Aviation Investigation Final Report

Location:	Oakdale, California	**Accident Number:**	LAX04FA150
Date & Time:	March 9, 2004, 14:10 Local	**Registration:**	N93707
Aircraft:	Ercoupe 415-C	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The airplane broke apart in flight while maneuvering. The pilot and a passenger were on a local flight and did not return. The wreckage was located strewn over an area of grassy hills. The wings and empennage sections were found separate from the main fuselage. The owner of the airplane had flown with the pilot just prior to the accident flight and reported that the pilot had been doing aileron rolls. The airplane had flown about 4 hours since its annual inspection. Prior to that time, the airplane was damaged during a hard landing and sat, unrepaired, for 2 years. Post accident examination of the airframe revealed extensive corrosion through the wing walk areas and wing spar center section, with corrosion affecting at least 20 rivets that secure the web to the upper spar cap. A Safety Board metallurgist determined that the area of the wing spar center section corrosion could not have been detected through current inspection methods and procedures. The critical buckling stress on the upper spar cap was several times as high as the estimated stress carried by the upper spar cap in straight and level flight, which indicates the failure most likely occurred in a steep turn or other high load maneuver. The collapse of the spar could only occur when enough rivets had corroded to allow the disconnected part of the spar cap to reach its critical buckling strength. Ercoupe Service Bulletin (SB) No. 18 was issued for the reinforcement of the center section belly skin as a direct result of cracks occurring in the center section belly skin at the rearmost rivet attachment in the center section belly skin outer stiffeners. Service Bulletin 31 was issued in July 2000, and required inspection within the next 5 hours of operation or at the next 100-hour or annual inspection, whichever occurred first. The SB was intended to detect corrosion and prescribed certain visual methods of inspection. AD 2002-26-02 was intended to detect and correct corrosion in the wing center section, which could result in failure of the wing center section structure during flight. The AD contained three methods of accomplishing the inspection: install inspection openings; use a scope and a light source; or remove outer wing panels to gain visual access to the wing walkway box structure. AD 2003-21-01 was issued in response to additional reports of corrosion on airplanes found during compliance with AD 94-18-04 R1. The actions of the AD were intended to prevent wing damage caused by

a corroded wing outer panel structural component. The AD called for installation of inspection openings in the outer wing panels and inspection of the area for corrosion and corrosion damage. It also called for repetitive inspections every 12 months. Comparison of the inspection requirements in the Service Bulletins and AD's to the area where the corrosion was present in the accident aircraft revealed that none of the inspection methods would likely have found the corrosion. All of the current inspection methods are done visually and there is no requirement for nondestructive inspection (NDI) or nondestructive testing (NDT).

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the in-flight separation of the main spar due to corrosion in the wing center section not detectable by inspection methods described in manufacturer's service bulletins and FAA Airworthiness Directives.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: MANEUVERING

Findings
1. (C) WING,SPAR - CORRODED
2. (F) MAINTENANCE,SERVICE BULLETIN/LETTER - INADEQUATE - MANUFACTURER
3. (F) INFORMATION INSUFFICIENT - MANUFACTURER
4. (C) WING,SPAR - OVERLOAD

Occurrence #2: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Findings
5. TERRAIN CONDITION - GROUND

Factual Information

HISTORY OF FLIGHT

On March 9, 2004, about 1410 Pacific standard time, an Ercoupe 415-C, N93707, experienced an in-flight separation of both wings and impacted hilly terrain 7 nautical miles southeast of Oakdale, California. The pilot was operating the airplane under the provisions of 14 CFR Part 91. The commercial pilot, who also held a certified flight instructor certificate, and one passenger, sustained fatal injuries. The airplane was destroyed. The flight departed the Oakdale Airport at 1400, for the local area personal flight. Visual meteorological conditions prevailed, and no flight plan had been filed.

According to an aviation maintenance technician (AMT) that worked on the airplane, the owner was receiving flight instruction to obtain her private pilot certificate. She had flown earlier that day. A relative of the owner, the passenger on the accident flight, departed with the CFI about 1400. The owner reported to the AMT that during her flight, the CFI was performing aileron rolls and fuel was pouring over the windscreen.

PERSONNEL INFORMATION

A review of Federal Aviation Administration (FAA) airman records revealed that the pilot held a commercial pilot certificate with ratings for airplane single and multiengine land, and instrument airplane. The pilot held a certified flight instructor (CFI) certificate with ratings for airplane single and multiengine land, and instrument airplane.

The pilot held a first-class medical certificate that was issued on November 29, 2002. It had no limitations or waivers.

An examination of the pilot's logbook indicated an estimated total flight time of 1,133 hours. He had en estimated 4 hours in this make and model. His last flight review was completed during his certified flight instructor multiengine checkride on December 19, 2002.

The pilot was employed as a CFI at the Sierra Academy of Aeronautics. His resume indicated that prior to that he taught aerobatics to students in Modesto, California, from July 2002 until October 2002. A school name was not listed.

The airplane owner was interviewed. She reported that she had flown with the CFI on the flight just prior to the accident flight. The flight consisted of climbs and descents. When she was asked if she went upside down in the airplane during that flight she responded affirmatively. She also reported that during a previous lesson on March 6, she and the CFI completed loop maneuvers.

A pilot that had flown formation with the accident pilot about a month prior to the accident said that he performed an aileron roll about 2,500 feet above ground level (agl) in a PT-22. He looked over and saw the accident pilot perform the same maneuver in the Ercoupe at 1,500 feet above ground level (agl). Following the flight, he did not speak to the accident pilot about the maneuver.

A former instrument student of the accident pilot reported that the accident pilot was his mentor and friend. While flying a hold, the accident pilot calmed the student and assisted him in flying the appropriate altitude. The student felt that the accident pilot was an excellent teacher.

A family member reported that the accident pilot attended 2 hours of aerobatic training to improve his skills as a pilot. The accident pilot was frustrated with flight schools that taught by rote learning and always wanted students to attain a certain level of proficiency. The family member also stated that the accident pilot was cautious with people that had not flown often.

AIRCRAFT INFORMATION

The airplane was an Ercoupe 415-C, serial number 1030. A review of the airplane's logbooks revealed a total airframe time of 1,600.9 hours at the last annual inspection. The logbooks had an entry for an annual inspection dated December 6, 2003. The tachometer read 396.9 at the last inspection. The current owner purchased the airplane in November 2003.

According to the previous owner, prior to his purchase, the owner had a hard landing. The airplane was ferried for repairs to Oakdale, but the owner passed away while the repairs were being made. The previous owner then purchased the airplane "as-is" and began researching the maintenance requirements for the airplane. It was noted that three ADs had been issued over the years since the nosegear was damaged. While determining how the inspections were to be performed, the previous owner and the aviation maintenance technician decided to remove the wings in order to gain better access to the center section.

They removed the wings and washed out the center section. It was then inspected using a high-power light and mirror. He noted finding nothing but "minor surface corrosion." Before reinstalling the wings, they sprayed the inside with a corrosion inhibitor.

Following the inspection, the previous owner decided to sell the airplane to a friend of the family that was just beginning flight training.

The entry in the airframe logbook for December 6, 2003, stated the following: "Performed annual inspection. Removed L & R (left and right) wings for compliance of AD 2002-26-02 center section. AD 2003-21-01 outer wing panels, AD 2002-26-02 c/w [complied with] IAW [in accordance with] action (1) (3) next due December, 2004. AD 2002-16-04 c/w IAW action (i), (4), (1), by installation of part number 48076 s/w AD 59-05-04, c/w 59-35-05, AD 59-05-04, AD

59-25-05, due every 100 hours or annual." The airplane was signed off as airworthy.

Ercoupe Service Bulletin (SB) No. 18 was issued for the reinforcement of the center section belly skin. This was a direct result of cracks occurring in the center section belly skin at the rearmost rivet attachment in the center section belly skin outer stiffeners.

On July 24, 2000, SB 31, Wing Center Section Inspection, was issued. The service bulletin required inspection within the next 5 hours of operation or at the next 100-hour or annual inspection, whichever occurred first. The SB was intended to detect corrosion and prescribed methods of inspection.

AD 2002-26-02 was intended to detect and correct corrosion in the wing center section, which could result in failure of the wing center section structure during flight. The AD contained three methods of accomplishing the inspection: install inspection openings; use a scope and a light source; or remove outer wing panels to gain visual access to the wing walkway box structure. It was noted that if any corrosion or corrosion damage was found, the components were to be fixed prior to further flight. The AD also required submitting a Malfunction and Defect Report, FAA Form 8010-4 within 10 days, if corrosion or damage was found.

AD 2003-21-01 was issued in response to additional reports of corrosion on airplanes found during compliance with AD 94-18-04 R1. The actions of the AD were intended to prevent wing damage caused by a corroded wing outer panel structural component. The AD called for installation of inspection openings in the outer wing panels and inspection of the area for corrosion and corrosion damage. It also called for repetitive inspections every 12 months.

All of the current inspection methods are done visually and there is no requirement for nondestructive inspection (NDI) or nondestructive testing (NDT).

The airplane was fueled in a private hangar prior to the accident. No fueling records were available.

METEOROLOGICAL INFORMATION

The closest official weather observation station was Modesto, California (MOD), which was located 11 nautical miles (nm) southwest of the accident site. The elevation of the weather observation station was 97 feet mean sea level (msl). An aviation routine weather report (METAR) for Modesto was issued at 1353. It stated: winds from 310 degrees at 13 knots; visibility 10 miles; skies clear; temperature 25 degrees Celsius; dew point 14 degrees Celsius; altimeter 30.07 inches mercury.

WRECKAGE AND IMPACT INFORMATION

Inspectors from the Federal Aviation Administration (FAA) responded to the accident scene. The airplane came to rest in open, hilly pasture. The wings detached from the fuselage and

were about 252 feet apart, and approximately 400 feet from the main wreckage. The empennage was approximately 200 feet from the fuselage. There was no fire. The primary wreckage was at 37 degrees 44.726 minutes north latitude by 120 degrees 37.886 minutes west longitude. The debris path of about 1,051 feet was on a magnetic heading of 315 degrees.

The engine came to rest inverted. The propeller remained attached to the engine. One tip blade was curled aft; the other blade was not curled. The spinner was crushed.

MEDICAL AND PATHOLOGICAL INFORMATION

The Stanislaus County Coroner completed an autopsy. The FAA Toxicology and Accident Research Laboratory performed toxicological testing of specimens of the pilot. The results of analysis of the specimens were negative for carbon monoxide, cyanide, volatiles, and tested drugs.

TESTS AND RESEARCH

Investigators examined the wreckage at Plain Parts, Sacramento, California, on March 17, 2004.

The fuselage had separated from the engine and was twisted and crushed. The front spar separated at its center section, which coincided with the location of two 6/32-inch screw holes. The upper spar on the left wing was bent upward and the webbing was buckled. The upper spar on the right wing was not bent. The fracture surface on the right lower spar was diagonal.

The wing walk box section was examined. The wing skin surface and hat sections displayed surface corrosion. The angle brace stiffners were flaking and the corrosion had the appearance of intergranular or exfoliation type corrosion.

A National Transportation Safety Board senior metallurgist examined the two fractured portions of the front spar from the center section of the wing. The spar fractured approximately along the centerline of the fuselage. The fracture extended through the upper and lower caps and the web portion. The total length of the two fractured spar pieces measured 51 inches.

Visual examination of the front spar revealed the upper and lower spar caps and webs contained mating fractures. The mating fractures for the upper spar cap were placed next to each other and visually examined. The upper spar cap portion adjacent to the fracture exhibited bending deformation consistent with the outboard ends of the spar cap bending upward relative to the spar. The upper spar cap was deformed slightly forward relative to the position of the lower spar cap and the upper portion of the web also was bent forward. Further to the left of the fracture location, the upper spar cap contained bending deformation that was

in the opposite direction to that associated with the fracture. The web portion in the center section between the upper and lower spar cap contained buckling deformation from excessive loading in the vertical direction. The web portion contained fractures on a plane of 45 degrees relative to the length of the web that is typical of an overstress separation.

The web of the wing spar is riveted to vertical flanges on the upper and lower spar caps. Twenty rivets between the web and upper cap flanges were found fractured, allowing this portion of the web to separate from the upper cap. Remnants of the fractured rivets remained attached to the upper spar cap, but the head portions of these rivets were missing. The 20 rivets fractured at the shank portion near the transition between the shank and head. The fractured rivets were firmly in place and the exposed portions of the rivet heads and tails showed no evidence of degradation from corrosion. One of the rivet faces was examined using a scanning electron microscope and showed intergranular features consistent with stress corrosion cracking in aluminum alloy. An ultrasonic inspection of several of the intact and fractured rivets did not indicate that any of the intact rivets were cracked.

The aft side of the wing spar contains vertical stiffeners that are attached by rivets to the web, lower flange of the upper cap, and upper flange of the lower cap. The wing spar contained 5 of these stiffeners within the region of the 20 rivets with fractures near the rivet head. At these five stiffener locations, the rivets through the upper spar cap flange also fractured at the transition between the bucked tail and shank. The fractured shank portion adjacent to the tails contained elongation deformation, and the fracture faces in this area showed a matter appearance typical of a ductile fracture. The ductile fractures were not covered with aluminum oxide.

The majority of the wing spar was covered with green primer, with the exception of the outboard ends that were covered with tan paint. The front face of the cap on the left piece contained two corrosion damage areas. The corrosion in these two areas extended between the layers of the extruded material of the upper cap, typical of exfoliation corrosion.

ADDITIONAL INFORMATION

The Safety Board investigator released the wreckage to the owner's representative on June 23, 2005.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	23,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	November 1, 2002
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	December 1, 2002
Flight Time:	1133 hours (Total, all aircraft), 4 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	Ercoupe	**Registration:**	N93707
Model/Series:	415-C	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	1030
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	December 1, 2003 Annual	**Certified Max Gross Wt.:**	1260 lbs
Time Since Last Inspection:	4 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	1600.9 Hrs at time of accident	**Engine Manufacturer:**	Continental
ELT:	Installed, not activated	**Engine Model/Series:**	C-85-12F
Registered Owner:	Jill Columbo	**Rated Power:**	85 Horsepower
Operator:	Phillip Jolley	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	MOD,97 ft msl	**Distance from Accident Site:**	17 Nautical Miles
Observation Time:	13:53 Local	**Direction from Accident Site:**	231°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	13 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	310°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.06 inches Hg	**Temperature/Dew Point:**	25°C / 14°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Oakdale, CA (027)	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	14:00 Local	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	37.746665,-120.631385

Administrative Information

Investigator In Charge (IIC):	Petterson, George
Additional Participating Persons:	Larry DeCosta; Federal Aviation Administration; Fresno, CA
Original Publish Date:	January 31, 2006
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=58879