

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



WPR22FA048

AIRFRAME EXAMINATION REPORT

April 18, 2023

A. ACCIDENT

Location: Temecula, California
Date: November 23, 2021
Time: 1033 LCL
Airplane: Zenith Zodiac 601XL, N601KS

B. AIRFRAME EXAMINATION REPORT

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C. DETAILS OF THE EXAMINATION

1.0 Accident Site

The airplane came to rest inverted and partially nose down on an east heading (figure 1), in a field about 250 ft north of a new housing development, and 2.75 miles southeast of French Valley Airport (F70).

A 70-ft-long debris field consisting of aluminum fragments, flight instruments, and significant quantities of clear canopy acrylic shards emanated from the main wreckage, west. The pilots flight bag, an iPad, seat cushion, sun visor and a fuel sump jar were located about 400 ft east of the main wreckage, dispersed in the general area below the descending segment of the flight track.

Both a ground and overhead drone search of the area below the flight track leading up to the initial upset did not reveal any other cabin contents, airplane parts, or canopy material.

1.1 Fuselage

The airframe was compressed aft, such that the engine and firewall were in line with the trailing edge of the wings. Both wings sustained crush damage through to the aft spar, both fuel tanks had been breached and the smell of fuel was present in the soil immediately surrounding the site (figure 2).

There was no evidence of bird strike to any of the airframe structure. Samples recovered from windshield fragments, both propellor blades, and the vertical and horizontal stabilizer were sent to the Smithsonian Institution's Feather Identification Lab using DNA and microscopic analysis. None of the samples contained bird material.

The flight instruments were completely fragmented along with the entire cabin, including the seats, which had been compressed up against the engine firewall. The engine controls were twisted and crushed such that their position prior to impact could not be determined.

The right seatbelt lap buckle was found unlatched. The pilot was seated in the left seat, and his lap belt attachments remained attached to the airframe, but the shoulder belt fitting had pulled away from the structure at its mount point. The left lap buckle was found in the latched position. The belt was cut by first response personnel during recovery of the pilot.

The airplane was equipped with a forward hinging tip-up canopy, that was comprised of an aluminum and steel frame structure with an acrylic bubble, supported in the open position by two gas struts. The original design used an automotive-style latch within the frame, that locked into a striker-pin on either side of the cabin sidewall canopy sill. The owner/builder had disabled the airplanes standard lock by removing the striker-pins mounted on the canopy sill and installed a lock that consisted of two over-center latches mounted to the rear canopy sill and frame (figure 17) with two 1/8 inch aluminum blind rivets per side. No secondary latch was installed.

A large quantity of canopy fragments had dispersed from the initial impact point, and 70 ft west. The fragments varied in thickness between 1/16th and 1/8th inch. Remnants of the canopy frame were comingled with the main wreckage, and the gas struts had broken away from both structures. The canopy sides remained attached to the rear bow, and the forward bow had broken away from the left side structure (figure 3). The latch hooks remained attached to the sides of the rear canopy structure.

Both over-center latches had separated from the airframe and were found with the main wreckage; it could not be determined which side each latch came from, so they were arbitrarily named A and B.

For latch A, the 7/32 inch head of a 1/8 inch diameter aluminum blind rivet was still in place, and appeared to have sheared from the rivet shank, which was not located. The other rivet was missing (figure 4). The inboard side of the over-centering arm and the corresponding threaded portion of the hook exhibited scratches and paint transfer marks (figure 4). The mating side of the mounting plate exhibited scratches and grooves in the vertical plane (figure 5), that were not present on latch B.

Both rivets were missing from latch B. The over-centering arm had deformed inward (figure 6), and the mounting plate was twisted (figure 7).

The ELT had detached from the airframe and pulled away from its antenna. Its power switch was found in the "OFF" position.

1.2 Empennage

The empennage had detached from the tailcone just forward of the horizontal stabilizer. The moving vertical stabilizer/rudder assembly remained attached to the tailcone by its hinges, and the horizontal stabilizer remained attached to the upper deck of the tailcone. The rudder control cables were continuous from the control arms (figure 8) through to the crushed foot pedal assembly (although the cables had been cut by first response personnel). The elevator control cables were continuous from the control arms through to the center bellcrank. Forward of the bellcrank, the elevator push-pull cable was crushed and severed. The elevator trim tab remained attached to the control surface and its control actuator and was at about the 12° tab-down position.

Remnants of fragmented and crushed autopilot servos were located, and due impact to damage their functionality prior to the accident could not be determined. According to the owner of the airplane, the autopilot had been disabled, and the servos had been electrically disconnected from the autopilot control system.

1.3 Wings

Both wings remained partially attached to the airframe center section. The leading edge skins, fuel tank assembly, and ribs were crushed almost flat against the main spar and had detached from the structure along with the aileron balance weight assemblies. The main spar had been forced aft and almost flush with the rear spar, resulting in the wing skins bulging out about 90° relative to the chord.

The standard cable-driven aileron flight control system had been replaced with a push-pull tube type. Maintenance records indicated that this modification was accomplished in September 2009.

The right aileron remained attached to the wing by the inboard section of its piano hinge (figure 9). The trim tab sustained bending damage along with the aileron, but appeared to be generally flush with the control surface. The outboard aileron bellcrank remained attached to the wing structure. The aileron-to-bellcrank control arm was intact and connected at both ends (figure 10). The main pushrod remained attached to the bellcrank and was continuous to the cabin center where it was crushed and had separated from the rod end (figure 11). The rod end remained attached to the base of the control stick (figure 12). The right flap remained attached to the aft spar; the flap control slot was intact, and the flap torque tube had bent away from the fuselage but remained attached at its outboard right fitting.

The left aileron remained attached to the wing by the inboard section of the piano hinge (figure 13). The outboard aileron bellcrank remained attached to the wing structure. The aileron-to-bellcrank control arm was intact and connected at both ends

(figure 14). The main pushrod remained attached to the bellcrank but was crushed and separated mid-span (figure 15). The other end of the pushrod remained attached to the base of the control stick (figure 12). The left flap remained attached to the aft spar; the flap control slot was intact.

The flap control motor had separated from the airframe and was broken into two sections. The flap position could not be determined.

1.4 Landing Gear

The main landing gear legs remained attached to the cabin center section, and the nose landing gear strut was partially attached to the firewall, which had compressed aft such that it was in line with the main landing gear (figure 2). All wheels remained attached to their respective legs.

1.5 Fuel/Fuel System

Both fuel tanks had been torn open and exhibited evidence of hydraulic deformation to their skins. The fuel system was breached in multiple areas. All remaining and identifiable fittings were finger tight, and the fuel selector valve face had detached from the valve head but appeared to be in the right tank position. No fuel strainer was identified. The tank fuel filler necks were torn open, and neither cap was identified.

1.6 Engine Examination

The engine sustained extensive impact damage, and sections of the intake manifold and most accessories were detached; the firewall had formed around the rear of the engine. There was no evidence of case perforation in an outward direction, or other evidence consistent with catastrophic internal engine failure. The pushrods were all either bent or pushed against the cooling fins of their respective cylinders. The oil filter was in place at its fitting, and the oil cooler was crushed. There was no evidence of oil streaks on any of the fuselages or flight surfaces, nor was there any evidence of oil leak within the engine compartment.

The ignition distributor had come away from its accessory pad, and its cap had fragmented revealing the points and cam. The points appeared new and in good condition. The cap mounting screws and remnants of the cap were still in place on the distributor housing, and the ignition leads had all severed.

The propeller hub remained attached to the crankshaft, and both composite propeller blades had detached at their roots and were located on the ground with the main wreckage. One blade exhibited leading edge knicks and dents, and chordwise scratches (figure 16). The other blade was bent about 6 inches from the root, but otherwise intact.

D. EXAMINATION PHOTOS



Figure 1 - Airplane at the accident site, facing northeast.



Figure 2 - Airplane at the accident site, facing north.



Figure 3 - Canopy frame. (Latch hooks highlighted)

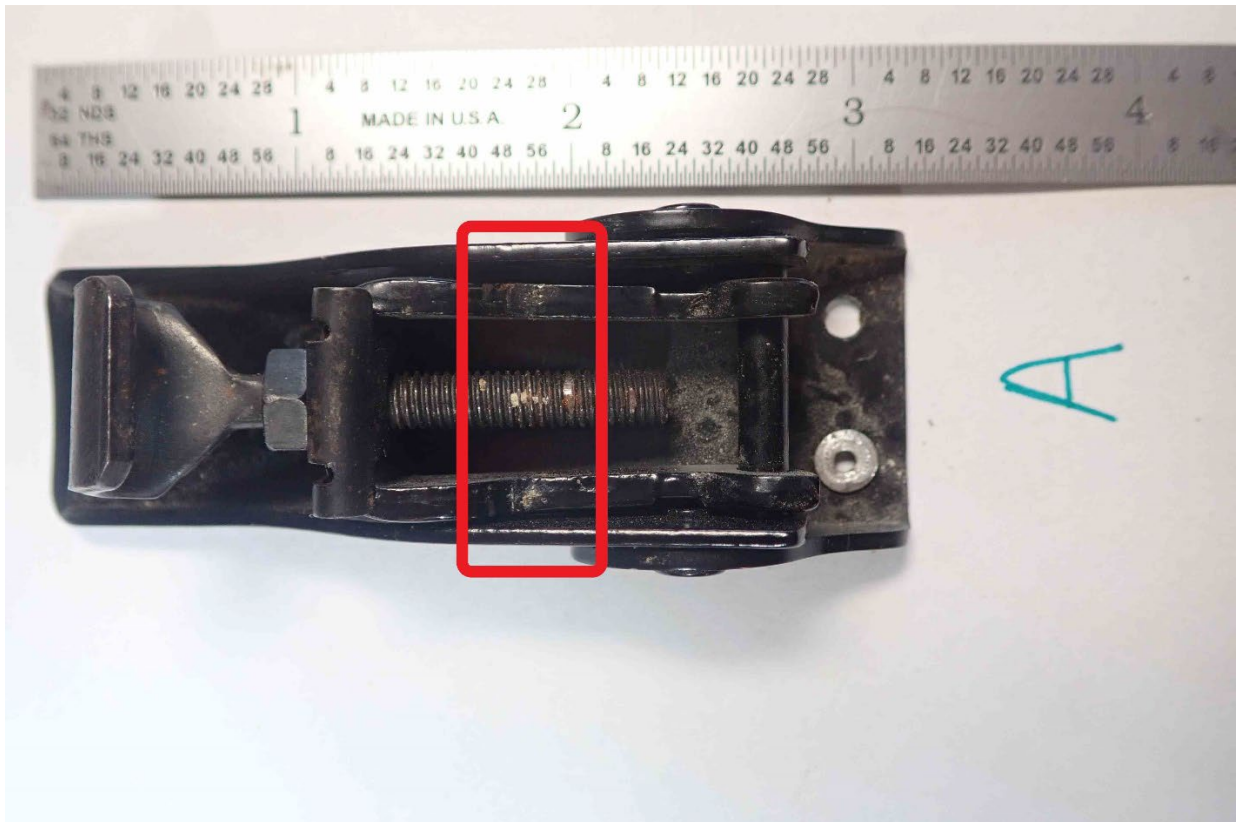


Figure 4 - Latch A scratches and paint transfer marks and rivet head.



Figure 5 - Latch A mating side of the mounting plate scratches and grooves in the vertical plane.

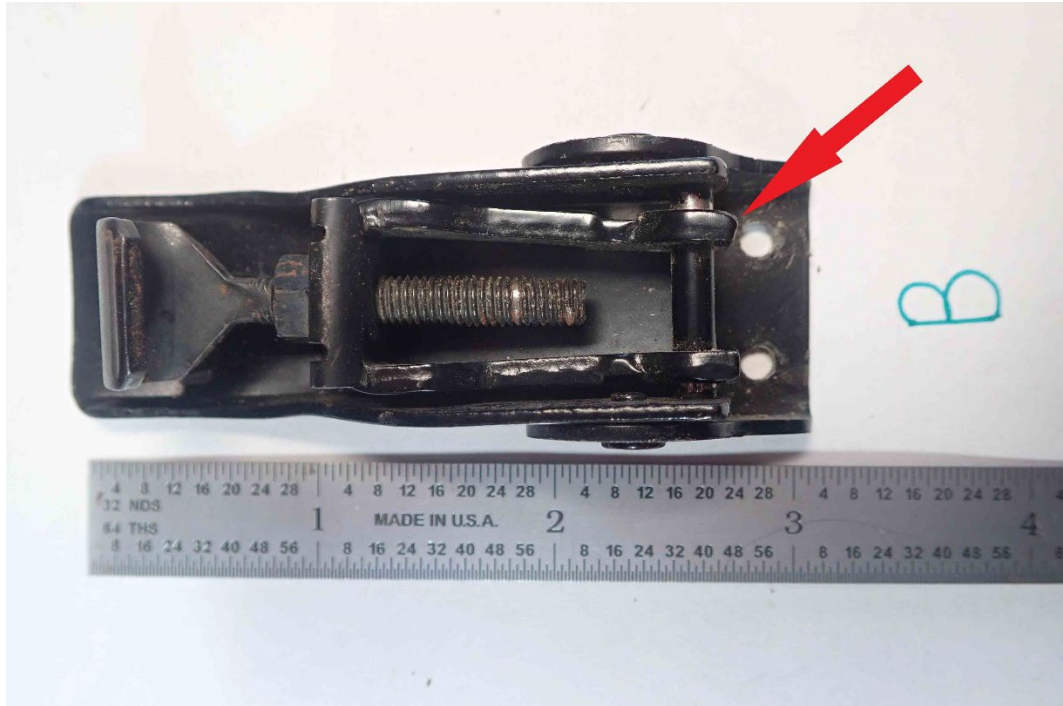


Figure 6 - Latch B deformed over-centering arm.



Figure 7 - Latch B twisted mounting plate.



Figure 8 - Rudder control arms.



Figure 9 - Right wing aileron and flap.



Figure 10 - Aileron bellcrank and control arm.



Figure 11 - Inboard control arm end and tube.



Figure 12 - Control stick base.



Figure 13 - Left aileron.



Figure 14 - Aileron bellcrank.



Figure 15 - Left aileron pushrod.



Figure 16 - Propeller blade.



Figure 17 - Location of canopy latches

Submitted by:
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