Aviation Investigation Final Report

Location:	Juneau, Alaska	**Accident Number:**	ANC11LA108
Date & Time:	September 26, 2011, 12:30 Local	**Registration:**	N230CH
Aircraft:	Eurocopter AS 350 BA	**Aircraft Damage:**	Substantial
Defining Event:	Dynamic rollover	**Injuries:**	2 None
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled		

Analysis

The helicopter pilot was landing at a remote off-airport site, located on an outcrop on the side of a steep slope. The pilot reported that after landing, he initiated the shutdown checklist, including a 2-minute cool down. About 1.5 minutes later, the pilot noticed a strong upslope wind, and the helicopter turned to the right. The pilot attempted to offset the turn with left pedal, but at low rpm, the pedal had no effect. The helicopter lifted off the ground about 3 to 5 feet in a slightly nose-high attitude and simultaneously rolled to the left. The pilot attempted to offset the roll with right cyclic input with no effect. The helicopter continued to lift and roll to the left until the main rotor blades impacted the ground. The helicopter came to rest on its left side.

The National Weather Service forecast included surface wind of 35 to 45 knots. Upslope wind conditions developed due to the terrain features and created a situation that the pilot was unable to overcome when the helicopter was at ground idle. Although the pilot checked current and forecast weather before departure, he was unaware that the forecast wind would have such an effect because of a lack of manufacturer data regarding the effect of upslope wind on an idle helicopter.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: Upslope wind conditions while the helicopter was operating at ground idle, which resulted in the helicopter rollover. Contributing to the accident was the lack of manufacturer data regarding the effect of upslope wind conditions on helicopter ground idle operations.

Findings

Aircraft	(general) - Attain/maintain not possible
Environmental issues	Updraft - Contributed to outcome
Organizational issues	Document/info verification - Manufacturer

Factual Information

History of Flight

Standing-engine(s) operating	Other weather encounter
Standing-engine(s) operating	Dynamic rollover (Defining event)

On September 26, 2011, about 1230 Alaska daylight time, a Eurocopter AS350BA helicopter, N230CH, sustained substantial damage after landing at a remote mountain site, about 22 miles northwest of Juneau, Alaska. The helicopter was being operated by Coastal Helicopters Inc., Juneau, as a visual flight rules (VFR) on-demand charter flight under the provisions of 14 Code of Federal Regulations Part 135, when the accident occurred. The commercial pilot and the sole passenger were not injured. Visual meteorological conditions prevailed, and company flight following procedures were in effect. The flight departed Juneau International Airport, Juneau, about 1212.

The pilot reported that the purpose of the flight was to pick up two US Forest Service scientists from a remote mountainside rock and tundra-covered outcrop, which protruded from a steep slope. He added that he had landed at the same site, about 2 hours earlier, in order to drop-off the pair of scientists. Before leaving Juneau for the return flight, the pilot said he received a weather briefing, and was told the wind could be gusting in the 20 knot range. However, the pilot reported that the winds were “relatively calm” when he landed at the site.

During an interview with a Federal Aviation Administration (FAA) aviation safety inspector from the Juneau Flight Standards District Office (FSDO) on September 27, the pilot reported that after landing he initiated the shutdown checklist, which included locking the collective in the down position, applying cyclic friction, and retarding the engine throttle to ground idle to begin the 2-minute engine cool down procedure.

The pilot said that shortly after beginning the cool down procedure, both the pilot and passenger noticed that the helicopter began to buffet slightly due to strong gusty wind conditions, which were significant enough to get their attention. Both of them talked about whether or not to continue the shutdown, and at that moment, about 1 ½ minutes into the engine cool down, he noticed a group of small trees to his right, and down slope from the helicopter, that began to be buffeted by a strong upslope wind. Shortly thereafter, the helicopter began to pivot to the right, and the pilot applied left tail rotor pedal to stop the pivot, but with no effect. With the collective still locked in the down position, and while the engine was still at ground idle, the helicopter rocked backwards, then it lifted off of the ground vertically in a slightly nose high attitude. The helicopter lifted approximately 3-5 feet above the ground, and then it rolled to the left. The pilot attempted to offset the roll with full right cyclic input with no effect. The helicopter continued to roll to the left until the main rotor blades impacted the ground. The helicopter came to a rest on its left side, sustaining substantial

damage to the fuselage, main rotor drive system, and tail boom.

The pilot noted that there were no preaccident problems with the helicopter.

METEOROLOGICAL INFORMATION

The closest weather reporting facility was the Juneau International Airport, 22 miles southeast of the accident site. At 1053, a weather observation from the Juneau Airport was reporting, in part: Wind, 230 degrees (true) at 6 knots; visibility, 10 statute miles; clouds and sky condition, few at 1,400 feet; temperature, 48 degrees F; dew point, 44 degrees F.

Two witnesses working on the weather station near accident site reported increased wind gusts just after the helicopter had landed.

A strong low pressure system was forecast to arrive over southeast Alaska on the day of the accident with surface winds at 35-45 knots. Wind conditions about 20 miles to the north of the accident site, were recorded at 27 and 29 knots at 1200 and 1300 on the day of the accident.

ADDITIONAL INFORMATION

According to the Airman's Information Manual, Mountain Flying, abrupt changes in wind direction and velocity commonly occur in mountainous areas; severe updrafts and downdrafts are common, particularly near or above abrupt changes of terrain such as cliffs or rugged areas. Severe turbulence can be expected, especially in high wind conditions.

According to Eurocopter, the idle rotor speed in an AS-350BA is listed at approximately 260 RPM (Aircraft checklist).

According to the Sikorsky Helicopter Flight Theory, Introduction to Helicopter Aerodynamics, increasing up-flow air through a rotor system effectively reverses airflow, and increases rotor RPM and thrust. Under these conditions, higher rotor speeds are attained with lower pitch settings.

Accident Simulation

At the request of Coastal Helicopters, Eurocopter U.S.A. was asked to provide technical assistance with regard to the helicopter involved in this accident. Eurocopter Air Safety Investigators were provided with details of the helicopter configuration, weather, and terrain conditions involved. The initial response received was that Eurocopter had no previous accidents on record of a similar nature (aircraft on ground at idle tipped by wind). At that time, accident information was sent to the Eurocopter Aerodynamics Department in France for further review and analysis.

Eurocopter’s aerodynamics department in France reported results of their simulation that re-

created the Coastal Helicopters accident.

Using photographs from the accident site, the estimated gross weight of the accident helicopter, the ground idle rotor speed, along with the location of the helicopter and the surrounding terrain, the simulation was completed using a wind impact angle of -50 degrees (referencing the rotor disk as 0 degrees). Using these parameters, the simulation resulted in the helicopter lifting off the ground with a wind speed of 37mph (32kts).

The relationship between wind angle impact and wind speed are inversely proportional. The greater the negative angle of wind impact underneath the rotor disk, the less wind is required to lift the helicopter. Conversely, the lesser the angle of wind impact on the rotor disk (more toward 0 degrees or closer to parallel with the disk) the greater the wind speed is required to lift the helicopter.

During the Juneau accident sequence, the aircraft lifted off the ground and began rolling to the left, exposing a greater portion of the underside of the rotor disk to an increasingly negative impact angle, meaning a lower wind speed required to create lift or the same wind speed creating even greater lift.

The reaction of the helicopter in response to strong winds and the resulting accident sequence in this case are not unprecedented. On December 17, 2008, a Kaman Aerospace Corporation, K-1200 helicopter, N267KA, sustained substantial damage after being upset by a wind gust while standing with engines and rotors operating near Santa Clarita, California (NTSB # WPR09LA057). The pilot reported that about 30 seconds after starting the helicopter's engine and while in ground idle, the mechanic disconnected the auxiliary power unit (APU). The pilot stated, in part: "...then the helicopter began to lift on the right side. I applied full right cyclic to counter the lifting. I ran out of cyclic and was on the stops. The aircraft was still lifting to the left. The right wheel then came off the ground and the tail of the aircraft lifted over the nose."

Given the lack of available data concerning the effects of orographic turbulence on helicopter operations in steep, up-sloping, mountainous terrain, the United States Department of the Interior issued an interagency aviation accident prevention bulletin, No. IA APB 12-01, which highlights the hazards of this phenomena.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	34,Male
Airplane Rating(s):	None	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	Instrument helicopter	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	October 28, 2010
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	February 23, 2011
Flight Time:	3428 hours (Total, all aircraft), 2252 hours (Total, this make and model), 3378 hours (Pilot In Command, all aircraft), 230 hours (Last 90 days, all aircraft), 63 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Eurocopter	**Registration:**	N230CH
Model/Series:	AS 350 BA	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	2734
Landing Gear Type:	High skid	**Seats:**	6
Date/Type of Last Inspection:	August 10, 2011 100 hour	**Certified Max Gross Wt.:**	4630 lbs
Time Since Last Inspection:		**Engines:**	1 Turbo shaft
Airframe Total Time:	15904 Hrs at time of accident	**Engine Manufacturer:**	HONEYWELL
ELT:	C126 installed, activated, did not aid in locating accident	**Engine Model/Series:**	LTS101-600A3A
Registered Owner:	COASTAL HELICOPTERS INC	**Rated Power:**	650 Horsepower
Operator:	COASTAL HELICOPTERS INC	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:	Coastal Helicopters Inc.	**Operator Designator Code:**	XCHA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	PAJN,21 ft msl	**Distance from Accident Site:**	23 Nautical Miles
Observation Time:	10:53 Local	**Direction from Accident Site:**	340°
Lowest Cloud Condition:	Few / 1400 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots / 25 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	230°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:		**Temperature/Dew Point:**	9°C / 7°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Juneau, AK (PAJN)	**Type of Flight Plan Filed:**	Company VFR
Destination:	Juneau, AK	**Type of Clearance:**	None
Departure Time:	12:00 Local	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	58.700553,-134.851943

Administrative Information

Investigator In Charge (IIC):	Lewis, Lawrence
Additional Participating Persons:	Reynaldo Madrid; FAA FSDO-05; Juneau, AK
Original Publish Date:	August 7, 2013
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=81898