**National Transportation Safety Board**

# FACTUAL REPORT AVIATION

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|---|---|
| NTSB ID: SEA06FA015 | Aircraft Registration Number: N950AL |
| Occurrence Date: 10/28/2005 | Most Critical Injury: Minor |
| Occurrence Type: Accident | Investigated By: NTSB |

## Location/Time

| Nearest City/Place | State | Zip Code | Local Time | Time Zone | |
|---|---|---|---|---|---|
| Olympia | WA | 98506 | 2324 | PDT | |

Airport Proximity: Off Airport/Airstrip

Distance From Landing Facility:

## Aircraft Information Summary

| Aircraft Manufacturer | Model/Series | Type of Aircraft |
|---|---|---|
| Agusta | A109E | Helicopter |

Revenue Sightseeing Flight: No

Air Medical Transport Flight: Medical Emergency

## Narrative

Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident:

HISTORY OF FLIGHT

On October 28, 2005, at 2324 Pacific daylight time, a twin-engine Agusta A109E helicopter, N950AL, sustained substantial damage after impacting an object and subsequently terrain during takeoff at the Providence St. Peter Hospital, Olympia, Washington. The helicopter was operated by CJ Systems Aviation Group of West Mifflin, Pennsylvania, under contract to Airlift Northwest of Seattle, Washington. The airline transport pilot, one flight nurse, and the patient were not injured. A second flight nurse sustained minor injuries. Visual meteorological conditions prevailed for the air ambulance flight, which was being operated in accordance with 14 CFR Part 135, and a company flight plan was filed. The flight was originating at the time of the accident, with its destination being the Harborview Medical Center, Seattle, Washington.

In telephone conversations with the NTSB investigator-in-charge (IIC), and according to the Pilot/Operator Aircraft Accident/Incident Report (NTSB form 6120.1), the pilot reported that following his preflight activities, and after both engines were online (started) and the avionics were on, "...I turned both engine controls to flight and verified that there were no caution lights, except the parking brake. I set the rotor rpm switch to 102% position and looked for the little yellow band at the top of the rotor rpm indicator. I said 'coming up' and pulled enough collective to bring the aircraft to a hover for just a second while I verified 102% RPM and caution lights out, then started pulling collective for takeoff power and added forward cyclic to start [the] climb-out. Just as I reached the point of no return I heard 'ROTOR LOW' in the headset and the aircraft began to settle. I started to look back inside at the instruments, but realized that the aircraft was settling fast and focused my attention back outside because there was a building in front of me. I reached for the Limit Override button with my thumb but could not find it. Then it was too late. I realized the aircraft was going to impact the building in front of me and there was nothing I could do to prevent it." The pilot stated that the next thing he remembered was the aircraft facing 180 degrees from the takeoff track and rolling over on its right side. The pilot reported that about 5 or 6 seconds after the aircraft had come to a stop he managed to reach the engine control knobs and shut down the engines. The pilot stated that after he confirmed that both flight nurses and the patient were all right, he shut off the electrical power and exited the helicopter. The pilot further stated that the wreckage was contained in a garden space between the main hospital building and an adjoining building. The pilot reported that the space was not more than 40 feet wide and the aircraft had impacted the side of the adjoining building and fallen to the ground beside it facing southwest. There was no post-crash fire. The pilot also reported that prior to the takeoff he had completed the companys' DO/VERIFY checklist procedure.

In a statement submitted to the IIC dated November 28, 2005, one of the two flight nurses on board the helicopter, who was seated in the forward aft facing seat, reported that as she and the other flight nurse were preparing the patient for the flight, the pilot was starting the helicopter's engines. "The helicopter sounded like it usually does during this process. [The pilot] asked if

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we were ready to depart and each of us responded in the affirmative. As we lifted from the helipad there was a distinct and dramatic reduction in the noise we usually hear, and we immediately seemed to lose our lift. We had moved forward on the helipad and I could see we were partially over the small wall that goes around the perimeter of the helipad. At this point it was clear that we were going to crash. I could see that we were not only losing lift, but we were actually losing what little altitude we had. There was violent shaking and violent noise for several seconds, and then we impacted the ground." The nurse reported that after the helicopter came to rest she assessed that the other nurse and the patient were okay, and that the pilot was talking and shutting the aircraft down.

In a statement submitted to the IIC, dated April 21, 2006, the second flight nurse, who was seated in the aft forward facing seat, stated that she was able to see the monitors and gauges in the front of the aircraft; she noted no anomalies. The nurse reported that the helicopter lifted off approximately 5 to 10 feet and prepared to move forward in a nose down attitude. The nurse stated, "At that point I heard a noise that sounded like powering down. I also heard the verbal warning stating 'rotor low, rotor low', as we began to fall. The aircraft's underside made contact with the side of the helipad structure as we were falling and the aircraft rotated prior to hitting the ground. After the impact we waited until the rotors had stopped turning. I have no recollection of the events that transpired until I was inside the emergency room."

The aircraft was recovered and transported to a secured storage facility for further examination by representatives of the NTSB, Federal Aviation Administration, Pratt and Whitney Canada, CJ Systems Aviation Group, Airlift Northwest, and Agusta Aerospace.

PERSONNEL INFORMATION

The pilot held an airline transport pilot certificate for helicopters, a BV-234 type rating, and commercial privileges for airplane single-engine land, airplane multiengine land, and instrument airplane. The pilot reported a total flight time in all aircraft of 8,014 hours and 6,911 hours total time as pilot-in-command. The pilot also reported 7,923 hours total time in all helicopters, 6,897 hours as pilot-in-command of helicopters, 15 hours total time in make and model, and 1625 hours in the Agusta A109AII helicopter. The pilot reported that he had flown 71 hours in the preceding 90 days, 20 hours in the last 30 days, and 1 hour in the last 24 hours. The pilot was issued a first class medical certificate on August 3, 2005, with a limitation for corrective lenses.

According to records supplied by CJ Systems, the pilot was hired by the company on April 17, 2000. The pilot successfully completed an Airman Competency/Proficiency Check on the Agusta A109AII aircraft on April 26, 2000. The pilot subsequently completed Agusta A109E differences training on July 7, 2005, followed by successfully completing the Agusta A109E Initial Flight Course on August 16, 2005, which consisted of 3.5 hours of flight training and an evaluation of maneuvers.

AIRCRAFT INFORMATION

The red and white helicopter, a 2004-model Agusta A109E aircraft, serial number 11628, was powered by two Pratt & Whitney Canada engines (serial numbers PCE BC 0500 and PCE BC 0501), each rated at 735 horsepower. The aircraft was equipped with a Full Authority Digital Engine Control (FADEC) system. According to the manufacturer the FADEC system ensures accurate control of the engine output speed and fast response changes in power demand. The helicopter was also equipped with a new ergonomic cockpit design, multifunctional liquid crystal display, a four-bladed fully articulated main rotor system, and a retractable landing gear.

According to the manufacturer, the helicopter's FADEC system incorporates all control units and accessories for complete automatic and manual control of the engine. It is comprised of three main components, the Fuel Management Module (FMM), the Electronic Engine Control unit (EEC) and the Permanent Magnet Alternator (PMA).

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The FMM is an electro-mechanical unit driven by the accessory gear box, which governs the fuel flow through the entire operational envelope of the engine. It can operate in the automatic mode (fuel flow controlled by the EEC) or in the manual mode mechanical back-up, (fuel flow controlled by the power lever angle of the FMM through the Engine Control Levers in the cockpit overhead panel and/or through the Engine Control Trim Switches on the collective stick). The FMM installed on the accessory gear box incorporates an electrical interface with the EEC, and through the EEC with the Integrated Display System (IDS).

The PMS is an engine driven power unit which provides electrical power to both the EEC and the FMM during normal engine operations. The backup power to the FMM and the EEC is provided by the aircraft's electrical system.

The EEC is a single channel digital electronic control unit, which, in conjunction with the FMM and a network of sensing devices, provides control of the engine over the complete operating range, achieved by modulating the fuel flow for each particular operating condition. The EEC controls the engine gas generator and power turbine speeds in response to the load demanded by the rotorcraft's rotor system. The EEC also controls fuel flow from engine start to full power within the established limits, and also controls the engine for normal flight, with selection provided through the two console mounted three (3) positioned Power Management Switches (PMS). The three modes are: OFF - fuel shutoff by the shutoff solenoid; IDLE - control governs the power turbine (Npt) at a speed of approximately 65 percent Npt; and FLT - control provides power turbine/main rotor speed governing at the nominal governing speed (100 percent or 102 percent). An ENGINE OUT warning is automatically displayed on the #1 Electronic Display Unit together with an Aural Warning and the Master Warning Light anytime an engine out condition exists (N1<50%). The ENGINE OUT warning is suppressed if the related PMS is set to the OFF position.

A one engine inoperative (OEI) advisory mode is also automatically presented on the #1 Electronic Display Unit when an ENGINE OUT condition exists or when one of the two ENG MODE switches is set to OFF. The OEI advisory mode is also presented when one PMS is set to IDLE (the other PMS is set to FLT) but only when the aircraft becomes airborne (weight on wheels inactive). In the OEI advisory mode and OEI legend is vertically displayed adjacent to N1, TOT and Torque scales, and the operative ranges are rearranged with the OEI limits. The IDLE legend is also vertically displayed adjacent to N2 and the N2 pointer turns red when the PMS is selected to IDLE. The OEI advisory mode is not presented on either the Master Warning light or Master Caution light warning system unless a real ENGINE OUT condition exists (N1<50%).

A Limit Override switch, located on the collective, is available for emergency situations to allow the EEC to operate the engine above pre-determined limits. The system is also equipped with a one-engine inoperative (OEI TNG) toggle switch, which simulates OEI that is governed at approximately 90 percent Npt. In this case an OEI TNG legend is vertically displayed adjacent to N1, TOT and Torque scales on the #1 Electronic Display Unit.

When the control system is in normal AUTO mode the EEC controls the engine fuel flow and consequently the engine Ng speed for all operating conditions of the powerplant. In the back-up (MANUAL) mode, the fuel flow can only be changed by moving the Engine Power Levers and/or activating the Engine Control Trim Switches to set an engine power condition.

The helicopter's Integrated Display System (IDS) is composed of two identical Electronic Display Units (EDUs) and a dual redundant Data Acquisition Unit (DAU). The IDS displays Primary and Secondary aircraft data, as well as Warning, Caution and Advisory messages. In the normal operating mode the #1 EDU displays Primary parameters (RPMs, TOT, Torque), and the #2 EDU displays Secondary parameters (temperatures, pressures, electrical quantities, etc.). Various display modes are possible, depending on the aircraft's status (i.e. in flight or on ground) and the System status (i.e. both EDUs operating or one EDU operating).

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The DAU and both EDUs receive primary engine parameters from both EECs, as well as additional parameters such as discretes, status and fault words from both EECs. The DAU also repeats EEC data to the EDUs, such as N1, TOT, Torques and NR/N2.

According to CJ Systems maintenance personnel the helicopter was maintained in accordance with the approved Extended Inspection Program, which was started in August, 2005. At the time of the accident the airframe and engines had accumulated a total of 189.6 hours since new. Aircraft logbooks reveal that the most recent inspection was conducted on October 28, 2005, at a total time of 186.4 hours.

PERFORMANCE

According to the Agusta A109E Rotorcraft Flight Manual, the following performance data was derived for Hovering Ceiling In and Out of Ground Effect with one engine inoperative: 1) HOVERING CEILING IN GROUND EFFECT ONE ENGINE INOPERATIVE - 6,500 pounds; 2) HOVERING OUT OF GROUND EFFECT ONE ENGINE INOPERATINVE - 5,600 pounds. At the time of takeoff the pilot reported the weight of the helicopter was 6,403 pounds.

AERDOME INFORMATION

The hospital's helipad is located on the second story rooftop directly over the emergency room department. The 3-foot thick concrete helipad measures 41 feet by 41 feet, and is identified by a medical symbol painted in red with elevated amber lights bordering its perimeter. The second story roof is bordered on the east, west, and south sides by an elevated concrete barrier measuring 2 feet 8 inches high by 18 inches wide. The distance from the barrier to the east side of the helipad is 11 feet 3 inches, 10 feet 6 inches to its south side, and 107 feet 3 inches to the helipad's west border. Access to the elevated helipad is provided by a 59 foot long by 8 foot wide concrete walkway, which extends from the building's second story south entry/exit door to the north side of the helipad. Each side of the walkway is bordered by elevated blue lighting. The helipad is also equipped with a lighted windsock.

METEOROLOGICAL INFORMATION

At 2254, approximately 30 minutes prior to the accident, the Automated Surface Observing System (ASOS) at the Olympia Airport (OLM), Olympia, Washington, located about 6 nautical miles south-southwest of the accident site, reported wind 240 degrees at 3 knots, 9 statute miles of visibility, light rain, broken clouds at 1,000 feet, overcast at 3,500 feet, temperature 9 degrees Centigrade, dew point 8 degrees Centigrade, and an altimeter setting of 30.02 inches of Mercury, with the ceilings reported to be variable between 800 feet and 1,400 feet.

At 2354, about 30 minutes after the accident occurred, the OLM ASOS reported wind 230 degrees at 3 knots, visibility 10 statute miles, overcast clouds at 800 feet, temperature 9 degrees Centigrade, dew point 8 degrees Centigrade, and an altimeter setting of 30.04 inches of Mercury. It was also reported that the rain had ended at 34 minutes past the hour, and ceilings were variable between 700 feet and 1200 feet.

WRECKAGE AND IMPACT INFORMATION

The helicopter departed from the hospital's second story helipad located at coordinates 47 degrees 03.40 minutes north latitude and 122 degrees 50.60 minutes west longitude, at an elevation of 317 feet msl. An initial impact signature was evidenced by red and yellow paint transfer observed on the inside portion of the building's 2 foot 8 inch protective concrete barrier, approximately 36 feet from the helicopter's departure point and in line with its departure path. Several pieces of the helicopter's tail rotor blades were located in close proximity to the initial impact area.

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(The helicopter's tail rotor blades are painted red and yellow.) Subsequent to the initial impact the helicopter descended across an open atrium area of approximately 65 feet before striking the west side of the adjacent powerplant building. Numerous slash marks on the side of the powerplant building were observed. The helicopter then spun around approximately 180 degrees before coming to rest on its right side in the dirt-filled courtyard, at coordinates 47 degrees 03.120 minutes north latitude and 122 degrees 50.833 minutes west longitude at an elevation of 225 feet msl. There was no post crash fire. A Federal Aviation Administration (FAA) aviation safety inspector, who traveled to the accident site, reported that both Power Management Switches were observed to be in the OFF position.

An examination of the wreckage by the IIC revealed that the main body of the helicopter was sitting upright and tilted approximately 45 degrees to its right side, having come to rest on a magnetic heading of 135 degrees. Further examination revealed that both engines were intact, the transmission was tilted forward, and all four main rotor blades were destroyed. The helicopter's cockpit and cabin areas were intact, with the exception of the forward windscreens, which were broken out in various places. Two pieces of the helicopter's nose cowling section were located 12 feet and 20 feet to the left of the aircraft. The rear engine cowling (doghouse) was located approximately 33 feet forward and about 45 degrees to the left of the main wreckage. All three landing gear remained attached to the aircraft. The nose landing gear was bent aft, the right main landing gear was bent up and aft, and the left main landing gear was observed in the extended down and locked position. An 8-foot section of one main rotor blade was located 22 feet 6 inches directly to the right of the aircraft, while another section of a main rotor blade was found 7 feet 6 inches aft of the first piece of main rotor blade debris. Three additional pieces of the main rotor blades, totaling 28 feet 6 inches in length were located aft of the right side of the helicopter, approximately 30 feet from the main wreckage. The aircraft's tail section, including the tail rotor assembly and tailskid were located approximately 13 feet aft and to the right of the helicopter. The #1 engine exhaust forward cowling and upper aft cowling were located about 15 feet forward and slightly to the right of the main wreckage.

On November 16, 2005, under the supervision of the IIC, a further examination of the helicopter wreckage was conducted by representatives of the FAA, Airlift Northwest, Agusta, and Pratt & Whitney Canada, at the facilities of ACE Aviation, located at the Renton Municipal Airport, Renton, Washington. A flight control continuity examination revealed that all three controls to the three servo actuators were broken, the controls to the mixing unit were intact, and that the tail rotor control tube was intact to the point where the aft tail was severed. The entire left fixed horizontal stabilizer, 48 inches in length, remained attached to the aircraft. The inboard 18 inches of the right fixed horizontal stabilizer remained attached, and the outboard 30 inches was separated. The inboard 33 inches of each tail rotor blade remained attached to the tail rotor assembly; the outboard sections of the tail rotor blades were destroyed.

PATHEOLOGICAL INFORMATION

On October 29, 2005, the pilot was administered a toxicological test by Pacific Toxicology Laboratories, near Chatsworth, California. The test was negative for all screened substances.

TEST AND RESEARCH

On November 7, 2005, under the supervision of the NTSB IIC, the helicopter's Honeywell Mark XXII Enhanced Ground Proximity Warning System (EGPWS) was inspected and downloaded at Honeywell's facility near Redmond, Washington. Data downloaded on the WARN.XLS file revealed that the #2 engine was producing no torque during the initial phase of the takeoff, and only minimal torque during the impact sequence. Data revealed that the #1 engine was producing continuous recorded torque values from the beginning of the takeoff of 41 inch pounds to a maximum of 145 inch pounds, and a final reading of 98 inch pounds prior to engine stoppage. On December 19, 2005, under the supervision of the NTSB IIC, an Acceptance Test Procedure (ATP) was performed on the unit. All

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tests were passed. (Refer to ATTACHMENT 1, "Honeywell Inspection and Download Report and Honeywell Acceptance Test Report" for a detailed description of the download and test results.)

On November 8, 2005, under the supervision of the NTSB IIC and a Federal Aviation Administration Avionics Aviation Safety Inspector, an examination and testing of the helicopter's electrical and powerplant system interface was conducted at the facilities of Ace Aviation, Renton, Washington. Six separate tests were conducted, the description and results of each outlined as follows:

TEST 1 - Verify that the torque input from the #1 ECU is correctly connected to the #1 Engine Torque input of the EGPWS computer
RESULTS - the wiring was verified to have proper continuity from the #1 ECU to the #1 Engine Torque Input to the EGPWS computer and to have proper isolation from ground.

TEST 2 - Verify proper operation of the #2 Engine PMS circuit to the #2 ECU
RESULTS - No problems were noted.

TEST 3 - Verify proper operation of the #1 Engine PMS circuit to the #1 ECU
RESULTS - No problems were noted.

TEST 4 - Inspect the maintenance pages of the IDS and look for faults
RESULTS - No faults were noted.

TEST 5 - Electrical Powerplant System Interface functional test
RESULTS - The aircraft systems were found to function as requested by the Technical note specified, with the exception of three deviations as noted in the Agusta report attached.

TEST 6 - Effects on Integrated Display System in case of connector P8615 unseating
RESULTS - This test was specifically requested by Airlift Northwest personnel to verify the effects on the IDS and a/c electrical systems in case of connector P8615 becoming unseated. The connector P8615 was loosen[ed] approximately to the position it was found [in] following the accident. The a/c was taken to the condition requested per Technical Note AAC-PSE-03-0912A, Rev. A, para 7.1.2.b with no anomalies observed. The P8615 connector wiring was then wiggled and the following effects were observed in the cockpit:
1) EDU #1 and EDU #2 flickering and master caution light flashing
2) On EDU #1 engines parameters partially lost, BUS TIE caution displayed in addition to the other cautions and warnings
3) EDU #2 in reversionary mode
4) GEN BUS #2 tripped

(Refer to ATTACHMENT 2, Agusta aerospace corporation "Electrical and Powerplant System Interface testing" for a detailed explanation of each test and procedure.)

Prior to the commencement of testing it was noted that connector P8615, located in the avionics bay on the forward top left hand side of the baggage compartment was observed to be not completely seated; a red seal ring was visible, which is indicative of an unseated condition. Also prior to testing, it was brought to the attention of the IIC by a CJ Systems mechanic, who was assisting the technicians in the examination, that he had observed an Agusta field representative physically move the connector's cannon plug from its original unseated position. In a statement provided to the IIC the Agusta field representative stated, "I wanted to determine that it was actually loose. I got into the baggage compartment and loosened it counterclockwise 2 clicks. Then tightened it clockwise the same 2 clicks. Nothing was changed. The evidence was not compromised."

On November 21, 2005, under the supervision of the IIC, two Electronic Display Units (EDUs) and one Data Acquisition Unit (DAU) were examined and functionally tested at the facilities of AMETEK, near Mukilteo, Washington. Electronic Display Unit #1, serial number 04031117, and Electronic Display

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Unit #2, serial number 04051130, were subjected to full ATP tests. There were no failures noted on any of the actual display functions. Data Acquisition Unit, serial number 04070425ABC, was placed on a test stand and the ATP test was run. When the ATP was run the DAU reported the last values from the aircraft, instead of the values that the ATP expected, which resulted in the unit to fail the Back-Up Torque Test. This is not considered a Unit Failure. (Refer to ATTACHMENT 3, AMETEK Aerospace test report.)

On January 4 & 5, 2006, under the supervision of the IIC, an examination of both of the helicopter's engines was conducted at the facilities of Pratt & Whitney Canada, Montreal, Canada. An examination of the #1 engine revealed no external damage. The power turbine could not be rotated as a result of the blade shrouds being seized in their honeycomb shroud. This was most likely caused by the impact sequence. The compressor and gearbox sections of the engine were free turning with no evidence of any damage. An examination of the #2 engine revealed no internal or external damage, which enabled an engine run test to be conducted. The tests results indicated that the engine was capable of producing power and no anomalies were noted.

On February 7, 2006, under the supervision of a Federal Aviation Administration inspector, two Electronic Engine Control (EEC) units, #1 EEC, serial number 04082861 and #2 EEC, serial number 04082857, were examined and tested at the facilities of Hamilton Sundstrand, near Windsor Locks, Connecticut. The units passed all tests with no anomalies noted. (Refer to ATTACHMENT 4, Hamilton Sundstrand test report.)

The fractured engine-to-transmission flexible couplings from the #1 and #2 engines were sent to the NTSB Materials Laboratory in Washington, D.C. for examination. The locations and patterns of the fractures of the two couplings were very similar. Both couplings separated as a result of fractures through the forward diaphragms at both the aft (engine) flexible fitting and forward (transmission) flexible fitting. Although there was a substantial amount of rotational smearing and/or impact damage on all of the fracture surfaces, there were areas of each fracture that retained evidence of the original separation. In all cases, the original fracture surface has a textured matte finish consistent with overstress separation. (Refer to ATTACHMENT 5, NTSB Report No. 06-085 for a detailed description of the examination.)

ADDITIONAL INFORMATION

PILOT TRAINING AND STANDARDIZATION

In a statement submitted to the IIC dated December 11, 2005, outlining his transition training experience into the Agusta A109E helicopter, the pilot reported that the ground school training was conducted at Agusta's training facility in Philadelphia, Pennsylvania, during August, 2005, by an engineer. The pilot stated, "The course was taught from the perspective of an engineer and I felt like a lot of the operational issues of the aircraft were not covered or were covered poorly." The pilot reported that one of the issues that came up during the course was the fact that there had been two accidents in the A109E where pilots had left the engine mode switch or switches (PMS switches) at idle and tried to take off. The pilot stated that they [Agusta] pointed out that there were no caution lights or warning systems in place to warn of an engine at "idle power" prior to takeoff. The pilot revealed that when he asked the instructor, "...since there have been two accidents of this nature, what has Agusta done or what is Agusta doing to modify the aircraft to provide some warning system to prevent this from happening again, his [the instructor's] answer was '...there was no modification necessary, since this was just pilot error.' " The pilot also stated that the helicopter's LIMIT OVERRIDE switch was talked about during ground school, but he had to correct the instructor about some of the information the instructor was conveying, which was in conflict with the Rotorcraft Flight Manual. The pilot further stated that while the LIMIT OVERRIDE switch was talked about during flight training, it was never demonstrated.

The pilot reported that the PMS switch issue also came up during his pilot training in the Agusta

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A109E relative to checklist procedures for engine start. The pilot stated it was pointed out that the Agusta training manual recommends starting both engines to [the] idle [position], then taking both to [the] flight [position] together. "I understood that to mean that this was a modified procedure to help prevent leaving one engine at idle. This was reinforced to me during my flight training a couple of weeks later when I specifically asked my flight instructor about this procedure and he indicated that the method of taking both [start] mode switches to flight together was the preferred method. For that reason I adopted that procedure to help prevent the possibility of leaving a throttle at idle." The pilot further stated in a follow-up telephone conversation with the IIC that after having been checked out and flying the line, that he almost felt paranoid at times with the positioning of the power management switches, given the previous accidents which were attributed to this issue.

The Agusta A109E Rotorcraft Flight Manual outlines the engine start sequence as follows:

ENGINE 1 START

Eng 1 Mode Switch : IDLE
Gas Producer (N1) : Note increasing and START legend vertically displayed
Engine temperature (TOT) : Note increasing and IGN legend vertically displayed
•••••••
Engine oil pressure : Check
Engine No.1 starter : Automatically deactivated when N1 is 50% START and IGN legends automatically suppressed
Main hydraulic system : When the main rotor begins to rotate, check rise in main hydraulic pressure
Hydraulic utility system : When accumulators are discharged, as main rotor begins to rotate, check pressure rise in both systems and note the activation of MAIN UTIL CHRG and EMER UTIL CHRG caution minimums. Note both caution messages are suppressed when systems are charged.
#1 engine power turbine speed (N2) : Check stabilized to IDLE speed of 65:+/-1%
Engine and transmission oil : Check pressure and temperature
ENG 1 MODE SWITCH : FLT
NOTE : In the starting phase it is suggested to select FLIGHT mode as soon as possible in order to speed up the engine oil heating
ENGINE 2 START : Repeat above procedure to start engine No. 2

The Agusta A109E General Familiarization Training Manual (TM A109E - GF) addresses the engine starting sequence as follows:

STARTING TO IDLE

Any one of the engines can be started to idle by moving the respective engine switch from OFF to IDLE. If the engine switch was in any other position than OFF, the start sequence is inhibited until the switch is moved to OFF and thereafter to IDLE. Once Npt Idle speed governing is achieved at 65% (min W.F. permitting), the other engine switch is selected to IDLE such that both engines share the rotor load at idle speed. Engine starter and ignition relays are under EEC control during starting and are switched out when gas generator speed, Ng reaches 50%. Torque or TOT matching between the two engines is active in idle. Npt governing. Engine starting abort can be

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accompanied by setting the PL to OFF.

The CJ Systems A109E EMS Checklist, Rev 0 02/26/01, outlines the engine start sequence, beginning with item #33 and concluding with item #38:

| | | | |
|---|---|---|---|
| Item #33 | : | FIRST ENG MODE SW | IDLE |
| Item #34 | : | ENG & TRSM --- PRESS & TEMPS | CHECKED |
| Item #35 | : | ENG MODE SWITCH | FLIGHT |
| Item #36 | : | SECOND ENG MODE SW | IDLE |
| Item #37 | : | ENG PRESS & TEMP | CHECKED |
| Item #38 | : | ENG MODE SWITCH | FLIGHT |

The wreckage was released to the owner's representative.

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NTSB ID: SEA06FA015

Occurrence Date: 10/28/2005

Occurrence Type: Accident

## Landing Facility/Approach Information

| Airport Name | Airport ID: | Airport Elevation | Runway Used | Runway Length | Runway Width |
|---|---|---|---|---|---|
| | | Ft. MSL | NA | | |

Runway Surface Type:

Runway Surface Condition:

Approach/Arrival Flown: NONE

VFR Approach/Landing: None

## Aircraft Information

| Aircraft Manufacturer | Model/Series | Serial Number |
|---|---|---|
| Agusta | A109E | 11628 |

Airworthiness Certificate(s): Normal

Landing Gear Type: Retractable - Tricycle

| Amateur Built Acft? | Number of Seats: | Certified Max Gross Wt. | Number of Engines: |
|---|---|---|---|
| No | 8 | 6613 LBS | 2 |

| Engine Type: | Engine Manufacturer: | Model/Series: | Rated Power: |
|---|---|---|---|
| Turbo Shaft | Pratt & Whitney Canada | PW 206C | 735 HP |

- Aircraft Inspection Information

| Type of Last Inspection | Date of Last Inspection | Time Since Last Inspection | Airframe Total Time |
|---|---|---|---|
| AAIP | 10/2005 | 3.2 Hours | 189.6 Hours |

- Emergency Locator Transmitter (ELT) Information

| ELT Installed?/Type | ELT Operated? | ELT Aided in Locating Accident Site? |
|---|---|---|
| Yes / | No | No |

## Owner/Operator Information

| Registered Aircraft Owner | Street Address | City | State | Zip Code |
|---|---|---|---|---|
| Airlift Northwest | | Seattle | WA | 98108 |

| Operator of Aircraft | Street Address | City | State | Zip Code |
|---|---|---|---|---|
| Airlift Northwest | | Seattle | WA | 98108 |

Operator Does Business As:

Operator Designator Code:

- Type of U.S. Certificate(s) Held: None

Air Carrier Operating Certificate(s):

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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Occurrence Date: 10/28/2005

Occurrence Type: Accident

## First Pilot Information

| Name | City | State | Date of Birth | Age |
|---|---|---|---|---|
| On File | On File | On File | On File | 57 |

Sex: M | Seat Occupied: Right | Occupational Pilot? | Certificate Number: On File

Certificate(s): Airline Transport

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

Rotorcraft/Glider/LTA: Helicopter

Instrument Rating(s): Airplane; Helicopter

Instructor Rating(s): None

Current Biennial Flight Review? 04/2005

Medical Cert.: Class 1 | Medical Cert. Status: Without Waivers/Limitations | Date of Last Medical Exam: 08/2005

| - Flight Time Matrix | All A/C | This Make and Model | Airplane Single Engine | Airplane Mult-Engine | Night | Instrument Actual | Instrument Simulated | Rotorcraft | Glider | Lighter Than Air |
|---|---|---|---|---|---|---|---|---|---|---|
| Total Time | 8014 | 15 | 76 | 14 | 1534 | 105 | 247 | 7923 | | |
| Pilot In Command(PIC) | 6912 | 15 | 14 | 1 | 1315 | 105 | 247 | 6897 | | |
| Instructor | | | | | | | | | | |
| Instruction Received | | | | | | | | | | |
| Last 90 Days | 71 | 15 | | | 21 | 3 | | 71 | | |
| Last 30 Days | 20 | 10 | | | 9 | 2 | | 20 | | |
| Last 24 Hours | 1 | 1 | | | | 1 | | 1 | | |

Seatbelt Used? Yes | Shoulder Harness Used? Yes | Toxicology Performed? Yes | Second Pilot? No

## Flight Plan/Itinerary

Type of Flight Plan Filed: Company VFR

| Departure Point | State | Airport Identifier | Departure Time | Time Zone |
|---|---|---|---|---|
| Same as Accident/Incident Location | | | 1124 | PDT |

| Destination | State | Airport Identifier |
|---|---|---|
| Seattle | WA | |

Type of Clearance: VFR Flight Following

Type of Airspace:

## Weather Information

Source of Wx Information:

National Weather Service

**National Transportation Safety Board**

# FACTUAL REPORT AVIATION

NTSB ID: SEA06FA015

Occurrence Date: 10/28/2005

Occurrence Type: Accident

## Weather Information

| WOF ID | Observation Time | Time Zone | WOF Elevation | WOF Distance From Accident Site | Direction From Accident Site |
|---|---|---|---|---|---|
| OLM | 2347 | | 206 Ft. MSL | 6 NM | 135 Deg. Mag. |

Sky/Lowest Cloud Condition: Thin Broken 794 Ft. AGL

Condition of Light: Night/Dark

Lowest Ceiling: Broken 794 Ft. AGL

Visibility: 9 SM

Altimeter: 30.02 "Hg

Temperature: 9 °C

Dew Point: 8 °C

Weather Conditions at Accident Site: Visual Conditions

Wind Direction: 240

Wind Speed: 4

Wind Gusts:

Visibility (RVR): Ft.

Visibility (RVV) SM

Precip and/or Obscuration:

Light - No Obscuration

## Accident Information

Aircraft Damage: Substantial

Aircraft Fire: None

Aircraft Explosion None

| - 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 | | | 1 | 1 | 2 |
| Passengers | | | | 1 | 1 |
| - TOTAL ABOARD - | | | 1 | 3 | 4 |
| Other Ground | | | | | |
| - GRAND TOTAL - | | | 1 | 3 | 4 |

National Transportation Safety Board

**FACTUAL REPORT**
**AVIATION**

NTSB ID: SEA06FA015

Occurrence Date: 10/28/2005

Occurrence Type: Accident

## Administrative Information

Investigator-In-Charge (IIC)

Thomas M. Little

Additional Persons Participating in This Accident/Incident Investigation:

Billie Jolly
Federal Aviation Administration
Renton, WA

Steve Lodwig
CJ Systems Aviation Group
West Mifflin, PA

Alessandro Crespi
Agusta aerospace corporation
Philadelphia, PA

Marc Gratton
Pratt & Whitney Canada
Quebec, Canada,

Noel Patterson
Honeywell
Redmond, WA