National Transportation Safety Board
Aviation Accident Final Report

Location:	Yabucoa, PR	**Accident Number:**	ERA11FA376
Date & Time:	07/01/2011, 1433 AST	**Registration:**	N8436Q
Aircraft:	CESSNA A185F	**Aircraft Damage:**	Substantial
Defining Event:	Windshear or thunderstorm	**Injuries:**	5 Fatal
Flight Conducted Under:	Part 91: General Aviation - Personal		

Analysis

Shortly after departure for a visual flight rules cross-country flight over ocean waters, the airplane encountered instrument meteorological conditions associated with a fast moving tropical wave. Examination of air traffic control radar data revealed that the airplane never reached a steady cruise state for any significant amount of time, and its ground track varied laterally on several occasions. This variance in altitude and ground track continued until about 17 minutes after takeoff when the airplane entered a right 270-degree turn and impacted the water while traveling downward at about 5,000 feet per minute. Examination of weather radar data and satellite imagery revealed that the tropical wave had produced overcast conditions, embedded thunderstorms with tops near 34,000 feet, heavy rain, and wind of about 47 knots. Correlation of the weather radar data to the airplane's ground track revealed that the non-instrument rated pilot was maneuvering around and through the weather, and that the airplane's position at the time of the accident correlated to the position of a thunderstorm. Examination of the wreckage after recovery from the ocean showed no evidence of preimpact mechanical failure or malfunction of the aircraft structure, flight control systems, engine, or propeller. It also revealed that the airplane was not equipped with any type of weather avoidance equipment. During the course of the investigation, no record of the pilot receiving a weather briefing was discovered.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's inadequate weather planning and improper decision to continue a visual flight rules flight into instrument meteorological conditions, which resulted in an encounter with a thunderstorm and subsequent loss of control.

Findings

Aircraft	Performance/control parameters - Not attained/maintained (Cause)
Personnel issues	Weather planning - Pilot (Cause) Decision making/judgment - Pilot (Cause)
Environmental issues	Ceiling/visibility/precip - Effect on operation (Cause) Thunderstorm - Effect on operation (Cause)

Factual Information

HISTORY OF FLIGHT

On July 1, 2011, at approximately 1433 Atlantic standard time, a Cessna A185F, N8436Q, was substantially damaged when it impacted the waters of the Caribbean Sea near Yabucoa, Puerto Rico. The certificated commercial pilot and four passengers were fatally injured. Instrument meteorological conditions (IMC) prevailed, and no flight plan was filed for the Title 14 Code of Federal Regulations Part 91 personal flight, which departed from Benjamin Rivera Noriega Airport (TJCP), Culebra Island, Puerto Rico, destined for Mercedita Airport (TJPS), Ponce, Puerto Rico.

On July 1, 2011, the pilot of the airplane and his four passengers departed TJPS and flew to TJCP to tour the island and spend some time on its beaches.

At approximately 1416 the airplane departed TJCP on its return flight, but never arrived at TJPS. Two days later on July 3, 2011 a family member reported to the Ponce Municipal Police that the airplane was overdue. A search by local, state, and federal authorities was then initiated.

As part of that search, a review of radar data provided by the Federal Aviation Administration (FAA) was conducted. Review of the radar data revealed that after departure from TJCP the airplane initially climbed to 2,000 feet above mean sea level (msl). Approximately 5 minutes later, it descended to 1,800 feet msl. Shortly thereafter, the airplane descended to 1,600 feet and maintained that altitude for approximately 8 minutes before entering a right 270 degree turn and descending below the floor of the radar coverage area. Interpolation of radar data indicated that the airplane's rate of descent during the turn was in excess of 5,000 feet per minute.

PERSONNEL INFORMATION

According to FAA records, the pilot held a commercial pilot certificate with a rating for airplane single-engine land. He did not possess an instrument rating and therefore his commercial certificate carried a limitation that he could not carry passengers for hire at night, or on cross-country flights of more than 50 nautical miles. He was not, however, restricted from flying at night or on cross-country flights of more than 50 nautical miles on personal flights. His most recent FAA second-class medical certificate was issued on January 8, 2011. On that date, he reported that he had accrued 6,895 total hours of flight experience.

AIRCRAFT INFORMATION

The accident aircraft was a six-seat, single-engine, strut braced, high-wing airplane of conventional metal construction. It was equipped with non-retractable conventional landing gear and was powered by a fuel injected, 300 horsepower, Continental IO-520-D, 6-cylinder air cooled engine.

The airplane was equipped for operations in instrument meteorological conditions, but was not equipped with any type of weather avoidance equipment. Its instrument panel was designed around the basic "T" configuration. The attitude indicator and directional indicator were located immediately in front of the pilot, and were arranged vertically with the attitude indicator on top. The airspeed indicator and altimeter were located to the left and right of the attitude indicator, respectively. A turn and bank indicator was also installed and was mounted

to the left of the directional indicator. The attitude indicator and directional indicator were powered by an engine driven vacuum system. The turn and bank indicator was powered by the airplane's electrical system.

According to FAA records, the airplane was manufactured in 1978. On December 11, 1980 it was substantially damaged during a takeoff accident when the airplane collided with trees in Ajuntas, Puerto Rico (NTSB Accident number: MIA81DKA03).

According to maintenance records, it was repaired and placed back into service on January 15, 2008. The airplane's most recent annual inspection was completed on March 15, 2011. At the time of the inspection, the airplane had accrued 662.9 total hours of operation.

METEOROLOGICAL INFORMATION

On the afternoon of the accident, a strong tropical wave was located in the Anegada Passage southeast of the British Virgin Islands, with most of its associated weather ahead of it, as far west as the Mona Passage which is located to the west of the island of Puerto Rico.

At 1413, FAA WSR88D Doppler weather radar detected isolated thunderstorms with tops around 30,000 feet msl near and southwest of the border between the Municipality of Yabucoa and the Municipality of Maunabo. From the Yabucoa/Maunabo border northeast to the Municipality of Naguabo mostly light rain was detected, although a scattered line of thunderstorms was rapidly approaching from the east southeast with one reflectivity max core over the west side of Vieques Island near 18.10N 65.56W, another near 18.00N 65.70W, and a third near 17.91N 65.70W.

By 1419 this line of scattered thunderstorms had become better defined and by 1424 it had moved to Yabucoa and extended northeast to 18.16N 65.56W.

Three minutes prior to the accident, at 1430 the line extended from the Yabucoa/Maunabo border near 18.01N 65.85W and a segment of the line extended northeast to 18.06N 65.72W. At that time the FAA WSR88D radar detected inbound winds of approximately 47 knots at 3,752 ft MSL near 18.03N 65.83W. Thunderstorm tops were estimated near 34,000 feet msl with max reflectivity of 50-55 dBZ (very heavy rain) from 18.01N 65.85W to 18.21N 65.53W. Satellite imagery was also consistent with the data generated by the WSR88D radar and indicated that high-topped overcast conditions existed.

By 1436 the southern part of the line had moved inland over Maunabo and extended east northeast along Yabucoa's coast to near 18.16N 65.68W, and by 1442 was inland along Yabucoa's coast, and thereafter through 1500 continued to move rapidly northwest.

WRECKAGE AND IMPACT INFORMATION

The main wreckage of the airplane was discovered to have come to rest in 85 feet of water approximately 1 mile offshore of the Port of Yabucoa.

Underwater examination by San Juan Police Department (SJPD) divers and Forces United for Rapid Action (FURA) divers from the Puerto Rico National Police, revealed that that the airplane had broken apart during the impact sequence and wreckage existed within an approximate 75 foot area on the ocean floor with the main cabin area near its midpoint. The left wing was separated from its mounting location and the right wing was fragmented. The engine was still in its normally mounted location however, the propeller had separated from the engine, the engine mounts were broken, and the engine was only attached to the firewall by

its Bowden cables. The forward fuselage was crushed and its top was peeled back. The remains of the cabin were filled with sand, silt, and debris. The aft fuselage was intact and the vertical stabilizer was still attached.

On July 18, 2011, the main wreckage was recovered. Examination of the wreckage revealed no evidence of any preimpact malfunction or failure of the airplane or flight control system and damage patterns existed that were consistent with a water impact.

The left wing exhibited multiple areas of crush and compression damage. Portions of the left aileron were still attached to its mounting location, and the left wing flap was still attached to its mounting location. The pitot tube was clear of obstructions and the fuel tank cap was closed. The wing tank fuel strainer was clean, and the fuel sending unit float assembly was functional.

The right wing was fragmented into multiple sections. The sections exhibited multiple areas of tearing, shearing, crushing, and compression damage. The right aileron was torn and fragmented and the right flap was fragmented. The fuel tank cap was closed. The wing tank fuel strainer was clean and the fuel sending unit float assembly was functional.

The rudder was still attached to the vertical stabilizer. The right horizontal stabilizer was missing its leading edge and it was bent aft and up, and its sheet metal surface was separated in multiple places from its internal structure. The right elevator was separated from the horizontal stabilizer and was not recovered; however an underwater photograph showed it was intact. The left horizontal stabilizer exhibited crush and compression damage. It was bent upward near its tip and a 12 inch section of the outboard portion of its elevator was separated. The separated section of the left elevator was recovered and exhibited tearing damage.

Control continuity was established from the cockpit to the breaks in the system which showed evidence of failure in tensile overload and from the breaks in the system to the left and right aileron bellcranks, the elevator bellcrank, and the rudder bellcrank.

The left control yoke tube was observed separated from the aileron control cable sprocket. The left aileron control cable was separated in tension overload in the aft door post near the wing root. The right control yoke tube remained attached to the sprocket and the right aileron cable was separated in tension overload in the forward cabin floor assembly area and near the wing root. The left rudder cable was continuous from the torque tube to the rudder bellcrank while the right rudder cable was separated in tension overload in the forward cabin floor assembly area. The elevator push/pull tube was separated from the base of the control column; control cable continuity was complete from the forward bellcrank to the elevator. The forward stabilator trim cable was separated in tension overload in the aft fuselage. The aft stabilator trim cable was continuous. Examination of the stabilator trim actuator indicated the stabilator was approximately 6-7 degrees stabilator down. Examination of the flap actuator indicated the flaps were extended approximately 20 degrees.

Examination of the cockpit area components revealed that the pilot's door, pilot's window, and baggage compartment door were closed and latched. The primer was in and locked and the magneto switch was in the "BOTH" position. The throttle was ¾ open, the vernier type propeller control's shaft was out about 1" which corresponded to the propeller pitch cruise range, and the mixture control was full rich.

The altimeter indicated 1,230 feet msl, and the Kollsman window displayed 30.00 inches of

mercury. The directional indicator read 119 degrees and internal examination of its gyro assembly revealed that rotational scoring was present on the rotor wheel.

Examination of the three-bladed constant speed propeller revealed no evidence of any preimpact malfunctions or failures. The propeller was found separated from the crankshaft flange. Two of the three blades were still attached to the propeller hub and one blade was found separated from the propeller hub. All three blades exhibited damage consistent with propeller rotation. All three blades exhibited multi-directional scratching; one blade exhibited twisting, one blade exhibited bending toward the non-cambered side of the propeller blade near its blade tip, and one blade exhibited gouging with curled and twisted blade material still attached at the periphery of the gouge.

Examination of the engine revealed no evidence of preimpact failure or malfunction and spiral cracking was observed aft of the crankshaft flange radii which was indicative of crankshaft rotation during impact. A portion of the propeller governor was missing. The crankcase was impact damaged, but all of the engine cylinders had remained attached to the crankcase. The starter was intact, and the alternator exhibited impact damage. The oil cooler was missing. The oil sump exhibited impact damage from the nose case to the accessory case section and examination of the engine oil dip stick revealed that there was no oil discernibly present in the oil sump. Examination of the oil filter element revealed that oil had been present, and that there was no particulate matter or debris present. Examination of the oil screen also did not reveal the presence of obstructions or debris.

Further examination revealed that the induction system and the exhaust system were impact damaged and the intake tubing for cylinder Nos. 1, 3, and 5, were missing.

Both magnetos were impact damaged and were non-functional. Internal examination revealed no evidence of preimpact malfunction or failure, and both magneto distributor driven drive shafts and drive gears, were intact.

All spark plugs exhibited impact damage and debris in the electrode area consistent with sand and salt-water immersion, but the exposed electrode areas exhibited normal operating signatures.

The lead seal and safety wire were present on the fuel pump and the fuel pump drive coupling was intact. When rotated by hand, the fuel pump drive shaft would rotate.

The throttle control assembly exhibited damage. The throttle fuel control throttle lever and throttle plate were partially open. The mixture control lever was in the mid-travel position. The safety wire was intact. The fuel inlet screen was impact damaged, but no debris or obstructions were discovered.

The fuel manifold valve safety wire was intact. Internal examination of the fuel manifold valve revealed a small amount of debris and approximately ¼ of a teaspoon of clear liquid internally. However, the diaphragm was intact and the diaphragm and plunger retaining nut were tight and secure. No scoring was observed on the fuel plunger assembly and no indication of fuel leakage was observed in the vent chamber side of the diaphragm. All fuel nozzles exhibited impact damage and debris internally.

Internal examination of the engine using a lighted borescope revealed that the internal combustion chambers, piston heads, and valve faces, exhibited visible material consistent with combustion deposits, sand, and salt-water immersion. The exposed cylinder bores were free of scoring and no evidence of hard particle passage was observed within the cylinder bore ring travel area.

Drivetrain continuity was confirmed when the crankshaft was rotated by hand at the crankshaft flange and thumb compression and suction was obtained on all cylinders. The cluster gear assembly was intact and movement of the rocker arms and accessory drive gears was confirmed.

The vacuum pump was impact damaged. The vacuum pump drive shaft could not be rotated by hand; however, the vacuum pump flex center and drive couplings were intact, and the rotor and vanes were intact. A material consistent with sand was observed in the vacuum pump housing.

MEDICAL AND PATHOLOGICAL INFORMATION

No post mortem examination or toxicological testing was performed.

TESTS AND RESEARCH

According to the data from the WSR88D radar and satellite imagery, high-topped overcast conditions and thunderstorms were present at the time of the accident. Correlation of the airplane's ground track data and the WSR88D radar data revealed that the airplane was maneuvering around and through weather on the return flight to TJPS and that the airplane's position at the time of the accident correlated to the position of a thunderstorm.

According to Aviation Weather for Pilots and Flight Operations Personnel (AC 00-6A) which was published by the FAA and National Weather Service, clouds with extensive vertical development are cumulus clouds that build vertically into towering cumulus or cumulonimbus clouds. The bases of these clouds form in the low to middle cloud base region, but can extend into high altitude cloud levels. Towering cumulus clouds indicate areas of instability in the atmosphere, and the air around and inside them is turbulent. These types of clouds often develop into cumulonimbus clouds or thunderstorms. Cumulonimbus clouds contain large amounts of moisture and unstable air, and usually produce hazardous weather phenomena, such as lightning, hail, tornadoes, gusty winds, and wind shear. These extensive vertical clouds can be obscured by other cloud formations and are not always visible from the ground or while in flight. When this happens, these clouds are said to be embedded, hence the term, embedded thunderstorms.

To pilots, the cumulonimbus cloud is perhaps the most dangerous cloud type. It appears individually or in groups and is known as either an air mass or orographic thunderstorm. Heating of the air near the Earth’s surface creates an air mass thunderstorm; the upslope motion of air in the mountainous regions causes orographic thunderstorms. Cumulonimbus clouds that form in a continuous line are nonfrontal bands of thunderstorms or squall lines.

Since rising air currents cause cumulonimbus clouds, they are extremely turbulent and pose a significant hazard to flight safety. For example, if an aircraft enters a thunderstorm, the aircraft could experience updrafts and downdrafts that exceed 3,000 fpm. In addition, thunderstorms can produce large hailstones, damaging lightning, tornadoes, and large quantities of water, all of which are potentially hazardous to aircraft.

A thunderstorm makes its way through three distinct stages before dissipating. It begins with the cumulus stage, in which lifting action of the air begins. If sufficient moisture and instability are present, the clouds continue to increase in vertical height. Continuous, strong updrafts prohibit moisture from falling. The updraft region grows larger than the individual thermals feeding the storm. Within approximately 15 minutes, the thunderstorm reaches the mature stage, which is the most violent time period of the thunderstorm's life cycle. At this point, drops of moisture, whether rain or ice, are too heavy for the cloud to support and begin falling in the form of rain or hail. This creates a downward motion of the air. Warm, rising air; cool, precipitation-induced descending air; and violent turbulence all exist within and near the cloud. Below the cloud, the down-rushing air increases surface winds and decreases the temperature. Once the vertical motion near the top of the cloud slows down, the top of the cloud spreads out and takes on an anvil-like shape. At this point, the storm enters the dissipating stage. This is when the downdrafts spread out and replace the updrafts needed to sustain the storm.

It is impossible to fly over thunderstorms in light aircraft. Severe thunderstorms can punch through the tropopause and reach staggering heights of 50,000 to 60,000 feet depending on latitude. Flying under thunderstorms can subject aircraft to rain, hail, damaging lightning, and violent turbulence. A good rule of thumb is to circumnavigate thunderstorms identified as severe or giving an intense radar echo by at least 20 nautical miles (NM) since hail may fall for miles outside of the clouds. If flying around a thunderstorm is not an option, stay on the ground until it passes.

ADDITIONAL INFORMATION

According to the Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25A), Weather is an important factor that influences aircraft performance and flying safety. Understanding the theories behind weather helps a pilot make sound weather decisions based on the reports and forecasts obtained from a Flight Service Station (FSS) weather specialist and other aviation weather services. Whether it is a local flight or a long cross-country flight, decisions based on weather can dramatically affect the safety of the flight.

During the investigation, no record of the pilot receiving a weather briefing or filing a flight plan was discovered.

History of Flight

Enroute-cruise	VFR encounter with IMC Windshear or thunderstorm (Defining event) Loss of control in flight
Uncontrolled descent	Collision with terr/obj (non-CFIT)

Pilot Information

Certificate:	Commercial	**Age:**	64, Male
Airplane Rating(s):	Single-engine Land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Without Waivers/Limitations	**Last Medical Exam:**	01/08/2011
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	06/30/2011
Flight Time:	(Estimated) 6895 hours (Total, all aircraft), 203 hours (Last 90 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	CESSNA	**Registration:**	N8436Q
Model/Series:	A185F	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	18503700
Landing Gear Type:	Tailwheel	**Seats:**	6
Date/Type of Last Inspection:	03/15/2011, Annual	**Certified Max Gross Wt.:**	3350 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	663 Hours	**Engine Manufacturer:**	CONT MOTOR
ELT:	Installed, not activated	**Engine Model/Series:**	IO-520-D
Registered Owner:	Ernesto Ortiz	**Rated Power:**	285 hp
Operator:	Antonio Torregrosa	**Air Carrier Operating Certificate:**	None

Meteorological Information and Flight Plan

Observation Facility, Elevation:	TJNR, 38 ft msl	**Observation Time:**	1450 AST
Distance from Accident Site:	15 Nautical Miles	**Condition of Light:**	Day
Direction from Accident Site:	38°	**Conditions at Accident Site:**	Instrument Conditions
Lowest Cloud Condition:	Few / 2400 ft agl	**Temperature/Dew Point:**	26°C / 22°C
Lowest Ceiling:	Broken / 3700 ft agl	**Visibility**	1 Miles
Wind Speed/Gusts, Direction:	22 knots/ 31 knots, 140°	**Visibility (RVR):**	
Altimeter Setting:	29.99 inches Hg	**Visibility (RVV):**	
Precipitation and Obscuration:	Heavy - Showers - Rain; Heavy - Thunderstorms - Rain; Mist		
Departure Point:	Isla de Culebra, PR (TJCP)	**Type of Flight Plan Filed:**	None
Destination:	Ponce, PR (TJPS)	**Type of Clearance:**	None
Departure Time:	1415 AST	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	4 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	5 Fatal		

Administrative Information

Investigator In Charge (IIC):	Todd G Gunther	**Adopted Date:**	06/28/2012
Additional Participating Persons:	Wifredo Perez; FAA/FSDO; San Juan, PR Peter J Basile; Cessna Aircraft Company; Wichita, KS Rodney M Martinez; Continental Motors Inc.; Mobile, AL		
Publish Date:	06/28/2012		
Investigation Docket:	http://dms.ntsb.gov/pubdms/search/dockList.cfm?mKey=80970		

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