Aviation Investigation Final Report

Location:	Hemet, California	**Accident Number:**	WPR19FA161
Date & Time:	June 8, 2019, 09:38 Local	**Registration:**	N123GN
Aircraft:	Lockwood AIRCAM	**Aircraft Damage:**	Substantial
Defining Event:	Aircraft structural failure	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Flight test		

Analysis

The pilot, who was also the owner/builder of the experimental amateur-built kit airplane, was conducting his first test flight in the airplane after having received a special airworthiness certificate 1 week earlier from the Federal Aviation Administration, which allowed him to begin Phase 1 flight testing. On the morning of the accident, several of the pilot's friends and acquaintances gathered to watch his first flight. A video showed that during takeoff, as the airplane reached about 20 ft above ground level, the left wing folded upward. The airplane immediately rolled left and subsequently impacted the ground.

Examination of the airplane revealed that the forward and rear left-wing lift struts remained connected to the wing but were not attached to the fuselage attachment fittings. Further examination revealed that the fittings on the fuselage were intact, and their corresponding bolt holes were undamaged; the bolts were present and secured to the lift struts with washers and nuts but had not been connected to the fuselage through the attachment fittings. The forward and rear right-wing strut were properly attached to the fuselage attachment fittings and the hardware was secure.

Two friends assisted the pilot during the build process. One of them was an airframe and powerplant mechanic, and he reported that the left wing had been removed and reinstalled several times during the build process due to build errors. Each installation required that the attachment hardware be removed and reinstalled, which the pilot performed each time on his own. The mechanic reported that he periodically reminded the pilot to verify that the attachment hardware had been installed correctly, but he continued to find loose screws and nuts throughout the build process.

The pilot likely attempted to install the lift struts on the fuselage after the wing's last reinstallation but failed to ensure that the left-wing lift strut bolts were secured to the fuselage attachment points through the attachment fittings. Although postaccident testing revealed that a correctly installed lift strut was closer to the fuselage along the attachment fitting than an incorrectly installed lift strut, the pilot did not detect the difference between the left and right wings. Postaccident examination of the airframe and

engine did not reveal any other mechanical malfunctions or failures that would have precluded normal operation. Therefore, the pilot's failure to properly attach the left wing to the fuselage likely led to its failure shortly after takeoff.

A Federal Aviation Administration designated airworthiness representative (DAR) inspected the airplane 1 week before the accident and issued the pilot a special airworthiness certificate the same day as he was comfortable with the overall assembly. The DAR was not responsible for the final construction and assembly of the airplane as this was the responsibility of the builder.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The pilot/builder's improper installation of the left wing during the build process, which resulted in the wing failing during takeoff.

Findings

Aircraft	Fus (attach fitting on wing) - Incorrect service/maintenance
Aircraft	Fus (attach fitting on wing) - Inadequate inspection
Aircraft	Fus (attach fitting on wing) - Failure

Factual Information

History of Flight

Takeoff	Aircraft structural failure (Defining event)
Takeoff	Nose over/nose down
Takeoff	Collision with terr/obj (non-CFIT)

On June 8, 2019, about 0938 Pacific daylight time, an experimental amateur-built Lockwood Aircraft Aircam airplane, N123GN, was substantially damaged when it was involved in an accident in Hemet, California. The pilot was fatally injured. The airplane was operated as a Title *14 Code of Federal Regulations* Part 91 personal flight.

According to the pilot's friends, the accident flight was the first test flight in the airplane after the pilot had received a special airworthiness certificate for the airplane 1 week earlier, allowing him to begin phase I flight testing. On the morning of the accident, the pilot's friends had gathered to watch his first flight. The pilot lined up the airplane on the runway centerline and began a slow ground roll for a few seconds before he advanced the throttles to takeoff power. A few seconds later, during takeoff, the airplane reached about 20 ft above ground level, at which point, the left wing folded upward. The airplane immediately rolled left, descended, and then impacted the ground inverted.

A review of a video of the accident recorded by a witness corroborated the witness interviews.

Pilot Information

Certificate:	Commercial	**Age:**	73,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	**Seat Occupied:**	Front
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	June 5, 2018
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	15.6 hours (Total, this make and model)		

Only one of the pilot's flight logbooks was recovered, which contained flights that occurred between April 24, 2018, and May 18, 2019, all of which were in the accident airplane make and model.

Aircraft and Owner/Operator Information

Aircraft Make:	Lockwood	**Registration:**	N123GN
Model/Series:	AIRCAM	**Aircraft Category:**	Airplane
Year of Manufacture:	2017	**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	AC-0248
Landing Gear Type:	Tailwheel	**Seats:**	2
Date/Type of Last Inspection:	May 10, 2019 Condition	**Certified Max Gross Wt.:**	1680 lbs
Time Since Last Inspection:	8 Hrs	**Engines:**	2 Reciprocating
Airframe Total Time:	7.6 Hrs as of last inspection	**Engine Manufacturer:**	Rotax
ELT:	Installed	**Engine Model/Series:**	912ULS
Registered Owner:	On file	**Rated Power:**	100 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The pilot purchased the airplane kit in 2017. Two friends assisted the pilot during the build process. One of the friends was an airframe and powerplant mechanic who provided instructional assistance, and the other friend assisted by collecting tools, holding heavy objects, wiring, and riveting. The mechanic stated that he would demonstrate part of the process for the pilot who would then complete the work. After the wings were initially installed, they performed a wind test, and then removed the wings. While reinstalling them, they put the struts on backward and had to remove them again. After this was corrected and the wings were again reinstalled, they found another discrepancy that required them to remove and reinstall the wings again. The mechanic recalled that the left wing may have been removed one more time after this.

During each removal and installation, the pilot's friends would help him jack the wing up while the pilot removed or installed the struts and hardware. The mechanic added that he would periodically remind the pilot to "check every bolt and nut and screw, everything." Although the pilot did what he asked, the mechanic continued to find loose screws and nuts on the airplane throughout the build process.

According the Aircam Construction manual, Section 12, "Airframe Assembly & Rigging," (See figure 1) the wings are secured to the fuselage by forward and rear lift struts that are bolted to attachment fittings on the center fuselage. During construction, the builder must lift the wing and fit the forward strut over the attachment fitting and then insert an AN5-16A bolt through the strut and attachments and secure them with AN960-516 washers and AN365-524 nuts torqued to 30 inch-lbs.

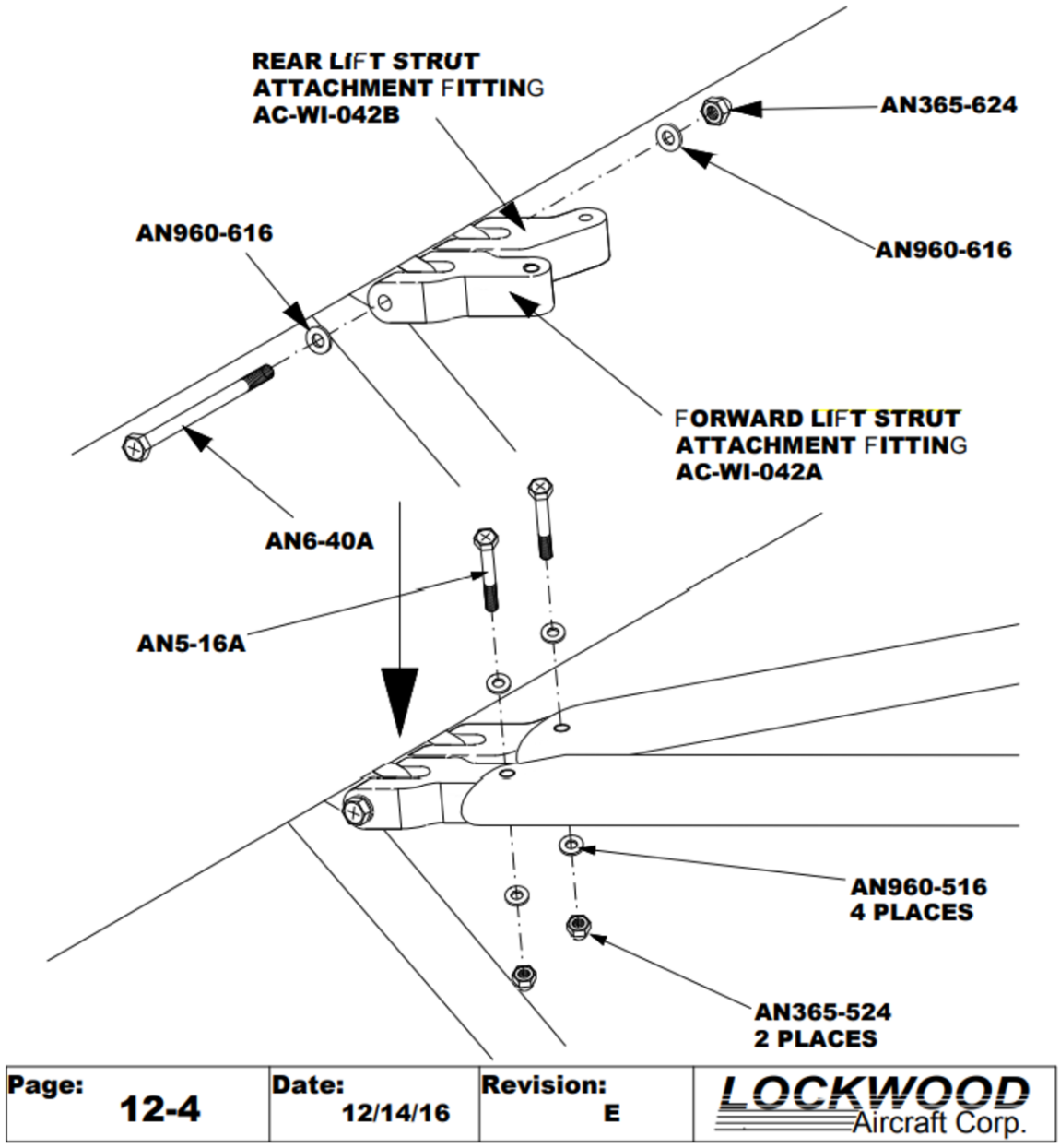

Figure 1: Lift Strut to Center Fuselage Construction Drawing

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	1514 ft msl	**Distance from Accident Site:**	
Observation Time:	09:35 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.93 inches Hg	**Temperature/Dew Point:**	19°C / 13°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Hemet, CA (HMT)	**Type of Flight Plan Filed:**	None
Destination:	Hemet, CA (HMT)	**Type of Clearance:**	VFR
Departure Time:	09:38 Local	**Type of Airspace:**	

Airport Information

Airport:	Hemet-Ryan HMT	**Runway Surface Type:**	Asphalt
Airport Elevation:	1514 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	23	**IFR Approach:**	None
Runway Length/Width:	4315 ft / 100 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	33.73389,-117.01721

The airplane came to rest inverted on the left runway edge, about 550 ft from the approach end of the runway. All major sections of the airframe were accounted for at the accident site. The debris path was oriented on a magnetic heading of 219°, and the initial impact point was marked by short parallel gouges in the runway about 125 ft from the main wreckage, which was positioned on a 111° magnetic heading. Multiple dents and compression wrinkles were observed on both sides of the forward fuselage at the

nose cone, which was scarred and cracked along the top. The fuselage frame at each wing strut attachment was compressed on both sides of the fuselage. The left wing was partially separated and folded beneath the main wreckage, and the wing tip was adjacent to the empennage. The right-wing compression tube was deformed, and the leading edge was crushed. Fuel stains were observed below the left wing on the runway surface.

An examination of the airplane revealed that the left aileron control tube was continuous from the cockpit to its respective control surface through a fracture in the aileron push/pull tube and a fracture at the wing root. The rudder, elevators, and right aileron were traced from the control surfaces to their flight controls in the cockpit. A measurement of the elevator trim tab jackscrew displayed 5/8 of an inch of exposed thread. According to the manufacturer, this measurement was consistent with a neutral trim position.

The forward and rear left-wing lift struts remained connected to the wing but were not attached to the fuselage attachment fittings. Further examination revealed that the bolts were present and secured to the lift struts with washers and nuts but had not been connected to the fuselage through the attachment fittings (See figure 2). The fittings on the fuselage were intact, and their corresponding bolt holes were undamaged. The forward and rear right-wing strut were properly attached to the fuselage attachment fittings and the hardware was secure.

Figure 2: The left picture shows the left-wing strut attachment fitting ends, and the right picture shows the fuselage attachment fittings as found at the accident site.

Examination of the airplane revealed that the AN5-16A bolts had been secured to each strut with the appropriate washers and nuts. However, the lift strut attachment fittings were not damaged. During a subsequent test, the struts felt secure after they were reinstalled to the lift strut attachment fittings, as they were during the accident flight, without the bolts running through the lift strut attachment fittings. The struts were then reinstalled with the bolts running through both the lift struts and attachment fittings in accordance with the manufacturer's rigging manual and felt secure when the investigators tried to pull

it from the fitting. The attachment fitting was taped during the examination to show the differences between the appearance of the assembly when the struts are correctly and incorrectly installed to the fitting (See figure 3).

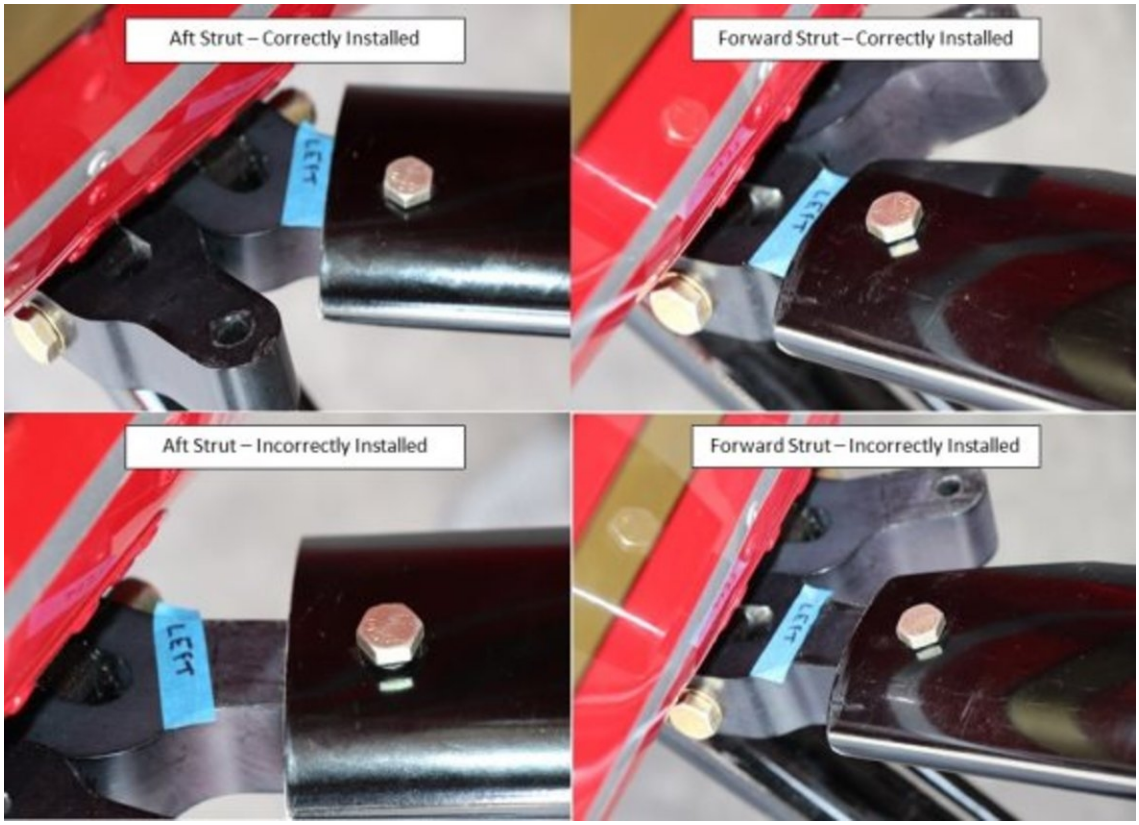

Figure 3: Photograph showing the left forward and aft wing strut installation with both bolts incorrectly and correctly installed in the attachment fitting bolt holes.

Medical and Pathological Information

The Riverside County Sheriff's Department Coroner-Public Administrator's Office, Perris, California, performed an autopsy on the pilot. The pilot's cause of death was multiple blunt impact injuries. No significant natural disease was identified.

Toxicology testing of the pilot's tissue specimens performed at the Federal Aviation Administration's (FAA) Bioaeronautical Sciences Laboratory were negative for illicit drugs, ethanol, and combustion products.

Additional Information

FAA Advisory Circular (AC) 90-89B

FAA Advisory Circular (AC) 90-89B, “Amateur-Build Aircraft and Ultralight Flight Testing Handbook,” issued on April 27, 2015, provided assistance to amateur builders in developing individualized aircraft flight-test plans; however, the AC was not mandatory. Appendix 1 of the AC, “Sample Checklist for a Condition Inspection,” included items specifically for the wings, including the wing attachment points and the wing, strut, and cable attachments and hardware for safety and condition.

FAA Order 8130.2

FAA Order 8130.2, “Issuing Special Airworthiness Certificates,” section 4-6, “Common Procedures for Issuing an Experimental Certificate,” stated that the Designated Airworthiness Representative (DAR) must review the application and inspect the aircraft before issuing an airworthiness certificate (assuming all criteria are met). The order did not provide a list of required inspection items nor was it the DAR’s responsibility to provide one.

Designated Airworthiness Representative (DAR)

According to the FAA website, www.FAA.gov

A Designated Airworthiness Representative is an individual appointed in accordance with 14 CFR §183.33 who may perform examination, inspection, and testing services when necessary to the issuance of certificates.

The pilot contacted a manufacturing DAR (DAR-F) in October 2018 to "get a head start" on the certification process for his airplane. According to the DAR-F, he sent the pilot several forms and instructions about the certification process. He added that, early in the application process, he provided applicants a generic inspection checklist, which included a section titled, "General Condition – Fuselage, Wing, Tail Assembly," that had 13 checklist items, none of which addressed the wing struts. On June 1, 2019, the DAR completed his review and inspection and then issued the special airworthiness certificate on the same day, which is not unusual. At that time, the airplane had 7.6 total flight hours.

The DAR-F reported that he followed FAA Order 8130.2 when he performed airworthiness inspections. His inspection of the airplane included the strut for hardware security, general condition, thread engagement, position, and tightness/security. During the inspection he found two discrepancies, which

included a loose jam nut and frayed throttle cable ends, but he noted that he did not feel uncomfortable issuing the certificate.

Administrative Information

Investigator In Charge (IIC):	Stein, Stephen
Additional Participating Persons:	Roderick Ealy; Federal Aviation Administraton; Riverside, CA Phillip Lockwood; Lockwood Aviation; Sebring, FL Jordan Paskevich; Rotech Flight Safety; Vernon
Original Publish Date:	May 5, 2021
Last Revision Date:	
Investigation Class:	Class 2
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=99569