



# Aviation Investigation Final Report

<b>Location:</b>	Marana, Arizona	<b>Accident Number:</b>	WPR11GA115
<b>Date &amp; Time:</b>	January 31, 2011, 11:15 Local	<b>Registration:</b>	N530RL
<b>Aircraft:</b>	MCDONNELL DOUGLAS HELI CO 369FF	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Dragged wing/rotor/float/other	<b>Injuries:</b>	1 Fatal, 2 Serious, 1 Minor
<b>Flight Conducted Under:</b>	Public aircraft		

## Analysis

The four-place, turbine-powered helicopter was being operated by the county sheriff's department in support of a county emergency communications system development and construction project. The accident flight was intended to enable technical personnel to conduct a site survey for the planned installation of a communications repeater tower near the top of a mountain. The sheriff's department pilot had satisfactorily completed training for and had demonstrated confined area, slope, and pinnacle landings. None of the three passengers were helicopter pilots, and no anti-torque pedals were installed at the front passenger's station. The mountain's remote location and its topography prevented postaccident availability of specific meteorological conditions at the time of the accident, but analysis of available data indicated that mostly overcast skies, intermittent rain, and a generally westerly wind at 10 to 15 knots were present. Those conditions were within the helicopter's and pilot's performance capabilities. The helicopter orbited the peak for general reconnoitering before the pilot attempted a landing. The pilot's selected landing zone was on a relatively level area of a pinnacle on the northeast side of the mountain, and the approach was from the southeast. The passengers reported that during the landing attempt, they felt a bump, and the helicopter rose a few feet, then the nose pitched down, and the helicopter began to spin to the right. The main rotor blades struck a rock outcrop, and the helicopter tumbled and slid about 120 feet down a shallow canyon on the northeast face of the peak before it was halted by rocks and scrub vegetation.

The wreckage was examined in situ, recovered, and examined in detail. All components were accounted for. All damage patterns were consistent with the helicopter's low-speed impact with terrain in the horizontal and vertical planes, and its subsequent tumble down the canyon.

The engine successfully met specification power settings during an operational run in a test fixture. No evidence of any preexisting mechanical defect or malfunction was noted during the examination or testing of the airframe and engine. Main and tail rotor damage patterns and debris distribution were consistent with rotor strikes under power. The witness and passenger descriptions of the helicopter's motions are consistent with a tail rotor ground strike and a subsequent loss of directional control. Although no reliable ground scars indicative of a tail rotor strike were found, that was likely precluded by the rocky, hard surface of the landing zone.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: An inadvertent tail rotor strike during an attempted pinnacle landing, which resulted in the pilot's loss of control of the helicopter. Inhospitable terrain/topography contributed to the severity of the accident.

### Findings

<b>Aircraft</b>	Tail rotor blade - Damaged/degraded
<b>Personnel issues</b>	Aircraft control - Pilot
<b>Environmental issues</b>	Mountainous/hilly terrain - Contributed to outcome

## Factual Information

### History of Flight

<b>Landing-flare/touchdown</b>	Dragged wing/rotor/float/other (Defining event)
<b>Landing-flare/touchdown</b>	Loss of control in flight
<b>Landing-flare/touchdown</b>	Roll over

### HISTORY OF FLIGHT

On January 31, 2011, about 1115 mountain standard time, a McDonnell-Douglas 369FF helicopter, N530RL, was substantially damaged during an attempted pinnacle landing on Waterman Peak near Marana, Arizona. The pilot received fatal injuries, two passengers received serious injuries, and one passenger received minor injuries. The public-use flight was operated by the Pima County Sheriff's Department (PCSD) in support of the Pima County Wireless Integrated Network (PCWIN) communications development project. Visual meteorological conditions prevailed, and no flight plan was filed for the flight.

The purpose of the flight was to enable PCWIN personnel to conduct a site survey for the planned installation of a communications repeater tower. The helicopter departed Tucson International Airport (TUS), Tucson, Arizona, about 1050, with the PCSD pilot in the left front seat, two Pima County employees in the right front and rear seats, and a private contractor in the left rear seat. Initially, the flight was in communication with, and being tracked by, TUS local and TRACON air traffic control (ATC) facilities as it headed for the peak, located about 30 miles west-northwest of TUS. Communications were intentionally terminated by the helicopter once it was well clear of TUS airspace.

The helicopter orbited Waterman Peak counterclockwise approximately twice, for general reconnoitering, before the attempted landing. The pilot's selected landing zone (LZ) was on a relatively level area of a pinnacle on the northeast side of the mountain. The approach was from the southeast. The passengers reported that during the landing attempt they felt a "bump"; the helicopter then either bounced or the pilot lifted off again, the nose pitched down, and the helicopter began to spin to the right. A ground-based witness located about 1,000 feet west of and below the LZ stated that the helicopter completed about four or five rotations before it disappeared from his view. The main rotor blades struck a rock outcrop northeast of the LZ, and the helicopter then tumbled and slid about 120 feet down a shallow canyon on the northeast face of the peak before it was halted by rocks and scrub vegetation. Two passengers used their mobile phones to call 911 for assistance. PCSD, US Customs and Border Protection, Arizona Department of Public Safety, and US military equipment and personnel participated in the victim rescue and recovery.

## PERSONNEL INFORMATION

Federal Aviation Administration (FAA) records indicated that the pilot held a commercial pilot certificate with rotorcraft-helicopter and instrument-helicopter ratings, and a private pilot certificate with airplane single and multi-engine land ratings. According to the pilot's personal flight log, he had approximately 11,500 total hours of flight experience, most of which was in helicopters. His first recorded flight in the accident helicopter make and model was in August 2008, and he had logged about 186 total hours in that equipment. In January 2011, excluding the accident flight, the pilot logged 6 flights, for a total of 7.5 hours, in the accident helicopter make and model. His most recent FAA second-class medical certificate was issued in February 2010.

According to PCSD information, the pilot joined PCSD in November 2008, and had about 30 years experience flying helicopters for the Arizona Department of Public Safety and the Maricopa County Sheriff's Department. PCSD records indicated that he had satisfactorily completed training for and demonstration of confined area, slope, and pinnacle landings.

The Pima County Office of the Medical Examiner autopsy report indicated that the cause of death was "multiple blunt force injuries." Both Pima County and the FAA Civil Aeromedical Institute reported that forensic toxicology examinations on specimens from the pilot revealed that no carbon monoxide, cyanide, ethanol, or any other screened drugs were detected.

## AIRCRAFT INFORMATION

The helicopter was manufactured new in 1985 as a Hughes model 369E, serial number 0128E. In September 1998 it was converted to a McDonnell Douglas model 369FF, serial number 0602FF, by McDonnell Douglas Helicopter, Incorporated. The helicopter was equipped with an Allison (Rolls-Royce) 250-C30 series turbine engine. It was registered to Pima County in 2008. The helicopter was left-seat command with dual controls, but the right-seat pedals were not installed for the accident flight.

The most recent 100-hour and annual maintenance inspections were completed on April 13, 2010, when the helicopter had a total time in service (TT) of 3,626.9 hours. At the time of the accident the helicopter had a TT of 3,740.3 hours. Review of the maintenance records indicated that the helicopter was in compliance with all applicable Service Bulletins and Airworthiness Directives.

Weight and balance calculations indicated that the helicopter was within its certificated weight and balance envelope for the flight. Fueling records indicated that the helicopter was serviced with the proper fuel, and had sufficient fuel on board for the flight.

## METEOROLOGICAL INFORMATION

About the time of the accident, there were two low pressure systems to the east, and a high pressure system to the northwest. No defined system surface boundaries were identified in the vicinity of the accident site. The station models surrounding the accident site indicated a general westerly wind at approximately 10 knots, with winds varying from the west-southwest to the west-northwest; scattered clouds; temperatures about 10 to 14 degrees C; and dew point about 0 to 4 degrees C. A National Weather Service (NWS) Convective Outlook forecast issued about 2 hours before the accident included a risk of general air mass type thunderstorms over eastern Arizona

The weather observation station closest to the accident site was located 19 miles southeast of the accident site, at an elevation of 2,417 feet. About 30 minutes before the accident, the station winds were from 090 degrees at 11 knots, with gusts to 16 knots. About the time of the accident, conditions included visibility 10 miles, and few clouds between 5,500 and 7,500 feet.

About 30 minutes before the accident, the next closest station, located approximately 30 miles southeast of the accident site, at an elevation of 2,643 feet, reported winds from 300 degrees at 9 knots, with gusts to 16 knots; visibility 10 miles, a ceiling of broken clouds at 7,000 feet; temperature 12 degrees C; and dew point 1 degree C. One hour later, that station observation included wind gusts to 24 knots.

The Geostationary Operational Environmental Satellite number 11 (GOES-11) visible image for 1100 depicted the accident site under the western portion of a band of clouds, with several embedded cumulus congestus type clouds in the larger stratocumulus cloud layer. The infrared image for the same period depicted cloud tops of 17,500 feet over the accident site. The 1130 GOES-11 visible image showed the band of clouds had moved eastward, with several well defined cumulus congestus to cumulonimbus cloud tops immediately downwind (east) of the accident site. There was an abrupt clearing of the clouds in the vicinity of the accident site, but nearby cloud formations indicated surface winds from the north.

The closest NWS Doppler Weather Surveillance radar was too far away to provide accident site wind data. The NWS issued in-flight weather advisories (in order of decreasing severity) designated as Convective SIGMETs, SIGMETs, and AIRMETs to notify pilots of the possibility of hazardous weather conditions. No Convective SIGMETs were current for the flight. An AIRMET Tango for moderate turbulence below 15,000 feet and an AIRMET Zulu for moderate icing between the freezing level and 18,000 feet were current for the flight.

Witness reports indicated that about the time of the accident, the mountain was visible below an overcast, and some rain had fallen. The closest ground-based witness, who was several hundred feet below the helicopter, stated that it was "windy," but his local topography was very different from the LZ topography. None of the passengers reported any wind.

It could not be determined what weather information the pilot obtained for the flight. Lockheed Martin Flight Services reported that no weather or other flight briefing services were provided

for the helicopter in the 24 hours preceding the flight.

## WRECKAGE AND IMPACT INFORMATION

The main wreckage, which consisted of the fuselage and tail boom, was located in a canyon below a pinnacle on Waterman Peak. Some rotor blade fragments, as well as fuselage and landing gear components, were distributed in the canyon, both above and below the main wreckage. The accident site elevation was approximately 3,595 feet.

The fuselage was on its left side, oriented approximately transversely across the canyon. The front canopy and canopy frame, as well as the aft 5 feet of the tail boom, were fracture-separated from the fuselage. Main rotor and tail rotor blade fragments were primarily found on top of the pinnacle. The rocky nature of the terrain limited the ground scarring. The rock outcrop at the top of the canyon contained main rotor blade fragments and scars. One 3-foot diameter shrub near the south east end of the LZ was uprooted, but its condition could not be directly associated with the accident sequence, and it may have been a result of rescue and recovery efforts.

The wreckage was examined in situ on the mountain on February 1, the day after the accident. The wreckage was recovered from the mountain on the afternoon of February 1, and examined in Phoenix on February 3 and 4. All components were accounted for. The five main rotor blades were highly fragmented, and their fragmentation and scoring damage was consistent with rotor strikes under power. The two tail rotor blades each were missing about 1/3 of their span, and the remaining root sections exhibited twisting, splitting, and chordwise scoring. The tail rotor fragments that were recovered were spread in an irregular pattern in a debris field about 250 feet long. Several of those fragments bore chordwise scoring. The tail rotor damage was consistent with rotor strikes under power. The pilot-side anti-torque pedals were fracture-separated from the helicopter. Metallurgical examination of the fractures determined that there was no evidence of pre-existing defects, and that the fractures were impact related.

The rotor transmission and gearboxes were intact, free to rotate, contained the proper amounts of oil, and had clean chip detectors. The tail rotor drive shaft damage was consistent with impact damage. Flight control continuity was validated from the cockpit to the respective end points; all damage and discontinuities were consistent with impact damage. The engine was slightly damaged. It was removed from the helicopter, and successfully met specification power during an operational run in a test fixture on February 7.

All damage patterns were consistent with a low speed impact in the horizontal and vertical planes, followed by the tumble down the canyon, with the engine driving the main and tail rotors. No evidence of any pre-existing mechanical defects or malfunctions was noted during the examination or testing of the recovered airframe and engine. Refer to the accident docket for detailed information.

The left rear seat passenger used his video camera to record portions of the flight for his family. The NTSB auditioned the image files, and determined that the data did not contain any imagery of the approach and/or accident.

## ORGANIZATIONAL AND MANAGEMENT INFORMATION

### PCSD Tactical Air Support Unit

The helicopter was operated by the Tactical Air Support Unit (TASU) of the PCSD. The primary mission of the TASU was support for law enforcement patrols, with a secondary mission of prisoner transport. The TASU also conducted a variety of missions in support of Pima County needs as required; the accident flight was one such mission. The TASU fleet consisted of four fixed wing aircraft, and one rotary wing aircraft, which was the accident helicopter. The TASU had 6 pilots, including the accident pilot and the Air Unit Supervisor, who was a fixed- and rotary-wing pilot with 20 years at PCSD. Two pilots were mission qualified on rotary wing aircraft, and four were mission-qualified on fixed wing aircraft. The accident pilot was not the primary TASU rotary wing pilot. The TASU personnel included three maintenance technicians to provide most fleet support. Heavy or specialized maintenance was contracted out to commercial vendors.

The helicopter was added to the PCSD fleet under the federal government's Urban Area Security Initiative (UASI), with the goal of providing support for "border crime" (human, drug and vehicle traffic) missions and SWAT missions. At the time of the accident, the helicopter was not fully employed in UASI missions. To date, its primary function had been for training, with the purpose of integrating the helicopter into the PCSD fleet. The helicopter was operated only in VFR conditions.

### TASU Procedures and Schedules

The TASU had some standing pre-coordination with ATC for missions conducted within the Tucson TRACON airspace. The coordination consisted of pre-assigned transponder codes and radio call signs. Unless precluded by geography and radio coverage, most TASU flights remained in communication with ATC for their duration.

According to TASU managers, the primary operational and weather minima were dictated by FAR Part 91. The TASU required pilots to evaluate conditions and the flight if the flight winds were either reported to be constant above 30 knots, or if there was more than a 15-knot difference between the wind and gust speeds.

Twice each year, the TASU conducted a 2-day operational and safety stand down. Once each year, PCSD conducted an agency-wide risk assessment, in accordance with Pima County requirements. However, the focus and purpose of that risk assessment was on workplace and health hazards to comply with Occupational Safety and Health Administration requirements,

and it did not address flight or mission safety aspects. The TASU did not mandate, conduct, or suggest any formal risk assessments for individual missions or flights. Mission/flight risk assessments were left to the individual pilots, and TASU managers stated that they did not "second guess" pilots' decisions not to fly. The TASU Air Unit Supervisor had the ultimate authority to approve or disapprove a flight, but normally, explicit approval was not required, since many flights were "standing" missions. However, his signature was required for extradition flights outside Pima County, and his manager's explicit approval was required for all other missions outside Pima County.

TASU pilots were typically scheduled for night or day rotations that lasted 4 to 6 months per rotation. Each crew consisted of a pilot and a tactical flight deputy, which was a non-pilot/non flying position, with a primary responsibility of equipment operator. The TASU did not have any mandatory flight time or duty time limits, but the recommended values were 6 to 8 hours per day flight time, and 14 hours per day duty time. There were no regularly scheduled day flights; those were operated on an on-demand basis by day-scheduled crews, and augmented by crews on call. The TASU operated regularly-scheduled night flights seven days per week.

#### Accident Pilot TASU Missions

The pilot's TASU missions in the helicopter consisted of "tactical insertions" of law enforcement personnel into airports and non-mountainous off-airport sites. He also practiced "slope landings" and "pinnacle landings," along with hover practice. PCSD personnel reported that the pilot had "long line" and "Bambi bucket" experience, but PCSD did not conduct those types of operations.

#### Accident Flight Background Information

The TASU Air Unit Supervisor received an email request from the individual responsible for PCWIN to use the helicopter for a site survey. The supervisor instructed the accident pilot to coordinate directly with the requesting individual, and advised the pilot that he should use the opportunity as a "practice/training" flight. TASU personnel reported that a few days before the flight, the pilot conducted a reconnoitering flight. Review of helicopter flight records indicated that the pilot conducted a 1.7-hour solo flight on January 20, 2011. The investigation was unable to determine any other relevant details of that flight.



## Pilot Information

<b>Certificate:</b>	Commercial; Private	<b>Age:</b>	60, Male
<b>Airplane Rating(s):</b>	Single-engine land; Multi-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	Helicopter	<b>Restraint Used:</b>	
<b>Instrument Rating(s):</b>	Helicopter	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>	Class 2 With waivers/limitations	<b>Last FAA Medical Exam:</b>	February 1, 2010
<b>Occupational Pilot:</b>	Yes	<b>Last Flight Review or Equivalent:</b>	September 1, 2009
<b>Flight Time:</b>	(Estimated) 11500 hours (Total, all aircraft), 186 hours (Total, this make and model)		

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	MCDONNELL DOUGLAS HELI CO	<b>Registration:</b>	N530RL
<b>Model/Series:</b>	369FF	<b>Aircraft Category:</b>	Helicopter
<b>Year of Manufacture:</b>		<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	0602FF
<b>Landing Gear Type:</b>	Skid	<b>Seats:</b>	4
<b>Date/Type of Last Inspection:</b>	January 12, 2011 100 hour	<b>Certified Max Gross Wt.:</b>	3100 lbs
<b>Time Since Last Inspection:</b>	15 Hrs	<b>Engines:</b>	1 Turbo shaft
<b>Airframe Total Time:</b>	3726 Hrs as of last inspection	<b>Engine Manufacturer:</b>	ALLISON
<b>ELT:</b>	C91A installed, activated, did not aid in locating accident	<b>Engine Model/Series:</b>	250-C30 SER
<b>Registered Owner:</b>	PIMA COUNTY BOARD OF SUPERVISORS	<b>Rated Power:</b>	650 Horsepower
<b>Operator:</b>	Pima County Sheriff's Department	<b>Operating Certificate(s) Held:</b>	None

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Day
<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>	10 miles
<b>Lowest Ceiling:</b>	Broken / 7000 ft AGL	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	9 knots / 16 knots	<b>Turbulence Type Forecast/Actual:</b>	/
<b>Wind Direction:</b>	90°	<b>Turbulence Severity Forecast/Actual:</b>	/
<b>Altimeter Setting:</b>		<b>Temperature/Dew Point:</b>	
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	Tucson, AZ (TUS )	<b>Type of Flight Plan Filed:</b>	None
<b>Destination:</b>	Marana, AZ	<b>Type of Clearance:</b>	None
<b>Departure Time:</b>	10:45 Local	<b>Type of Airspace:</b>	

## Wreckage and Impact Information

<b>Crew Injuries:</b>	1 Fatal	<b>Aircraft Damage:</b>	Substantial
<b>Passenger Injuries:</b>	2 Serious, 1 Minor	<b>Aircraft Fire:</b>	None
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	1 Fatal, 2 Serious, 1 Minor	<b>Latitude, Longitude:</b>	32.351387,-111.476112(est)

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Huhn, Michael
<b>Additional Participating Persons:</b>	Kenton Fenning; FAA FSDO; Scottsdale, AZ David Riser; Rolls-Royce; Indianapolis, IN John Hopper; McDonnell Douglas Helicopter Inc; Mesa, AZ Michael Grider; Pima County Sheriff Department; Tucson, AZ Adrian Booth; Boeing; Mesa, AZ
<b>Original Publish Date:</b>	December 5, 2012
<b>Last Revision Date:</b>	
<b>Investigation Class:</b>	<a href="#">Class</a>
<b>Note:</b>	The NTSB traveled to the scene of this accident.
<b>Investigation Docket:</b>	<a href="https://data.nts.gov/Docket?ProjectID=78250">https://data.nts.gov/Docket?ProjectID=78250</a>

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 [here](#).