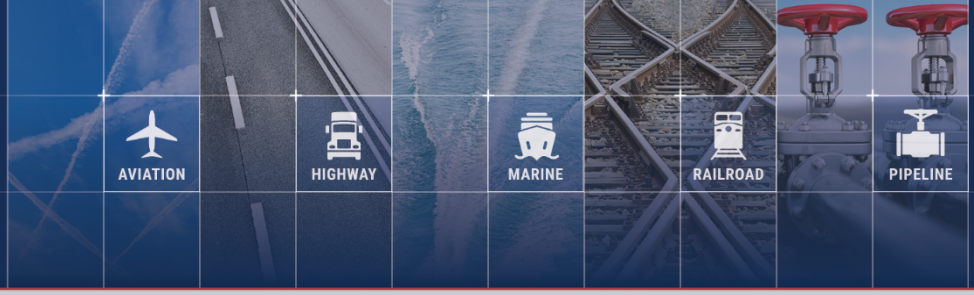

Aviation Investigation Factual Report

Location:	ELTOPIA, Washington	**Accident Number:**	SEA98LA124
Date & Time:	July 7, 1998, 06:15 Local	**Registration:**	N5360V
Aircraft:	Hiller UH-12E	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	1 Minor
Flight Conducted Under:	Part 137: Agricultural		

Factual Information

HISTORY OF FLIGHT

On July 7, 1998, approximately 0615 Pacific daylight time, a Hiller UH-12E agricultural helicopter, N5360V, registered to and being operated by Jack Gillette Flying Service, and being flown by a commercial pilot, was destroyed during a collision with terrain in a corn field immediately following takeoff near Eltopia, Washington. Following the ground impact, the helicopter was consumed by a post-crash fire. The pilot sustained minor injuries. Visual meteorological conditions existed, and no flight plan had been filed. The flight, which was to have been conducted for the purpose of dispensing an insecticide, was to have been operated under 14CFR137.

The pilot reported that he had just taken off to the south. About 30 seconds into the flight, a control paddle departed the helicopter, and control was lost. The helicopter impacted the ground and rolled inverted, after which the pilot exited (refer to photograph 1 and DIAGRAM I).

AIRCRAFT INFORMATION

An inspector from the Federal Aviation Administration's (FAA) Spokane Flight Standards District Office (FSDO) examined the helicopter's logs and records, and also conducted a post-crash examination of the helicopter at the accident site. He reported that the helicopter's total time in service was 8,600.2 hours, and 69.1 hours of service had accumulated since following the last inspection.

A review of the helicopter's logbook revealed that an annual inspection had been accomplished on March 11, 1998, at a total airframe time of 8,531.1 hours. The annual inspection signoff contained an entry stating in part "-C/W AD 97-10-16 DYE CHK CUFF & SPAR TUBE AS PER PAR A & SB 36-1 REV 3-" (refer to ATTACHMENT L-I). The most recent inspection in the logbook which immediately preceded the March 11, 1998, inspection, was recorded as an annual on March 4, 1997, at a total time of 8,305.6 hours. Additionally, a register of Airworthiness Directive (AD) compliancy notes was maintained with the helicopter's log records. One page of this listing showed that AD 97-10-16 had been complied with on 2/3/98, at a total time of 8,531.1, and again at a total time of 8,631.1 hours. This entry was signed off, as in the helicopter's logbook, with an Inspection Authorization (IA) identification number of IA1982827 (refer to ATTACHMENT ADL-I).

Airworthiness Directive (AD) 97-10-16 (effective date 6/26/97) states in part: "To prevent separation of the control rotor blade assembly and subsequent loss of control of the helicopter, accomplish the following:

(a) Within the next 100 hours time-in-service (TIS) after the effective date of the AD, unless previously accomplished within the last 100 hours TIS, and thereafter at intervals not to exceed 100 hours TIS from the date of the last inspection, or at the next annual inspection, whichever occurs first, inspect the blade spar tube and cuff for corrosion or cracks, or elongation, corrosion, burrs, pitting or fretting of the bolt holes, and repair, as necessary, in accordance with the Accomplishment Instructions of Hiller Aviation Service Bulletin No. 36-1, Revision 3, dated October 24, 1979," (refer to ATTACHMENT AD-I).

Hiller Aviation Service Bulletin (SB) No. 36-1, Revision 3, (dated October 24, 1979), provides specific procedures and corrective actions for the inspection of the retention bolt holes and control rotor cuffs (refer to ATTACHMENT SB-I). Among the procedures outlined, the SB specifically addresses the following procedures:

"A. Remove the two bolts attaching the control rotor blade spar to the cuff and withdraw the blade from the cuff." "B. Inspect for corrosion on the exterior and interior of the spar tube as well as-" "C. Remove rust spots by-" "D. Dye-penetrant inspect the spar area which fits inside the control rotor cuff, paying particular attention to-" "E. Inspect spar tube retention bolt holes for elongation, corrosion, burrs,-" "F. If burrs are found, deburr bolt holes, paying particular attention to-" "G. Dye-penetrant inspect the outer seven (7) inches of the control rotor cuff paying particular attention to the four bolt holes. If cracks are found-" "H. If the control rotor attach bolts (AN174-26) show signs of wear or rust, they should be replaced.-" "I. Protect the spar tube by lightly coating areas of bare metal with two coats of zinc chromate primer." "J. Reinstall-" "K. Apply sealant material between bolt head or nut and cuff, covering the edges of the washer for the purpose of-" "L. Upon compliance, make appropriate entry in helicopter log book."

WRECKAGE AND IMPACT INFORMATION

The control paddle was subsequently recovered some distance from the main crash site. Post-crash examination by the Spokane FSDO inspector revealed that the yellow control paddle blade cylindrical spar tube had separated at a bolt hole inside the main rotor cuff (refer to photographs 2 and 3). The separation surfaces displayed corrosion. The yellow spar tube and cuff, along with the opposing blue spar tube and cuff, were shipped to the Safety Board's metallurgical laboratory in Washington, D.C., for further examination.

TESTS AND RESEARCH

Metallurgical examination revealed that the blue blade and yellow blade spars were both separated, with the inboard end of each spar retained inside the cuff. The separation of the yellow blade spar occurred through both of the outboard retention bolt holes, while the separation of the blue spar occurred through only one of the outboard retention bolt holes, with the rest of the fracture occurring further outboard toward the tip of the spar.

BLUE BLADE SPAR

The blue blade spar was significantly deformed adjacent to the outboard fracture face. The direction of deformation was consistent with downward motion of the outboard end of the blade, and a small buckle was noted on the underside of the spar. A corresponding bend was noted on the inboard side of the spar, at approximately seven o'clock (with twelve o'clock in the up position), where a section of the spar material was folded over the edge of the cuff. The fracture spiraled around the spar, with the fracture surface oriented along the shear plane, consistent with an overstress separation.

The outside surface of the spar had not been painted or primed where it had been inserted into the cuff, and significant corrosion pitting was evident in this area. The inside surface of the spar on both sides of the fracture had been brushed with a yellow-green material, consistent with the application of a chromated primer. No sealant material was noted on the retention bolt heads, nuts, or washers. Both priming of the surface and sealing of the bolts is required by Airworthiness Directive 97-10-16.

YELLOW BLADE SPAR

The separation of the yellow blade spar was on a transverse plane, intersecting both of the outboard retention bolt holes. The majority of the bottom half of the fracture surface was flat (intersecting the surface of the spar at a 90 degree angle) and smooth in appearance. Most of the upper half of the fracture surface was also smooth, but it was on a slightly angled plane. The small portion of each of these fracture surfaces were shiny and angled along the shear plane, consistent with an overstress separation area.

The bottom half of the fracture surface near one of the retention bolt holes showed a distinct semi-circular area, consistent with a fatigue origin at the outside edge of the spar. A similar origin existed on the opposite side of the same retention bolt hole. The fatigue origins were located at the corner between the outside surface of the spar and the bolt hole. Away from the retention bolt hole, on both sides of the spar, multiple crack arrest markings were seen.

Examination of the wall of this same retention bolt hole on the inboard side revealed material which had been displaced both inward and outward, past the level of the inside and outside surfaces. Examination of the inside and outside surfaces of the spar in this same area revealed cracks running radially outward from the surface of the hole and a slight elongation of the hole in the inboard direction. The displaced material and the presence of these radial cracks are consistent with crushing damage of the bolt against the inboard surface of the retention bolt hole.

The inside surface of both the outboard and inboard sides of the spar had been brushed with a yellow-green coating, consistent with a chromated primer. Like the blue spar, no paint or primer was noted on the outside surface of the outboard side where it had been inserted into the cuff, nor was paint or primer observed on the outside surface of the retained side when removed from the cuff. The outside surface of the spar on both sides of the fracture

contained a significant amount of corrosion pitting. No sealant material was noted on the retention bolt heads, nuts, or washers.

The outboard fracture surface was examined with ultraviolet light prior to cleaning. No fluorescent crack-detection media was noted on the fracture surface. Energy-dispersive spectrometry (EDS) of both sides of the fracture surface showed no trace of phosphorous, a material commonly found in dye penetrant solutions.

The inboard fracture surface was cleaned with Endox to remove oxidation buildup, then examined with a scanning electron microscope (SEM). The fracture surface in the vicinity of the origin area on both sides of bolt hole was damaged, so no exact origin location could be determined. Examination near the origins revealed scattered corrosion pitting on the outside surface. The fracture surface away from the origin contained microfissures, consistent with fatigue, over a large portion of the surface. Refer to attached Materials Laboratory Factual Report #99-68.

ADDITIONAL INFORMATION

The spar spars and cuffs were returned to the owner via registered mail on February 18, 1999. The helicopter's logs and records were shipped via certified mail to the owner on March 2, 1999.

Pilot Information

Certificate:	Commercial	**Age:**	44,Male
Airplane Rating(s):	None	**Seat Occupied:**	Center
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--w/ waivers/lim	**Last FAA Medical Exam:**	April 30, 1998
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	10134 hours (Total, all aircraft), 10103 hours (Total, this make and model), 226 hours (Last 90 days, all aircraft), 75 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Hiller	**Registration:**	N5360V
Model/Series:	UH-12E UH-12E	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Restricted (Special)	**Serial Number:**	2113
Landing Gear Type:	Skid	**Seats:**	3
Date/Type of Last Inspection:	April 4, 1998 Annual	**Certified Max Gross Wt.:**	3200 lbs
Time Since Last Inspection:	69 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	8600 Hrs	**Engine Manufacturer:**	Lycoming
ELT:	Not installed	**Engine Model/Series:**	VO-540-C2A
Registered Owner:	JACK GILLETTE FLYING SERVICE	**Rated Power:**	305 Horsepower
Operator:		**Operating Certificate(s) Held:**	
Operator Does Business As:		**Operator Designator Code:**	WSGG

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	PSC ,407 ft msl	**Distance from Accident Site:**	15 Nautical Miles
Observation Time:	05:53 Local	**Direction from Accident Site:**	142°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	340°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	15°C / 14°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:		**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	06:14 Local	**Type of Airspace:**	Class G

Airport Information

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

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Minor	**Latitude, Longitude:**	46.500381,-119.050598(est)

Administrative Information

Investigator In Charge (IIC):	Mccreary, Steven
Additional Participating Persons:	JOHN J BIANCO; SPOKANE , WA LORI L DARROW; WASHINGTON , DC
Report Date:	March 3, 1999
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=42821