Aviation Investigation Final Report

Location:	OAKLAND, California	**Incident Number:**	LAX95IA027
Date & Time:	October 29, 1994, 07:45 Local	**Registration:**	N191AF
Aircraft:	FAIRCHILD SA-227AC	**Aircraft Damage:**	None
Defining Event:		**Injuries:**	1 None
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled		

Analysis

THE PILOT EXPERIENCED A LOSS OF AILERON CONTROL SHORTLY AFTER TAKEOFF. THE PILOT RETURNED TO THE AIRPORT AND LANDED WITHOUT FURTHER INCIDENT. EXAMINATION OF THE AIRPLANE REVEALED THE CABLE BROKE NEAR ITS 90-DEGREE ATTACH PULLEYS. THE SAFETY BOARD MATERIALS LABORATORY CONDUCTED A METALLURGICAL EXAMINATION OF THE CABLE'S FRACTURED SURFACES. THE EXAMINATION REVEALED THE CABLE SEPARATED DUE TO HIGH-STRESS/LOW-CYCLE FATIGUE CRACKING. MOST WIRE ENDS IN THE VICINITY OF THE SEPARATION WERE SEVERELY BENT. SUCH DAMAGE WOULD MOST LIKELY BE PRODUCED BY A KINK IN THE CABLE. A CABLE KINK CREATES VERY HIGH TENSILE STRESSES ALONG THE OUTSIDE OF THE KINK AND WOULD GENERATE PREMATURE HIGH-STRESS FATIGUE CRACKING. THE 15 HOURS OF TIME SINCE INSTALLATION IS CONSISTENT WITH SOME SORT OF SEVERE CONDITION SUCH AS A KINK. THE MECHANIC MOST LIKELY INSTALLED THE CABLE WITH ONE END TWISTED COMPARED WITH THE OTHER END.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be: the company maintenance personnel's improper installation of the aileron cable.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings
1. FLT CONTROL SYST,AILERON CONTROL CABLE/ROD - SEPARATION
2. FLT CONTROL SYST,AILERON CONTROL CABLE/ROD - FATIGUE
3. (C) MAINTENANCE,INSTALLATION - IMPROPER - COMPANY MAINTENANCE PERSONNEL

Factual Information

On October 29, 1994, at 0745 hours Pacific daylight time, a Fairchild SA-227AC, N191AF, experienced a loss of aileron control shortly after departing runway 27L at Oakland International Airport, Oakland, California. The airplane was operating as Ameriflight (AMF) flight 1894, a nonscheduled cargo flight, under Title 14 CFR Part 135. The pilot had filed and began a company visual flight rules flight plan to Reno, Nevada. The airplane, operated by Ameriflight, Burbank, California, did not sustain any damage. The certificated airline transport pilot, the sole occupant, was not injured. Visual meteorological conditions prevailed. The pilot returned to Oakland International Airport without further incident.

Ameriflight maintenance personnel told National Transportation Safety Board investigators that the right aileron cable broke at its 90-degree pulley attach points. They also said that the cable had accrued 15 hours since it was installed. The cable replacement was required by a Federal Aviation Administration (FAA) airworthiness directive.

Safety Board investigators sent the broken aileron cable, with an exemplar from the cable stock used by Ameriflight maintenance personnel, to the Safety Board Metallurgical Laboratory. The Safety Board metallurgist reported that during examination of the cable, he found substantial bending deformation in a uniform direction in most wires next to the separation. He also said that a magnified optical examination revealed no evidence of wear or corrosion near the separation or anywhere else on the cable.

The metallurgist conducted a scanning electron microscope (SEM) examination of the broken cable. The examination showed that some separated ends displayed necking down or fractures in a 45-degree plane. This condition is typical of overstress separations.

Additionally, the metallurgist said, in part, that he

> . . .found many of the cable ends contained relatively flat fracture areas on a transverse plane, which could result from fatigue cracking. These flat surface areas usually terminated at a longitudinal fracture area . . . . A detailed SEM examination of the flat fracture area on these cable ends revealed ". . .a somewhat roughened and micro fissured fracture morphology, but no classical fatigue striations were found. Ductile dimples, a characteristic of overstress separations, were found in portions of the wire separations outside of the flat fracture areas. . . ."

The cable material quality and strength conformed to the manufacturer's specifications.

The operator reported that the mechanics and inspectors who changed the cable said the new cable could not have been kinked due to the procedure used. The mechanics said that the new

cable end was attached to the old cable after cutting off the swaged-on fitting at the underfloor bellcrank end. The new cable is then pulled in by pulling out the old cable from the control yoke end. If the new cable were kinked, it would not pass through the keepers around the pulleys in the control circuit and other confined areas in the cable run.

The operator did not say that during the final connection of the cable the attached ends could be twisted.

The airplane manufacturer's representative told Safety Board investigators in a telephone interview conducted on December 7, 1994, that a kink could be induced during the installation process. He said that the maintenance procedures required the mechanic to swage the ends of the cable and conduct a pull-test greater than 1,200 pounds. He also said that if the cable was kinked, it would fail during the pull-test preinstallation.

Pilot Information

Certificate:	Airline transport	**Age:**	32,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:**	No
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	May 18, 1994
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	5200 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	FAIRCHILD	**Registration:**	N191AF
Model/Series:	SA-227AC SA-227AC	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	AC-491
Landing Gear Type:	Retractable - Tricycle	**Seats:**	2
Date/Type of Last Inspection:	October 12, 1994 Annual	**Certified Max Gross Wt.:**	14500 lbs
Time Since Last Inspection:	15 Hrs	**Engines:**	2 Turbo prop
Airframe Total Time:	22395 Hrs	**Engine Manufacturer:**	GARRETT
ELT:	Installed, not activated	**Engine Model/Series:**	TPE-331-11U
Registered Owner:	AMERIFLIGHT, INC	**Rated Power:**	1000 Horsepower
Operator:		**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:		**Operator Designator Code:**	JIKA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:		**Distance from Accident Site:**	
Observation Time:		**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	6 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	0°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:		**Temperature/Dew Point:**	
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	(OAK)	**Type of Flight Plan Filed:**	VFR
Destination:	RENO , NV (RNO)	**Type of Clearance:**	VFR
Departure Time:	07:44 Local	**Type of Airspace:**	Class D

Airport Information

Airport:	OAKLAND INTERNATIONAL OAK	**Runway Surface Type:**	
Airport Elevation:	6 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	0	**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Precautionary landing

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	None
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 None	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	Llorente, A.
Additional Participating Persons:	RAY MURPHY; OAKLAND , CA
Original Publish Date:	October 13, 1995
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=28950