National Transportation Safety Board
Aviation Accident Final Report

Location:	Edgartown, MA	**Accident Number:**	NYC01FA073
Date & Time:	01/30/2001, 1835 EST	**Registration:**	N6837Y
Aircraft:	Cessna 402C	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	2 Serious
Flight Conducted Under:	Part 135: Air Taxi & Commuter - Scheduled		

Analysis

The pilot departed on a scheduled flight conducted under night instrument meteorological conditions. Arriving in the area of the destination airport, the weather was reported as, winds from 220 degrees at 18 knots, gusts to 25 knots; 1/2 statute miles of visibility and haze; vertical visibility of 100 feet. The pilot was vectored and cleared for the ILS 24 approach. As the airplane crossed the glideslope, the pilot observed that the "ride" became increasingly bumpy and turbulent, with a strong wind component from the right. The approach lights came into view as the airplane neared the runway, but soon disappeared due to the low visibility. The pilot executed a missed approach, and as full power was applied, the airplane began to move laterally to the left. During the missed approach, a "thunk" was heard on the left side of the fuselage, and the airplane descended into the trees. The airplane came to rest in a wooded area about 1/4 mile from the Runway 24 threshold, about 1,000 feet to the left of the extended centerline. Review of the approach plate for the ILS 24 approach revealed that the glide slope altitude at the final approach fix for the non-precision approach, which was located about 4 miles from the approach end of the runway, was 1,407 feet. The glide slope altitude at the middle marker, which was located about 0.6 miles from the approach end of the runway, was 299 feet. Review of radar data revealed that the airplane intercepted the glideslope about 4 miles from the threshold of runway 24. In the following 2 minutes, 30 seconds, the airplane deviated below and returned to the glideslope centerline approximately 4 times, with a maximum deviation of 2-dots below the glideslope centerline. About 1-mile from the runway, the airplane began a trend downward from the glideslope centerline, descending below the 2-dot low deviation line of the glideslope to an altitude of about 300 feet, when the last radar hit was recorded. During the approach, the airplane's groundspeed varied between 50 and 125 knots. According to the Aeronautical Information Manual chapter on Navigation Aids, Instrument Landing System (ILS), it stated that "Make every effort to remain on the indicated glide path." It also cautioned the pilot to, "Avoid flying below the glide path to assure obstacle/terrain clearance is maintained."

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 a stabilized approach with an adequate vertical and lateral track. Also causal was his failure to maintain obstacle clearance.

Findings

Occurrence #1: IN FLIGHT COLLISION WITH OBJECT
Phase of Operation: APPROACH - FAF/OUTER MARKER TO THRESHOLD (IFR)

Findings
1. OBJECT - TREE(S)
2. (C) CONTINUED - PILOT IN COMMAND
3. (F) WEATHER CONDITION - GUSTS
4. MINIMUM DESCENT ALTITUDE - CONTINUED BELOW - PILOT IN COMMAND
5. (F) WEATHER CONDITION - LOW CEILING
6. (F) WEATHER CONDITION - HAZE/SMOKE
7. LIGHT CONDITION - NIGHT

Factual Information

HISTORY OF FLIGHT

On January 30, 2001, about 1835 eastern standard time, a Cessna 402C, N6837Y, operated by Hyannis Air Service Inc., D.B.A. Cape Air flight 415, was destroyed after impacting terrain while on approach to the Vineyard Haven Airport (MVY), Edgartown, Massachusetts. The certificated airline transport pilot and passenger were seriously injured. Night instrument meteorological conditions prevailed at the accident site and an instrument flight rules flight plan was filed for the scheduled commuter flight conducted under 14 CFR Part 135.

According to the pilot, he had departed the T.F. Green State Airport, Providence, Rhode Island, about 1820, and proceeded to MVY. The cruise portion of the flight was conducted at 3,000 feet, with the autopilot engaged. When the airplane arrived in the MVY area, an air traffic controller vectored the airplane to the runway 24 ILS final approach course, and instructed the pilot to descend to 1,500 feet. During the descent, the flight became "choppy" as the airplane traveled in and out of the cloud tops. Upon intercepting the final approach course, the pilot selected the flaps to 10 degrees, and reduced the airspeed to 120 knots. The air traffic controller cleared the flight for the approach, and instructed the pilot to contact the common traffic advisory frequency at MVY. As the airplane crossed the glideslope intercept altitude, the pilot disengaged the autopilot and lowered the landing gear. He observed that the "ride" became increasingly bumpy and turbulent, with a strong wind component from the right. The approach lights came into view as the airplane neared the runway, but soon disappeared due to the low visibility. The pilot elected to execute a missed approach, and as full power was applied, the airplane began to move laterally to the left. The pilot recalled that the localizer needle was fully deflected to the right at one point during the missed approach. During the missed approach, a "thunk" was heard on the left side of the fuselage, and the airplane descended into the trees.

The pilot additionally stated that the airplane was "100 percent," and no abnormalities were noted with the engines or airframe. He did not recall hearing any audible tones; except for the autopilot disconnect tone. The pilot also did not recall what the indicated airspeed was during the final approach to the runway.

The passenger, who was seated in the second aft right hand seat, stated that the flight was very bumpy as they approached the MVY area. At one point during the approach, the airplane made a big drop, for which the pilot corrected. She then heard "beeps" coming from the cockpit area. The airplane then made a second violent movement, which the pilot seemed to not be able to control. During that violent movement, the passenger recalled hearing several "beeps" coming from the cockpit area again. As the airplane descended out of the clouds, the passenger observed "a row of lights" which were parallel to the airplane. The airplane then contacted treetops and descended to the ground. The passenger did not recall hearing any changes to the engine noise, but was not sure.

Review of recorded radio transmissions at the MVY air traffic control tower revealed a transmission from the pilot, at 1832:12, that he was "7 miles out on the ILS 24." At 1833:44, a series of five "mike clicks" were recorded. At 1834:48, the pilot transmitted that he was "three out on the ILS 24." No further radio transmissions were received from the airplane.

The airplane came to rest in a wooded area about 1/4 mile from the Runway 24 threshold,

about 1,000 feet to the left of the extended centerline.

The accident occurred during the hours of darkness, at 41 degrees, 23.96 minutes north latitude, 70 degrees, 35.96 minutes west longitude, at an elevation of 62 feet msl.

PILOT INFORMATION

The pilot held an airline transport pilot certificate with ratings for airplane single engine land, multi-engine land, and instrument airplane.

The pilot's most recent Federal Aviation Administration (FAA) first class medical certificate was issued on August 23, 2000.

The pilot had accumulated about 1,891 hours of total flight experience, 342 hours of which were in the same make and model as the accident airplane.

According to company records, Hyannis Air Services hired the pilot on May 8, 2000, for a position as a second in command (SIC) pilot. He remained an SIC until upgrade training was completed on October 4, 2000. On October 11, 2000, the pilot began initial operating experience (IOE) as a captain in the Cessna 402C. The IOE continued until its completion on October 17, 2000. During the IOE flights, the pilot accumulated about 15.4 hours of flight experience. After completion of the IOE, the pilot accumulated about 213 hours of flight experience as a line captain.

AIRCRAFT INFORMATION

A review of the airframe and engine records did not reveal evidence of any anomalies. The airplane's most recent Approved Aircraft Inspection Program (AAIP) was completed on January 12, 2001, at a total aircraft time of 19,131.5 hours. The left engine had accumulated 2,091.0 total hours of operation since being rebuilt. The right engine had accumulated 2,427.5 total hours of operation since being rebuilt.

METEOROLOGICAL INFORMATION

The weather recorded by the MVY Automated Surface Observing System, at 1827 was, winds from 220 degrees at 18 knots, gusts to 25 knots; 1/2 statute miles of visibility and haze; vertical visibility of 100 feet; temperature 46 degrees Fahrenheit; dew point of 30 degrees Fahrenheit; and an altimeter setting of 29.44 inches of mercury.

AERODROME INFORMATION

Runway 24 at MVY was a 5,500-foot long, 100 foot wide, hard surfaced asphalt transverse grooved runway. The runway was equipped with high intensity runway edge lights, and runway end identifier lights.

According to MVY airport personnel, some of the Airport Rescue Fire Fighters did not recall if the approach lighting system was illuminated when they responded to the accident site; however some of the rescue personnel did recall that the lights were off because they had "timed out." When the second daily field inspection was conducted at 1730, the airport employee who did the inspection recalled that the lights were working as far as he could tell.

AIDS TO NAVIGATION

The runway 24 ILS was "flight checked" by a FAA flight inspection airplane the day after the accident. No abnormalities were noted.

Review of the approach plate for the ILS Runway 24 approach revealed that the glideslope altitude, at BORST intersection, which was located about 4 miles from the approach end of the runway, was 1,407 feet agl. The glide slope altitude at the middle marker, which was located about 0.6 miles from the approach end of the runway, was 299 feet agl. The landing minimums for the approach were a decision height of 200 feet agl, and 1/2 mile visibility.

The 24 ILS was equipped with a medium intensity approach light system, and runway alignment indicator lights.

WRECKAGE INFORMATION

Examination of the accident site on January 31, 2001, revealed that the terrain consisted of low-lying brush and hardwood trees, which reached to a height of about 25 feet. The hardwood trees, which predominantly surrounded the accident site, had branches of varying diameters that were cut at 45-degree angles and displayed black paint transfer. The cut branches were located on the ground, and snared in other trees along the wreckage path. The first tree strike area was located about 200 feet prior to the main fuselage. The wreckage path was oriented on a 192-degree bearing, with the main fuselage coming to rest against hardwood trees on a 021-degree heading. Additionally, a post-crash fire had consumed the cabin area of the main fuselage.

About 25 feet from the first tree strike, a 26-inch section of the left wing tip was located. Examination of the wing tip section revealed a 4-inch "u"-shaped dent on the leading edge, about 13 inches from the separation point. About 10 feet in front of the wing tip was a 38-inch piece of the left wing outboard section. About 2 feet beyond the left wing outboard section, a 13 foot long, 4 inch deep, ground scar was observed.

Examination of the main wreckage revealed that the right wing outboard section sustained damage from a post-crash fire. The right engine remained attached to the inboard section. Two propeller blades from the engine hub assembly had been separated. The third propeller blade remained attached to the hub assembly. The propeller blades exhibited chordwise scratching and curled tips.

The empennage remained attached to the main fuselage. The rudder was deflected to the right, about 10 degrees. The rudder trim tab was deflected to the right about 12 degrees. The elevators for the left and right horizontal stabilizers were deflected upward to their respective stops. The elevator trim was in the approximate neutral position. The emergency locator transmitter was recovered from the empennage section, and found in the on position, but was not activated.

The inboard section of the left wing remained attached to the fuselage. The engine and propeller assembly remained attached to the wing, but sustained heat damage from the post crash fire. Examination of the propeller blades revealed chordwise scratching and s-bending to all three propeller blades.

Control cable continuity from the separated end of the inboard section of the left wing to the aileron and trim tab was confirmed. Control cable continuity from the separated end of the inboard section of the right wing, was confirmed to the aileron. The control cable continuity for the rudder, elevator, and trim surfaces located on the tail section of the airplane, were confirmed to the cockpit area.

All separated control cable ends were examined with a 10-power magnifying glass. The cable

end strands were separated at 45-degree angles, which were consistent with tension overload, and no corrosion was observed at the separation points.

The control stops for the left aileron, rudder, and the left and right elevators were examined. No abnormal wear was observed.

The pilot's altimeter was recovered and indicated an altitude of minus 140 feet and the kollsman window indicated 29.44 inches of mercury. The horizontal situation indicator (HSI) was observed on a heading of 190 degrees. The heading bug on the HSI was selected to 246 degrees. The glide slope indicator was centered and the localizer needle was deflected full scale left. Impact forces and fire damage destroyed all communication and navigation radios.

The throttle quadrant of the central pedestal was recovered and examined. The two throttles and propeller controls were found in the full forward position. The left engine fuel mixture lever was observed in the full forward position and the right engine fuel mixture lever was in the full lean position.

All three landing gear assemblies were separated from the main fuselage.

The position of the landing gear selector was observed in the "DN" position. The flap position was observed to be about 12 degrees. The cockpit flap selector was observed to be in the full extend position, and the flap position indicator was observed in the mid-range position.

The left and right engines were examined on February 1, 2001.

The left engine's turbocharger rotated freely. The post crash fire destroyed the fuel pump. The throttle plate was observed in the full open position. The fuel mixture control was observed at the 1/8 range from full rich. The post crash fire consumed the fuel screen. Thumb compression was obtained on all cylinders except the number 5 cylinder. The engine rotated freely through the accessory drive section. Valve train continuity was confirmed to all cylinders except the number 5 cylinder. Damage was observed to the number 5 cylinder exhaust rocker arm. The top spark plugs on all six cylinders were removed; their electrodes were intact and light gray in color. Fuel was observed in the fuel distribution manifold.

The right engine's turbocharger and fuel pump rotated freely. The throttle plate was observed in the full open position. The fuel mixture control was observed at the 1/3 range from full rich. Fuel was observed in the fuel screen. Thumb compression was obtained to all cylinders. The engine rotated freely through the accessory drive section. Valve train continuity was confirmed to all cylinders. The top spark plugs on all six cylinders were removed; their electrodes were intact and light gray in color. Fuel was observed in the fuel distribution manifold.

TESTS AND RESEARCH

Radar Data

Review of the NTSB Recorded Radar Study Factual Report, revealed that the airplane intercepted the glideslope about 4 miles from the threshold of runway 24. In the following 2 minutes, 30 seconds, the airplane deviated below and returned to the glideslope centerline approximately 4 times, with a maximum deviation of 2-dots below the glideslope centerline. About 1-mile from the runway, the airplane began a trend downward from the glideslope centerline, descending below the 2-dot low deviation line of the glideslope to an altitude of about 300 feet, when the last radar return was recorded.

The data also revealed that airplane's groundspeed, as it crossed the BORST intersection, was

about 81 knots. As the airplane continued, it's groundspeed varied between 70 and 100 knots, before decreasing to 50 knots, 3.8 miles from the runway threshold. The groundspeed then increased to 101 knots and immediately deceased to 62 knots. About 2.3 miles from the runway threshold, the airplane maintained a groundspeed of 78 knots, until increasing to 125 knots about 1 mile from the runway. The last radar return indicated a groundspeed of 95 knots.

The report included a wind profile table, provided by a Safety Board meteorologist. The winds at 1,000 feet were computed as 250 degrees at 30 knots

Aural Tone Test

On March 30, 2001, the Safety Board investigator requested that the passenger of the accident flight listen to a set of aural tones produced by the airplane's systems. Also present at the test were representatives from the FAA, Massachusetts Aeronautical Commission, and Hyannis Air Services. The airplane utilized for the test was the same make and model of the accident airplane. The passenger was asked to sit in the same seat, which she was seated on the night of the accident. While parked on an airport ramp, the engines were started and power was increased to a setting similar to what would be used to maintain 120 knots indicated airspeed on an approach. The tones audibly sounded were the landing gear warning horn, the autopilot disconnect warning horn, the stall warning horn, and the flap extension horn. The approach marker beacon tones could not be tested due to the proximity of the airplane to the markers. When the stall warning horn was activated, the response from the passenger was "that's it, with out a doubt."

ADDITIONAL INFORMATION

Weather Conditions

About 3 hours prior to the accident, another company airplane, also a Cessna 402C, executed the runway 24 ILS approach into MVY. The pilot of that airplane stated that the weather was; winds from 180 degrees at 15 knots, gusts to 28; broken clouds at 200 feet.

About 30 minutes prior to the accident, a deHavilland DHC-6 airplane executed the runway 24 ILS approach at MVY. The pilot's recollection of the approach was that it took approximately 10 degrees correction to the right to track the localizer. The "ride down" on the glideslope was smooth until 500 feet msl, when he experienced "sudden violent turbulence with a downdraft that made it difficult to track the glideslope." The pilot continued the approach until reaching 300 feet msl, and executed a missed approach because he did not "obtain outside visual contact." The flight then diverted to another airport.

Weight and Balance

Prior to the accident flight, company personnel computed a weight and balance for the flight. The airplane was determined to be within limits specified by the manufacturer.

Stall Awareness Training

According to FAA Advisory Circular 61-67B, Stall and Spin Awareness training, "Turbulence can cause an aircraft to stall at a significantly higher airspeed than in stable conditions. A vertical gust or windshear can cause a sudden change in the relative wind, and result in an abrupt increase in angle of attack. Although a gust may not be maintained long enough for a stall to develop, the aircraft may stall while the pilot is attempting to control the flightpath,

particularly during an approach in gusty conditions. When flying in moderate to severe turbulence or strong crosswinds, a higher than normal approach speed should be maintained. In cruise flight in moderate or severe turbulence, an airspeed well above the indicated stall speed and below maneuvering speed should be used."

ILS Procedures

According to the Aeronautical Information Manual chapter on Navigation Aids, Instrument Landing System (ILS), it stated that "Make every effort to remain on the indicated glide path." It also cautioned the pilot to, "Avoid flying below the glide path to assure obstacle/terrain clearance is maintained."

Wreckage Release

The airplane wreckage was released on February 1, 2001, to a representative of the owners insurance company.

Pilot Information

Certificate:	Airline Transport	**Age:**	40, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	08/23/2000
Occupational Pilot:		**Last Flight Review or Equivalent:**	10/05/2000
Flight Time:	1668 hours (Total, all aircraft), 348 hours (Total, this make and model), 1463 hours (Pilot In Command, all aircraft), 149 hours (Last 90 days, all aircraft), 49 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N6837Y
Model/Series:	402C	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	402C0467
Landing Gear Type:	Retractable - Tricycle	**Seats:**	10
Date/Type of Last Inspection:	01/12/2001, AAIP	**Certified Max Gross Wt.:**	6850 lbs
Time Since Last Inspection:	41 Hours	**Engines:**	2 Reciprocating
Airframe Total Time:	19131 Hours at time of accident	**Engine Manufacturer:**	Continental
ELT:	Installed, not activated	**Engine Model/Series:**	TSIO-520VB
Registered Owner:	Hyannis Air Service Inc.	**Rated Power:**	325 hp
Operator:	Hyannis Air Service Inc.	**Operating Certificate(s) Held:**	Commuter Air Carrier (135); On-demand Air Taxi (135)
Operator Does Business As:	Cape Air	**Operator Designator Code:**	HYIA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument Conditions	**Condition of Light:**	Night/Dark
Observation Facility, Elevation:	MVY, 68 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	1827	**Direction from Accident Site:**	240°
Lowest Cloud Condition:		**Visibility**	0.5 Miles
Lowest Ceiling:	Indefinite (V V) / 100 ft agl	**Visibility (RVR):**	
Wind Speed/Gusts:	18 knots / 25 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	220°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.44 inches Hg	**Temperature/Dew Point:**	8°C / -1°C
Precipitation and Obscuration:			
Departure Point:	Providence, RI (PVD)	**Type of Flight Plan Filed:**	IFR
Destination:	Edgartown, MA (MVY)	**Type of Clearance:**	IFR
Departure Time:	1820 EST	**Type of Airspace:**	Class E

Airport Information

Airport:	Vineyard Haven Airport (MVY)	**Runway Surface Type:**	Asphalt
Airport Elevation:	68 ft	**Runway Surface Condition:**	Wet
Runway Used:	24	**IFR Approach:**	ILS
Runway Length/Width:	5500 ft / 100 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Serious	**Aircraft Fire:**	On-Ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Serious	**Latitude, Longitude:**	41.387778, -70.587778

Administrative Information

Investigator In Charge (IIC):	Stephen M Demko	**Report Date:**	06/25/2003
Additional Participating Persons:	Ronald Williams; FAA; Bedford, MA Richard Bunker; Massachusetts Aeronautics Commission; Boston, MA Andrew Hall; Cessna Aircraft Company; Wichita, KS Al Butler; Continental Motors; Mobile, AL		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov, or at 800-877-6799. Dockets released after this date are available at http://dms.ntsb.gov/pubdms/.		