



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

STRUCTURES GROUP CHAIRMAN'S FACTUAL REPORT

October 7, 2019

A. ACCIDENT: CEN19FA030

Operator: Bismarck Air Medical
Location: Harmon, North Dakota
Date: November 18, 2018
Time: 2240 Central Standard Time
Aircraft: Cessna 441
Registration: N441CX

B. STRUCTURES GROUP

Chairman: Clinton R. Crookshanks
National Transportation Safety Board
Denver, Colorado

Member: Eleazar Nepomuceno
National Transportation Safety Board
Seattle, Washington

Member: Eric West
Federal Aviation Administration
Washington, District of Columbia

Member: Henry Soderlund
Textron Aviation
Wichita, Kansas

Member: Jonathan Ternes
Bismarck Air Medical
Bismarck, North Dakota

C. SUMMARY

On November 18, 2018, at 2240 central standard time, a Cessna 441, N441CX, was destroyed when it broke up in-flight and impacted an open field near Harmon, North Dakota. The airline transport certificated pilot, flight nurse, and paramedic were fatally injured. The airplane was registered to and operated by Bismarck Air Medical under the provisions of Title 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed at the time of the accident, and an instrument flight rules (IFR) flight plan had been filed for the air medical cross-country flight. The flight originated from Bismarck Municipal Airport (BIS), Bismarck, North Dakota, at 2230, and was en route to Sloulin Field International Airport (ISN), Williston, North Dakota.

D. DETAILS OF THE INVESTIGATION

1.0 Airplane Overview

The Cessna 441 Conquest II is a twin-engine, pressurized, low wing, all metal airplane with a conventional tail and retractable tricycle landing gear (Figure 1¹). The airplane is 39.02 feet long, 13.14 feet tall at the tail, and has a wingspan of 49.33 feet. The airplane is powered by two Garrett TPE331 turboprop engines with McCauley 4-blade full-feathering tractor propellers. The accident airplane was configured for air medical transport and had small winglets installed at the outboard end of each wing increasing the wingspan by about 6 inches.

Cessna defines the location of parts of the airplane longitudinally and laterally using station locations and vertically using waterline locations measured in inches from a datum as shown in Figures 2 and 3. The fuselage station (FS) datum is located forward of the nose of the airplane. The center wing station (CWS) datum is located at the centerline of the airplane and distances on the left and right sides are measured outboard to the end of the center wing. The panel (outboard) wing station (PWS) datum is located at the attach point to the center wing and is defined as PWS 10.00 on the left and right outboard wings. The horizontal stabilizer station (SS) datum is located at the centerline of the airplane and distances on the left and right sides are measured outboard. The waterline (WL) datum is parallel to the ground and located 84 inches below the propeller centerline. The Cessna 441 wing is manufactured in 3 pieces. The center wing spans from outboard of the left engine to outboard of the right engine (LCWS 120.411 to RCWS 120.411) and is about 20 feet long. The outboard wing sections, each about 14.5 feet long (PWS 10.00 to PWS 184.32) attach to the center wing at left or right CWS 120.411 (PWS 10.00). The center wing is constructed with 3 spars, a front spar centered at FS 169.05, a main spar centered at FS 177.45, and a rear spar centered at FS 204.05. The outboard wings are constructed with 2 spars, a main spar and an aft spar that connect with the center wing main and aft spars.

2.0 Debris Field

The airplane broke up into many pieces and the wreckage was scattered in an area of farm fields about 20 miles northwest of Bismarck Municipal Airport. The debris field was about 2,500 feet long and about 750 feet wide and oriented in a north-south direction. The southern end of the debris

¹ All Figures are presented in Appendix A.

field consisted of lighter weight parts of the airplane including baggage doors and the left and right horizontal stabilizers. The northern end of the debris field was marked by the left and right engines. The fuselage and wing debris was scattered throughout the middle of the debris field.

3.0 Wreckage Exam

The wreckage was examined by the group at the storage facility in Bismarck, ND, June 13-14, 2019.

Fuselage

A section of the forward fuselage and a section of the aft fuselage were recovered somewhat intact with extensive damage. The center portion of the fuselage was fragmented into many pieces.

The forward fuselage was mostly intact from about FS 14, the forward bulkhead, to about FS 156, the aft end of the cockpit, but had extensive damage. The radome was separated from the forward bulkhead at FS 14. The forward avionics bay was separated at the FS 43 bulkhead but remained attached to the section by the wires. Both baggage doors and the avionics bay door were separated from the forward fuselage. The forward fuselage was recovered upright and had severe upward crushing of the lower half. There was an area of mechanical deformation, fractured structure, scratched paint, and gouging of the skin on the upper right fuselage above the right windshield and both windshields were fractured. The right fuselage skin was peeled open below the area of damage and the upper fuselage was crushed downward above the cockpit.

The center fuselage structure between about FS 156 and FS 246 was fractured and separated into several pieces. Most of the fuselage structure, including the three window frames from each side, was identified in the recovered wreckage.

The aft fuselage was mostly intact from about FS 246, the forward side of the entry door, to about FS 404, the aft end of the fuselage, but had extensive damage. The aft fuselage separated along the FS 246 frame. The upper portion of the aft fuselage was fractured near FS 325, the aft pressure bulkhead, and the aft fuselage was bent down around this point. The vertical stabilizer remained attached to the aft fuselage at the FS 357 and FS 386 bulkheads, but it was deformed aft and downward. The dorsal fin remained attached to the upper aft fuselage but was fractured coincident with the FS 325 fuselage damage and with the leading edge of the vertical stabilizer. The aft fuselage was recovered upright and had severe upward crushing of the lower half. The cabin door was intact and installed.

Empennage

The vertical stabilizer remained attached to the aft fuselage and both attach points were intact. The leading edge was deformed to the right between about WL 140 and WL 200. The rudder was fractured from the vertical stabilizer but remained attached by the control cables. The upper portion of the rudder including the counterweight was separated from the rudder. The upper rudder hinge was intact, and the hinge fitting was pulled from the rudder. The center rudder hinge was intact, and the hinge fitting was pulled from the vertical stabilizer. The lower rudder hinge pin was intact, and the rudder hinge fitting was fractured. The rudder trim tab was intact and remained attached.

The horizontal stabilizer and elevators separated from the aft fuselage during the accident and were recovered in the debris field. The left and right forward horizontal stabilizer attach bolts were intact and installed but the fuselage bulkhead segments were torn from the fuselage. The aft horizontal stabilizer attach bolts were intact and installed in the aft fuselage bulkhead, but the aft attach flange was fractured from the horizontal stabilizer. The right side of the horizontal stabilizer was fractured and separated near RSS 10. The spars were deformed upward at the fracture location. The right horizontal stabilizer was partially intact. A section of lower skin was separated between RSS 10 and RSS 43. The right side of the horizontal stabilizer rear spar was separated between RSS 10 and RSS 51 and not identified in the recovered wreckage. The left side and center section of the horizontal stabilizer was intact and mostly undamaged between RSS 10 and LSS 114. There was some crushing damage to the leading edge between about LSS 10 and LSS 18. The left and right fixed trailing edge segments were separated from the horizontal stabilizer and mostly undamaged.

The left and right elevators separated from the horizontal stabilizer during the accident. The center elevator control horn was intact in the aft fuselage and both torque tubes were separated from the control horn fittings. The right elevator was mostly intact and had slight downward deformation along its length. The right trim tab remained attached to the right elevator. The right trim actuator was fractured from the horizontal stabilizer and right elevator. The right elevator counterweight separated from the right elevator near RSS 107. The left elevator was partially intact and damaged. The left elevator lower skin was separated outboard of LSS 18. The left elevator was deformed upward about 60° near LSS 58. The left trim tab remained attached to the left elevator and was deformed upward coincident with the elevator. The left trim actuator was intact and attached to the tab but fractured from the horizontal stabilizer. The left elevator counterweight was separated from the left elevator near LSS 107. The right and left center and outboard elevator hinges were intact, and the hinge fittings were pulled out of the elevators.

Wings

The right wing was mostly intact from about RCWS 27 to the tip near RPWS 187 but damaged. The right wing was recovered laying on its upper surface and there was crushing damage to the upper skin along its length. There was a hole in the upper skin above the right main landing gear. The right winglet and wingtip were attached. There was leading edge impact damage and lower skin mechanical damage and fracturing along the entire chord between about RPWS 53 and RPWS 67. The main and rear spars were partially fractured near RPWS 60. The right aileron was intact and attached to the right wing and had buckling damage on the upper and lower skins. The right outboard flap was intact and attached to the right wing by the push rods, but the rollers were disengaged. The right inboard flap was mostly intact but separated from the wing. There was buckling and fracturing of the upper flap skin between about RCWS 79 and RCWS 85. The right engine and mount were separated from the wing.

The left wing was fractured into two major pieces and several smaller pieces. The inboard section of left wing was mostly intact from about LCWS 27 to LPWS 105. The outboard section of left wing was mostly intact between LPWS 108 to LPWS 166. The left wingtip and winglet were separated from the outboard wing section. There was an area of extensive mechanical damage, crushing, and deformation between LPWS 75 and LPWS 166 that included scratched paint, black transfer marks, and gouging of the aluminum. A section of the leading edge and lower wing skin was separated between about LPWS 105 and LPWS 128. There were two distinct impact

impressions in the leading edge centered near LPWS 122 and LPWS 151. There were red transfer marks on the upper wing skin between about LPWS 129 and LPWS 150. The left outboard flap was intact and attached to the inboard section of wing with little damage. The left inboard flap was intact and attached to the inboard section of wing but was damaged between about LCWS 75 and LCWS 120. The left aileron was separated and fractured into 3 pieces, all with extensive mechanical damage, crushing, deformation and gouging damage. The inboard aileron section spanned from about LPWS 72 to LPWS 108, the center aileron section spanned from about LPWS 108 to LPWS 139, and the outboard aileron section spanned from about LPWS 139 to LPWS 148. The outboard aileron hinge pin was intact, and the outboard hinge was fractured. The inboard aileron hinge was intact, and the hinge fitting was pulled from the wing. The aileron trim tab remained attached to the left inboard aileron section. The left engine and mount were separated from the wing.

The center wing area between about LCWS 27 and RCWS 27 where it passes through the fuselage was extensively damaged and deformed. The forward spar upper cap was fractured near RCWS 18 and LCWS 1, and the section between the fractures was separated. The forward spar upper cap exhibited s-bending in the fore-aft and up-down directions when reconstructed. The forward spar lower cap was fractured near RCWS 16 and LCWS 18, and the section between the fractures was separated. The forward spar lower cap exhibited upward bending deformation when reconstructed. The main spar upper cap was fractured near CWS 0 (airplane centerline). The main spar upper cap exhibited s-bending in the fore-aft direction between about LCWS 24 and RCWS 15. The main spar lower cap was fractured near LCWS 24. The main spar lower cap vertical flange was fractured and separated and not identified in the recovered wreckage. The main spar lower cap exhibited upward bending deformation. The rear spar upper cap was fractured near RCWS 27, RCWS 11 and LCWS 26 and the sections between the fractures were separated. The rear spar upper cap exhibited upward bending deformation when reconstructed. The rear spar lower cap was fractured near RCWS 20. The rear spar lower cap exhibited upward bending deformation. The fractures in the spar caps were matched at all forward, main, and rear spar fracture locations.

Cowling

The left and right engines separated from the wings during the breakup. The left engine impacted the ground on the outboard side. The left upper cowl was mostly intact but had extensive crushing and mechanical damage on the outboard side. The leading edge of the left upper cowl was folded down. There was no obvious damage to the upper or inboard sides of the left upper cowl. The right engine impacted the ground on the outboard side. The right upper cowl was mostly intact but had extensive crushing and mechanical damage on the outboard side. There was a distinct area of crushing, black transfer marks, scratching and gouging on the aft half of the upper right cowl from the inboard side around to the outboard side.

All the fractures examined had angular features and a dull, grainy appearance consistent with overstress separation. There was no evidence of corrosion or other pre-existing conditions on any of the structure examined.



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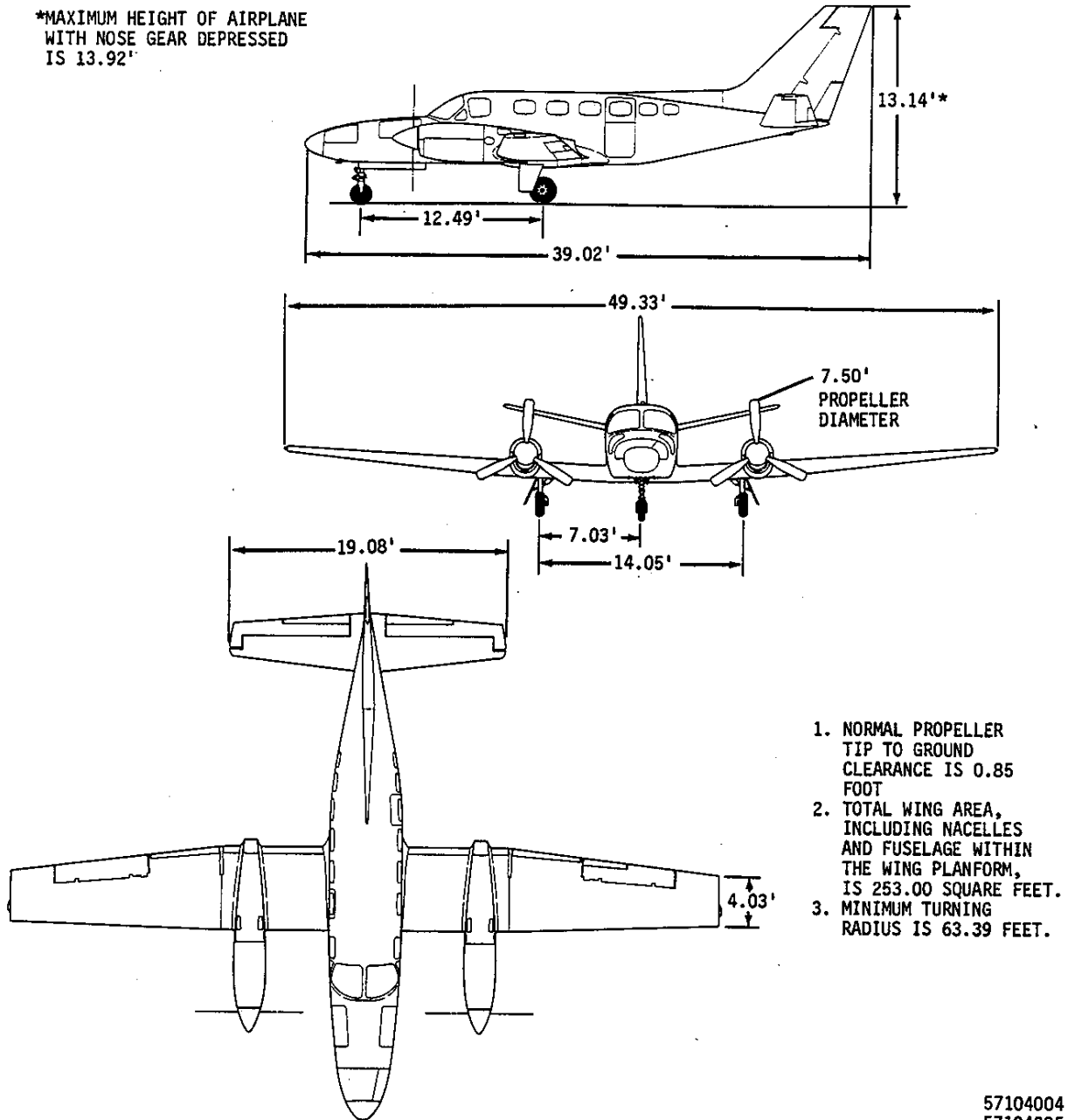
STRUCTURES

Group Chairman's Factual Report

CEN19FA030

**Appendix A – Figures
(3 pages)**

*MAXIMUM HEIGHT OF AIRPLANE
WITH NOSE GEAR DEPRESSED
IS 13.92'



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Figure 1 - Cessna 441 Conquest II 3-view drawing

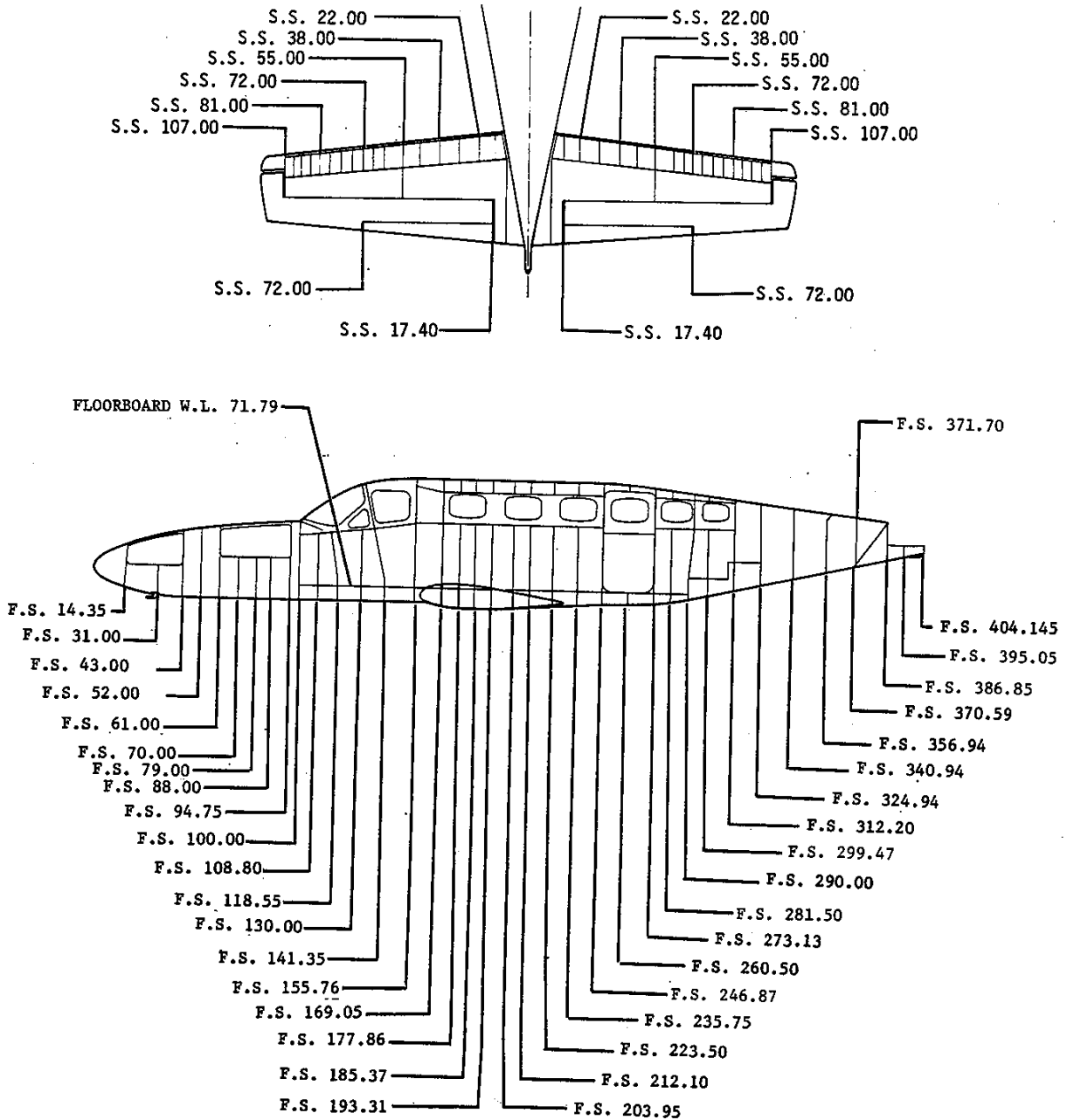


Figure 2 – Cessna 441 fuselage station and stabilizer station diagram

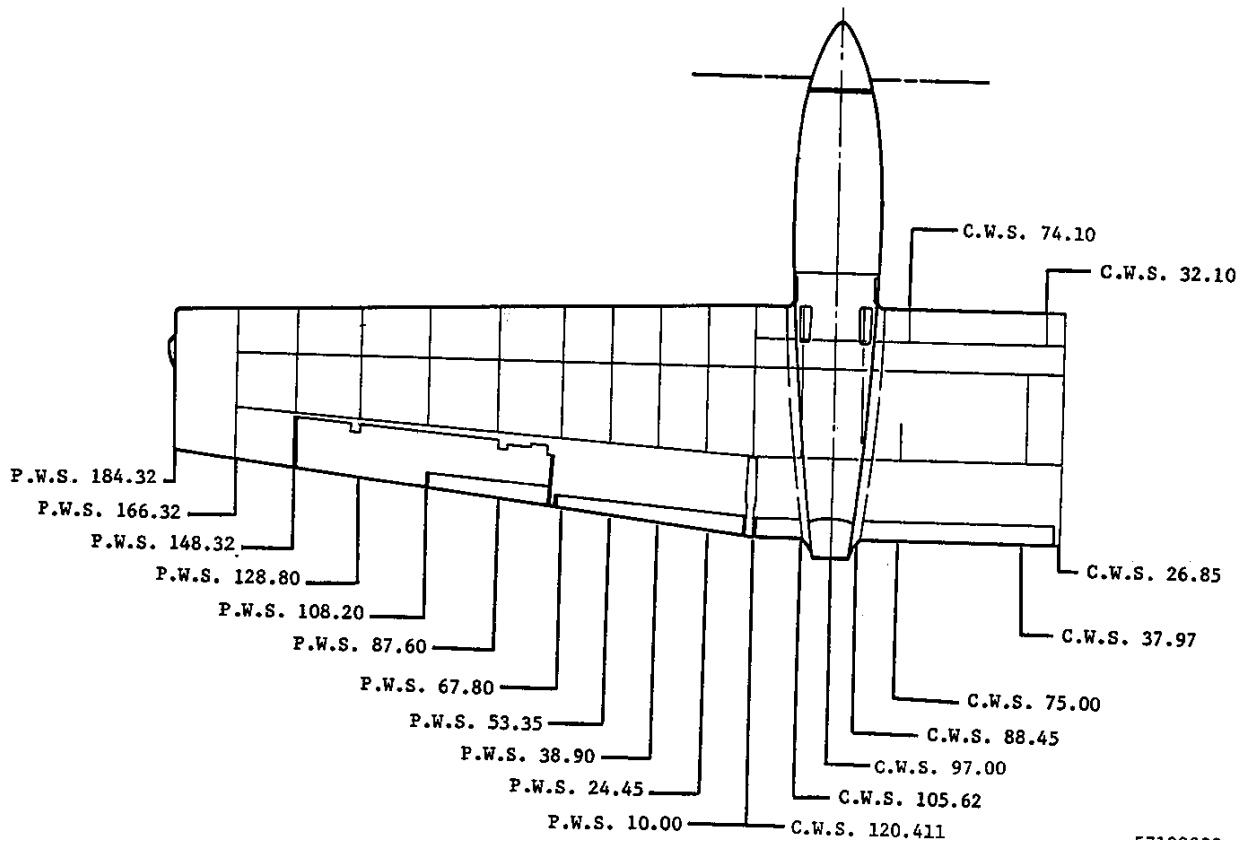
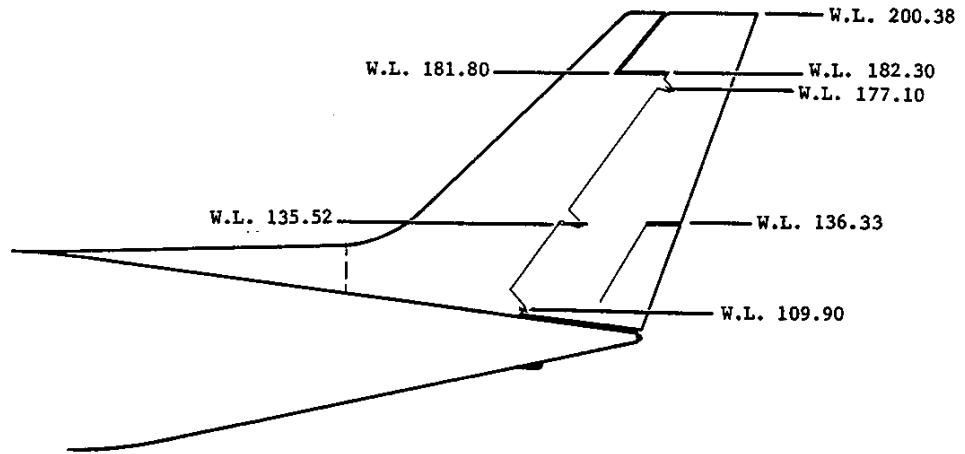


Figure 3 – Cessna 441 wing station and waterline station diagram