



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

AIRFRAME AND ENGINE EXAMINATION

WPR18FA013

This document contains 46 embedded photos.

A. ACCIDENT

Location: Four Corners, CA
Date: October 21, 2017.
Aircraft: Extra 330/LC, Registration N414MT, Serial: 1300
NTSB IIC: Elliott Simpson

B. EXAMINATION PARTICIPANTS:

Elliott Simpson (Present March 28/29)
National Transportation Safety Board

Mark Platt (Present March 28)
Lycoming Engines

Jocelyn MacGregor (Present March 28)
Federal Aviation Administration

Doug Vayda (Present March 28/29)
Southeast Aero Services Inc.
Representing Extra Flugzeugproduktions

C. SUMMARY

Examination of the airplane was conducted at the facilities of South West Aircraft in Chino California on March 28 and 29, 2018.

The entire aircraft was received in five large canvas bags, which contained the engine, black soot and ash, fibrous strands, fragmented sections of steel airframe tubing, burnt remnants of airframe and engine components, and about a dozen disjointed and unburnt composite skin sections. The left canopy frame on the lock side along with canopy plexiglass fragments were located separately from the main wreckage.

The identifiable components were separated, and then organized into their respective subsystems for examination (Photo 1). Except for the tail section, all steel airframe tubing members had fragmented and deformed into sizes varying from 3 to 24 inches. Except for the separated skin sections, the canopy, tailwheel assembly, and all composite components had been eviscerated by fire.

Remnants of all flight control surfaces were located, and no bird remnants or feathers were found. All seatbelt latches were located and were in the locked position.

D. DETAILS OF THE INVESTIGATION

1.0 Airframe Examination

1.1 Empennage

The last 24 inches of the tubular steel tail section was crushed, but largely intact, with fire consuming most of the alloy and plastic components attached to it (Photo 2). Two parachute “pilot” springs were found entangled in the forward section of the frame members. (Photo 3). Remnants of the vertical stabilizer aft spar remained attached to the upper airframe attachment bracket and the lower mounting bolts. The vertical stabilizer forward spar attachment bolt was in place at the airframe member (Photo 4). The horizontal stabilizer forward and aft spar attachment members were intact but bent, with all four attachment bolts in place. Remnants of the forward spar were still present sandwiched against their respective fittings (Photo 5).

1.2 Rudder

The rudder spar had fragmented into two sections, and the rudder weight had detached (Photo 6). Both spar hinges were bent downwards, and their bolts had pulled through the hinge webbing. The lower hinge bellcrank remained attached to the spar, and the corresponding airframe-side of the hinge remained attached to the tail, with remnants of the hinge bolt still inside the hinge bearing. The left rudder and tailwheel cables remained attached to the bellcrank (Photo 7). The right rudder and tailwheel cable had detached from the bellcrank, which exhibited melting damage at the point of attachment (Photo 7, 8).

The forward and aft rudder pedals had detached from the airframe.

The right rudder cable was continuous through the three aft fairleads and aft pulley fixture to the “S” tube of the rear pedal, where it had separated at the cable exit point. The separation appeared to have been pinched off at the exit. Forward of the separation (Photo 9), the cable end remained attached by its fastening to the airframe. The forward portion of the cable had separated into multiple fragments, and the cable end remained attached to the forward pedal.

The left rudder cable was continuous through the three aft fairleads and aft pulley fixture, through the “S” tube of the rear pedal and continuous to its fastening at the airframe (Photo 10). The forward portion of the cable had separated into multiple fragments; the cable end remained attached to the forward pedal.

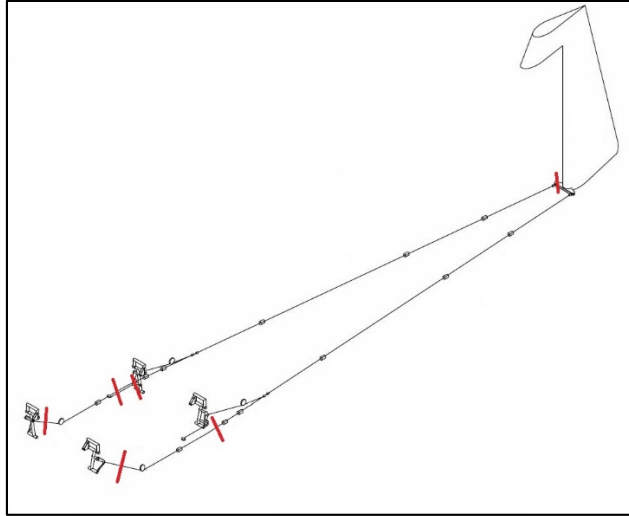


Image 1 – Rudder Control System Separation Points

1.3 Elevator

The elevator center hinge assembly remnants were composed of center fragments of the elevator spar, mass balance, base of the actuator arm, and hinge tab (Photo 11). The hinge tab had detached from the airframe, leaving the rivet shafts in place. A 24-inch-long section right elevator spar remained connected to the outboard rib via its hinge. Similarly, a 6-inch-long section left elevator spar remained connected to the outboard rib via its hinge. Both inboard hinge arms were located; the right arm remained attached to burnt rib fragments, no rib remnants remained on the left arm (Photo 12).

All three bellcranks were deformed and had torn away from the airframe, and all push-pull tubes had detached from their respective eyebolts at each bellcrank and the elevator actuator arm (Photo 13). All eyebolt heads remained attached to their respective bellcranks and exhibited bending deformation damage to their threaded rod ends. The base of the aft and forward control columns had detached from the torque tube assembly. Neither control stick was positively identified (Photo 14).

The main elevator trim Bowden cable had separated from the airframe; the trim assemblies had sustained crush damage preventing an accurate assessment of its position at impact. No trim tab was located.

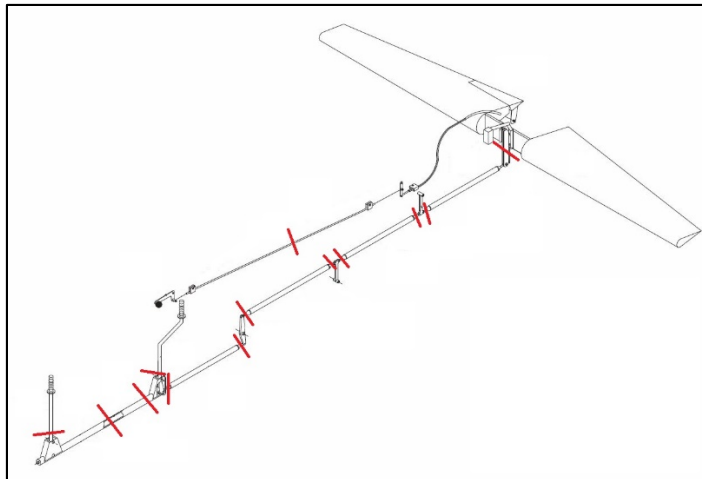


Image 2 – Elevator Control System Separation Points

1.4 Ailerons

Sections of burnt carbon fiber remnants of both wing trailing edge spars were located, along with the left aileron tip cap (Photo 15). All aileron hinge bars were located, and each exhibited a combination of bending and thermal damage. The right aileron spade assembly was bent and intact, with burnt remnants of the composite spade remaining (Photo 16). The left spade arm had broken away from the hinge, and the smaller quantities of spade remnants remained, along with a section of the aileron (Photo 17).

All bellcranks were deformed and had torn away from the wing, and all push-pull tubes had either detached from their respective eyebolts at each bellcrank or torn away from their tube ends. All damaged eyebolt heads exhibited bending deformation to their threaded rod ends.

The tangs of the control stick bellcrank were bent and had detached from the push-pull tubes (Photo 18).

1.5 Wings

Most of the wing primary structure was consumed by fire, and no wing fuel tank remnants could be found. Each wingtip rib and strobe light power assembly was identified (Photo 19, 17).

The left and right main spar attachment flanges remained partially attached to the fragmented airframe members (Photo 20). Both main wing bolts and flange bushings were in place, and burnt remnants of wing spar were still sandwiched between their respective spar attachment flange assemblies.

Both wing aft spar attachment lugs had broken away from their respective spars. The right lug remained attached to its airframe fitting (Photo 21). The left lug had detached and exhibited inward deformation to the airframe mounting hole (Photo 22).

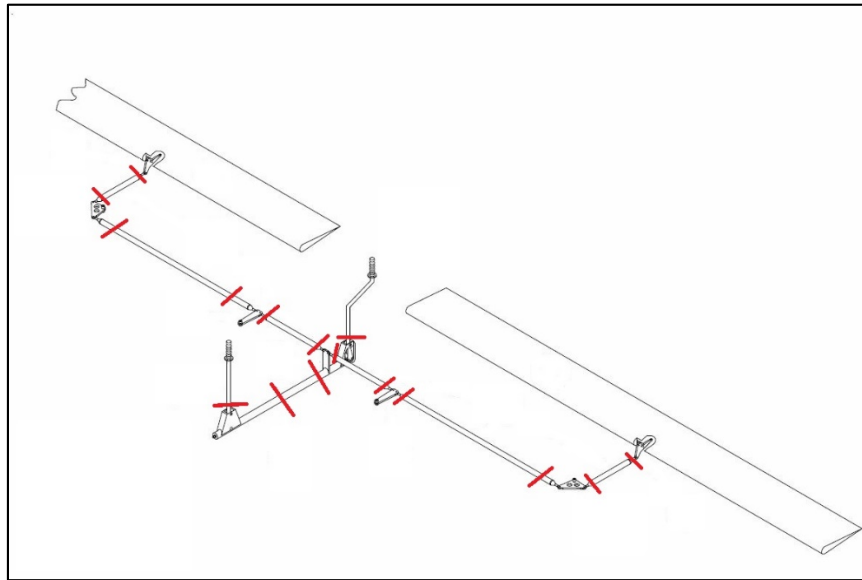


Image 3 - Aileron Control System Separation Points

1.6 Cabin

All avionics and instruments sustained extensive crush and/or fire damage, preventing an accurate assessment of their settings and indications at impact. The fuel selector valve was not located. The center fuel tank and fuel system lines were crushed, torn and fragmented (Photo 23).

Four rear seat assembly adjustment pins were all located in their respective seat fixtures (Photo 24). The front seat was the fixed type.

Both the front and rear main and supplementary seatbelt latches were accounted for, along with both belt ratchets. Both systems were in the belt-locked position (Photo 25). Eight of the seatbelt mount points were located, all remained firmly bolted to their respective airframe members.

Remnants of both parachutes were found, including two D-rings, two pilot springs, and four locking buckles (Photo 26).

1.7 Canopy

The plexiglass of the canopy had shattered into multiple fragments (Photo 27, 28) and were all located in the secondary debris field. The largest piece was found in the wildfire burn area and exhibited thermal damage. The camera mount for the rear facing camera remained attached to a section of plexiglass (Photo 29).

The remaining canopy frame sections and corresponding hinge and latch barrels were laid out and examined (Photo 30). Five distinct sections of the canopy frame were identified and included

the left canopy frame with both lock handles and incorporating and all three locking pins; the rear canopy arch, which included the door overtravel lanyard bolt (Photo 31); an aft section of the right canopy frame with hinge pin; the center hinge pin; a 12-inch section of the forward canopy skin radius.

The left frame had fractured mid-span, revealing the canopy lock interconnect components. The rear latch was 1/2 inch short of the “LOCK” position (Photo 36), and the forward latch was in the “UNLOCK” position (Photo 32). The forward locking pin was completely retracted, consistent with the “UNLOCK” position (Photo 32). The center locking pin was in the midway position (Photo 33). The aft pin was 3/8 in short of the “LOCKED” position (Photo 34). The forward locking barrel remained attached to the airframe; the chamfered channel appeared undamaged, although it was coated in thermal deposits and corrosion (Photo 35).

The airframe sides of all three barrel hinges were located. The forward and aft hinges remained firmly attached to their respective steel frame members. One of the two mounting bolts for the center hinge had sheared, and the hinge had folded 90 ° aft. All of the chamfered channels within the hinge barrels appeared undamaged.

The 12-inch-long section of the aft right canopy (hinge side – Photo 30) had detached from the airframe and was located unburnt within an area of the debris field that had escaped flames.

The aft end of the hinge pin had bent about 10° outwards, cracking the painted coating (Photo 37). Another hinge pin, identified as pin #2 pin was blackened and soot-covered, and was not attached to the canopy. It exhibited a similar 10° outward bend (Photo 38). A third hinge pin, identified as pin #3 sustained similar thermal exposure with more pronounced bending damage, and was located at the accident site following this examination by family of the pilot. (Photo 46)

1.8 Landing Gear

The main landing gear had detached from the airframe. The two landing gear clamps exhibited similar deformation to their mounting tabs (Photo 39). The composite tailwheel assembly had detached from the airframe at its attachment bolts, and neither of the steering springs or chains were attached.

2.0 Engine Examination

Model: AEIO-580-B1A

Serial: L-187-79E

The engine had detached from the airframe, and experienced significant impact damage, liberating most of the ancillary components including the starter motor, governor, alternator, fuel injection servo, both magnetos, and all but one push rod (Photo 40). The cylinder heads from cylinders 1 and 2 had detached from their respective barrels, which were both bent aft. The oil sump had fragmented, exposing the lower engine crankcase and bottom half of the oil dipstick, which was bent aft. The

accessory case had broken away, revealing the crankshaft, camshaft, and idler gears and the forward crankcase had been breached, exposing the governor drive gears.

The only recovered components for the left magneto were the internal drive shaft and the coil. The right magneto sustained impact damage and could not be rotated. Burnt and torn remnants of the ignition harness remained attached at the rocker cover clamps. The top spark plugs from cylinder 4, 5, 6, and the bottom plugs for 3, 5, and 6 were removed and examined. All plug electrodes exhibited normal to worn out-normal wear signatures when compared to the Champion AV-27 Check-A-Plug chart. The top plugs for cylinder 4 and 6 were coated in oil, all other plugs exhibited dark grey discoloration (Photo 41,42). All remaining plugs which were located, had fragmented.

Visual inspection of the combustion chambers for cylinders 3, 4, 5, and 6 was accomplished through the spark plug bores utilizing a borescope; there was no evidence of catastrophic internal damage and all combustion surfaces exhibited dark grey deposits.

The fuel injection servo diaphragm section had detached from the throttle body. The throttle control arm and its associate fitting remained attached. The fuel inlet screen was clear. The induction screen appeared to have been forced into the induction bore, along with dirt and composite debris (Photo 43).

The flow divider along with its respective lines had detached from engine. The unit was disassembled and examined. No obstructions were noted, and the diaphragm was intact and pliable (Photo 44). The fuel pump had detached, and the valve housing assembly had bent away from the diaphragm assembly.

The oil suction screen was free of significant debris, and only the threaded base of the oil filter was located. The oil pump was removed, and both of its gears were intact, and the walls of the pump cavity were undamaged.

The crankcase webs on the underside of the engine were broken open to facilitate internal examination. From the opening, the crankshaft, camshaft lifting surfaces, and connecting rods could be observed. A light coating of oil was present throughout, and all components were clean and free of any indications of catastrophic damage or heat discoloration (Photo 45).

The propeller hub of the three-blade constant speed propeller remained attached to the crankshaft. All blades had separated, with remnants from two recovered. Recovered remnants included sections of splintered wood, two twisted and deformed leading edge caps, and one blade root assembly.

3.0 Examination Photos



Photo 1 – Airframe Remnants



Photo 2 – Tail Section



Photo 3 – Parachute Pilot Springs



Photo 4 – Vertical and Horizontal Stabilizer Attachments



Photo 5 - Vertical and Horizontal Stabilizer Attachments



Photo 6 – Rudder Spar



Photo 7 – Rudder Bellcrank



Photo 8 – Rudder Bellcrank



Photo 9 – Right Rudder Cable



Photo 10 – Left Rudder Cable



Photo 11 – Elevator Spar and Mass Balance



Photo 12 – Elevator Remnants



Photo 13 – Elevator Control System Remnants



Photo 14 – Aft Control Stick Weldment at Bellcrank



Photo 15 – Aileron Control System Remnants



Photo 16 – Right Aileron Spade



Photo 17 – Left Aileron Spade and Wingtip



Photo 18 – Aileron Control Bellcrank Tangs



Photo 19 – Right Wing Tip



Photo 20 – Wing Main Spar Flanges



Photo 21 – Right Aft Attachment Lug



Photo 22 – Left Aft Attachment Lug



Photo 23 – Center Fuel Tank Remnants



Photo 24 – Seat Frames



Photo 25 – Seat Belt Buckles



Photo 26 – Parachute Buckles and Pilot Springs



Photo 27 – Canopy Fragments



Photo 28 – Canopy Fragments



Photo 29 – Camera Mount

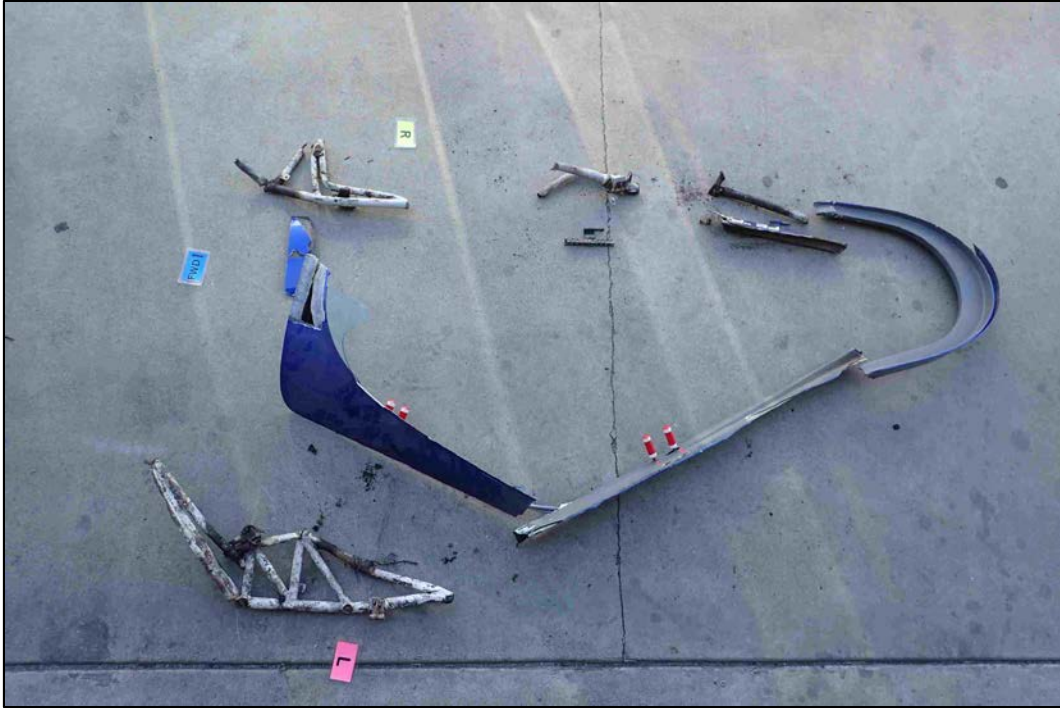


Photo 30 – Canopy Frame



Photo 31 – Aft Canopy Frame



Photo 32 – Canopy Forward Locking Pin and Handle



Photo 33 – Canopy Center Locking Pin



Photo 34 – Canopy Aft Locking Pin and Handle



Photo 35 – Airframe Forward Locking Barrel



Photo 36 – Left Rear Locking Handles



Photo 37 – Canopy Aft Right Hinge Pin



Photo 38 –Hinge Pin #2



Photo 39 – Landing gear Clamps



Photo 40 – Engine



Photo 41 – Bottom Spark Plugs



Photo 42 – Top Spark Plugs



Photo 43 – Fuel Injection Servo Induction Bore



Photo 44 – Fuel Flow Divider Components



Photo 45 – Inside Crankcase



Photo 46 –Hinge Pin #3

Submitted by: Elliott Simpson