



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

# Aviation Investigation Final Report

<b>Location:</b>	Yuma, Arizona	<b>Accident Number:</b>	SEA08LA038
<b>Date &amp; Time:</b>	November 23, 2007, 19:30 Local	<b>Registration:</b>	N104EA
<b>Aircraft:</b>	Hiller UH-12E	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>		<b>Injuries:</b>	1 None
<b>Flight Conducted Under:</b>	Part 137: Agricultural		

## Analysis

While conducting an aerial application flight, the pilot reported that he was initiating a turn over a set of power lines at an altitude of about 60 feet above ground level (agl). As the helicopter crossed over a series of power lines, the pilot heard a "loud pop" and felt an extreme vibration. The pilot maneuvered the helicopter away from the power lines and initiated a forced landing to an open field. He reported that control of the helicopter was "marginal" as the helicopter descended. Shortly before touchdown, the helicopter began to drift (un commanded) to the left and the pilot lowered the collective. The helicopter touched down hard, pivoted to the left and rolled over onto its right side. Post accident examination of the helicopter revealed that a control rotor had separated from the rotor system. The separated control rotor was found in the area where the vibration started. Examination of the control rotor assembly revealed the tubular spar of the blue control rotor was circumferentially fractured at the outboard cuff bolt location. Magnified examinations of the outboard fracture surfaces revealed surface features consistent with fatigue progression in two fronts around the spar. Fatigue initiation locations were identified on opposite sides of one of the outboard bolt holes in the spar. One fatigue origin was identified on the bore surface of the bolt hole and the other was mechanically damaged preventing determination of its exact location. The bore surface was rough and no obvious corrosion was noted in the hole. From the bolt hole the fatigue propagated almost entirely around the spar with very small overstress regions connecting the fatigue to the opposite bolt hole in the spar. No corrosion was noted in the originating bolt hole, however, the exterior surface of the spar exhibited wide spread pitting corrosion and fretting on the faying surfaces with the control rotor cuff. Additional localized corrosion was noted on the interior faying surface of the cuff. Maintenance records indicated that the most recent 100-hour inspection was conducted about 77 hours prior to the accident. The logbook entry associated with the inspection indicated that Airworthiness Directive AD 97-10-16 had been complied with. 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..."

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: Fatigue fracture of the control rotor blade spar and failure of maintenance personnel to follow maintenance directives.

### Findings

Occurrence #1: FORCED LANDING

Phase of Operation: MANEUVERING - AERIAL APPLICATION

#### Findings

1. (C) ROTOR SYSTEM,MAIN ROTOR BLADE - FATIGUE
2. (C) MAINTENANCE,100-HOUR INSPECTION - NOT FOLLOWED - OTHER MAINTENANCE PERSONNEL
3. (C) ROTOR SYSTEM,MAIN ROTOR BLADE - FRACTURED

## Factual Information

On November 23, 2007, about 1930 mountain standard time, a turbine powered Hiller UH-12E helicopter, N104EA, sustained substantial damage during landing following an in-flight separation of a control rotor, about 3 miles northeast of Yuma, Arizona. The helicopter is registered to Tri-rotor Spray and Chemical of Ulysses, Kansas, and operated under the provisions of Title 14, CFR Part 137. The commercial pilot, the sole occupant, was not injured. Night visual meteorological conditions prevailed for the aerial application flight that originated near Yuma approximately 10 minutes prior to the accident.

In a written statement, the pilot reported that he was initiating a turn over a set of power lines at an altitude of about 60 feet above ground level (agl). As the helicopter crossed over the power lines, the pilot heard a "loud pop" and felt an extreme vibration. The pilot maneuvered the helicopter away from the power lines and initiated a forced landing to an open field. He reported that control of the helicopter was "marginal" as the helicopter descended. Shortly before touchdown, the helicopter began to drift (un commanded) to the left and the pilot lowered the collective. The helicopter touched down hard, pivoted to the left and rolled over onto its right side.

Post accident examination of the helicopter by the pilot and operator revealed that a control rotor (blue) had separated from the rotor system. The separated control rotor was found in the area where the vibration started.

The control rotor assembly was sent to the NTSB Office of Research and Engineering, Materials Laboratory for further examination. Examination of the control rotor assembly revealed the tubular spar of the blue control rotor was circumferentially fractured at the outboard cuff bolt location. Magnified examinations of the outboard fracture surfaces revealed surface fracture features indicative of fatigue progression in two fronts around the spar. Fatigue initiation locations were identified on opposite sides of one of the outboard bolt holes in the spar. One fatigue origin was identified on the bore surface of the bolt hole and the other was mechanically damaged preventing determination of its exact location. The bore surface was rough and no obvious corrosion was noted in the hole. From the bolt hole, the fatigue propagated almost entirely around the spar with very small overstress regions connecting the fatigue to the opposite bolt hole in the spar. No corrosion was noted in the originating bolt hole; however, the exterior surface of the spar exhibited widespread pitting corrosion and fretting on the adjoining surfaces with the control rotor cuff. Additional localized corrosion was noted on the interior faying surface of the cuff.

Review of the airframe maintenance logbook revealed the most recent annual inspection was conducted on August 9, 2007, at a total airframe time of 8,159.7 hours. The entry for the annual inspection stated that Airworthiness Directive (AD) 97-10-16 had been complied with

and a cuff inspection AD was due at 8,259.7 hours. The most recent 100-hour inspection was conducted on October 18, 2007, at an airframe total time of 8,251.8 hours. The entry for the 100-hour inspection indicated that AD 97-10-16 had been complied with by dye penetrant inspection. No defects were noted. The most recent maintenance inspection performed on the helicopter was a 50-hour inspection, conducted on November 11, 2007, at an airframe total time of 8301.0 hours.

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."

The procedures outlined in the SB specify inspections and associated maintenance actions for the fatigue locations identified during the metallurgical examination.

## Pilot Information

<b>Certificate:</b>	Commercial	<b>Age:</b>	43, Male
<b>Airplane Rating(s):</b>	Single-engine land; Multi-engine land	<b>Seat Occupied:</b>	Center
<b>Other Aircraft Rating(s):</b>	Helicopter	<b>Restraint Used:</b>	
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 2 Without waivers/limitations	<b>Last FAA Medical Exam:</b>	October 1, 2007
<b>Occupational Pilot:</b>	Yes	<b>Last Flight Review or Equivalent:</b>	July 1, 2007
<b>Flight Time:</b>	4200 hours (Total, all aircraft), 125 hours (Total, this make and model), 4140 hours (Pilot In Command, all aircraft), 35 hours (Last 90 days, all aircraft), 30 hours (Last 30 days, all aircraft), 5 hours (Last 24 hours, all aircraft)		

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Hiller	<b>Registration:</b>	N104EA
<b>Model/Series:</b>	UH-12E	<b>Aircraft Category:</b>	Helicopter
<b>Year of Manufacture:</b>		<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Restricted (Special)	<b>Serial Number:</b>	HA3028
<b>Landing Gear Type:</b>	Skid	<b>Seats:</b>	3
<b>Date/Type of Last Inspection:</b>	October 1, 2007 AAIP	<b>Certified Max Gross Wt.:</b>	3100 lbs
<b>Time Since Last Inspection:</b>		<b>Engines:</b>	1 Turbo shaft
<b>Airframe Total Time:</b>	8251.5 Hrs as of last inspection	<b>Engine Manufacturer:</b>	Allison
<b>ELT:</b>	Not installed	<b>Engine Model/Series:</b>	C20B
<b>Registered Owner:</b>	On file	<b>Rated Power:</b>	420 Horsepower
<b>Operator:</b>	On file	<b>Operating Certificate(s) Held:</b>	

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Night
<b>Observation Facility, Elevation:</b>		<b>Distance from Accident Site:</b>	
<b>Observation Time:</b>		<b>Direction from Accident Site:</b>	
<b>Lowest Cloud Condition:</b>	Clear	<b>Visibility</b>	
<b>Lowest Ceiling:</b>	None	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	3 knots / None	<b>Turbulence Type Forecast/Actual:</b>	/
<b>Wind Direction:</b>	315°	<b>Turbulence Severity Forecast/Actual:</b>	/
<b>Altimeter Setting:</b>		<b>Temperature/Dew Point:</b>	15°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	Yuma , AZ	<b>Type of Flight Plan Filed:</b>	None
<b>Destination:</b>		<b>Type of Clearance:</b>	None
<b>Departure Time:</b>	19:20 Local	<b>Type of Airspace:</b>	

## Wreckage and Impact Information

<b>Crew Injuries:</b>	1 None	<b>Aircraft Damage:</b>	Substantial
<b>Passenger Injuries:</b>		<b>Aircraft Fire:</b>	None
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	1 None	<b>Latitude, Longitude:</b>	32.656387,-114.605834

## Administrative Information

**Investigator In Charge (IIC):** Hogenson, Dennis

**Additional Participating Persons:** Randall T Prine; Federal Aviation Administration; Scottsdale, AZ

**Original Publish Date:** April 30, 2008

**Last Revision Date:**

**Investigation Class:** [Class](#)

**Note:**

**Investigation Docket:** <https://data.nts.gov/Docket?ProjectID=67159>

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