



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

June 2, 2015

AIRWORTHINESS

Group Chairman's Factual Report

WPR14FA369

A. ACCIDENT: WPR14FA369

Operator: Lee Behel
Location: Reno, Nevada
Date: September 8, 2014
Time: 1516 Pacific Daylight Time
Aircraft: Backovich GP-5
Registration Number: N501GP

B. STRUCTURES GROUP

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

Member: William Kunder
Federal Aviation Administration
Reno, Nevada

Member: Robert Fair
Sport Class
Bend, Oregon

C. SUMMARY

On September 8, 2014, about 1516 Pacific daylight time, an experimental amateur built Backovich GP-5 airplane, N501GP, was destroyed when it impacted terrain following an in-flight breakup while conducting a practice race at the Reno-Stead Airport (RTS) Reno, Nevada. The airplane was registered to Lancair Northwest LLC, Portland, Oregon, and operated by the pilot under the provisions of Title 14 Code of Federal Regulations Part 91. The commercial pilot, the sole occupant of the airplane, was fatally injured. Visual meteorological conditions prevailed and no flight plan was filed for the air race flight. The local flight originated from RTS about 5 minutes prior to the accident.

D. DETAILS OF THE INVESTIGATION

1.0 Airplane

The Backovich GP-5 airplane was an experimental amateur built airplane designed by George Pereira specifically for air racing and was completed in 2011 in its current configuration (Figure 1¹). The one-of-a-kind airplane is 24 feet, 2 inches long, has a wing span of 22 feet, 2 inches, and is equipped with retractable conventional landing gear. The airplane was manufactured with wood primary structure and had a fiberglass overwrap layer on the exterior surfaces. The

¹ All figures are presented in Appendix A to this report.

airplane was powered by a Chevy automotive engine. No design drawings or engineering documents exist for the airplane. The airplane was designated race number 5 “Sweet Dreams”.

Photographic and video evidence was obtained from spectators that captured the accident sequence². The evidence showed that the airplane was established in a left bank when a portion of the outboard right wing separated. The airplane began rolling to the right and descended to impact with the ground. The empennage fragmented and separated as the airplane was rolling and descending.

2.0 Airplane Examination

The airplane came to rest within the confines of the National Championship Air Races (NCAR) Sport Class race course between pylons 5 and 6³. There were three distinct debris fields located in the sagebrush covered terrain. The first debris field along the route of flight contained the outboard portion of the right wing, fragmented portions of the right aileron, the aileron bellcrank, and numerous pieces of wing skin and internal wing structure. The second debris field along the route of flight contained the right and left horizontal stabilizers, right and left elevators, the fragmented vertical stabilizer and rudder, pieces of the empennage structure, and several pieces of the acrylic canopy. The third debris field along the route of flight contained the initial impact crater and the highly fragmented remains of the airplane, engine and propeller. There was no evidence of a post-crash fire. The entire airplane was accounted for in the three debris fields.

The debris from the first and second debris fields was collected separately for further examination. The g-meter was found in the third debris field. One pointer was situated just above zero, one was situated at -4.5 and one was situated at -4.0. The Advanced Flight Systems AF-4500 multifunction display (MFD) screen and main body were recovered separated in the third debris field. The Pectel SQ6 Engine Control Unit (ECU) was also recovered in the third debris field. The MFD and ECU were sent to the NTSB Vehicle Reorders Laboratory for download and analysis. See the NTSB Onboard Electronic Devices Specialist’s Factual Report in the public docket for the details of the investigation.

Right Wing

The group reconstructed the outboard right wing using the pieces recovered in the first debris field. The largest intact piece of right wing included the forward portion of rib 9, rib 10, rib 11, the wingtip outboard of rib 11, the forward spar outboard of rib 10, and portions of the upper and lower skins. Most of the outboard 50 inches of right wing was conclusively identified in the recovered debris from the inboard end of the aileron to the wing tip. The outboard 50 inches of upper wing skin was identified and reconstructed between the forward and rear spars (Figure 2). The leading edge structure forward of the forward spar and inboard of rib 9 (about 32 inches inboard of the wing tip) was not conclusively identified. The forward portion of rib 9 was intact forward of the forward spar. The aft portion of rib 9 between the forward and rear spars was reconstructed. The location of rib 9 is annotated by the yellow line in Figures 2 and 3. The nose of the leading edge between rib 9 and about 9 inches inboard of the wing tip was not conclusively identified. Most of the lower wing skin from rib 9 outboard was identified and

² See the NTSB Image Recorders Specialist’s Factual Report in the public docket for more information.

³ See the wreckage diagram in the public docket.

reconstructed between the forward end of the nose ribs and the rear spar (Figure 3). A triangular section between ribs 9 and 10 and forward of the forward spar was not conclusively identified. Rib 10 was intact and located about 10 inches outboard of rib 9 or 22 inches inboard of the wing tip. There was a rectangular section of lower wing skin missing just outboard of rib 10 that extended from the rear spar location forward about 4 inches. The area was consistent with the location of the outboard aileron balance weight.

The forward spar was a box structure on this airplane. The forward spar upper spar cap transitioned from a solid rectangular cap to two finger caps about 7 inches inboard of rib 9. Examination of the wreckage revealed a spliced section of forward spar upper spar cap about 18.5 inches long that spanned from about 10.5 inches inboard of rib 9 to about 8 inches outboard of rib 9. The spliced section contained the transition area with a single scarf joint at the inboard end in the rectangular area and two scarf joints at the outboard end in the finger area. The spliced section of forward spar upper spar cap remained attached to a section of the wing upper skin. The upper spar cap was fractured through the grain of the splice piece at the inboard scarf joint. The bond line and remaining portion of the scarf were not identified. The upper spar cap fingers were fractured through the grain of the splice piece from about rib 9 outboard. The forward finger scarf was intact. The aft finger was also fractured at the scarf with both adhesive and wood grain failure in the scarf area. The outboard ends of the finger scarfs also had thin wood doublers installed on the lower surface of the upper spar cap. There was no evidence of doublers installed at the inboard scarf joint on the upper spar cap.

The identified portions of the forward spar lower spar cap only consisted of the two fingers, there was no transition area. Each finger had a spliced section between about 7 inches inboard of rib 9 to about 6 inches outboard of rib 10. The inboard scarfs were fractured through the adhesive with no fracture of the wood in the scarf areas (Figure 4). The mating surfaces of the forward and aft finger scarf joints are annotated by the yellow and green arrows, respectively, in Figure 3. Each of the fingers was also fractured about 10 inches inboard of rib 9 (inboard of the end of the scarf joints) with features consistent with positive bending overload. The outboard scarf joints were intact and each had a thin wood doubler installed on the upper surface of the lower spar cap. There was no evidence of doublers installed at the inboard scarf joints on the lower spar cap. There was significant excessive dried adhesive present throughout the area of the spliced section of spar.

The aileron bellcrank was recovered separated from the wing structure but still remained attached to a section of the forward spar aft web just inboard of rib 9. The section of aft web extended from about 8 inches inboard of rib 9 to about 3 inches outboard of rib 9. The section of aft web from about 3 inches outboard of rib 9 to rib 10 was separated from the wing. The aileron push-pull tube was fractured about 7.5 inches inboard of the bellcrank attach point with features consistent with bending overload. The aileron control link was fractured in the threaded portion at the aft end about 10 inches aft of the bellcrank attach point. The forward spar forward web was fractured about 10 inches inboard of rib 9 and intact from the fracture to the wing tip. Most of the rear spar was reconstructed from the inboard aileron hinge to the outboard aileron hinge. This portion of rear spar was separated from the recovered outboard wing section and recovered in many pieces. A section of rear spar around the center aileron hinge was not identified in the wreckage.

Several pieces of the right aileron were recovered in the first debris field to include the inboard end with inboard hinge and balance weight attached, about 70% of the trailing edge, a section of lower skin and aileron fairing, the outboard end, two ribs, several pieces of the upper and lower leading edge, sections of the aileron spar, and the outboard hinge (Figure 5). The remaining structure was not conclusively identified in the debris including the center hinge and outboard balance weight. Examination of the inboard and outboard hinges did not show any evidence of over travel or repeated contact with the stops.

Many small pieces of wing skin, wing stringers, and wing ribs were recovered in the first debris field that could not be definitively placed on the reconstruction. There was no evidence of dry rot or other discrepancies in the pieces examined.

3.0 Aircraft Records⁴

The airplane was originally completed in 2002 and received a special airworthiness certificate on December 30, 2002, in the experimental category with registration number N153GB. Lee Behel flew the airplane in the 2010 NCAR and subsequently purchased the airplane on behalf of Lancair Northwest, LLC, on October 6, 2010. The airplane registration number was changed to N501GP on November 12, 2011. The airplane received a new special airworthiness certificate on July 10, 2012, in the experimental category with experimental operating limitations for phase 1 and phase 2. The airplane was entered and raced in the 2012 NCAR where it placed fourth. It was not entered in the 2011 or 2013 NCAR.

The airframe logbook had numerous entries from its beginning on November 28, 2002, through September 15, 2010, when the last entry was made before the sale. The airframe had accrued 41.5 hours time in service (TIS) by this date. The entries detailed ongoing issues with the engine and numerous test flights. An entry on August 7, 2010, certified that the flight testing was complete at 40.25 hours TIS.

The first entry after the sale was made on January 26, 2012, in which a new electrical system, engine mount, engine, and avionics were installed at 42.5 hours TIS. A condition inspection was also completed at this time. Four additional logbook entries were made before the accident date. On February 5, 2013, work was documented on the landing gear and a condition inspection was signed off at 98.0 hours TIS. On March 18, 2014, work was documented to repair cracks in the left wing lower skin and repair the elevator bellcrank bulkhead. A condition inspection was signed off at 128.2 hours TIS. On September 2, 2014, work was documented to repair cracks in the right wing lower skin and to tighten and re-safety a bolt on the right aileron bellcrank. The condition inspection was signed off at 128.2 hours TIS. On September 3, 2014, work was documented on the tail wheel at an unknown TIS.

The engine logbook documented the installation of the engine on January 26, 2012, with a tach time of 0.0 hours. A total of 4 entries in the engine logbook documented minor maintenance and condition inspections of the engine that matched dates on 4 of the entries in the airframe

⁴ See Attachment 1 to this report for the pertinent records.

logbook. Three of the engine entries contained tach times that matched with the tach time reported in the airframe logbook but the corresponding increase in airframe time did not correlate. The propeller logbook documented the installation of the propeller on January 2, 2012, with a total time of 0.0 hours. Three additional entries in the propeller logbook documented condition inspections of the propeller that matched dated entries in the airframe and engine logbooks. The propeller total time entered on February 5, 2013, did not correlate with either the airframe or engine times.

4.0 Tests and Research

The crew chief reported that the airplane suffered a collapse of both main landing gear during a landing at Hollister Municipal Airport, Hollister, CA, on March 11, 2012, following a test flight. According to information provided by the FAA, the pilot was unable to get the right main landing gear in the down and locked position. During the landing, the right main landing gear collapsed and the left main landing gear broke off the airplane. The airplane sustained damage to both main landing gear and doors, the right wing, air scoop, and propeller. Photographs provided to the investigation showed significant damage to the right wing upper and lower skins and leading edge (Figures 6 and 7). Damage to the internal wing structure could not be quantified from the photographs. According to the crew chief, the wing was removed from the airplane and sent to the designer for repair.

The airplane was flown to EAA AirVenture in Oshkosh, WI, in July 2013. During the return flight, the accident pilot reported to the crew chief that the pitch characteristics were abnormal. Inspection of the airplane found the bulkhead where the elevator quadrant was attached had fractured from its mounts. The damage was repaired and documented in the airframe logbook.

The crew chief reported that the cracks in the right and left wing lower skins were located in a similar location on each wing, aft of the forward spar in the area of the main landing gear trunnions. The cracks were reportedly repaired in accordance with FAA AC43.13-1B.

In a telephone interview with the designer⁵, George Pereira, he stated that the wing was a one-piece construction at original manufacture. The forward spar was a box spar and was designed to carry all of the wing bending loads. The spar caps were of one-piece design with no splices along the length. The rear spar and wing skins carried the wing torsion loads. He informed the investigation that the design drawings had been lost. He recalled repairing the right wing after the landing gear failure in March 2012 but only recalled repairing the leading edge and leading edge ribs on the right wing. He did not recall any spar damage on the right wing. No engineering was generated for the repair and he stated it was all performed in accordance with AC 43.13-1B.

The accident pilot performed a practice flight on the NCAR course during the morning of September 8 and called a mayday during the flight. The pilot reported to the crew chief that the airplane began to shake when he applied power. The crew examined the data from the engine control unit and found that the rev limiter had engaged as the rpm increased to the set limit of about 6000 rpm. Normal inspection of the airplane by the crew did not reveal any discrepancies.

⁵ See Attachment 2 to this report for the Record of Conversation.

The pilot reported to another Sport Class pilot that he thought the airplane was going to come apart it was shaking so badly during the event.

FAA Advisory Circular AC43.13-1B “contains methods, techniques, and practices acceptable to the Administrator for the inspection and repair of nonpressurized areas of civil aircraft, only when there are no manufacturer repair or maintenance instructions.” Chapter 1 - Wood Structure, Section 4 - Repairs, contains information on the design of scarf joints and the repair of wing spars. Figure 1-8 in the AC provides information on the method to splice box spar flanges. See Figure 8 for the AC figure. The AC states that reinforcement plates must be used on all scarf repairs to spars and provides minimum dimensions for scarf joints. The information in Figure 8 shows that for box spar flanges, the scarf should have a minimum slope of 15 times the thickness of the flange being spliced. Reinforcement plates should be at least $1/2t$ thick and $21t$ long where t represents the thickness of the flange being spliced.

The group planned to reexamine the wreckage after obtaining the logbooks and other information. Unfortunately, the insurance company disposed of the wreckage without the knowledge or approval of the NTSB.

Submitted by:
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