NYC08FA292

HISTORY OF FLIGHT

On August 11, 2008, at 0839 eastern daylight time, an experimental amateur built Jones Lancair IV-P, was substantially damaged by an in-flight fire shortly after takeoff from Stafford Regional Airport (RMN), Stafford, Virginia. The certificated airline transport pilot and his one passenger were uninjured. Visual meteorological conditions prevailed, and no flight plan was filed for the personal local flight conducted under 14 Code of Federal Regulations (CFR) Part 91.

The airplane was equipped with a dual battery system. According to the pilot, after departing runway 33 at RMN he turned on the "rear battery switch" to charge the battery. Upon reaching 3,000 feet above mean sea level he engaged the autopilot to run a flight test. After turning the airplane to the right and left utilizing the heading select knob he suddenly smelled smoke.

At this point the airplane was about 12 nautical miles from the airport. The pilot checked all of the engine indications and they were "normal." He then checked all of the circuit breakers and they were also "normal." While turning towards the airport, the pilot then turned off both battery, and both alternator switches.

The pilot noticed that the smoke seemed to be getting "heavy" in the cockpit and breathing was "uncomfortable." He joined the downwind leg of the airport traffic pattern. He then turned on the "front battery" and transmitted that he was on the downwind leg of the traffic pattern and that he was going to land on runway 33. At this point he lowered the wing flaps and slowed to approach speed.

The pilot heard another pilot transmit over the radio that he was on the right base leg for runway 33 and after acquiring the airplane visually, planned to land after the other aircraft, and shut off the battery once again. He then noticed when he was a 1/2 mile from touchdown that his landing gear was not down as the landing gear was actuated by an electrically powered hydraulic pump, and he had the battery off. He then executed a "go-around," and rejoined the traffic pattern for landing.

As the pilot once again joined the downwind leg of the traffic pattern, he manually extended the landing gear using the hand operated pump as he was not sure what the source of the smoke was and thought that it might be the hydraulic pump motor. He then "pulled" the landing gear circuit breaker and when he "got pump resistance," he turned on the front battery and confirmed that the landing gear was down by observing that all three landing gear down indicator lights were illuminated.

As the pilot flew the airplane on to the final for runway 33 the smoke was "very heavy and thick." The electric pitch trim was unavailable, but the landing and rollout were "normal." When the airplane was slowed to a safe taxi speed, the pilot opened the door and the smoke was "immediately" evacuated.

The pilot observed that everything was "normal up front" and taxied the airplane to its hangar and shut down the engine. Upon exiting the airplane and looking toward the rear of the airplane, he was shocked to see "billowing clouds of black and gray acrid smoke." He then shouted to his passenger "the planes on fire get out."

The pilot then retrieved a key to the baggage compartment door, opened the door, and smoke and heat "hit him full in the face." He then ran into the hangar and retrieved a cordless electric drill and Phillips head screwdriver bit. Five of the six screws were already loose from the fire and he removed the remaining screw, which held the floor in place with the cordless drill. He then reached in and removed the baggage compartment floor and false bulkhead from the rear of the baggage compartment. It was still very hot though, and the pilot could not see the battery or hydraulic pump due to the smoke.

The passenger at this time retrieved a fire extinguisher and the pilot took it and discharged the fire extinguisher into the battery area. He then could see the battery. The battery had a visible flame for a "few seconds" and he discharged the fire extinguisher once again. When the "dust" from the fire extinguisher had settled, he observed a red glow in the center of the battery box.

PERSONNEL INFORMATION

According to FAA records, the pilot held an airline transport certificate with multiple ratings including airplane single-engine-land. He reported 11,360 total hours of flight experience on his most recent application for a Federal Aviation Administration (FAA) second-class medical certificate, dated August 12, 2008.

AIRCRAFT INFORMATION

The accident airplane was a single engine, pressurized, low wing monoplane with retractable landing gear, and a three bladed constant speed propeller. It was powered by a turbocharged 350 horsepower Continental TSIO-550-E that drove a primary and standby alternator which powered the airplanes main and standby electrical systems. It was equipped with an electronic flight instrumentation system (EFIS) and was classified by the FAA as a technically advanced aircraft.

According to FAA and maintenance records, the airplane's special airworthiness certificate was issued on September 2, 2006.The airplane's most recent conditional inspection was completed on October 28, 2007 and at the time of the accident, the airplane had accrued 96 total hours of operation.

METEOROLOGICAL INFORMATION

A weather observation taken about 1 minute after the accident, at RMN included; wind at 310 degrees at 3 knots, visibility 10 miles, temperature 20 degrees Celsius (C), dew point 16 degrees C, and an altimeter setting of 29.89 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

Examination of the airplane by National Transportation Safety Board Investigators revealed the fire had damaged approximately three feet of the aft fuselage in the area of the standby (rear) battery box and baggage compartment.

The damaged section of the aft fuselage exhibited areas of peeling and blistered paint, softness, delamination, and sooting. Internal examination of the aft fuselage also revealed evidence of fire damage to the wiring harness, standby battery contactor, standby battery box, and standby battery.

Further examination revealed that a charred rubber like substance had adhered to the top of the standby battery and its vent caps, along with the charred remnants of a rectangular shaped wood block. The standby battery’s vent caps were partially melted, and holes with charring along their circumference were present along the upper edges on one side of the battery.

Examination of the wiring forward of the baggage compartment area revealed no evidence of any damage.

The primary and standby voltage regulators, the remains of the standby battery, and the standby battery contactor, were removed by the Safety Board for further examination.

TESTS AND RESEARCH

Download of the EFIS revealed no anomalies with the main electrical system of the airplane. The standby system was not recorded.

According to the pilot, the last time that any work had been performed had been in “mid- July,” is when he had installed an auxiliary power plug in the backseat of the airplane. The airplane had flown since the installation however, with no problems.

Review of the regulator manufacturer's schematics which were provided by the pilot to the NTSB revealed that they did not include a provision for a standby battery.

Three pages of hand drawn schematics of the airplane's wiring system provided by the pilot revealed that he had modified the basic design shown on the regulator manufacturer's schematics to include a standby battery, however it was discovered, that the drawings contained discrepancies which prevented determination of the airplane electrical system's actual configuration.

Standby Battery Box

According to the pilot, when he had built the standby battery box, he had glassed in “nuts” to vent the top of the battery box, and at the lowest point in the battery box had installed a 1/4 inch diameter tube, as a drain line.

Additionally, In order to “rubberize” the battery box he had coated the entire inside of the box with RTV silicone.

Standby Battery

Examination of the wet cell standby battery did not reveal any preaccident malfunctions or failures.

Fire damage was evident externally but, internal examination of the battery revealed, no evidence of a fire internally. Further examination also revealed that the separators between the plates were intact, no evidence of sulphation was present, no shredded material existed at the bottoms of the plates, and no evidence of shorting of the cells was present.

Standby Battery Contactor

The standby battery contactor exhibited fire damage externally. Internal examination did not reveal any evidence of fire exposure, and no preaccident malfunctions or failures were discovered.

Regulators and Mounting Location

External examination of the regulators and their mounting location revealed that, the regulator’s cases were made of metal, they were rectangular in design, and a plastic terminal strip which protruded from a slot in the metal case was mounted on one side.

They were mounted forward and to the right, of the accident airplanes firewall on a sheet of aluminum inside the engine compartment. The main electrical system’s regulator was mounted above the standby electrical system’s regulator and they were both mounted so that the regulators plastic terminal strips faced forward towards the engine cowling’s right inlet.

Examination of the wiring which lead to the plastic terminal strips revealed that no drip loops or other means to keep condensation (water) from running down the wiring was present. Further examination of the mounting area revealed staining adjacent to the lower right corner of the standby electrical system's regulator on a copper terminal strip, which was mounted below the standby electrical system's regulator.

Testing of both regulators revealed that when power was applied to the main electrical system's regulator it was functional. However, when NTSB investigators attempted to connect a power source to the standby electrical system's regulator, visible sparking was observed between the case and the terminal strip.

Internal examination of the standby electrical system's regulator revealed that it was not potted and that the internal components were mounted on a circuit board which was not conformally coated. No weather seal existed between the plastic terminal strip and the metal case. Evidence of staining and arcing was present on the inside of the case, and portions of the plastic terminal strip exhibited evidence of melting.

Kit Manufacturer's Firewall Fastbuild Options

Review of the airplane kit manufacturer's published Options and Accessories list revealed that the regulators were offered as part of engine and firewall fast build programs, and that the regulators were mounted in a similar location to the accident airplane's on the firewall.

N437RP

At the request of the NTSB, the owner of a similar airplane to the accident airplane who had the fuselage delivered to him from the manufacturer, provided photographs of the airplane as it was delivered to him in 1999, and in its present configuration.

Examination of the photographs revealed that the kit had been originally delivered with a single regulator mounted in a similar location to the accident airplane's (forward of the firewall in the engine compartment) with no drip loop present.

Further examination of the photographs also revealed, that the owner had later removed and re-did all the wiring on the firewall, and added a second regulator. This installation was also similar to the accident airplane's installation, However, in this installation, the regulators were stacked on top of each other on standoffs. They were oriented with the plastic terminal strips facing the right side of the airplane. Once again it was discovered that no drip loop existed in the wiring going to the regulator's plastic terminal strips.

Manufacturer's Information and Guidance

According to documentation supplied with the regulators, they were not FAA approved under a supplemental type certificate.

According to the regulator manufacturer, both the main and standby electrical systems were designed to be operated at the same time so that when the system sensed a drop in voltage it would turn the standby system on.

The regulator manufacturer was also aware of an occurrence a few years earlier of water running down the wiring and entering a regulator.

According to the installation instructions supplied for the regulator, the manufacturer recommended when mounting the regulator, to "try and choose a location that will protect it from heat, vibration, and water. We recommend on the pilot side of the firewall, or inside the cabin somewhere close to the panel."

According to the pilot, he was aware of the recommendation to mount the regulators in the cockpit, but thought that the heat in the airplane would be worse in the cockpit than in the engine compartment. Additionally, he believed that the regulators were “sealed in Bakelite,” and it would provide “ease of access” to mount them on the firewall.

ADDITIONAL INFORMATION

According to FAA Advisory Circular, AC-43.13-1B, "operation of storage batteries beyond their ambient temperature or charging voltage limits can result in excessive cell temperatures leading to electrolyte boiling, rapid deterioration of the cells and battery failure. When charging rates are excessive, the electrolyte may boil to the extent that fumes containing droplets of the electrolyte are emitted through the cell vents. The battery fumes and gases can cause an explosive mixture."

Material Safety Data Sheets

A review of multiple battery manufacturers Material Safety Data Sheets (MSDS) revealed that batteries should be protected from overcharging and sources of ignition. Hydrogen gas, which may explode if ignited, is produced by batteries, especially when charging, and batteries should be adequately ventilated and isolated from sources of ignition.

Multiple MSDS also advised that overcharging could create sulfur trioxide, carbon monoxide, sulfuric acid mist, and sulfur dioxide, sulfuric acid could react violently with strong reducing agents, metals, strong oxidizers and water. Sulfuric acid contact with combustibles and/or organic materials may also cause fire and/or an explosion.

Wood is classified as both a combustible and organic material.

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