Aviation Investigation Final Report

Location:	LIVERMORE, California	**Accident Number:**	LAX95LA332
Date & Time:	September 10, 1995, 11:23 Local	**Registration:**	N5689T
Aircraft:	ENSTROM F-28C	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	1 Fatal, 2 Serious
Flight Conducted Under:	Part 91: General aviation		

Analysis

The helicopter was being used to give 5-minute for-hire sightseeing rides to airshow patrons. The pilot transmitted over the local control frequency that he had a power failure and was going down. Another airborne helicopter pilot saw the helicopter about 300 feet above ground in a nose-high attitude and yawing to the right as it descended vertically. The witness said the yaw continued during the descent until it was slightly nose low at ground impact. Responding fire department units did not find fuel leaks in the tanks or lines. FAA inspectors found the fuel system intact with no evidence of tank or line rupture. About 1 pint of fuel was drained from each of the fuel tanks during recovery of the helicopter. The operator said a computed tabulation system was used to keep track of the fuel onboard the helicopter. On paper estimated fuel usage was subtracted from the amount believed onboard and fuel added during the day was added to the total. No calibrated dipstick was used to determine the amount of fuel in the tanks. All three main rotor blades were found coned upwards. The tail rotor blades were not damaged. The engine was put in a production test cell and ran normally. Tests of the fuel gage showed it read accurately at zero. As the amount of fuel was increased, a progressively higher error was noted. At 1/4 system capacity, the gage read twice the amount it should.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the pilot's inadequate preflight fuel load determination procedures which resulted in fuel exhaustion. In addition, the pilot's delayed and improper use of the collective and cyclic flight controls following the engine failure led to his failure to maintain airspeed and main rotor rpm. The inaccuracy of the fuel indicating system was a factor in the accident.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - NONMECHANICAL
Phase of Operation: CRUISE

Findings
1. (C) FLUID,FUEL - EXHAUSTION
2. (C) AIRCRAFT PREFLIGHT - INADEQUATE - PILOT IN COMMAND
3. (F) ENGINE INSTRUMENTS,FUEL QUANTITY GAGE - FALSE INDICATION
4. (C) FUEL SUPPLY - NOT VERIFIED - PILOT IN COMMAND

Occurrence #2: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: CRUISE

Findings
5. (C) AUTOROTATION - DELAYED - PILOT IN COMMAND
6. (C) ROTORCRAFT FLIGHT CONTROLS - IMPROPER USE OF - PILOT IN COMMAND
7. (C) AIRSPEED - NOT OBTAINED/MAINTAINED - PILOT IN COMMAND
8. (C) ROTOR RPM - NOT MAINTAINED - PILOT IN COMMAND

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Factual Information

On September 10, 1995, at 1123 hours Pacific daylight time, an Enstrom F-28C helicopter, N5689T, collided with the ground following a loss of power about 2.5 miles northeast of the Livermore, California, airport. The helicopter was operated by Calaveras Aviation of San Andreas, California, and was engaged in providing 5-minute-for-hire sightseeing rides to patrons attending an airshow at the airport. Visual meteorological conditions prevailed at the time and no flight plan was filed for the operation. The helicopter was destroyed in the collision sequence. The certificated commercial pilot and one passenger sustained serious injuries; however, the second passenger onboard expired at the hospital as a result of his injuries. The flight originated at 1120 for a 5-minute flight around the airport environment.

In a verbal statement to FAA inspectors, the pilot reported that he had no memory of the accident flight. The operator declined three written and one verbal requests to complete a written aircraft accident report.

Airborne pilots in other helicopters participating in the ride program, and ground witnesses, reported hearing the pilot transmit over the local control frequency that he had a power failure and was going down. The pilot of one helicopter said he immediately looked toward the position of the accident aircraft when he heard the transmission. The witness observed the helicopter about 300 feet above ground level in a nose-high attitude and yawing to the right as it descended vertically. The witness said the helicopter's yaw continued during the descent until it was slightly nose low at ground impact.

A Livermore Fire Department battalion chief in charge of fire units responding to the accident site was interviewed. He reported that the helicopter was initially examined for evidence of fuel leakage or spillage as emergency medical technician personnel were attending to the occupants trapped in the wreckage. No fuel was observed leaking from the helicopter, and the ground under the fuel tanks was dry. No fuel smell was detected by the fire personnel.

The helicopter was examined by Federal Aviation Administration airworthiness inspectors from the Flight Standards District Office, Oakland, California, immediately after the accident, and again after recovery from the site. The examining inspector reported that the fuel system was intact with no evidence of tank or line rupture. The right fuel tank was found to have a crack in the outer fiberglass shell; however, the internal rubber bladder was found intact following removal of the outer shell. About 1 pint of fuel was drained from each of the fuel tanks during recovery of the helicopter.

The aircraft owner/operator was interviewed by telephone. He reported that for the sightseeing rides during the airshow on Friday and Saturday, a computed tabulation system was used to keep track of the fuel onboard the helicopter. On a sheet of paper estimated fuel

usage was subtracted from the amount believed onboard, and fuel put into the tanks during the day was added to the total. No calibrated dipstick was used to definitively determine the amount of fuel in the tanks. The tabulation sheet is attached to this report.

After recovery of the helicopter from the accident site, it was examined by an FAA airworthiness inspector with technical assistance provided by Enstrom Helicopter Corporation.

Control system and drive train continuity was established throughout the helicopter. All three main rotor blades were found coned upwards. The tail rotor blades were not damaged.

According to Enstrom, the fuel system consists of two 20-gallon bladder fuel tanks encapsulated in fiberglass shells. The unusable fuel quantity is 1 gallon per tank. The fuel quantity indicating system consists of one gage calibrated in pounds which presents the cumulative amount in both tanks. The Enstrom technical representative stated that the helicopter was designed and certificated under CAR 6 regulations and the fuel gage is only required to read accurately at zero.

The fuel gage and indicating system calibration was tested. One tank sending unit was disabled and the system rigged so that only one tank was being read by the gage for the test. Water was used in place of fuel. One gallon of water, comprising the unusable fuel quantity for the tank, was added. The gage read zero. One gallon increments were then added to the tank to a total of five, and the resultant gage readings noted. The following table presents the as-tested gage readings compared to the computed values:

USABLE TANK QUANTITY	GAGE READING	SHOULD READ
1 Gallon	10	12
2 Gallons	40	24
3 Gallons	60	36
4 Gallons	80	48
5 Gallons	115	60

The engine driven fuel pump was removed and installed in a calibrated test bench where it flowed to specifications. The engine was shipped to the Textron Lycoming factory for examination under the supervision of an FAA inspector. The inspector's report is attached to this report. The engine was installed in a production test cell where it was operated through a normal test protocol. Normal engine operation and performance was observed.

Fuel system annunciator light assemblies for low fuel pressure (red) and normal fuel pressure (green) were removed from the instrument panel and sent to the Safety Board's metallurgical laboratory for analysis.

The filament from the red assembly was intact and showed no sign of elongation.

A major portion of the filament from the green assembly was separated and lying loose inside the bulb glass. No stretching was observed. Examination of the filament pieces which remained attached to the post and the separated segment revealed a blocky appearance

typical of an aged filament. Small amounts of molten and resolidified filament material was found adjacent to the separated ends.

Pilot Information

Certificate:	Commercial	**Age:**	38,Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	June 13, 1995
Occupational Pilot:	UNK	**Last Flight Review or Equivalent:**	
Flight Time:	270 hours (Total, all aircraft), 40 hours (Total, this make and model), 150 hours (Pilot In Command, all aircraft), 12 hours (Last 90 days, all aircraft), 4 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	ENSTROM	**Registration:**	N5689T
Model/Series:	F-28C F-28C	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	474-2
Landing Gear Type:	Skid	**Seats:**	3
Date/Type of Last Inspection:	July 6, 1995 Annual	**Certified Max Gross Wt.:**	2350 lbs
Time Since Last Inspection:	132 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	1412 Hrs	**Engine Manufacturer:**	LYCOMING
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	HIO-360-E1AD
Registered Owner:	RODGER L. AINSWORTH	**Rated Power:**	205 Horsepower
Operator:	CALAVERAS AVIATION	**Operating Certificate(s) Held:**	None
Operator Does Business As:		**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	LVK ,397 ft msl	**Distance from Accident Site:**	2 Nautical Miles
Observation Time:	11:25 Local	**Direction from Accident Site:**	10°
Lowest Cloud Condition:	Clear	**Visibility**	20 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	10 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	260°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	(LVK)	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	VFR
Departure Time:	11:20 Local	**Type of Airspace:**	Class D

Airport Information

Airport:		**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal, 1 Serious	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal, 2 Serious	**Latitude, Longitude:**	37.679157,-121.750511(est)

Administrative Information

Investigator In Charge (IIC):	Rich, Jeff
Additional Participating Persons:	KIM O DAVIES; OAKLAND , CA WILLIAM TAYLOR; MENOMINEE , MI
Original Publish Date:	April 29, 1996
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=29215