



AIRPLANE & ENGINE EXAMINATION

WPR17LA104

Firebaugh, California

May 15, 2017

1644 PDT

Lancair Evolution; N846PM

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1.0 HISTORY OF FLIGHT

On May 15, 2017, about 1644 Pacific daylight time, an experimental amateur built Lancair International, Lancair Evolution, N846PM, was substantially damaged during a forced landing attempt at Firebaugh Airport (F34), Firebaugh, California. The private pilot and 2 rear seat passengers did not sustain any injuries. A front seat passenger and rear seat passenger received minor injuries. The airplane was owned and operated by a private individual and operated by the pilot under the provisions of Title *14 Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed and an instrument flight rules flight plan was filed for the cross-country flight that departed Livermore Municipal Airport (LVK), Livermore, California at approximately 1606. The personal flight was destined for Marana Regional Airport (AVQ), Marana, Arizona.

The pilot reported that he and 4 family members were enroute to their home airport following a recent stay in Northern California. The departure, climbout, and most of the cruise flight was smooth and uneventful; however, further into the flight, at an altitude of 25,000 feet, the windshield “exploded” instantaneously without any pre-indication. The airplane instantly lost cabin pressure and the pilot’s headset departed the airplane, so he activated the ancillary oxygen and donned his oxygen mask. During his subsequent steep descent, the pilot found a nearby airport with the requisite landing distance. He entered the airport’s identifier into the onboard global positioning system and followed the course line. At 12,000 feet, the pilot leveled off and made visual contact with the airport. He was unable to locate the airport’s windsock during the descent, but chose to land on runway 12. While on the downwind leg, the pilot deployed one notch of flaps and attempted to maintain a target airspeed of 110 knots. After he turned to the final leg of the airport traffic pattern, the pilot deployed the landing gear, but the left main landing gear did not show a green indication. After he recycled the landing gear and received the same indication, the pilot decided to land with the landing gear in the UP position. According to his recount, although the airplane made contact with the runway at a high rate of speed, the touchdown was smooth and level. The airplane then overran the runway, impacted a fence, and traversed a road before it came to rest in a field.

Postaccident examination by a Federal Aviation Administration inspector revealed substantial damage to both wings.



Photo 1: Airplane at rest at accident site

2.0 ENGINE

2.1 ENGINE INFORMATION

Engine Manufacturer: Pratt & Whitney Canada

Engine Model Number: PT6A-135A

Engine Serial Number: PZ1670

Recent Inspection: Inspection – 187.8 hours

Recent Recorded TSMOH: never overhauled

Time Since Inspection: 13.2 hours

2.2 ENGINE EXAMINATION

The spinner exhibited scratching parallel to the flight path. All four propeller blades remained attached to the turbine shaft, with 3 blades exhibiting uniform bending in the direction of rotating with the fourth blade, located on the bottom, exhibited a sharper bend consistent with the airplane resting on the ground. All four propeller blades exhibited leading edge scratches, while all four propeller tips exhibited damage consistent with a propeller ground strike. One propeller blade had chord-wise scratches, while the other three blades had length-wise scratches. One

propeller blade exhibited trailing edge scratches and deformation. (All damage was consistent with an impact with a chain link fence.)

Investigators removed the upper engine cowling and the engine appeared without major deformation. The left exhaust stack exhibited inboard compression, which wrinkled the power turbine exhaust case. The propeller rotated freely, by hand, from the blades aft to the C-flange without any noise or binding. The accessory drive belt for the air conditioner rotated, by hand, freely, which indicated that the accessory gear box, compressor, and compressor turbine wheel were able to rotate freely.

The left exhaust stack was removed and the power turbine blades exhibited no damage or wear. The Py fuel line remained tight from the fuel control to the propeller governor. The P3 line was also found tight. The P3 air filter was removed to gain access to the oil filter. The oil filter was removed and was observed without debris. The oil within the filter appeared light in color. The P3 air filter was examined and no debris was observed. The low-pressure filter in the fuel control unit was removed and was observed without debris. A small sample of fuel remained in the fuel control unit. The fuel sample smelled of Jet-A fuel and was light in color.

The chip detector was removed. A small metal fragment was observed in the chip detector, but the size of the fragment was not enough to bridge the gap between the magnets to initiate a warning light.

The inlet screen was removed and the first stage compressor was able to rotate freely. Using mirrors, the blades appeared normal, without wear.

The throttle, propeller, condition lever (hi and low idle), and “Manual Override System” levers were manually adjusted by an investigator inside the cockpit and visually observed by another investigator. The levers moved properly without issue.

About 3 quarts of oil were observed on the dipstick in the oil sump.

3.0 WINDSHIELD EXAMINATION

The windshield fractured into numerous pieces. Portions of the windshield that were common to the airframe remained encased in the window frame which is common to the airframe fuselage structure. Three pieces of the windshield along the lower edge of the windshield were easily removed from the window frame common to the airframe. Large portions of the windshield extending beyond the edge of the integral window frame from about the 4 to 6 o'clock and about 6 to 8 o'clock positions remained attached to the airframe. Additional sections of the windshield remained attached to the windshield frame common to the airframe but did not extend beyond the edge of the window frame cutout in the fuselage. The window frame common to the airplane fuselage at the 2, 6 and 10 o'clock positions had visible signs of damage to the composite airframe structure.

The entire windshield frame common to the fuselage was removed including all of the composite structure that the windshield is bonded to was removed for further investigation and associated

windshield plexi-glass. The composite airframe window frame structure, windshield pieces and a small section forward were sent to Wichita State Universities National Institute of Aviation Research. The material characteristics of the composite fuselage structure, the adhesive used to bond the windshield to the composite airframe structure and the windshield are documented in a separate report available in the NTSB public docket.

4.0 LANDING GEAR EXAMINATION

4.1 System Description

The landing gear system is hydraulically actuated and mechanically driven; held in place by locking actuators. The split nose landing doors are operated through a cradle for the landing gear oleo strut that moves with the landing gear during a retraction or extension. Both main landing gear doors are connected to the base of the right and left main landing gear oleo struts and move in conjunction with both gear as they are retracted or extended. In the deployed position, the landing gear are held in place by hydraulic pressure and will not retract unless the airplane is moving slower than about 80 mph, which is triggered by a pitot pressure sensing switch and a hydraulic system relay. Once deployed, the nose landing gear is secured by a locking actuator, and the main landing gear are held in place by locking actuators.

The emergency landing gear system is comprised of a gas strut used to deploy the landing gear, which will fall and lock under their own weight. A gas shock strut is used to force the nose landing gear to the down and locked position. The emergency system is activated by placing the landing gear handle in the down position and using the emergency by-pass valve on the spar box below the pilot's legs. The pilot is required to pull the hydraulic pump circuit breaker before turning the emergency dump valve to force the landing gear down, which is not included in the system description.

A landing gear annunciator display, located at the top of the instrument panel, is used by the pilot to monitor the status of the landing gear when retracted, deployed, or in transition. When the pilot places the landing gear handle in the down position, three red lights will appear on the display to show the landing gear in motion. The yellow text "HYD PRESS" will appear in the bottom of the annunciator display to indicate that the hydraulic pump is in operation. The yellow text will disappear when the gear completes the retraction or extension cycle. The display panel should not present any indicator light when the landing gear is fully retracted and should show a green "L", "N", and "R" when the gear is in the extended position to show that all three gear are deployed and locked.

In the event of a landing gear deployment failure, all three red "unsafe" indicator lights will flash and the green light representing the failed gear will not appear on the display. This warning system is accompanied by an aural alarm that can be muted by depressing a red pushbutton to the right of the display. The pushbutton silences the aural alarm of the gear warning system, but does not affect the display. Once the pushbutton is depressed, an 18 second timer begins and the aural alarm will reactive if the unsafe indication is not resolved at the end of the preset time. The three green lights must display for the unsafe indicator lights to disappear and the aural alarm to cease.

4.2 Examination and Gear Test

The airplane was at rest against the floor of the examination facility with the landing gear retracted. The nose landing gear door cradle was bent, which initially prevented the nose gear from deploying. The cradle and rod ends were disconnected to facilitate the landing gear tests. Additionally, both the left main landing gear down and up position relay modules had been dislodged from their terminals in the avionics bay. The airplane was placed on jack stands and the airplane's battery power was applied. A series of 5 landing gear tests were performed with either a retraction, extension or full cycle. During the first test, the landing gear by-pass valve was actuated and both the right and left main landing gear extended in free fall, but did not lock. Both main landing gear were forced by hand into the locked position. At the conclusion of the first test, the display showed two flashing red unsafe lights and one sustained unsafe light above the green "N" light, which indicated that the nose landing gear was down and locked. The left main landing gear relays had not been installed at this point.

The relays were installed in the terminal bay, which showed a green "L" and "N" indication on the display with two red sustained unsafe lights and a red flashing light. The landing gear handle was placed in the UP position and once the gear retracted the display showed three sustained red lights. The gear was then deployed again, which repeated its previous display: two sustained red lights and a red flashing light accompanied by "L" and "N" green indications. The left and right main landing gear relays were swapped, which produced the same result.

The right main landing gear relay contacts did not actuate during this test. An examination of the right main landing gear limit switch wiring revealed that a male cannon plug had been separated from its female connector. Pins 13 and 14 control the right main landing gear down indication according to the airplane's landing gear schematic. Once both pins were reconnected, the red unsafe lights disappeared from the display and all three green landing gear lights appeared. When the gear was subsequently retracted, the red unsafe flashing lights appeared. Pins 23 and 23 were reconnected as they control the right main landing gear UP display indication, which produced a sustained right red unsafe light. The left and nose main landing gear red unsafe lights continued to flash.

A final landing gear extension test using the by-pass valve showed that the nose landing gear extended and locked, while the main landing gear could enter free fall, but could not lock.

4.3 Summary of Findings

The landing gear swing tests showed that the left, right, and main landing gear deployed when the landing gear was extended normally. During both tests, the emergency by-pass valve successfully deployed and locked the nose landing gear; however, the right and main landing gear did not lock.

Once the left main landing gear modules were installed in the terminal bay, the left main landing gear down indications worked normally and showed a green "L" light indication on the annunciator display. The pilot did not report any abnormal indications with the landing gear system during the accident flight until he attempted to deploy the gear following the

decompression. After the accident, the fire department responded to the accident site immediately and monitored the aircraft wreckage until representatives of the Federal Aviation Administration (FAA) arrived the following day and documented the position of the left main landing gear relay modules. The FAA photographs showed both relay modules laying on their side outside the terminal bay and disconnected from their terminals.

Additionally, the gear tests yielded an unsafe gear indication when the landing gear was in the retracted position. However, the investigative team elected not to troubleshoot the landing gear UP unsafe indications as it was determined that the system's ground wires were likely dislodged during the accident sequence and there were no reports of a gear UP failure in the pilot's accident report.

The airplane's most recent condition inspection began on May 14, 2017 at a total time of 195.5 hours time in service. The record stated that the airplane was placed on jacks and the nose landing gear door actuator and spring assemblies were inspected for "fit and function." The spring was adjusted and 20 landing gear cycles were completed with no anomalies notes. Prior to this inspection the airplane was serviced in concurrence with the airplane's conditional annual inspection on May 8, 2017, at 187.7 hours in service at which time the service facility removed and replaced the left main landing gear actuator with a new strut and performed multiple landing gear extensions and retractions without any anomalies. In the previous maintenance entry with the same date, they removed and re-installed the cabin canopy window (left side window) due to dis-bondment. The last maintenance entry for that same month was dated May 3, 2017, at which time the facility complied with Evolution Service Bulletin 016-0032, landing gear hydraulic down lock valve kit installation. The subsequent landing gear extensions and retractions revealed no anomalies.