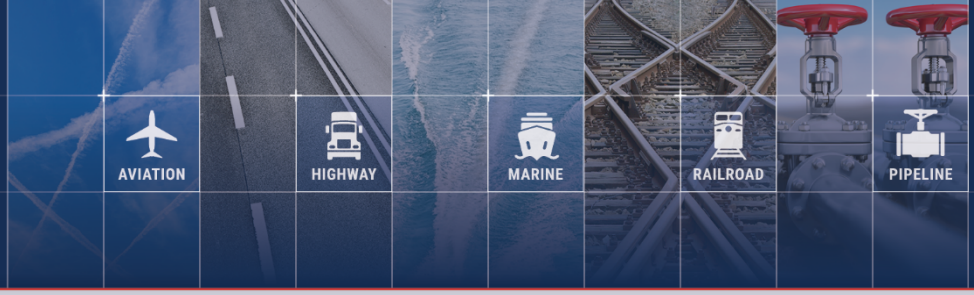


# Aviation Investigation Factual Report

| | | | |
|---|---|---|---|
| **Location:** | Pacoima, California | **Accident Number:** | WPR11FA045 |
| **Date & Time:** | November 12, 2010, 07:48 Local | **Registration:** | N1231A |
| **Aircraft:** | Eurocopter AS350B2 | **Aircraft Damage:** | Substantial |
| **Defining Event:** | Loss of engine power (partial) | **Injuries:** | 2 None |
| **Flight Conducted Under:** | Part 91: General aviation - Aerial observation | | |

## Factual Information

HHISTORY OF FLIGHT

On November 12, 2010, at 0748 Pacific standard time, a Eurocopter AS350B2, N1231A, experienced a loss of engine power shortly after departure from Whiteman Field, Pacoima, California. During the subsequent forced autorotation, the helicopter experienced a hard landing, and the tail boom separated. Tiny Bubbles Aviation, Inc., was operating the helicopter under the provisions of 14 Code of Federal Regulations (CFR) Part 91. The commercial pilot and one passenger were not injured. The helicopter sustained substantial damage to the airframe. The local electronic news gathering (ENG) flight was departing at the time in visual meteorological conditions. No flight plan had been filed.

The pilot stated that the helicopter lifted off from taxiway Alpha, and was parallel to runway 12. A climb was established, and all systems were in the normal operating range. The pilot proceeded on a right downwind departure, and planned to exit the airport area on a 45-degree angle. During the turn from the upwind to the downwind leg, he noticed a slight and momentary upward change in the sound of the engine revolutions per minute (rpm). The turn to downwind leg was normal, and remained so until he was abeam midfield and preparing for the left 45-degree departure. The pilot noted a second and much more pronounced rise in engine rpm, and thought that the engine might overspeed, so he began to lift the collective up to arrest the rpm rise, and prepare for a possible emergency governor operation.

The pilot stated that in less than a second, the engine speed sound reversed from a high sound to a rapid rpm decrease. He immediately lowered the collective to the full-down position, adjusted the cyclic to establish a 60- to 65-knot attitude, and looked forward for a suitable landing area. The helicopter was in a stable, steady-state autorotation, but there was no area directly ahead for an emergency landing without causing an extreme hazard to homes and people on the ground. He turned the helicopter 90 degrees toward the airport, which was the only open area that he thought he could possibly reach. Upon rollout, he realized that at the current airspeed and rate of descent, the helicopter would not clear the 40-foot powerlines on the airport boundary.

The pilot stated that he smoothly and firmly lowered the nose to an approximate 90-knot attitude. About 1 second later, he raised the collective lever, which increased the rotor pitch and extended the glide. After 3 to 4 seconds, it became apparent that the helicopter was going to clear the obstructions, and get to the airport property. At this time, he noted that the yellow GEN light was illuminated on the annunciator panel.

The pilot determined that the airspeed and rate of descent were unacceptably high to perform a safe touchdown, and the helicopter was positioned 90 degrees to the runway centerline, and heading toward intersection Charlie, which had parked airplanes and the airport fuel pit just beyond it. Shortly before crossing the wires, he raised the nose back to the 60- to 65-knot attitude, and lowered the collective to the full down position. After crossing the wires, he aggressively rolled the helicopter into a left bank to align it with runway 30, and added a little collective pitch halfway through the turn. As he completed the

turn, he again lowered the collective; the rate of descent had predictably climbed very high, and he raised the nose to trade airspeed to arrest the descent rate.

The pilot added collective about 20 feet above ground level to further arrest the descent rate. He noted that neither of those inputs had the ideal effect, and the helicopter was settling far too rapidly. He then raised the collective further in an attempt to reduce the descent rate, lowered the nose, and firmly applied all remaining collective pitch just before the skids touched down. The helicopter's attitude was more nose high than he preferred, but with as much forward speed as it had, he felt that he had to hold that position.

The helicopter settled hard on the runway centerline, but held a good position for a short time before it began to rock forward quite hard so the pilot countered with a smooth and steady aft cyclic input. As it settled back hard on the skids, he began to neutralize the cyclic. The helicopter was on the ground, aligned with the centerline, and sliding at 25 knots.

As the fore and aft rocking stopped and the helicopter was solidly on the skids, it began a right yaw. The pilot applied full left anti-torque pedal to no effect as the helicopter continued to slide and yaw right. The pilot gently began rolling the cyclic to the right trying to time it to be at full deflection away from a possible left rollover as the helicopter began yawing through 90 degrees from the touchdown heading. The helicopter came to a stop, upright on the skids, and facing 160 degrees right of the centerline. The rotor blades were turning about 50 rpm, and the photographer on board voiced that they would wait until the rotor blades stopped before egressing. While the blades were stopping, the pilot turned off the electrical master switch and two fuel pumps, and moved the throttle lever to the idle cut-off position. After the blades stopped, they exited, and walked a safe distance away. The pilot noted that the aft 1/3 of the tail boom had separated, and was lying on the runway. He also noted white smoke emanating from the exhaust stack; it stopped smoking about 30 seconds later.

The pilot estimated that the time from the power loss to the helicopter coming to rest was 18-23 seconds.

## AIRCRAFT

The helicopter was a Eurocopter AS350B2, serial number 3682. The operator reported that the helicopter had a total airframe time of 3,456.5 hours at the time of the accident. It had a 100-hour inspection completed on October 5, 2010.

The engine was a Honeywell LTS101-700D2 turboshaft, serial number LE-46130C. The original Turbomeca Aeriel 1D1 engine had been replaced in accordance with STC Number SR01647SE held by SOLOY, LLC. Total time recorded on the engine was 4,042 hours, and time since major overhaul was 546.5 hours.

## TESTS AND RESEARCH

### Follow Up Examinations

#### Engine

Investigators examined the engine at the Honeywell facilities in Phoenix, Arizona, from January 25-27, 2011. A detailed report is part of the public docket for this accident.

January 25, 2011

During the initial visual evaluation, the engine was turned with a spline adapter tool in the starter pad to verify rotation of the Gas Producer (GP) section. The Power Turbine (PT) section rotated freely.

At the conclusion of the evaluation, the engine was prepared for a run in a test cell.

January 26, 2011

Prior to the first start attempt in a test cell, a borescope inspection of the bottom of the PT and compressor section identified no mechanical damage or contamination. Cranking the engine verified an increase in oil pressure. No metallic debris was noted on the gearbox chip detector.

The first test run lasted approximately 6 minutes at idle; there was a residual fuel leak from plenum drain at shutdown. White smoke was noted to be emanating from the engine inlet for approximately 4-5 minutes following shutdown.

The second test run lasted approximately 33 minutes. In accordance with the engine test instructions (TI), the engine was operated at ground idle and flight idle.

A third test run lasted approximately 1 hour 31 minutes. The engine was operated in accordance with the TI, and verified the engine's ability to reach take-off power.

During the PT governor check, the PT governor appeared to not govern the PT speed as the waterbrake was slowly unloaded. Power turbine speed (NPT) increased to 107 percent before the waterbrake was reapplied.

The engine was then shut down, and rigged for an overspeed (o/s) protection check.

January 27, 2011

The electronic overspeed system operation check was performed successfully using a Honeywell slave overspeed controller.

Upon completion with the slave equipment, the accident helicopter's overspeed controller box was installed. The electronic overspeed system operation check was performed successfully using the accident helicopter's overspeed controller.

An additional test was performed to verify the actual overspeed trip point. The overspeed protection system activated at 109.1 percent NPT, which was within limits, and three additional tests had the same results.

A leak check of the pneumatic system was performed using a soapy water solution. Leaks were observed in the following locations:
Px Bleed orifice threads
Pc filter to T1 sensor at the Pc filter – note that this line was removed previously to facilitate removal of the engine from the helicopter.
Pc filter t-fitting cap.

The Power Turbine Governor (PTG) and Fuel Control Unit (FCU) line replaceable units (LRU's) were removed for further testing at the Honeywell facility in South Bend, Indiana.

PTG and FCU Examinations

Examination of the PTG and FCU were conducted on February 23, 2011, at the Honeywell Engines Systems and Services Facility in South Bend, Indiana. A complete report on the testing of the PTG and FCU is part of the public docket for this accident.

PTG

A functional test was not possible due to the inability to achieve the first test point; there was no PR-PG pressure signal. The ambient vent screen was removed in order to inspect the test bench coupling interface to the unit. The drive was correct and operative with no anomalies noted. Metal debris was observed on the throttle cam / cam lever assembly that was internal to the unit. The spool bearing cap showed excessive movement.

Disassembly of the unit revealed that the spool bearing was not properly supporting the interfacing spool bearing cap. Spool bearing debris, which consisted of bearing retainer pieces and two loose balls, were in the drive body cavity.

Examination of the inner race under magnification indicated shoulder wear noted in the direction of the governor (GOV) drive (toward GOV mount pad).

FCU

The FCU was Model DP-S1; part number 2549165-1; serial number 337045.

During a visual inspection, the speed input drive shaft rotated freely. The throttle shaft rotated freely from minimum to maximum.

A functional pneumatic air leak test on the Px-Py air circuit revealed zero leakage, which was normal.

The fuel control unit was tested in accordance with Test Specification TS12991. Several parameters fell outside of test limits.

Based on the results of the testing, the unit was not disassembled.

Honeywell Materials Lab Testing

Bearing pieces, inner and outer spool bearing race pieces, and debris were taken to the Honeywell materials laboratory for examination. A summary report of the findings is part of the public docket for this accident.

Ball Inspection

Scanning electron microscope (SEM) inspection indicated that there was material transfer and smearing. Dents and spalling were noted as well as embedded hard particles that were aluminum oxide and diamond.

Inner Race

Visual inspection revealed that the surfaces were rough in appearance. SEM inspection revealed substantial smearing, tearing, and roughness in the raceway. There were hard particles in the race that were diamond in appearance. The race damage was caused by hard particles, and hard particle damage was still occurring at the end of the failure.

Outer Race

SEM inspection revealed that hard particles with a diamond appearance were in the race.

Materials Lab Summary

Significant quantities of imbedded diamond particles were observed in the inner and outer races. A few diamond particles were imbedded on the surface of the sample ball. There was evidence of damage from the particles in the races; the race wear was significant. No external source of contamination could be identified. Diamond particles were used in the manufacturing process for the ball bearings.

Honeywell Service Bulletin (SB) GT-73-351

Honeywell SB GT-73-351 (Revision 0, 7 July 2010) applied to this engine at the time of the accident. It required replacement of the spool bearing (part number 2523973N) with a new spool bearing (part number 2523973N) depending on time in service. It indicated a compliance time of 900 hours for bearing replacement. As a result of this accident, Honeywell issued SB GT-73-351 (Revision 2, 27 Jun 2011), which reduced the service life to 600 hours.

Summary of Findings

The testing and examination of the engine disclosed a degraded power turbine (PT) governor spool bearing, which rendered the PT governor incapable of modulating governor servo (Py) pressure to the fuel control. Postaccident examination of the engine revealed no evidence of mechanical malfunctions or failures that would have precluded normal operation.

## Pilot Information

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| **Certificate:** | Airline transport; Commercial; Flight instructor | **Age:** | 50 |
| **Airplane Rating(s):** | Single-engine land; Single-engine sea; Multi-engine land | **Seat Occupied:** | Right |
| **Other Aircraft Rating(s):** | Helicopter | **Restraint Used:** | Unknown |
| **Instrument Rating(s):** | Airplane; Helicopter | **Second Pilot Present:** | No |
| **Instructor Rating(s):** | Airplane multi-engine; Airplane single-engine | **Toxicology Performed:** | No |
| **Medical Certification:** | Class 2 With waivers/limitations | **Last FAA Medical Exam:** | November 1, 2010 |
| **Occupational Pilot:** | Yes | **Last Flight Review or Equivalent:** | August 22, 2010 |
| **Flight Time:** | 10500 hours (Total, all aircraft), 7300 hours (Total, this make and model) | | |

## Aircraft and Owner/Operator Information

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|---|---|---|---|
| **Aircraft Make:** | Eurocopter | **Registration:** | N1231A |
| **Model/Series:** | AS350B2 | **Aircraft Category:** | Helicopter |
| **Year of Manufacture:** | 2003 | **Amateur Built:** | |
| **Airworthiness Certificate:** | Normal | **Serial Number:** | 3682 |
| **Landing Gear Type:** | Skid | **Seats:** | 6 |
| **Date/Type of Last Inspection:** | October 5, 2010 100 hour | **Certified Max Gross Wt.:** | 4961 lbs |
| **Time Since Last Inspection:** | | **Engines:** | 1 Turbo shaft |
| **Airframe Total Time:** | 3456 Hrs at time of accident | **Engine Manufacturer:** | Honeywell |
| **ELT:** | Installed, not activated | **Engine Model/Series:** | LTS101-700-D2 |
| **Registered Owner:** | Tiny Bubbles, Inc. | **Rated Power:** | |
| **Operator:** | Tiny Bubbles, Inc. | **Operating Certificate(s) Held:** | None |

## Meteorological Information and Flight Plan

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| **Conditions at Accident Site:** | Visual (VMC) | **Condition of Light:** | Day |
| **Observation Facility, Elevation:** | KBUR,778 ft msl | **Distance from Accident Site:** | |
| **Observation Time:** | 07:53 Local | **Direction from Accident Site:** | |
| **Lowest Cloud Condition:** | Clear | **Visibility** | 10 miles |
| **Lowest Ceiling:** | None | **Visibility (RVR):** | |
| **Wind Speed/Gusts:** | / | **Turbulence Type Forecast/Actual:** | / |
| **Wind Direction:** | | **Turbulence Severity Forecast/Actual:** | / |
| **Altimeter Setting:** | 30.32 inches Hg | **Temperature/Dew Point:** | 14°C / -4°C |
| **Precipitation and Obscuration:** | No Obscuration; No Precipitation | | |
| **Departure Point:** | Pacoima, CA (WHP ) | **Type of Flight Plan Filed:** | None |
| **Destination:** | Pacoima, CA (WHP ) | **Type of Clearance:** | None |
| **Departure Time:** | 07:47 Local | **Type of Airspace:** | |

## Airport Information

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|---|---|---|---|
| **Airport:** | Whiteman Field WHP | **Runway Surface Type:** | Asphalt |
| **Airport Elevation:** | 1003 ft msl | **Runway Surface Condition:** | Dry |
| **Runway Used:** | 30 | **IFR Approach:** | None |
| **Runway Length/Width:** | 4120 ft / 75 ft | **VFR Approach/Landing:** | Forced landing |

## Wreckage and Impact Information

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| **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:** | 34.259445,-118.413612(est) |

## Administrative Information

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| **Investigator In Charge (IIC):** | Plagens, Howard |
| **Additional Participating Persons:** | Jerry Badillo; FAA FSDO; Van Nuys, CA<br>David Studtmann; Honeywell ; Phoenix, AZ<br>Larry Welk; Angel City Air; Pacoima, CA<br>David Stauffer; SOLOY Aviation Solutions; Olympia, WA |
| **Report Date:** | April 2, 2014 |
| **Last Revision Date:** | |
| **Investigation Class:** | Class |
| **Note:** | The NTSB traveled to the scene of this accident. |
| **Investigation Docket:** | https://data.ntsb.gov/Docket?ProjectID=77785 |