National Transportation Safety Board
Aviation Accident Final Report

Location:	Smethport, Pennsylvania	**Accident Number:**	NYC06MA005
Date & Time:	October 7, 2005, 23:42 Local	**Registration:**	N7YL
Aircraft:	Augusta 109E	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Positioning		

Analysis

The single-pilot helicopter was flying under instrument flight rules in night instrument meteorological conditions. The controller instructed the pilot to fly heading 340 degrees to intercept the localizer course for an instrument landing system approach. At that time, the helicopter was about 1.5 miles from the localizer centerline, headed 095 degrees, about 150 knots groundspeed. Consequently, the helicopter flew through and ended up well east of the 322-degree localizer course. During the resulting 135-degree turn to rejoin the final approach course, the pilot was issued an approach clearance, but told to "maintain 4,000." The helicopter's track approached the runway centerline, and then turned sharply away from, and to the right of the inbound course. The track showed an approximate heading of 100 degrees, when the radar target disappeared. During the 1 minute and 10 seconds following the pilot's acknowledgement of the 4,000-foot altitude assignment, the helicopter descended only 300 feet, slowed to approximately 65 knots groundspeed, and turned 140 degrees right of course. At the point where the helicopter re-intercepted the localizer, the autopilot was capable of capturing the localizer, but incapable of capturing the glideslope. If altitude hold remained engaged at that point of the flight, and the pilot reduced collective to initiate a descent, the autopilot would adjust pitch in an effort to maintain the selected altitude. Similar scenarios in helicopters and flight simulators have resulted in unusual attitudes and zero airspeed descents to the ground. The pilot had accrued 9,616 total hours of flight experience. He had 100 total hours of instrument flight experience; of which 10 hours was simulated instrument flight experience. Examination of the wreckage revealed no mechanical anomalies. Examination of voice communication tapes revealed that the controller used non-standard approach clearance procedures, did not comply with requirements for weather dissemination, and did not comply with the appropriate intercept angle of 45 degrees for helicopters as prescribed in Federal Aviation Administration orders.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's failure to maintain aircraft control. Factors in the accident were, night instrument meteorological conditions, pilot workload, and improper air traffic control procedures by the approach controller.

Findings

Occurrence #1: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: APPROACH - IAF TO FAF/OUTER MARKER (IFR)

Findings
1. WEATHER CONDITION - CLOUDS
2. (C) AIRCRAFT CONTROL - NOT MAINTAINED - PILOT IN COMMAND
3. (C) SPATIAL DISORIENTATION - PILOT IN COMMAND
4. LIGHT CONDITION - DARK NIGHT
5. (C) COMMUNICATIONS/INFORMATION/ATC - IMPROPER - ATC PERSONNEL(ARTCC)
6. EXCESSIVE WORKLOAD (TASK OVERLOAD) - PILOT IN COMMAND

Occurrence #2: IN FLIGHT COLLISION WITH OBJECT
Phase of Operation: APPROACH - IAF TO FAF/OUTER MARKER (IFR)

Findings
7. OBJECT - TREE(S)

Factual Information

HISTORY OF FLIGHT

On October 7, 2005, at 2342 eastern daylight time, an Agusta 109E, N7YL, operated by CJ Systems Aviation Group Inc., was destroyed when it impacted trees and terrain in Smethport, Pennsylvania, while performing an instrument approach to Bradford Regional Airport (BFD), Bradford, Pennsylvania. The certificated commercial pilot was fatally injured. Night instrument meteorological conditions (IMC) prevailed, and an instrument flight rules (IFR) flight plan was filed for the flight that originated from Kane Community Hospital (PA91), Kane, Pennsylvania, at 2324. The positioning flight was conducted under 14 CFR Part 91.

In an interview, a mission flight nurse stated that he and another nurse were onboard the helicopter during a positioning flight from their base in Harborcreek, Pennsylvania, to Kane Community Hospital. Upon arrival at the hospital, he and the other nurse deplaned to prepare a patient for transport to Pittsburgh, Pennsylvania, while the helicopter departed for Bradford Airport to refuel.

Examination of radar and voice communication data provided by the Federal Aviation Administration (FAA) revealed that the helicopter departed Kane Hospital helipad and tracked the Copter GPS 246 Departure procedure course. The pilot contacted air traffic control (ATC), at 2324:47, stated that he had departed the hospital, and was "VFR to uh Bradford three thousand two hundred climbing to five."

Over the next 4 minutes, the pilot requested the instrument landing system (ILS) runway 32 approach to Bradford Regional Airport, and he and the controller discussed whether the helicopter would be vectored to the final approach course or if the full approach procedure would be flown.

The controller stated, "say your heading I've got you heading the wrong way for Bradford." The pilot replied that he was heading 246 degrees, which was prescribed in the procedure, but the controller questioned the response. The pilot reaffirmed his intention to fly to Bradford, and the controller assigned a 040-degree heading.

The pilot acknowledged the instructions; the helicopter then reversed direction, and assumed a northeasterly track. About 3 minutes later, the controller stated, "fly heading of zero eight five radar vectors runway three two I-L-S."

The pilot acknowledged the radio call, and the helicopter assumed an easterly track.

At 2339:01, the controller stated, "seven yankee lima fly heading of three four zero join the localizer report established please." At that time, the helicopter was at 5,000 feet, on an easterly track, about 1 mile west of the runway extended centerline, about 150 knots groundspeed. The pilot acknowledged the instructions.

The radar track depicted the helicopter on an easterly heading as it flew through the 322-

degree final approach course, about 4 miles outside of the outer marker.

At 2340:03, the controller advised the pilot that the helicopter was "on the right side of the I-L-S," and the pilot acknowledged the call. At 2341:09, the controller asked if the pilot was established on the ILS. The pilot responded that he was "recapturing." The controller then asked if the pilot had said "affirmative," and the pilot replied "affirmative." At 0341:19, the controller transmitted, "Lifeguard seven yankee lima roger cleared I-L-S three two uh runway at Bradford uh maintain four thousand feet and uh report cancellation on this frequency..." The pilot read back the clearance at 0341:33. There were no further transmissions from the helicopter.

When the pilot replied "recapturing" the controller insisted the pilot respond "affirmative," which the pilot subsequently did.

At the time the controller advised that the helicopter was right of the localizer course, the radar track depicted the helicopter about midway through a left turn to about a 310-degree heading, at 5,000 feet, and about 1 mile east of the runway centerline.

The helicopter's track approached the localizer course centerline, and then turned sharply away from, and to the right of the inbound course. The radar target showed an approximate track of 100 degrees, when the target disappeared. During the 1 minute and 10 seconds following the pilot's acknowledgement of the 4,000-foot altitude assignment, the helicopter descended only 300 feet, slowed to approximately 65 knots groundspeed, and turned 140 degrees right of course.

The final three plots of the radar track showed a sharp left turn back towards the localizer course, and an approximate ground speed of 55 knots. The last radar plot was approximately over the crash site at 4,300 feet, about 1 mile east of the extended runway centerline, and 4 miles from the airport.

In an interview, a witness that lived approximately 1 mile from the crash site said that he did not see the helicopter, but heard it pass overhead. He said he was familiar with the sound, as he had lived close to the final approach course for runway 32 for many years.

The witness said the sound was louder than usual, and he felt the helicopter was closer to his home and lower than usual. The witness described the sound as smooth and continuous, with no change in aircraft noise. After the helicopter over flew his position, he heard the sound of an explosion.

On October 8, 2005, the FAA generated an alert notice at 0101, and a ground search for the helicopter began in the early morning hours of October 8, 2005. A search by air was not conducted due to weather. The helicopter wreckage was found on October 9, 2005, and was examined at the site on October 10, 2005.

The accident occurred during the hours of darkness approximately 40 degrees, 53 minutes north latitude, and 78 degrees, 06 minutes west longitude.

PERSONNEL INFORMATION

The pilot held a commercial pilot certificate with ratings for rotorcraft helicopter and instrument helicopter. The commercial certificate was issued February 10, 1979, and the instrument rating was added June 18, 1997. His most recent FAA second-class medical certificate was issued on October 19, 2004, and he reported 9,616 total hours of flight experience on that date.

The pilot's logbook was not recovered; however, some flight times were extracted from company records. In the 90 days prior to the accident, the pilot logged 56 hours, all of which was in the Augusta 109E. In this time period, he logged 25 hours of flight experience at night, 3 hours of simulated instrument experience, and 3 hours of actual instrument flight experience.

The company reported that the pilot had 110 total hours of instrument flight experience, and estimated that of this 70 hours were simulated instrument flight experience, and 40 hours were actual instrument flight experience. Later, the company reported that the pilot had accrued 100 hours of instrument flying experience, 10 hours of which was simulated.

AIRCRAFT INFORMATION

The helicopter was manufactured in 2001, and had accrued 1,905 total airframe hours. It was maintained under an Approved Aircraft Inspection Program (AAIP), and its most recent inspection was completed August 5, 2005.

The helicopter was equipped with an Integrated Flight Control System (IFCS). The system provided attitude automatic stabilization and automatic path control. Both stabilization and automatic path computation were actuated through the helipilot (autopilot) system and the flight director system.

A review of maintenance records revealed numerous entries related to autopilot malfunctions and failures. The malfunctions included erratic command bars on pilot and copilot displays, and uncommanded pitch and roll oscillations that occurred during preflight checks and also in flight. Over a 2-year span, 10 autopilot computers were changed on the accident helicopter due to their exposure to "high vibration levels."

A service bulletin (109EP-51) was released February 9, 2005, to address the vibration issues with the installation of shock-isolating mounts on the mounting trays for the autopilot computers. According to the site mechanic where the helicopter was based, he didn't recall having to change any computers once the service bulletin was applied.

METEOROLOGICAL INFORMATION

At 2337, the weather reported at Bradford Regional Airport included an overcast ceiling at 600 feet, with 2 1/2 miles of visibility in mist. The temperature was 50 degrees Fahrenheit, and the dew point was 48 degrees Fahrenheit.

WRECKAGE AND IMPACT INFORMATION

The helicopter impacted heavily wooded terrain about 2,000 feet elevation and all major components were accounted for at the scene. The initial impact point was in a treetop about 50 feet above the ground on level terrain. The wreckage path was about 180 feet long, and oriented about 100 degrees. The helicopter was fragmented, burned, and melted along the entire path. There were several pieces of angularly cut wood along the wreckage path, and several trees with fire damage and long angular slices along their trunks.

The wreckage path was documented at 1-foot increments called wreckage points (WP). At WP 33, a large tree, about 15 inches in diameter, was broken off about 25 feet above the ground. Sheets of composite material were embedded vertically into the trunk fracture.

The vertical fin was at WP 41. The tailboom was abeam the vertical fin, about 30 feet right of the wreckage path centerline. Structure that contained the number 1 hanger bearing was also at WP 41, 25 feet left of centerline. Both the left and the right antenna from the accident helicopter were destroyed by impact and postcrash fire.

The main wreckage, which consisted mostly of the main transmission with the mast and rotor head attached, was entangled at the base of three trees at WP 66. The cockpit and cabin area were consumed by fire, and all the flight and system instruments had been destroyed.

Because of impact and fire damage, control continuity could not be established. All flight controls, tubes, and bellcranks that were examined displayed impact damage and failures consistent with overload.

All four rotor blades were located at the site. They were extensively damaged by impact and fire. The red, white, and yellow blade grips were still attached to the rotor head. The blue blade grip, with damper attached, was located about 12 feet to the right of the transmission and rotor head.

All four main rotor blade spars were exposed, with the associated composite and honeycomb material scattered along the wreckage path.

Examination of the rotor head revealed that the red and white pitch change links were still attached to their hubs and the swashplate. The pitch change link for the yellow blade was broken at the swashplate, and the blue pitch change link was broken at the blade grip. All fractures were consistent with overload.

The red, white, and yellow dampers were still attached to the rotor head, but separated from their respective blade grips. The blue main rotor blade damper was separated from the rotor head, but still attached to its blade grip.

The engines were entangled in aircraft structure at WP 75, and both were extensively damaged by fire. The number one engine was largely intact. The number two engine was broken open, with internal components scattered on the ground.

Continuity of the powertrain could not be established. The combining gearbox was fractured into several pieces, and the oil cooler impeller was exposed. All drive couplings and driveshafts showed fracture surfaces that were consistent with impact and torsional overload.

A section of tree trunk, about 6 feet long and consistent with the fractured tree at WP 33, was found 180 feet beyond the initial point of impact. The trunk section was about 15 inches in diameter. The bark and wood along one side was shaved clean and displayed angular slices. There was aircraft structural sheet metal and associated hardware embedded in the wood.

TESTS AND RESEARCH

The engines were reexamined at Turbomeca, USA, Grand Prairie, Texas, on January 19, 2006, under the supervision of the FAA.

Examination of the number one engine revealed rotational tearing of the coupling at the accessory drive gearbox. The single-stage high-pressure turbine showed signs of rub on nozzle segments at the 1:00 o'clock position. The power turbine shaft had a torsional tear consistent with rotation and impact.

Examination of the number two engine revealed that the inlet axial compressor blades displayed impact damage and rotational tearing. The power turbine shaft was sheared and worn smooth from rotation at the accessory drive gearbox and the gas generator connection.

COMMUNICATION

A Safety Board air traffic control specialist convened an air traffic control group at Cleveland Air Route Traffic Control Center (ZOB), Oberlin, Ohio, on October 18, 2005. The group reviewed radar and voice communication recordings, collected documentation, conducted interviews, and the Safety Board specialist completed a factual report.

When questioned about the ILS runway 32 approach, the controller was unable to estimate the glideslope altitude at the point that the helicopter crossed the ILS localizer. Given an approach chart, he was able to identify the glideslope altitude at the outer marker as 3,333 feet. When he issued the approach clearance, the controller stated, "...cleared ILS three two uh runway at Bradford uh maintain four thousand feet." The controller was unable to explain what he intended by appending the 4,000 foot restriction to the approach clearance. He also stated that when he issued the approach clearance he had no feel for the relationship between the helicopter's altitude and the glideslope altitude at the helicopter's location.

According to FAAO 7110.65, the controller shall, "Assign headings that will permit final approach course interception on a track that does not exceed the interception angles specified in the TBL 5-9-1." The appropriate intercept angle values were 30 degrees for fixed-wing aircraft and 45 degrees for helicopters.

According to FAAO 7110.65, paragraph 5-9-1(b), controllers should position aircraft as follows: "For a precision approach, at an altitude not above the glideslope/glidepath or below the minimum glideslope intercept altitude specified on the approach procedure chart."

The FAA conducted a postaccident flight inspection of the ILS runway 32 approach at Bradford Regional Airport, and the results were "Satisfactory," with no deficiencies noted.

MEDICAL AND PATHOLOGICAL INFORMATION

The FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed the toxicological testing of the pilot. Chlorpheniramine, an antihistamine, was detected in the heart and liver.

The antihistamine chlorpheniramine was available over-the-counter under the commercial name Chlor-trimeton. According to the manufacturer, the side effects associated with chlorpheniramine included headache, fatigue, and dizziness. Among the warnings listed for consumers was, "Use caution when driving a motor vehicle or operating machinery."

According to his supervisor, the pilot was very physically fit, but "had a sinus condition on occasion." The flight nurse also stated the pilot "always seemed to have sinus problems."

The Mount Nittany Medical Center, State College, Pennsylvania, performed an autopsy on the pilot.

ADDITIONAL INFORMATION

According to the operator's director of training, as well as pilots employed by the airframe manufacturer, after the helicopter flew through the final approach course, and turned to the west, the autopilot could still capture the localizer course. However, once the helicopter was in the vicinity of the localizer course, and above the glideslope, the autopilot would be unable to capture the glideslope.

If altitude hold remained engaged at that point of the flight, and the pilot reduced collective to capture the glideslope, the autopilot would adjust pitch in an effort to maintain the selected altitude.

The Flight Safety Foundation publication Helicopter Safety, May-June 1997, Helicopter Autopilots Demand Careful Management, discussed some scenarios of "autopilot mismanagement."

One scenario described was in a flight simulator, where the crew reached a selected altitude, but no corresponding collective/power adjustment was made. Therefore, "As the aircraft approached the target altitude, the altitude preselect feature enunciated a "capture." Illumination of the altitude-hold button on the flight director followed. A few seconds later, the gear-up warning horn began to sound, triggered by airspeed below [60 knots].

"Surprised, the pilots scanned the instruments and saw that the airspeed was rapidly decreasing, the aircraft pitch attitude was very nose-high and the aircraft was in a descent...Therefore, the autopilot attempted to maintain altitude by increasing pitch attitude, thus decreasing the airspeed. At the selected power setting, the descent could not be prevented

by the autopilot and airspeed decreased until the gear-up warning horn alerted the pilots."

Another scenario took place on an actual flight. In this scenario "The [pilot] was surprised to see that the attitude directional indicator (ADI) was indicating extreme nose-up pitch. A quick scan of other instruments showed that the airspeed was rapidly decreasing, and the vertical speed indicator was showing a descent. The pilot quickly took manual control of the aircraft; increasing the collective pitch and lowering the aircraft nose to recover from the unusual attitude. He succeeded, but afterwards was shaken by the event."

On April 17, 2007, flight simulations were conducted in a Level D full-motion simulator at the Augusta-Westland Training Academy, Sesto, Italy, utilizing the radar data from the accident flight. While the instrument displays in the simulator differed from the accident helicopter, the stabilization and autopilot systems were identical.

Four simulations were conducted, initiated from the same point at 145 knots at 5,000 feet, but each with different selection times for the autopilot modes (Heading, Altitude, Approach). A fifth simulation was conducted at a lower speed of 110 knots and with Approach (ILS) mode selected prior to reaching the localizer course.

During the first simulation, approach mode was selected as the helicopter passed through the localizer centerline. The autopilot captured the localizer, but the turn resulted in a wide overshoot. Later in the approach, the autopilot captured the glideslope, but the helicopter pitched 10 degrees nose-down, descended at 3,000 feet per minute, and reached the simulator's maximum airspeed of 183 knots. The simulation was stopped 950 feet above ground level.

During the fifth simulation, the approach mode was selected prior to localizer intercept. The autopilot captured and tracked both the localizer and glide slope, and automatically disengaged the heading and altitude modes.

During simulations 2, 3, and 4, the turns to intercept the localizer course were completed in heading mode, and approach mode was selected after completion of the turn. The autopilot captured the localizer, but not the glideslope. All three approaches resulted in a "slight" reduction in altitude, pitch up attitude of 10 to 30 degrees, slowing to below 30 knots, and finally a vertical descent.

The flight profile and vertical fall of the last phase of simulations 2, 3, and 4 were consistent with the accident flight and ultimate position of the wreckage, and coincided closely with the last radar sweep. At the end of simulation 3, the pilot recovered the helicopter and resumed controlled flight.

Pilot Information

Certificate:	Commercial	**Age:**	59,Male
Airplane Rating(s):		**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	October 1, 2004
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	June 1, 2005
Flight Time:	9616 hours (Total, all aircraft), 300 hours (Total, this make and model), 56 hours (Last 90 days, all aircraft), 11 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Augusta	**Registration:**	N7YL
Model/Series:	109E	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	11502
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	August 1, 2005 AAIP	**Certified Max Gross Wt.:**	6283 lbs
Time Since Last Inspection:	124 Hrs	**Engines:**	2 Turbo shaft
Airframe Total Time:	1905 Hrs at time of accident	**Engine Manufacturer:**	Turbomeca
ELT:	Installed, not activated	**Engine Model/Series:**	Arrius 2K1
Registered Owner:		**Rated Power:**	675 Horsepower
Operator:		**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:	Lifestar	**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Night/dark
Observation Facility, Elevation:	BFD,2143 ft msl	**Distance from Accident Site:**	4 Nautical Miles
Observation Time:	23:37 Local	**Direction from Accident Site:**	142°
Lowest Cloud Condition:		**Visibility**	2.5 miles
Lowest Ceiling:	Overcast / 600 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	10°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.86 inches Hg	**Temperature/Dew Point:**	10°C / 9°C
Precipitation and Obscuration:	N/A - None - Mist		
Departure Point:	Kane , PA (PA91)	**Type of Flight Plan Filed:**	IFR
Destination:	Bradford, PA (BFD)	**Type of Clearance:**	IFR
Departure Time:	23:24 Local	**Type of Airspace:**	

Airport Information

Airport:	BRADFORD REGIONAL BFD	**Runway Surface Type:**	Asphalt
Airport Elevation:	2143 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	32	**IFR Approach:**	ILS
Runway Length/Width:	6499 ft / 150 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	On-ground
Total Injuries:	1 Fatal	**Latitude, Longitude:**	41.754722,-78.553886

Administrative Information

Investigator In Charge (IIC):	Rayner, Brian
Additional Participating Persons:	Joe McBride; FAA/FSDO; West Mifflin, PA James Blakley; CJ Systems Aviation; West Mifflin, PA Charles Anderson; Augusta; Philadelphia, PA Robert W Young; Turbomeca USA; Grand Prairie, TX
Original Publish Date:	December 20, 2007
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=62626