

# **Aviation Investigation Factual Report**

Location:	S. SN FRANCISCO,	California	Accident Number:	LAX93FA272
Date & Time:	July 2, 1993, 15:48	Local	Registration:	N2473B
Aircraft:	BELL	47G2-M	Aircraft Damage:	Destroyed
Defining Event:			Injuries:	1 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation - Other work use			

# **Factual Information**

## History of the Flight

On July 2, 1993, at 1548 hours Pacific daylight time, a Bell 47G2-M helicopter, N2473B, crashed in an open field at South San Francisco, California, about 4 miles northwest of San Francisco International Airport (SFO). The pilot was conducting a visual flight rules photo flight. The helicopter, registered to and operated by Dev Air, Inc., Carson City, Nevada, was destroyed. The certificated private pilot sustained serious injuries; the certificated commercial pilot/passenger sustained fatal injuries. Visual meteorological conditions prevailed. The flight originated at San Carlos Airport, San Carlos, California, at 1436 hours.

Safety Board Investigators reviewed the recorded communications at the Federal Aviation Administration (FAA), San Carlos and San Francisco International Airports. The communications media review revealed that the pilot received and acknowledged a takeoff clearance from San Carlos Airport at 1436 hours.

At 1437:50 hours, the local controller instructed the pilot to contact the SFO Airport Traffic Controller Tower for a clearance through the Terminal Control Area. At 1438:02 hours, the pilot contacted the SFO local controller and requested and received a clearance through the SFO TCA; the local controller instructed the pilot to report passing south of runways 1. At 1445:45 hours, the pilot reported passing south of runway 1. The local controller asked the pilot if he was going to remain in that area; the pilot responded "Negative. Seven three bravo is going on to San Francisco for a photo shoot." The local controller instructed the pilot to "continue on course, keep the freeway off your right hand side."

At 1446:43 hours, the local controller instructed the pilot to "...continue right direct towards the air traffic control tower and just hold over the north/south runway, south of runways 28; the pilot acknowledged the clearance.

Between 1433 hours and 1438 hours, the local controller issued numerous wind shear alerts to departing flights. Between 1438 hours and 1447 hours, the local controller did not issue any wind shear alerts.

At 1539:18 hours, the pilot contacted the SFO local controller and said, "...is uh just up north of the uh two eighty one oh one interchange we'd like to transition ata uh tca for san carlos..." The local controller instructed the pilot to set his transponder to 4702 and then ident; the pilot complied with the controllers instructions. At 1540:18 hours, the local controller stated, "helicopter seven three bravo is radar contact eight miles northwest of the san francisco airport cleared through the san francisco tca vfr at or below seven hundred feet san francisco altimeter's two niner seven niner keep highway one oh one off your left side at all times.

At 1541:40, the local controller instructed the pilot to hold over candlestick park until advised. At 1544:30 hours, the local controller the local controller instructed the pilot to proceed along highway 101 as previously cleared; the pilot acknowledged the clearance. At 1548:06 hours, the local controller instructed the pilot to proceed "...direct midfield..." The pilot did not acknowledge this or any other transmissions made by the local controller.

The local and the relieving controllers reported that radar contact on N2473B was lost at 1548 hours.

Mr. Charles Johnson, Principal Operations Inspector, FAA, San Francisco International Flight Office (SFO-IFO), Burlingame, California, responded to the accident site at 1615 hours. Upon arriving at the accident site, Inspector Johnson began interviewing witnesses.

A ground witness told him that while at the Marina, about 1/2 mile east of the accident site, he observed the accident helicopter proceed northbound and then circle the Hitachi Building, located about 1/2 mile from the accident site, to the left until it was southbound. When the helicopter approached the accident site, it entered into a violent "pitch-up" and nosed over in a right banking attitude. The helicopter appeared to level-off momentarily as it descended to the top of the tree line and then crashed.

Another witness reported that he was driving southbound along Highway 101 when he observed the helicopter proceeding southbound. After the helicopter passed over his vehicle, it pitched up and entered into a steep nose down right turn and continued in this attitude until it disappeared behind the tree line. This witness did not see the impact.

Ground witnesses, rescue, and police personnel reported that the prevailing wind direction was extremely variable at a velocity of about 50 miles per hour (mph). SFO ATCT personnel reported that between 1530 hours and 1630 hours several pilots reported severe wind shear conditions of about 50 knots (57.5 mph). During this time, twenty five airplanes, mostly large airline transport category aircraft, executed missed approaches due to the severe wind shear conditions.

The pilot could not recall any of the events preceding the accident.

## **Crew Information**

The pilot held a private pilot certificate with airplane single engine land and rotorcraft helicopter ratings. The latest third-class medical certificate was issued to the pilot by a designated Airman Medical Examiner on January 8, 1991; the certificate contained a must wear corrective lenses limitation endorsement. A third-class medical certificate is valid for 24-calendar months.

Safety Board investigators did not recover the pilot's flight hours logbook. The total flight time

noted on page 3 of this report was obtained from the pilot's last medical application form. Safety Board investigators were also unable to determine if the pilot completed a biennial flight review within the 24-calendar months preceding the accident.

The passenger held a commercial pilot certificate with airplane single engine land and instrument airplane ratings. He also held an unrestricted first-class medical certificate which was issued on January 25, 1993. The flight hours reflected in supplement E of this report were obtained from the pilot/passenger's last medical application form.

## Aircraft Information

The pilot and his wife are principals of Dev Air, Inc., the helicopter's registered owner, and reside in Woodside, California. The aircraft flight hours reflected on page 4 of this report were obtained from the aircraft's maintenance records. The maintenance records examination revealed that Sun Coast Air, Inc., Salinas, California, performed the last annual inspection on June 11, 1993. The aircraft accrued 7,489.6 hours and the engine accrued 375.9 hours at the time of the inspection. The aircraft accrued 7.1 hours since the inspection at the time of the accident.

The maintenance records examination disclosed no evidence of any unresolved maintenance discrepancies against the aircraft and that all applicable airworthiness directives were complied with.

The aircraft flight records and fueling slips indicate the aircraft was last fueled on June 27, 1993, when it received 20.2 gallons of 100 Low Lead octane gasoline. According to the pilot's wife, who purchased the fuel, this fueling filled both fuselage fuel tanks. The pilot's wife told Safety Board investigators that the accident flight was the first flight since it was last refueled on June 27, 1993.

The helicopter's recording hobbsmeter and the flight records confirmed the pilot's wife statement. According to the hobbsmeter and the flight records, the total elapsed time between the last refueling and the accident was 1.2 hours.

## Meteorological Information

Visual meteorological conditions prevailed at the time of the accident. The San Francisco International airport 1450 and 1550 hours surface weather observation was:

Clear skies; visibility - 15 miles; temperature - 66 degrees F; dew point - 50 degrees F; surface winds - 280 degrees at 34 knots (39.1 mph), gusting to 42 knots (48.3 mph)

Clear skies; visibility - 15 miles; temperature - 65 degrees F; dew point - 50 degrees F; surface winds - 280 degrees at 31knots (35.65 mph), gusting to 38 knots (44.05 mph)

## Wreckage and Impact Information

The crash site is in about a half square mile open field with railroad tracks and a tree line traversing to the north and south on the western edge of the field and a body of water on the east side of the field. The helicopter came to rest on its right side on a heading of 020 degrees (all headings/bearings noted in this report are oriented toward magnetic north).

Ground scars and the wreckage examination disclosed that the helicopter struck the ground in a near vertical descent flight path while turning to the right. A red paint transference mark on the ground was found about 8 feet south of the main wreckage tail skid. The red paint transference mark was a similar color to the helicopter's tail skid.

All of the helicopter's major components were found at the main wreckage area. The main rotor blades remained attached to the rotor head assembly. Both main rotor blades exhibited a ground impact signature, but their tip weights were intact. The wooden blade sections were shattered. The leading edge on a blade displayed aft bending.

Continuity of the cyclic and collective rotating group was established and operated with inputs from the cockpit cyclic and collective controls. All of the pitch change and connecting linkage were connected at their respective attach points. One stabilizer bar was found bowed downward in compression; the remaining stabilizer bar was straight, but bent aft about 10 degrees.

The main rotor hub displayed numerous mast bumping marks. The main rotor assembly rotated freely through the transmission assembly and the fan drive; the fan assembly blades were found bent in the rearward direction. The main rotor shaft swash plate support was found cracked.

The right anti-torque pedal was seized in the full forward position. Continuity of the cables to the separated tail rotor gear box was established. The cables, however, were loose.

The tail boom assembly was found buckled downward and its lower attach points were separated. The tail rotor short shaft, which connects the transmission output drive to the tail rotor drive, was found about 12 feet north/northeast of the main wreckage. The tail rotor short shaft was intact and did not display any abnormal wear or score marks on its gears.

The tail rotor assembly separated from the tail boom, but was found adjacent to the aft end of the tail boom assembly. The 90 degrees tail rotor gear box rotated normally. One tail rotor blade fractured about three inches from its attached blade grip. Both tail rotor blades exhibited extensive leading edge gouging, chordwise scoring, and "S" twisting.

The cockpit/cabin area occupiable space was extensively compromised. The upper section of the cockpit/cabin area was found bent downward and to the right. Plastic plexiglass bubble remnants were scattered throughout the wreckage area.

Both seats exhibited extensive downward crushing to the lower support structure. Both seats were equipped with seat belts; the pilot's left seat, however, was the only seat equipped with a shoulder harness. The throttle on the right seat collective was found turned counterclockwise about 30 degrees beyond the start setting. According to the pilot's wife, the mark on the right seat collective is set to the 12 o'clock position for starting.

The right main landing skid separated from its respective attach points and was found at the initial impact point (about eight feet south of the cabin resting position). The fractured surfaces displayed tension overload signatures. The left main landing skid remained attached at its respective attach points. The forward section of the left skid was found bent upward; the heel was undamaged.

Both fuel tanks are interconnected. The left fuel tank sustained impact damage but was not ruptured. The left tank was found empty and the right tank contained more than 12 gallons of fuel. Fuel spillage through the "Y" drain was evident beneath the helicopter.

## **Engine Examination**

The engine was examined on July 9, 1993. The parties listed on page 5 of this report, except Mr. Syslo, Bell Helicopter Textron, were present during the examination. The maintenance records found at the accident site indicate the engine was new when installed on the accident aircraft.

The engine's vertical mounting flange was found cracked throughout the attaching base. The accessory case mounting flange was also found broken. Pieces of the fragments jammed the accessory drive gears. The engine could not be rotated due to the jammed gears. When the accessory case was removed, the engine rotated normally. Compression was evident during the rotation of the crankshaft. Continuity of the gear and valve train assembly was established.

Upper spark plugs are new. No excessive ovaling, carbon, or lead deposits were observed.

The magneto timing could not be performed due to the the jammed accessory gears. Both magnetos produced spark upon rotation of their respective drive shafts.

The oil and carburetor screens were found free of contaminants.

Disassembly of the transmission showed no evidence of any preexisting malfunctions or failures. The freewheeling unit functioned in accordance with the manufacturer's specifications.

Medical and Pathological Information

The San Mateo County Coroner's Office conducted post mortem and toxicological examinations on the passenger. The pathologist attributed the passenger's death to multiple blunt injuries. The toxicological examinations were negative for alcohol or drugs.

The pilot received multiple fractures. Toxicological examinations were not conducted; nor were they requested.

**Tests and Research** 

The United States Army FM 1-203 (Flight Manual) states, in part: "In operations at high forward speeds, the following conditions are most likely to produce [rotor] blade stall:

1) High blade loading (high gross weight) 2) Low-rotor RPM 3) Steep or abrupt turns 4) Turbulent air.

In single-rotor helicopter, warnings of approaching retreating blade stall are:

1) Abnormal vibration 2) Pitch up of the nose 3) Tendency for the helicopter to roll in the direction of the stall side."

#### **Pilot Information**

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Certificate:	Private	Age:	52,Male
Airplane Rating(s):	Single-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	Helicopter	Restraint Used:	
Instrument Rating(s):	None	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	Class 3 Expired	Last FAA Medical Exam:	January 8, 1991
Occupational Pilot:	No	Last Flight Review or Equivalent:	
Flight Time:	1000 hours (Total, all aircraft)		

# Aircraft and Owner/Operator Information

Aircraft Make:	BELL	Registration:	N2473B
Model/Series:	47G2-M 47G2-M	Aircraft Category:	Helicopter
Year of Manufacture:		Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	1450
Landing Gear Type:	Ski	Seats:	2
Date/Type of Last Inspection:	June 11, 1993 Annual	Certified Max Gross Wt.:	2450 lbs
Time Since Last Inspection:	7 Hrs	Engines:	1 Reciprocating
Airframe Total Time:	7497 Hrs	Engine Manufacturer:	LYCOMING
ELT:	Not installed	Engine Model/Series:	VO-435-25A
Registered Owner:	DEV AIR, INC.	Rated Power:	270 Horsepower
Operator:		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
<b>Observation Facility, Elevation:</b>	SFO ,11 ft msl	Distance from Accident Site:	4 Nautical Miles
Observation Time:	15:50 Local	Direction from Accident Site:	135°
Lowest Cloud Condition:	Clear	Visibility	15 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	31 knots / 38 knots	Turbulence Type Forecast/Actual:	/
Wind Direction:	280°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29 inches Hg	Temperature/Dew Point:	18°C / 10°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	SAN CARLOS (SQL)	Type of Flight Plan Filed:	None
Destination:		Type of Clearance:	VFR
Departure Time:	14:36 Local	Type of Airspace:	Class B

# **Airport Information**

Airport:	SAN FRANCISCO INTL SFO	Runway Surface Type:	
Airport Elevation:	11 ft msl	Runway Surface Condition:	
Runway Used:	0	IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	None

# Wreckage and Impact Information

Crew Injuries:	1 Serious	Aircraft Damage:	Destroyed
Passenger Injuries:	1 Fatal	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Fatal, 1 Serious	Latitude, Longitude:	37.649524,-122.420173(est)

## **Administrative Information**

Investigator In Charge (IIC):	Llorente, A.
Additional Participating Persons:	CHARLES JOHNSON; SAN FRANCISCO , CA CHARLES R LITTLE; CHINO , CA JOSEPH A SYSLO; FT WORTH , TX ANTONIO R ROMERO; SAN FRANCISCO , CA
Report Date:	March 17, 1994
Last Revision Date:	
Investigation Class:	<u>Class</u>
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=28333

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, "accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person" (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB's statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available <u>here</u>.