broken. (See Figure 91) The right flap actuator was found in the orientation of full flaps up. (See Figure 92)

Figure 91. Broken outboard right flap actuator. (Photo from: Textron)

Figure 92. Right flap actuating assembly extension indicated by arrow. (Photo from: Textron)

ATTACHMENT A

INSTRUMENT EXAMINATION CHARACTERISTICS LISTING

This Attachment provides details about damage and markings found in individual instruments cited in the body of the report.

Attitude Indicator:

- The indicator was found in a portion of the instrument panel with the facial features softly hydroformed to the gyroscope case. Crushed glass and biologic material were in the facial features. The reference image of an airplane silhouette was complete and nearly in the original position, displaced 4 degrees to left of center.
- From the level instrument frame, the displayed roll was 38.5 degrees from inverted and level, with the left wing (on the right) closer to the ground.
- The pitch display was 45 degrees nose down, as scaled from the facial display.

Altimeter:

- The altimeter was complete, less the facial glass and indicator needles.
- The Kollsman Window was found set at a quarter to a third of the distance between 29.92 and 29.94 in Hg.
- The remaining broken hub of what appeared to have been the thousands needle was found oriented toward slightly more than the 100 feet indication.

Fuel Quantity:

- Of the many cuts in the face of the indicator, few were along the movement of the needle.
- Paint cuts in the instrument face existed specifically at each end of the travel paths for the needle tip and needle counterweight.
- A series of paint disturbances radially outward from the pivot were in the orientation of the needle at one display location of slightly less than 1/8 of a full display.
- Note fuel calibration is only required for empty, making the exact quantity a rough estimate.

Left Engine core:

- The face was obscured when first found. Cleaning found the face to have been hydraulically pressed forward, especially toward the edges. The sides of the case had folded inward, with the biologic material trapping and encasing the display needle.
- Two scales were displayed by the indicator; a larger needle and a smaller inset dial which was missing the needle. The smaller dial was not recessed as seen on the face of the right engine gauge.
- The large needle was fixed and immovable.
- The short counterbalance tail was found straight and pointing toward the 30% marking. The tail had been pressed forward into the face.
- The long end was found slightly bent in a manner of the center pivot being fixed and the tip bent away from the inward fold of the instrument case, indicative of a bend following immobilization at the center pivot.

- No other strike marks, impressions, or markings on the face were found along the circumferential path of the needle tail.
- Compacted biological material was found as ridges along each side of the tail and the material did not fall away with the softer material during cleaning. This created silhouettes on the sides of the needle and around the counterbalance.

Right Engine core:

- The instrument face was partially encased in crushed glass and biologic material with the face pushed forward into the mechanism.
- The indicator had two scales, a larger needle denoting the ten percent graduations, and a smaller inset recessed dial denoting single units. The needle of the inset dial was not visible.
- The large needle was straight, fixed, and immovable.
- The counterbalance tail was pointing toward 48%
- The large needle was beyond the scale of 0-100%. Overlaying a rectangular shape to the scale on the other side of the instrument (from 36.5%-50.5%) and adding the value of 100% resulted in a display of 114%. The needle at this orientation covered/concealed the small needle beneath the large needle.
- Along the path of the large needle and along the circumferential path of the needle tail were no other impressions or markings on the face which were consistent with the path of the needle.
- The smaller dial for single digits was recessed and in two places the primary needle had been hydroformed into the smaller dial for single digits.
- The face of the display had a “clean shadow” beneath the tail of the large needle.
- Beneath the large needle was relatively cleaner than the general instrument face.

Left Prop Tachometer:

- The face contained two needles; a shorter needle to display thousands of revolutions and a longer needle to display hundreds.

Thousands (short) needle:

- The needle was found twisted with the tip lifted away from the instrument face.
- The bent thousands needle was found at a display of about 700 rpm.
- The raised side of the twisted edge had a round imprint the diameter of the right facial screw and the location was the distance of the screw to the needle pivot. Aligning with the circular area on the screw head, the needle display was oriented toward about the 2,300 rpm marking. The face was relatively clean in this area.
- The top side of the needle had a “plowed” accumulation of debris along the widest portion, indicative of movement before coming to rest.
- The tail of the needle had also been slightly twisted and bent downward. The length of the tail was almost the distance of the pivot to the left facial screw and with rotation the corner of the tail appears to slightly cover the edge of the screw.
- The inboard edge of the left facial screw had a downward scrape and the top corner of the needle tail was clean. Placing the shape of the tail toward the screw resulted in the needle pointing toward about 2,300 rpm.

Hundreds (long) needle:

- The needle was also found twisted and was immobile at a display of about 450 rpm.
- The round counterbalance of the needle tail was caught on the side of the thousands needle, which had markings consistent with being displaced into the hundreds needle.
- Light scrapes in the arc of the needle tip were found between about 540 rpm and 450 rpm on the face of the instrument.

Right Prop Tachometer:

- The face contained two needles; a shorter needle to display thousands of revolutions and a longer needle to display hundreds. The outside edges of the face were found pressed into the instrument mechanism and the area was found packed with biological debris.

Thousands (short) needle:

- The needle was found fixed between the 2,000 and 3,000 display markings, near the 2,500 rpm display.
- The needle was over the right facial screw with the tip and an edge pressed to the facial display around the screw.
- The tail of the needle was straight in relation to the pointer and also pressed to the face, such that the corner was too close to the face to pass over the left facial screw. The screw had no scrape marks.
- Biologic debris was found packed around the needle tail.

Hundreds (long) needle:

- The needle was found pointing toward the 450 rpm display with the length of the needle raised away from the face.
- The counterbalance on the tail had been bent forward into the instrument face and the bend was sharp enough to crack the paint on the needle.
- A cut in the paint of the instrument face existed at a display of about 470 rpm and the cut was parallel to the edge of the needle. Parallel marks exist which were not radiating from the center of the instrument, indicating that the origin of this cut was indeterminate.

Left Fuel Flow:

- The face of the display was found tightly packed with biologic remains and crushed glass after gentle cleaning of loose debris.
- The single needle was found indicating about 360 Lbs per hour.
- The face was examined for other potential indications and none were found in the radial travel path or at the orientation of the edges of the needle.

Right Fuel Flow:

- The facial display was not found.

Left Oil Temp:

- The gauge had been crushed in the lower left quarter and packed with biologic material covered by sand and other debris.

- The single display needle had been displaced upward to indicate about 98 degrees.

Right Oil Temperature:

- The edges of the display had been hydroformed forward around the mechanism and coated with a mixture of biologic and other debris.
- Cleaning revealed a display of about 85 degrees. The center cover over the needle pivot had been hydroformed around the needle.

Left Interstage Turbine Temperature:

- The instrument face was found encased in biologic material.
- The indicator had one needle which was found straight, fixed, and immovable. The center pivot of the needle had a cover disc which was found hydroformed onto the base of the needle.
- Outboard of the cover disc, the center of the needle was soft formed forward, toward the instrument face. The face had no scrub marks at that radius.
- Biologic material was found packed near the tip silhouettes the needle tip.
- A clean shadow without biologic material existed beneath the needle.

Right Interstage Turbine Temperature:

- The upper half of the instrument face was encased in biologic material.
- The center pivot of the needle had a cover disc and sharp hydroform marks at the width of the needle (red arrows) were in the edge.
- The indicator had one needle which was straight, fixed, and immovable at 650 °C.
    - Biologic material was found beneath the needle in this orientation.
    - The location did not fit the hydroform marks.
- Orienting the shape of the needle to beneath the hydroform marks resulted in the needle indicating about 700 °C.
- A cut in the white paint of the number “7” aligned with the width of the needle at a display of about 700 °C.

Left Prop Torque:

- The gauge was found packed with biologic material pressing the facial features forward into the mechanism, with the upper left and upper right corners crushed inward.
- The center pivot of the needle had a cover disc and two sets of hydroform marks were found in the disc in two directions.
- The sharper hydroform marks originated at the center of the disc and a line extended from the center pointed toward a display of about 625 LB.FT.
- The tip of the single needle was found at a display of about 1070-1080 LB.FT.
    - The hydroform marks associated with this indication were muted and less distinct than marks indicating 625 LB.FT.
- The pivot end of the needle was found displaced from center.

Right Prop Torque:

- The upper left face was found packed with biologic debris and glass fragments, with portions of the face pressed forward into the mechanism. A glass fragment was oriented downward and into the edge of the display needle.
- Once gently cleaned the needle was found immovable at about the 630 LB.FT display.
- The center pivot of the needle had a cover disc and hydroform marks at the width of the needle shaft were in the edge of the disc at slightly above the 630 LB.FT. indication.
- The shape of the upper edge of the needle fit two accumulations of biologic material with the display at about 660 LB.Ft.
- Under magnification, a downward displacement of material existed from the 660 toward 630 LB.FT. indications.
- The bottom of the needle had a “plowed” accumulation of debris.

Left Fuel Pressure:

- The indicator had a single needle, immobile at a display of about the same 28 psi displayed in the right gauge, packed with glass and other debris.
- The face of the display and cover over the center of the needle had a slight hydroform over the base of the needle in this display.

Right Fuel Pressure:

- The indicator had a single needle, immobile at a display of 28 psi.
- The face of the display and cover over the center of the needle had been hydroformed forward.
- Minor nicks in the edge of the cover and a general deformation of the cover existed in about the displayed needle position.
- No deformities at the edge of the cover were found to exist apart from the displayed position of the needle.

Left Oil Pressure:

- The case was found bent inward in the lower left corner and across the top.
- The indicator had a single needle, found loose and able to move when the instrument case was moved.
- An imprint of a needle width path was on the face of the instrument and the center cover disc was soft-edged hydroform ridge along this orientation.
- The indicated temperature at the imprint was about 68 psi.

Right Oil Pressure:

- The face was found packed with biologic material pressing the face into the mechanism. The case had been bent inward in the lower left corner and across the top.
- The indicator had a single needle, found displaced to the left of the center pivot and the tip was at 68 psi.
- A cut in the face and hydroform of the center cover disc were found oriented to a display of 72 psi.

ATTACHMENT B

Airplane Maintenance Manual Illustrations

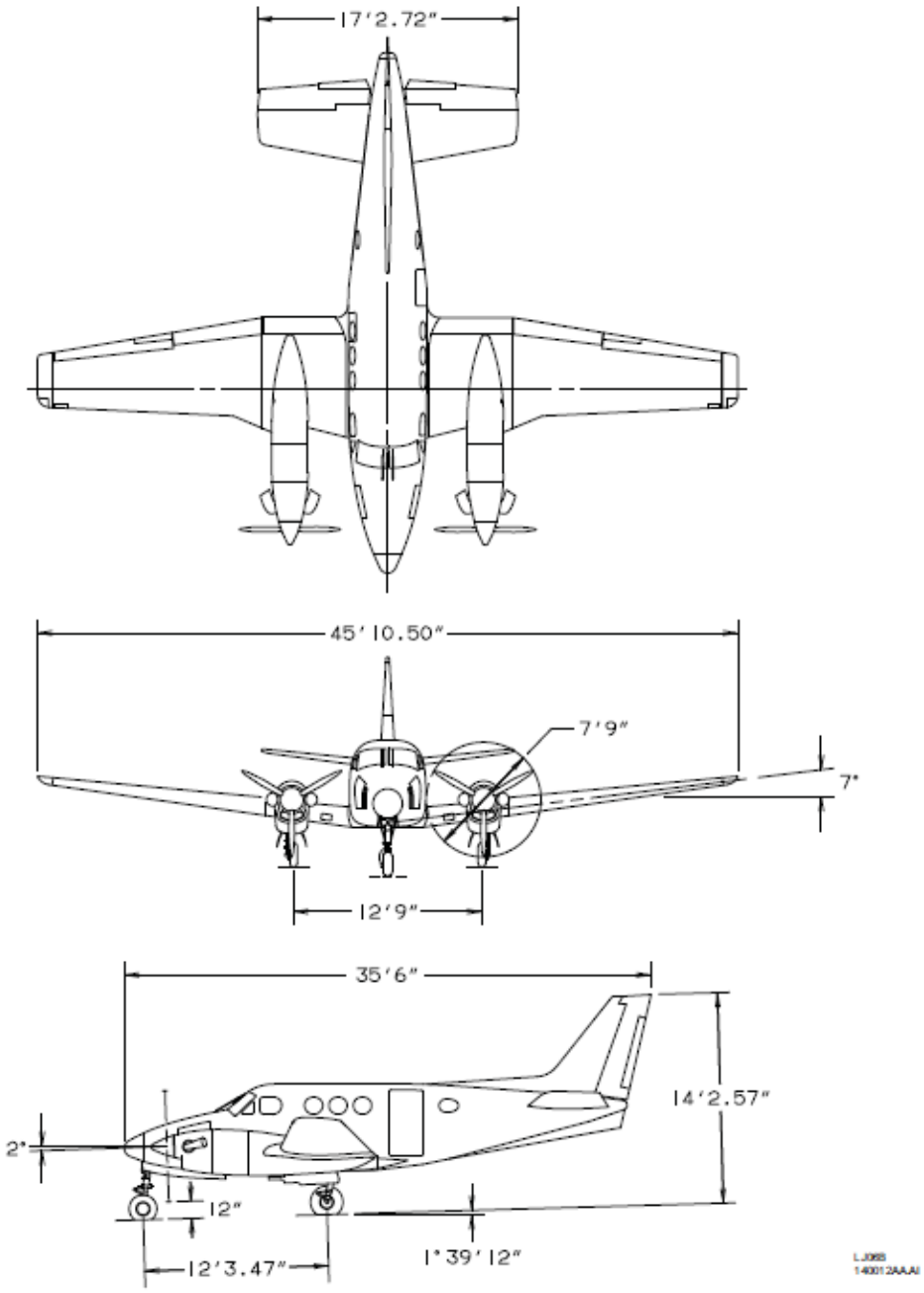

Figure 1
Airplane Dimensions
(LJ-1 thru LJ-317)

Figure B1. Dimensions from AMM

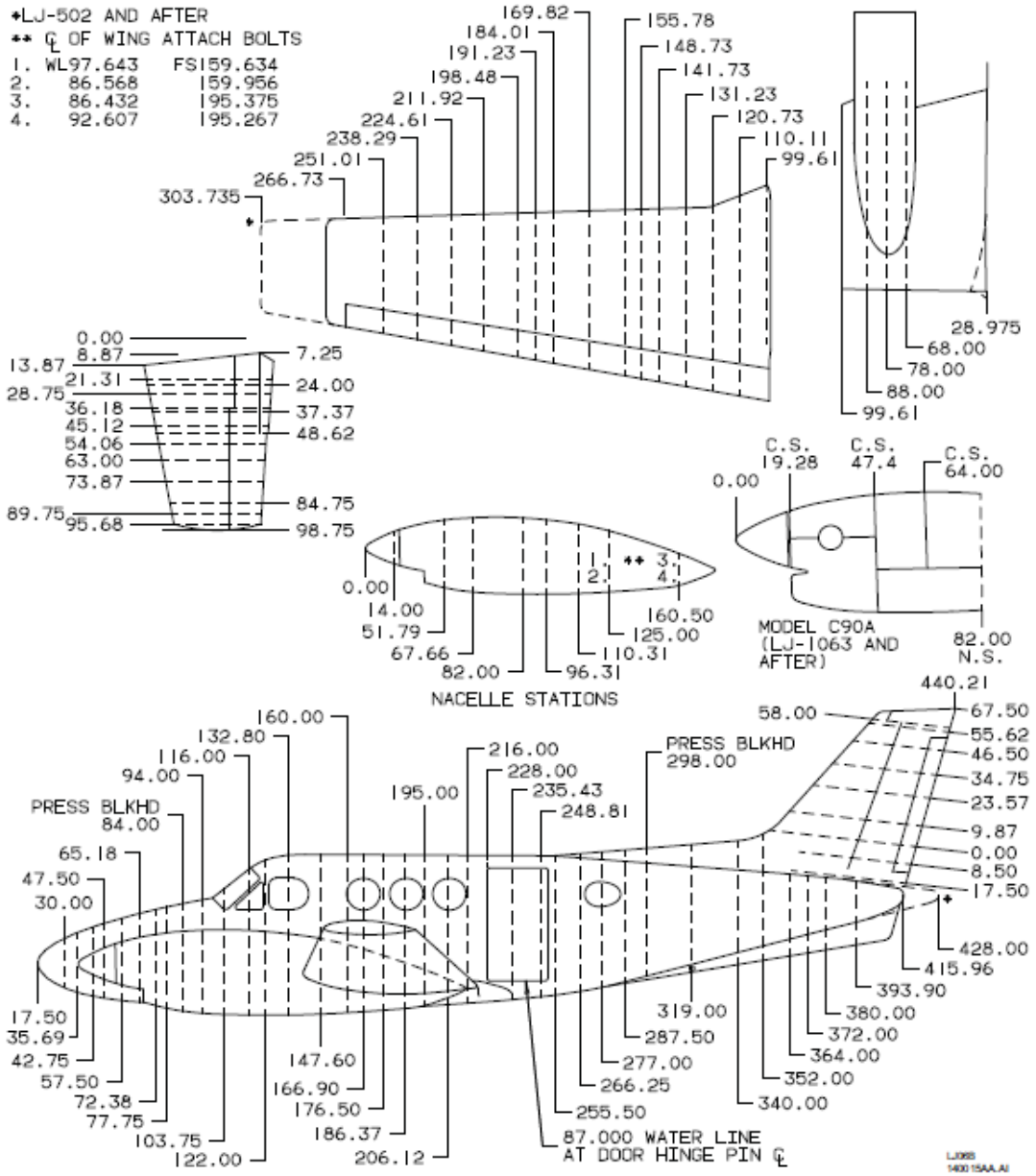

Figure 4
Stations Diagram
(LJ-1 and After; LW-1 and After)

Figure B2. Aircraft stations from AMM

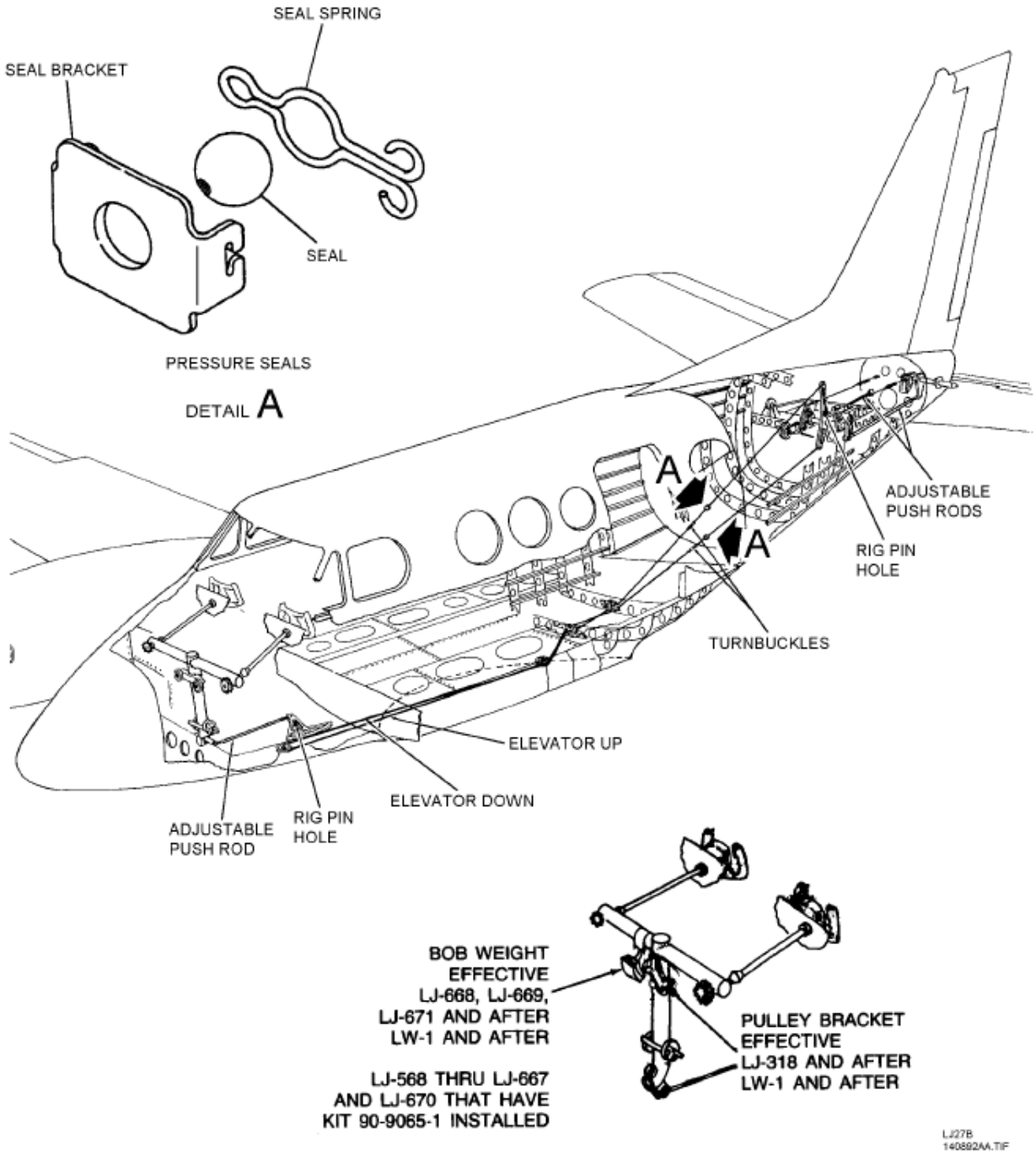

Figure 502 (Sheet 1 of 2)
Elevator Control System

Figure B3. Elevator control system from AMM.

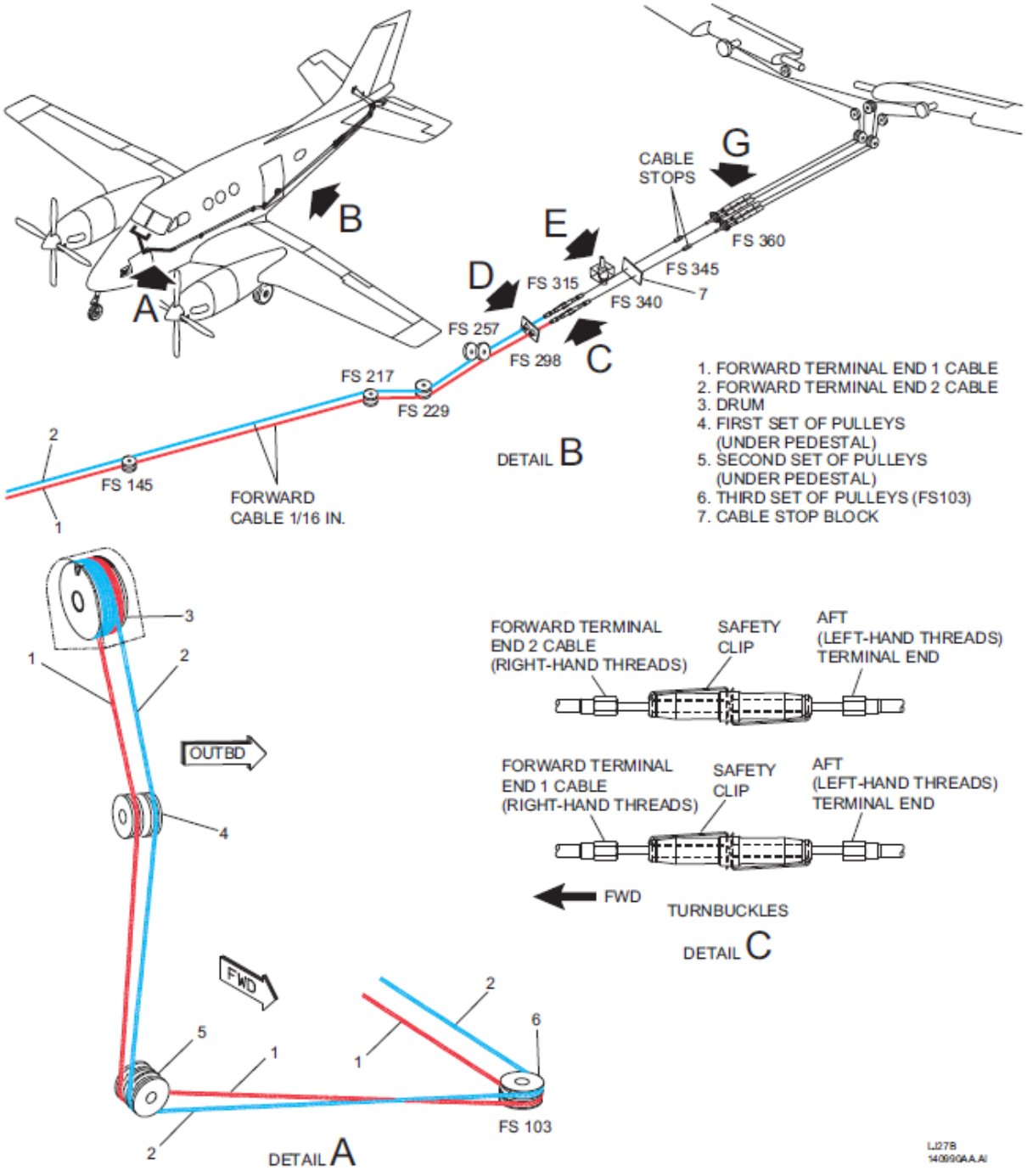

Figure 402 (Sheet 1 of 2)
Elevator Tab Control System

Figure B4. Elevator trim system from AMM

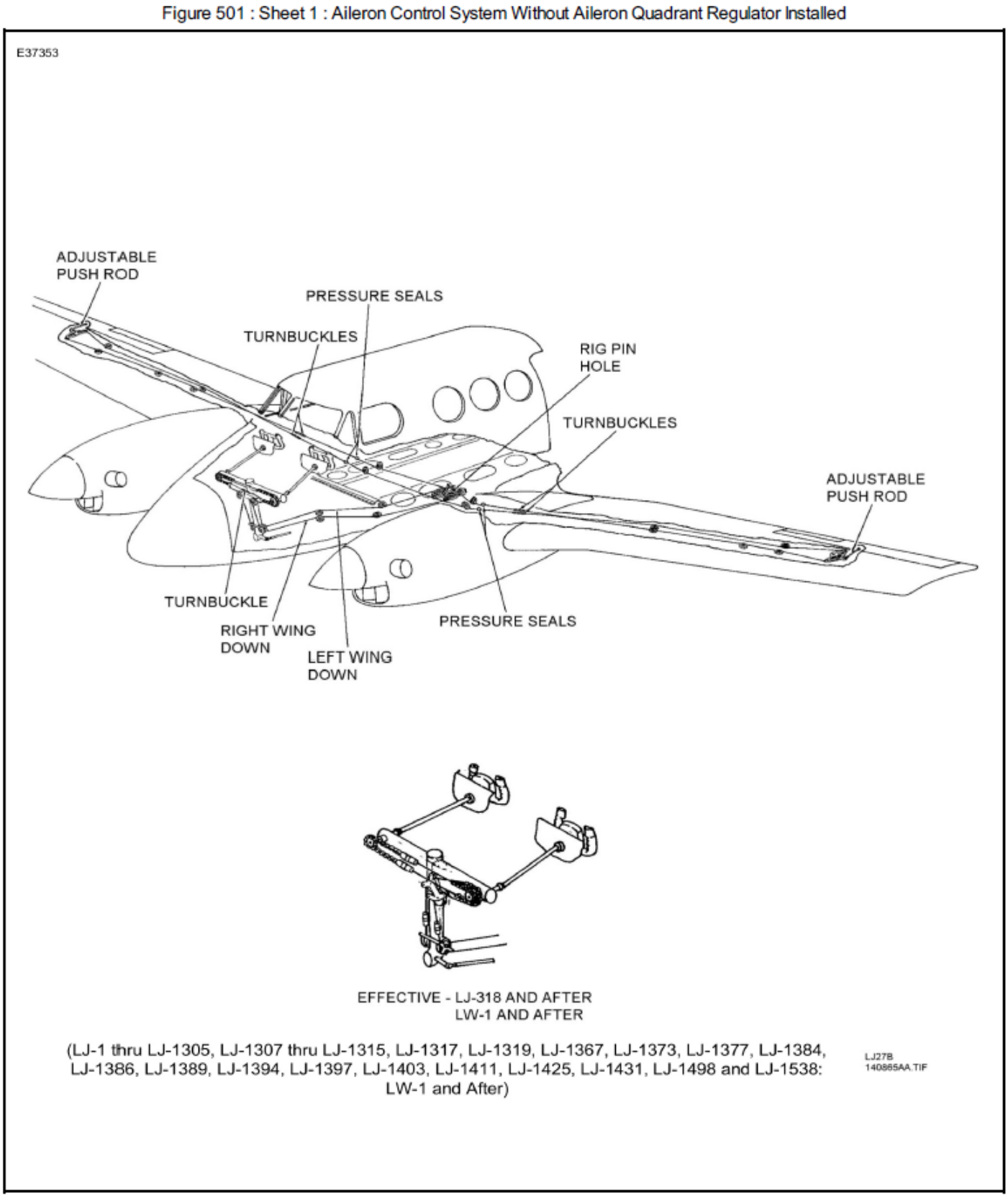

Figure B5. Aileron control system from AMM.

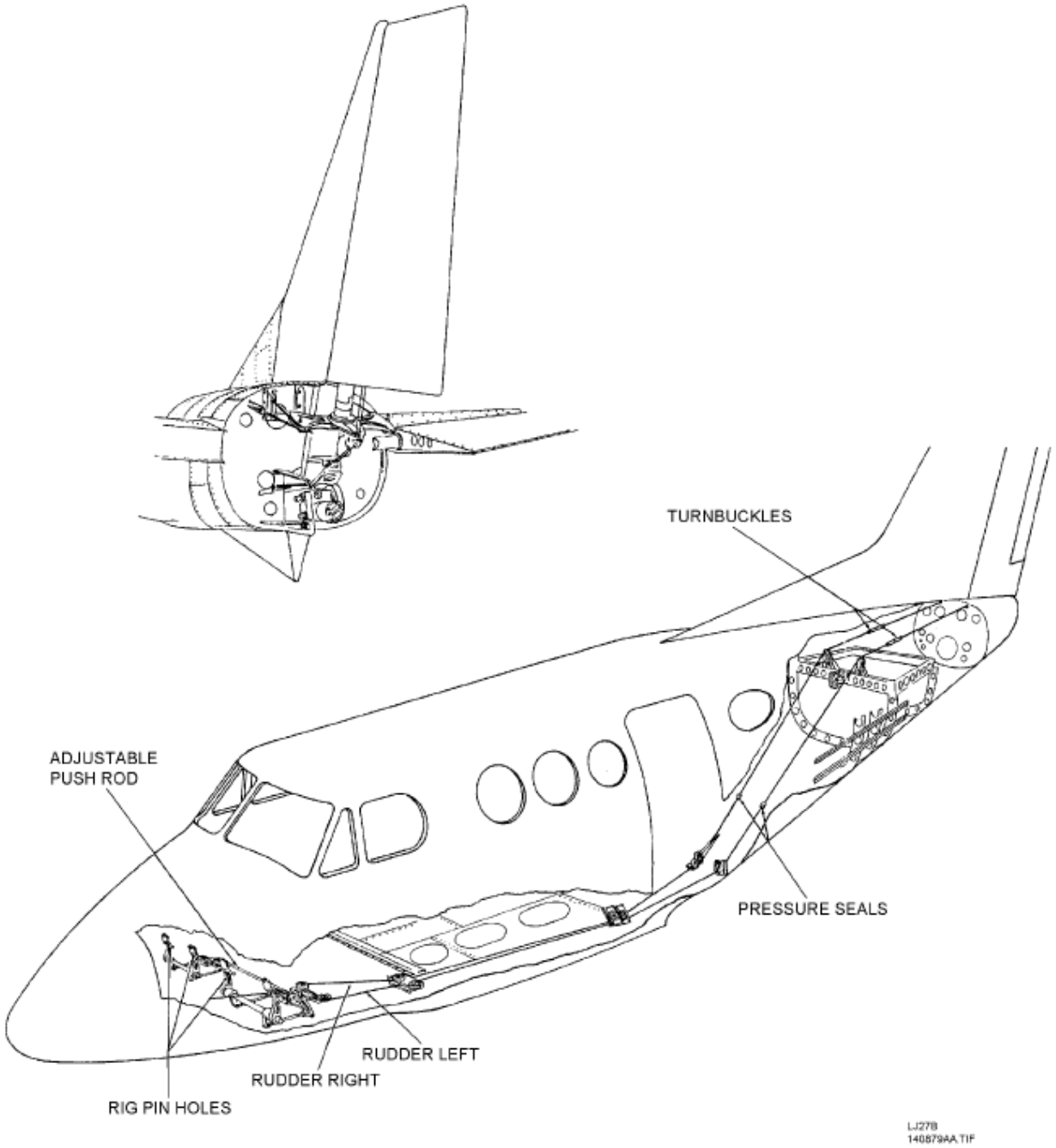

Figure 501 (Sheet 1 of 2)
Rudder Control System

Figure B6. Rudder control system from AMM.

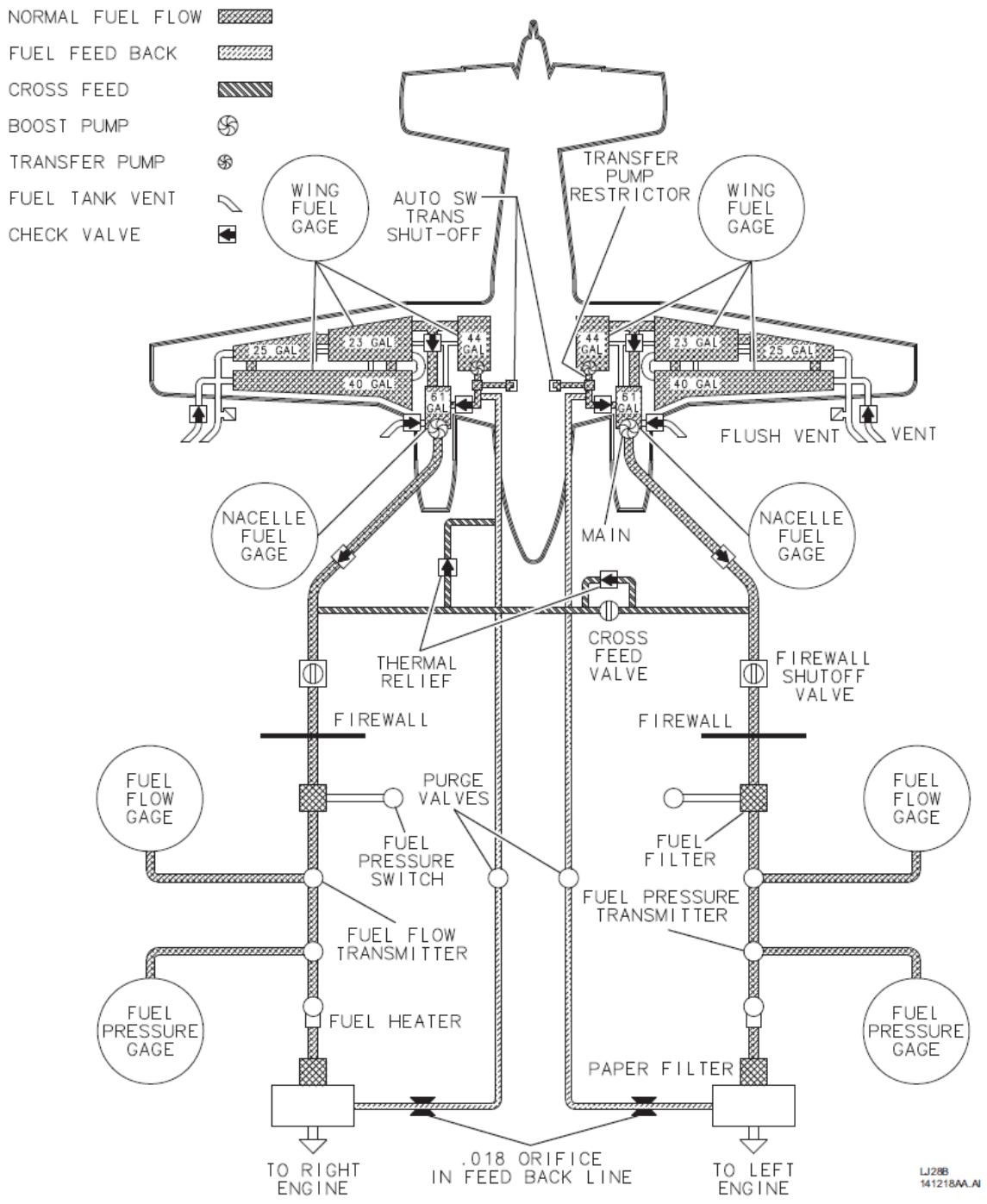

Figure 3
Fuel System (LJ-76, LJ-114 thru LJ-501)

Figure B7. Airplane Maintenance Manual depiction of fuel system (Page 16).