 <b>National Transportation Safety Board</b> <b>FACTUAL REPORT</b> <b>AVIATION</b>		NTSB ID: LAX05LA074		Aircraft Registration Number: N142MK	
		Occurrence Date: 01/21/2005		Most Critical Injury: None	
		Occurrence Type: Accident		Investigated By: NTSB	
Location/Time					
Nearest City/Place Pahoa	State HI	Zip Code 96778	Local Time 1530	Time Zone HST	
Airport Proximity: Off Airport/Airstrip		Distance From Landing Facility:			
Aircraft Information Summary					
Aircraft Manufacturer MDHI		Model/Series 369E		Type of Aircraft Helicopter	
Revenue Sightseeing Flight: Yes			Air Medical Transport Flight: No		
Narrative					
<p>Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident:</p> <p>*** Note: NTSB investigators may not have traveled in support of this investigation and used data provided by various sources to prepare this aircraft accident report. ***</p> <p>HISTORY OF FLIGHT</p> <p>On January 21, 2005, approximately 1530 Hawaiian standard time, an MD Helicopters, Inc., (MDHI) 369E, N142MK, impacted small trees during an autorotational landing near the town of Pahoa, Hawaii. K &amp; S Helicopters, Inc., Kailua-Kona, Hawaii, doing business as Paradise Helicopters, operated the helicopter as an on-demand air tour sightseeing flight under the provisions of 14 CFR Part 135. The commercial pilot and four passengers were uninjured. The helicopter sustained substantial damage. Visual meteorological conditions prevailed, and a company visual flight rules flight plan had been filed. The sightseeing flight departed the Hilo International Airport near Hilo, Hawaii, approximately 30 minutes prior to the event.</p> <p>According to a written statement provided by the pilot, while returning from a tour flight, the helicopter developed a "sudden vibration in the tail rotor pedals followed immediately by a loud 'crack' or 'snap', and then an extremely loud banging noise and a sharp vibration in both airframe as well as the tail rotor pedals." The pilot immediately lowered the collective and spotted a clearing in the forest to set the helicopter down. He informed the passengers that they were going to have to make a landing. As the pilot was setting up for landing in the clearing, he increased the collective to adjust the helicopter's glide path angle, but the helicopter and tail rotor pedals began shaking violently. He added that the shaking was so extreme that the instrument panel was completely unreadable.</p> <p>Due to his fear that the tail rotor gearbox or tail boom would separate, he elected to lower the collective and roll the throttle to idle and continued flying toward the clearing. During the landing flare, the tail section snagged a tree and stopped the helicopter's forward flight. The pilot applied maximum collective to cushion the landing and the helicopter came into contact with low trees and shrubs.</p> <p>The tail rotor blades and tail rotor gearbox assembly separated from the helicopter and came to rest adjacent to the tail boom. The vertical stabilizer, horizontal stabilizer, and tail boom sustained impact damage. A tree branch also punctured the belly skin of the helicopter near the right forward strut of the skid.</p> <p>Post accident examination of the tail rotor blades revealed one blade (serial number A466) was missing the majority of its abrasion strip and was fractured through the airfoil section approximately 19 inches from the inboard end of the pitch horn. Neither the abrasion strip nor the outboard section of that blade was recovered.</p> <p>The tail rotor blades were shipped to the National Transportation Safety Board Materials Laboratory in Washington, D.C. for further examination.</p>					
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## Narrative (Continued)

## AIRCRAFT INFORMATION

The helicopter was equipped with two tail rotor blades (part number 500P3100-101; serial numbers A466 and A410) that counteracted the torque produced by the main rotor system. The tail rotor blades were manufactured with an abrasion strip that was adhesively bonded to the leading edge of the blade and secondarily secured to the blade with two rivets on the root end of the strip. A review of the helicopter's flight manual, under section IV titled, "Normal Procedures; Pilot's Preflight Guide," revealed the pilot is to, "visually check each tail rotor blade abrasion strip for evidence of debonding along the abrasion strip/airfoil bond line." The pilot reported examining the tail rotor blades and their abrasion strips prior to the accident flight, but did not notice any evidence of a debond condition.

The helicopter underwent its last 100-, 200-, and 300-hour inspections on January 5, 2005, at a helicopter total time of 7,592.6 hours. The helicopter accumulated a total of 7,657.8 hours at the time of the accident.

A review of the helicopter's maintenance manual, under the 100-hour and annual inspection sections, revealed that the abrasion strips should be inspected and should be "free of damage, no excessive erosion noted and no separation in bond around edges or at tip end of blade (ref. Tail Rotor Blade Inspection)." That referenced tail rotor blade inspection section indicated that the leading edges should be inspected for erosion or dents. The abrasion strip should also be visually inspected for paint cracking or chipping along the abrasion strip/airfoil bond line. The inspection process recommends that one use a 10X magnifying glass to check the bond line for debonding between the epoxy adhesive and abrasion strip. If any debonding is detected, the blade should be removed from service.

A note affiliated with the tail rotor abrasion strip inspection indicates that if debonding is suspected, but cannot be confirmed by visual inspection, mechanics are to refer to the Abrasion Strip Dye Penetrant and Tap Test Inspection. Those references provide detailed inspection instructions to carry out the penetrant or tap inspections. A review of the 100-hour checklist provided by the company revealed the tail rotor blade inspection had been initialed by the mechanic as completed. The list of replaced components that accompanied that inspection indicated that among other things, the tail rotor pitch change link bearings were replaced.

Review of the operator's component records revealed that tail rotor blade A410 was installed on the accident helicopter on March 10, 2004, with 1,024.4 hours since new and 0.0 hours since overhaul. At the time of the event, blade A410 accumulated 2,298.4 hours since new, of which 1,274.0 hours were accrued on the accident helicopter. Tail rotor blade A466 was installed on the accident helicopter on September 6, 2003, with 559.1 hours since new and 0.0 hours since its last overhaul. Blade A466 accumulated 2,379.7 hours since new, of which 1,820.6 hours were accrued on the accident helicopter.

Both blades were overhauled at the manufacturer's facility. During each overhaul, the blades underwent inspection and modification as required by Airworthiness Directive (AD) 2003-08-51 [pitch horn section inspection and rework]. According to the manufacturer, the blade abrasion strips were inspected during their overhaul.

It was noted during review of the operator's maintenance records that the original serviceable component record and Federal Aviation Administration (FAA) Form 8130-3 Airworthiness Approval Tag for A466 were not utilized, and a faxed copy of the original records, dated February 1, 2005 [15 days following the accident], had been supplied to the Safety Board. That faxed copy indicated that the blade had been installed on the accident helicopter on September 6, 2003.

## TESTS AND RESEARCH

Metallurgical examination of the tail rotor blades revealed blade A410 displayed heavy leading edge impact damage about midspan with associated crushing and tearing of the abrasion strip and blade skin.

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## Narrative (Continued)

The abrasion strip remained attached except in the areas of severe local distortion of the blade.

As previously mentioned, blade A466 was missing its outboard portion of the blade and its leading edge abrasion strip was fractured at its outboard rivet near the inboard end of the blade. Magnified examinations of the fracture location revealed deformation and crushing consistent with leading edge impact. Fibrous material was uncovered in the fracture area indicative of contact with woody material. The fracture surfaces at the separation were consistent with tearing overstress separations with no indications of preexisting cracking.

A thick dark blue adhesive covered both sides of the leading edge of blade A466 where the abrasion strip was originally bonded. The adhesive appeared consistent with the blue 3M AF-163 film adhesive described in the manufacturer's assembly process specification. The exposed surfaces of the adhesive were smooth with a glossy finish interrupted by regions of chordwise striations. The smooth glossy surfaces of the adhesive were indicative of a preexisting debond of the abrasion strip. For comparison, the leading edge abrasion strip was mechanically removed from blade A410. The laboratory separated adhesive was light blue in color with a rough matte finish, in contrast to the darker blue smooth glossy finish on the abrasion strip separation of the A466 blade. The striations appeared consistent with relative movement between the surface of the adhesive and the abrasion strip. At many locations, dark sooty deposits accompanied the chordwise marks. The striations and dark deposits were visible on both sides of the blades. In addition, a prominent spanwise impression was present on the inboard side of the blade (installed right side of blade). Close examinations revealed several regions where the chordwise abrasions of the adhesive surface had penetrated to the blade skin at the leading edge. The fine abrasions penetrated the gray colored adhesive primer and had removed material from the skin. Near the fracture, impact damage and longitudinal scrapes overlaid one of the abraded areas.


The abrasion strip was fractured at the outboard rivet and less than 1-inch of the strip remained attached to the blade by the two rivets. High magnification optical examinations of the fractured edge of the strip uncovered fatigue fracture artifacts between the rivet and the aft edge of the strip. The fatigue initiated at the rivet hole on the left side of the blade and propagated through most of the ligament between the rivet and the trailing edge of the strip. The remaining fracture in this ligament and on the other abrasion strip fractures showed yielding and features typical of overstress separations.


## ADDITIONAL INFORMATION

The manufacturer supplied the Safety Board with a report indicating another blade, serial number A470, had a similar adhesive separation that A466 experienced. According to that report, the A470 blade had sustained "a strike" that resulted in the separation of the strip from the blade; however, the report also indicated that a pre-existing debond situation was present prior to the impact failure. The manufacturer reported that blades A466 and A470 came from the same manufacturing batch (each batch consists of 50 blades). As of this reports writing, the manufacturer has inspected all but 7 blades from that batch.

A search of the Service Difficulty Report (SDR) system revealed one other blade had undergone a partial abrasion strip debond, but the serial number of the blade was not listed in the report.

The operator notified the Federal Aviation Administration of the event immediately following the accident; however, the Safety Board learned of the accident from one of the passengers on February 3, 2005.

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<b>Landing Facility/Approach Information</b>					
Airport Name	Airport ID:	Airport Elevation Ft. MSL	Runway Used NA	Runway Length	Runway Width
Runway Surface Type:					
Runway Surface Condition:					
Approach/Arrival Flown: NONE					
VFR Approach/Landing: Forced Landing					
<b>Aircraft Information</b>					
Aircraft Manufacturer MDHI		Model/Series 369E		Serial Number 187E	
Airworthiness Certificate(s): Normal					
Landing Gear Type: Skid					
Amateur Built Acft? No	Number of Seats: 5	Certified Max Gross Wt. 3000 LBS	Number of Engines: 1		
Engine Type: Turbo Shaft	Engine Manufacturer: Rolls-Royce	Model/Series: 250-C20B	Rated Power: 420 HP		
- Aircraft Inspection Information					
Type of Last Inspection 100 Hour	Date of Last Inspection 01/2005	Time Since Last Inspection 65.2 Hours	Airframe Total Time 7592.6 Hours		
- Emergency Locator Transmitter (ELT) Information					
ELT Installed?/Type Yes /	ELT Operated? No	ELT Aided in Locating Accident Site? No			
<b>Owner/Operator Information</b>					
Registered Aircraft Owner Schuman Aviation Co. Ltd		Street Address 1534 Uluhaku PI			
		City Kailua	State HI	Zip Code 96734	
Operator of Aircraft K & S Helicopters, Inc.		Street Address P.O. Box 5371			
		City Kailua-Kona	State HI	Zip Code 96745	
Operator Does Business As: Paradise Helicopters			Operator Designator Code: K2DA		
- Type of U.S. Certificate(s) Held:					
Air Carrier Operating Certificate(s): On-demand Air Taxi					
Operating Certificate:			Operator Certificate:		
Regulation Flight Conducted Under: Part 135: Air Taxi & Commuter					
Type of Flight Operation Conducted: Non-scheduled; Domestic; Passenger Only					

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**First Pilot Information**

Name On File	City On File	State On File	Date of Birth On File	Age 46
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Sex: M	Seat Occupied: Left	Occupational Pilot?	Certificate Number: On File
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Certificate(s): Flight Instructor; Commercial

Airplane Rating(s): Multi-engine Land; Single-engine Land

Rotorcraft/Glider/LTA: Helicopter

Instrument Rating(s): Airplane

Instructor Rating(s): Airplane Multi-engine; Airplane Single-engine

Current Biennial Flight Review? 08/2004

Medical Cert.: Class 2	Medical Cert. Status: Without Waivers/Limitations	Date of Last Medical Exam: 01/2005
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- Flight Time Matrix	All A/C	This Make and Model	Airplane Single Engine	Airplane Multi-Engine	Night	Instrument		Rotorcraft	Glider	Lighter Than Air
						Actual	Simulated			
Total Time	8795	3650						5950		
Pilot In Command(PIC)										
Instructor										
Instruction Received										
Last 90 Days		190								
Last 30 Days		66								
Last 24 Hours										

Seatbelt Used? Yes	Shoulder Harness Used? Yes	Toxicology Performed? No	Second Pilot? No
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**Flight Plan/Itinerary**

Type of Flight Plan Filed: Company VFR

Departure Point Hilo	State HI	Airport Identifier ITO	Departure Time 1500	Time Zone HST
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Destination Local Flight	State	Airport Identifier	
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Type of Clearance: None

Type of Airspace:

**Weather Information**

Source of Wx Information:  
Unknown

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**Weather Information**

WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
KOA	1453	PST	Ft. MSL	45 NM	285 Deg. Mag.
Sky/Lowest Cloud Condition: Scattered			3600 Ft. AGL	Condition of Light: Day	
Lowest Ceiling: Overcast			4500 Ft. AGL	Visibility: 10 SM	Altimeter: 29.84 "Hg
Temperature: 27 °C	Dew Point: 21 °C	Weather Conditions at Accident Site: Visual Conditions			
Wind Direction: 250	Wind Speed: 7	Wind Gusts:			
Visibility (RVR): Ft.	Visibility (RVV) SM				
Precip and/or Obscuration: No Obscuration; No Precipitation					

**Accident Information**

Aircraft Damage: Substantial	Aircraft Fire: None	Aircraft Explosion: None
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- Injury Summary Matrix	Fatal	Serious	Minor	None	TOTAL
First Pilot				1	1
Second Pilot					
Student Pilot					
Flight Instructor					
Check Pilot					
Flight Engineer					
Cabin Attendants					
Other Crew					
Passengers				4	4
- TOTAL ABOARD -				5	5
Other Ground					
- GRAND TOTAL -				5	5

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Administrative Information

Investigator-In-Charge (IIC)

Nicole L. Charnon

Additional Persons Participating in This Accident/Incident Investigation:

Dave Lusk  
Federal Aviation Administration  
Honolulu, HI

Calvin G Dorn  
K&S Helicopters, Inc.  
Kailua-Kona, HI

Frank Palminteri  
Helicopter Technology Company  
Los Angeles, CA