Aviation Investigation Final Report

Location:	Miami, Florida	**Accident Number:**	ERA18FA194
Date & Time:	July 17, 2018, 12:59 Local	**Registration:**	N16281
Aircraft:	Piper PA34	**Aircraft Damage:**	Destroyed
Defining Event:	Midair collision	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

A low-wing multiengine airplane departed the airport on an evaluation flight in the local training area with a commercial pilot candidate and designated pilot examiner onboard. The student pilot and a flight instructor onboard a high-wing airplane were returning to the same airport on a cross-country instructional flight. About 6 minutes after the low-wing airplane departed, the airplanes collided nearly straight-on about 1,500 ft mean sea level and 9 miles northwest of the airport. At the time, the low-wing airplane was clear of the Class D airspace and no longer communicating with air traffic control (ATC). One of the pilots in the high-wing airplane had contacted ATC just before the collision. The controller acknowledged the transmission and issued a traffic advisory, but no further communications were received. Neither airplane was equipped with a traffic information system, nor were they required to be.

An aircraft performance and cockpit visibility study revealed that both airplanes would have remained relatively small, slow-moving objects in each other's windows until about 12 seconds before the collision, and subsequently grown in size suddenly; however, it is likely that none of the pilots saw the other airplane given that radar data does not indicate that either airplane performed evasive maneuvers to avoid the collision No preimpact mechanical malfunctions were identified with either airplane. Toxicology testing identified low levels of delta-9-tetrahydrocannabinol (THC) and metabolites in the high-wing flight instructor's blood and urine. Their presence indicates that the instructor had used marijuana at some time before the accident, but it is unlikely that the psychoactive effects of THC remained or contributed to the accident.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The failure of both pilots in both airplanes to see and avoid the other airplane as they converged nearly head-on at the same altitude.

Findings

Personnel issues	Monitoring other aircraft - Pilot
Personnel issues	Monitoring other aircraft - Instructor/check pilot
Personnel issues	Monitoring other aircraft - Pilot of other aircraft

Factual Information

History of Flight

Enroute-cruise	Midair collision (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On July 17, 2018, at 1259 eastern daylight time, a Piper PA-34-200, N16281, and a Cessna 172N, N6428D, collided in midair about 9 miles northwest of Miami Executive Airport (TMB), Miami, Florida. The private pilot and designated pilot examiner (DPE) onboard the Piper and the flight instructor and student pilot onboard the Cessna were fatally injured; both airplanes were destroyed. Both airplanes were registered to and were being operated by Dean International, Inc., as Title 14 Code of Federal Regulations Part 91 flights. The Piper pilots were conducting an evaluation flight for a commercial pilot certificate and the Cessna pilots were conducting a cross-country instructional flight. Visual meteorological conditions prevailed and no flight plan was filed for either flight. The Piper departed TMB on a local flight at 1253, and the Cessna departed Immokalee Regional Airport (IMM), Immokalee, Florida, at 1217, destined for TMB.

According air traffic control data provided by the Federal Aviation Administration (FAA), the Piper was en route to a nearby training area at an altitude of about 1,500 ft mean sea level (msl) and was no longer communicating with the TMB tower controller as the airplane was outside the Class D airspace. The Cessna was returning to TMB at an altitude of about 1,500 ft msl and had contacted the TMB tower controller just before the collision. The controller acknowledged the transmission and issued a traffic advisory, but no further communications were received from the Cessna. Review of radar data revealed the two targets converged nearly straight-on. At the time of the collision, the Piper was flying northwest and the Cessna was flying southeast.

Pilot Information

Certificate:	Private	**Age:**	19,Female
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	September 29, 2017
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	253 hours (Total, all aircraft)		

Check pilot Information

Certificate:	Airline transport; Commercial	**Age:**	72,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land; Multi-engine sea	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Glider	**Restraint Used:**	3-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	August 16, 2017
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	26000 hours (Total, all aircraft)		

Piper

The pilot held a private pilot certificate with ratings for airplane single-engine land and instrument airplane. Her most recent first-class FAA medical certificate was issued on September 29, 2017. According to her application for a commercial pilot certificate, dated July 17, 2018, she reported a total flight experience of 253 hours. The pilot's logbook was not recovered.

The DPE held an airline transport pilot certificate with ratings for airplane single-engine land, airplane single-engine sea, airplane multiengine land, and airplane multiengine sea. He also held a commercial pilot certificate with a rating for glider. Additionally, he held a flight instructor certificate with ratings for airplane single-engine, airplane multiengine, and instrument airplane. His most recent second-class FAA medical certificate was issued on August 16, 2017. At that time, he reported a total flight experience of 26,000 hours. The DPE's logbook was not recovered.

Cessna

The flight instructor held a commercial pilot certificate with ratings for airplane single-engine land and instrument airplane. He also held a flight instructor certificate with a rating for airplane single-engine. His most recent first-class FAA medical certificate was issued on December 15, 2014. According to his application for a flight instructor certificate, dated March 18, 2018, he reported a total flight experience of 311 hours. The flight instructor's logbook was not recovered.

The student pilot's most recent first-class FAA medical certificate was issued on March 20, 2018. According to the student pilot's logbook, he had a total flight experience of 52 hours.

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N16281
Model/Series:	PA34 200	**Aircraft Category:**	Airplane
Year of Manufacture:	1973	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	34-7350122
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	June 19, 2018 Annual	**Certified Max Gross Wt.:**	4200 lbs
Time Since Last Inspection:		**Engines:**	2 Reciprocating
Airframe Total Time:	10153 Hrs as of last inspection	**Engine Manufacturer:**	Lycoming
ELT:	C91 installed, not activated	**Engine Model/Series:**	IO-360-C1E6
Registered Owner:	Dean International Inc	**Rated Power:**	200 Horsepower
Operator:	Dean International Inc	**Operating Certificate(s) Held:**	Pilot school (141)

The Piper was a six-seat, low-wing, retractable tricycle gear airplane manufactured in 1973. It was powered by two counter-rotating Lycoming IO-360 200-horsepower engines, both equipped with two-blade Hartzell constant-speed propellers. Review of maintenance records revealed that the most recent annual inspection was completed on June 19, 2018. At that time, the airframe had accumulated about 10,153 total hours of operation. The left engine had accumulated about 10,207 total hours of operation, of which 1,147 hours were since major overhaul. The right engine had accumulated about 11,401 total hours of operation, of which 1,147 hours were since major overhaul.

The Cessna was a four-seat, high-wing, fixed tricycle gear airplane, manufactured in 1979. It was powered by a Lycoming O-320, 160-horsepower engine equipped with a two-blade McCauley fixed-pitch propeller. Review of maintenance records revealed that the most 100-hour inspection was completed on June 13, 2018. At that time, the airframe had accumulated about 18,447 total hours of operation. The engine had accumulated about 13,256 total hours of operation, of which 2,541 hours were since major overhaul.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	TMB,10 ft msl	**Distance from Accident Site:**	9 Nautical Miles
Observation Time:	12:53 Local	**Direction from Accident Site:**	135°
Lowest Cloud Condition:	Scattered / 3500 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	120°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30.1 inches Hg	**Temperature/Dew Point:**	32°C / 24°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Miami, FL (TMB)	**Type of Flight Plan Filed:**	None
Destination:	Miami, FL (TMB)	**Type of Clearance:**	None
Departure Time:	12:53 Local	**Type of Airspace:**	

The recorded weather at TMB at 1253 included wind from 120° at 5 knots, 10 statute miles visibility, scattered clouds at 3,500 ft and 4,200 ft, temperature 32°C, dew point 24°C, altimeter setting of 30.10 inches of mercury.

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	25.757778,-80.556945(est)

The Piper main wreckage was located about 620 ft west of the collision point as indicated by radar data. The wreckage was mostly intact and upright, with the vertical stabilizer and outboard section of right wing separated. The vertical stabilizer was located about 50 ft west of the main wreckage and the outboard section of right wing was located by aerial drone about 220 ft north-northeast of the main wreckage. Both engines remained attached to the airframe and the propellers remained attached to their respective engine. The right engine propeller was in a feathered position and the corresponding cockpit controls for both engines were in the aft position, consistent with impact damage. One right propeller blade exhibited little damage and the other right propeller blade was bent forward. One left engine propeller blade exhibited little damage and the other was bent aft. The landing gear selector handle was in the down position and the landing gear was found mid-extension. The flaps were in the retracted

position. Flight control continuity was confirmed and measurement of the stabilator trim jackscrew corresponded to a nose-up trim setting midrange between neutral and full nose-up. Measurement of the rudder trim shaft corresponded to an approximate neutral rudder trim. The two front seats were equipped with lapbelts and shoulder harnesses. The right seat restraint was unlatched by rescue personnel and the left seat restraint was cut by rescue personnel.

The Cessna main wreckage was located about 1,340 ft southeast of the collision point, as indicated by radar data. The airplane came to rest upright and its left wing had separated. The left wing was located by aerial drone about 1,320 ft northwest of the main wreckage. The engine remained attached to the airframe and the propeller remained attached to the engine. One propeller blade exhibited little damage and the other blade was bent aft and exhibited chordwise scratches. The flaps were found in the retracted position and flight control continuity was confirmed. Measurement of the elevator trim jackscrew corresponded to an approximate 5° trim tab up (nose-down) position. The two front seats were equipped with lapbelts and shoulder harnesses. The right seat restraint was not recovered and the left seat restraint was separated consistent with overload.

During the wreckage examinations, red and blue paint transfer was found on a top inboard section of Cessna's right wing. Tire marks were found on the Piper's right wingtip and the left main landing gear tire of the Cessna was not recovered. Additionally, the right upper strut attachment fitting from the Cessna was found in the Piper tailcone. The Cessna's left front wing spar carry-through fitting (near the left wing root) was found in the outboard right wing of the Piper. In addition, a section of the Cessna's right wing spar was found in the Piper's vertical stabilizer. The findings were consistent with a nearly head-on, off-center collision with the Cessna in a slight left bank to the Piper's right.

Medical and Pathological Information

The Miami-Dade County Medical Examiner Department, Miami, Florida, performed autopsies on all four pilots.

Toxicology testing was performed on all four pilots by the FAA Forensic Sciences Laboratory. The results were negative for the pilot of the Piper. The testing identified ibuprofen in the blood of the DPE in the Piper, which is not considered impairing.

The testing identified ethanol at 0.049 gm/dl in the Cessna student pilot's cavity blood, 0.020 gm/dl in liver, and 0.047 gm/dl in muscle. In addition, N-propanol and N-butanol were found in cavity blood and muscle. Ethanol may be produced in body tissues by microbial activity after death. N-butanol and N-propanol are other alcohols commonly produced in tissues after death.

The testing also identified 0.0015 µg/mL of delta-9-tetrahydrocannabinol (THC), the main psychoactive component of marijuana, in the Cessna flight instructor's cavity blood and urine. In addition, two inactive metabolites, 11-hydroxy-delta-9-tetrahydrocannabinol and 11-nor-9-carboxy-delta-9-tetrahydrocannabinol (THC-COOH), were found in urine and 0.0044 µg/mL 11-nor-9-carboxy-delta-9-tetrahydrocannabinol (THC-COOH) was found in cavity blood. Marijuana is a psychoactive drug with therapeutic levels as low as 0.001 µg/ml. According to National Highway Traffic Safety

Administration's Drugs and Human Performance Fact Sheets, "It is difficult to establish a relationship between a person's marijuana blood or plasma concentration and performance impairing effects. Concentrations of parent drug and metabolite are very dependent on pattern of use as well as dose. THC concentrations typically peak during the act of smoking, while peak 11-OH THC concentrations occur approximately 9-23 minutes after the start of smoking. Concentrations of both analytes decline rapidly and are often < 0.005 ug/mL at 3 hours."

Additional Information

Aircraft Performance and Cockpit Visibility Study

Automatic Dependent Surveillance—Broadcast (ADS-B) and Traffic Information Services—Broadcast (TIS-B) data were reviewed to calculate the position and orientation of each airplane during the minutes preceding the collision. The information was then used to estimate the approximate location of each airplane in the other airplane's windows and to simulate the traffic information that could have been presented to the pilots had the airplanes been equipped with a cockpit display of traffic information (CDTI) (neither was so equipped).

The study revealed that the Piper and the Cessna would have remained relatively small, slow-moving objects in each other's windows until about 12 seconds before the collision, and subsequently grown in size suddenly. About 18.5 seconds before the collision, the Cessna would have been obscured from the Piper pilot's (nominal) field of view by the Piper's instrument panel, though the Cessna would have remained unobscured in the Piper DPE's (nominal) field of view.

Simulation of CDTI displays for both airplanes indicated that both pilots could have been made aware of the presence of the other airplane at least as soon as the Piper became airborne, that is, about 6 minutes and 10 seconds before the collision. However, given the numerous traffic targets near TMB at the time of the accident, there would have been little reason for the pilots of each airplane to pay particular attention to the target representing the other until the airplanes drew much closer to each other. About 39.5 seconds before the collision, each airplane would have received an aural and visual ADS-B Traffic Advisory System (ATAS) alert of the other as they penetrated each other's protected airspace zone. The Cessna would also have received a second ATAS alert 30.5 seconds before the collision, as the ATAS algorithm predicted it would penetrate the Piper's collision airspace zone. The CDTI displays on both aircraft would have depicted the airplanes in alert status (solid yellow arrowheads enclosed in a yellow circle), converging on each other up until the collision occurred.

For more information, see Aircraft Performance & Cockpit Visibility Study in the NTSB public docket for this accident.

Administrative Information

Investigator In Charge (IIC):	Gretz, Robert
Additional Participating Persons:	Tony Saavedra; FAA/FSDO; Miramar, FL Jonathon Hirsch; Piper Aircraft; Vero Beach, FL Ricardo Asensio; Textron; Wichita, KS
Original Publish Date:	November 6, 2019
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=97806

Aviation Investigation Final Report

Location:	Miami, Florida	**Accident Number:**	ERA18FA194
Date & Time:	July 17, 2018, 12:59 Local	**Registration:**	N6428D
Aircraft:	Cessna 172	**Aircraft Damage:**	Destroyed
Defining Event:	Midair collision	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

A low-wing multiengine airplane departed the airport on an evaluation flight in the local training area with a commercial pilot candidate and designated pilot examiner onboard. The student pilot and a flight instructor onboard a high-wing airplane were returning to the same airport on a cross-country instructional flight. About 6 minutes after the low-wing airplane departed, the airplanes collided nearly straight-on about 1,500 ft mean sea level and 9 miles northwest of the airport. At the time, the low-wing airplane was clear of the Class D airspace and no longer communicating with air traffic control (ATC). One of the pilots in the high-wing airplane had contacted ATC just before the collision. The controller acknowledged the transmission and issued a traffic advisory, but no further communications were received. Neither airplane was equipped with a traffic information system, nor were they required to be.

An aircraft performance and cockpit visibility study revealed that both airplanes would have remained relatively small, slow-moving objects in each other's windows until about 12 seconds before the collision, and subsequently grown in size suddenly; however, it is likely that none of the pilots saw the other airplane given that radar data does not indicate that either airplane performed evasive maneuvers to avoid the collision No preimpact mechanical malfunctions were identified with either airplane. Toxicology testing identified low levels of delta-9-tetrahydrocannabinol (THC) and metabolites in the high-wing flight instructor's blood and urine. Their presence indicates that the instructor had used marijuana at some time before the accident, but it is unlikely that the psychoactive effects of THC remained or contributed to the accident.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The failure of both pilots in both airplanes to see and avoid the other airplane as they converged nearly head-on at the same altitude.

Findings

Personnel issues	Monitoring other aircraft - Instructor/check pilot
Personnel issues	Monitoring other aircraft - Student/instructed pilot
Personnel issues	Monitoring other aircraft - Pilot of other aircraft

Factual Information

History of Flight

Enroute-cruise	Midair collision
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On July 17, 2018, at 1259 eastern daylight time, a Piper PA-34-200, N16281, and a Cessna 172N, N6428D, collided in midair about 9 miles northwest of Miami Executive Airport (TMB), Miami, Florida. The private pilot and designated pilot examiner (DPE) onboard the Piper and the flight instructor and student pilot onboard the Cessna were fatally injured; both airplanes were destroyed. Both airplanes were registered to and were being operated by Dean International, Inc., as Title 14 Code of Federal Regulations Part 91 flights. The Piper pilots were conducting an evaluation flight for a commercial pilot certificate and the Cessna pilots were conducting a cross-country instructional flight. Visual meteorological conditions prevailed and no flight plan was filed for either flight. The Piper departed TMB on a local flight at 1253, and the Cessna departed Immokalee Regional Airport (IMM), Immokalee, Florida, at 1217, destined for TMB.

According air traffic control data provided by the Federal Aviation Administration (FAA), the Piper was en route to a nearby training area at an altitude of about 1,500 ft mean sea level (msl) and was no longer communicating with the TMB tower controller as the airplane was outside the Class D airspace. The Cessna was returning to TMB at an altitude of about 1,500 ft msl and had contacted the TMB tower controller just before the collision. The controller acknowledged the transmission and issued a traffic advisory, but no further communications were received from the Cessna. Review of radar data revealed the two targets converged nearly straight-on. At the time of the collision, the Piper was flying northwest and the Cessna was flying southeast.

Flight instructor Information

Certificate:	Commercial	**Age:**	22,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane single-engine	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	December 15, 2014
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	311 hours (Total, all aircraft)		

Student pilot Information

Certificate:	Student	**Age:**	22,Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 With waivers/limitations	**Last FAA Medical Exam:**	March 20, 2018
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	52 hours (Total, all aircraft)		

Piper

The pilot held a private pilot certificate with ratings for airplane single-engine land and instrument airplane. Her most recent first-class FAA medical certificate was issued on September 29, 2017. According to her application for a commercial pilot certificate, dated July 17, 2018, she reported a total flight experience of 253 hours. The pilot's logbook was not recovered.

The DPE held an airline transport pilot certificate with ratings for airplane single-engine land, airplane single-engine sea, airplane multiengine land, and airplane multiengine sea. He also held a commercial pilot certificate with a rating for glider. Additionally, he held a flight instructor certificate with ratings for airplane single-engine, airplane multiengine, and instrument airplane. His most recent second-class FAA medical certificate was issued on August 16, 2017. At that time, he reported a total flight experience of 26,000 hours. The DPE's logbook was not recovered.

Cessna

The flight instructor held a commercial pilot certificate with ratings for airplane single-engine land and instrument airplane. He also held a flight instructor certificate with a rating for airplane single-engine. His most recent first-class FAA medical certificate was issued on December 15, 2014. According to his application for a flight instructor certificate, dated March 18, 2018, he reported a total flight experience of 311 hours. The flight instructor's logbook was not recovered.

The student pilot's most recent first-class FAA medical certificate was issued on March 20, 2018. According to the student pilot's logbook, he had a total flight experience of 52 hours.

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N6428D
Model/Series:	172 N	**Aircraft Category:**	Airplane
Year of Manufacture:	1979	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	17272794
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	June 13, 2018 100 hour	**Certified Max Gross Wt.:**	2300 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	18447 Hrs as of last inspection	**Engine Manufacturer:**	Lycoming
ELT:	Installed, not activated	**Engine Model/Series:**	O-320-D2G
Registered Owner:	Dean International Inc	**Rated Power:**	160 Horsepower
Operator:	Dean International Inc	**Operating Certificate(s) Held:**	Pilot school (141)

The Piper was a six-seat, low-wing, retractable tricycle gear airplane manufactured in 1973. It was powered by two counter-rotating Lycoming IO-360 200-horsepower engines, both equipped with two-blade Hartzell constant-speed propellers. Review of maintenance records revealed that the most recent annual inspection was completed on June 19, 2018. At that time, the airframe had accumulated about 10,153 total hours of operation. The left engine had accumulated about 10,207 total hours of operation, of which 1,147 hours were since major overhaul. The right engine had accumulated about 11,401 total hours of operation, of which 1,147 hours were since major overhaul.

The Cessna was a four-seat, high-wing, fixed tricycle gear airplane, manufactured in 1979. It was powered by a Lycoming O-320, 160-horsepower engine equipped with a two-blade McCauley fixed-pitch propeller. Review of maintenance records revealed that the most 100-hour inspection was completed on June 13, 2018. At that time, the airframe had accumulated about 18,447 total hours of operation. The engine had accumulated about 13,256 total hours of operation, of which 2,541 hours were since major overhaul.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	TMB,10 ft msl	**Distance from Accident Site:**	9 Nautical Miles
Observation Time:	12:53 Local	**Direction from Accident Site:**	135°
Lowest Cloud Condition:	Scattered / 3500 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	120°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30.1 inches Hg	**Temperature/Dew Point:**	32°C / 24°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Immokalee, FL (IMM)	**Type of Flight Plan Filed:**	None
Destination:	Miami, FL (TMB)	**Type of Clearance:**	None
Departure Time:	12:17 Local	**Type of Airspace:**	

The recorded weather at TMB at 1253 included wind from 120° at 5 knots, 10 statute miles visibility, scattered clouds at 3,500 ft and 4,200 ft, temperature 32°C, dew point 24°C, altimeter setting of 30.10 inches of mercury.

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	25.757778,-80.556945(est)

The Piper main wreckage was located about 620 ft west of the collision point as indicated by radar data. The wreckage was mostly intact and upright, with the vertical stabilizer and outboard section of right wing separated. The vertical stabilizer was located about 50 ft west of the main wreckage and the outboard section of right wing was located by aerial drone about 220 ft north-northeast of the main wreckage. Both engines remained attached to the airframe and the propellers remained attached to their respective engine. The right engine propeller was in a feathered position and the corresponding cockpit controls for both engines were in the aft position, consistent with impact damage. One right propeller blade exhibited little damage and the other right propeller blade was bent forward. One left engine propeller blade exhibited little damage and the other was bent aft. The landing gear selector handle was in the down position and the landing gear was found mid-extension. The flaps were in the retracted

position. Flight control continuity was confirmed and measurement of the stabilator trim jackscrew corresponded to a nose-up trim setting midrange between neutral and full nose-up. Measurement of the rudder trim shaft corresponded to an approximate neutral rudder trim. The two front seats were equipped with lapbelts and shoulder harnesses. The right seat restraint was unlatched by rescue personnel and the left seat restraint was cut by rescue personnel.

The Cessna main wreckage was located about 1,340 ft southeast of the collision point, as indicated by radar data. The airplane came to rest upright and its left wing had separated. The left wing was located by aerial drone about 1,320 ft northwest of the main wreckage. The engine remained attached to the airframe and the propeller remained attached to the engine. One propeller blade exhibited little damage and the other blade was bent aft and exhibited chordwise scratches. The flaps were found in the retracted position and flight control continuity was confirmed. Measurement of the elevator trim jackscrew corresponded to an approximate 5° trim tab up (nose-down) position. The two front seats were equipped with lapbelts and shoulder harnesses. The right seat restraint was not recovered and the left seat restraint was separated consistent with overload.

During the wreckage examinations, red and blue paint transfer was found on a top inboard section of Cessna's right wing. Tire marks were found on the Piper's right wingtip and the left main landing gear tire of the Cessna was not recovered. Additionally, the right upper strut attachment fitting from the Cessna was found in the Piper tailcone. The Cessna's left front wing spar carry-through fitting (near the left wing root) was found in the outboard right wing of the Piper. In addition, a section of the Cessna's right wing spar was found in the Piper's vertical stabilizer. The findings were consistent with a nearly head-on, off-center collision with the Cessna in a slight left bank to the Piper's right.

Medical and Pathological Information

The Miami-Dade County Medical Examiner Department, Miami, Florida, performed autopsies on all four pilots.

Toxicology testing was performed on all four pilots by the FAA Forensic Sciences Laboratory. The results were negative for the pilot of the Piper. The testing identified ibuprofen in the blood of the DPE in the Piper, which is not considered impairing.

The testing identified ethanol at 0.049 gm/dl in the Cessna student pilot's cavity blood, 0.020 gm/dl in liver, and 0.047 gm/dl in muscle. In addition, N-propanol and N-butanol were found in cavity blood and muscle. Ethanol may be produced in body tissues by microbial activity after death. N-butanol and N-propanol are other alcohols commonly produced in tissues after death.

The testing also identified 0.0015 µg/mL of delta-9-tetrahydrocannabinol (THC), the main psychoactive component of marijuana, in the Cessna flight instructor's cavity blood and urine. In addition, two inactive metabolites, 11-hydroxy-delta-9-tetrahydrocannabinol and 11-nor-9-carboxy-delta-9-tetrahydrocannabinol (THC-COOH), were found in urine and 0.0044 µg/mL 11-nor-9-carboxy-delta-9-tetrahydrocannabinol (THC-COOH) was found in cavity blood. Marijuana is a psychoactive drug with therapeutic levels as low as 0.001 µg/ml. According to National Highway Traffic Safety

Administration's Drugs and Human Performance Fact Sheets, "It is difficult to establish a relationship between a person's marijuana blood or plasma concentration and performance impairing effects. Concentrations of parent drug and metabolite are very dependent on pattern of use as well as dose. THC concentrations typically peak during the act of smoking, while peak 11-OH THC concentrations occur approximately 9-23 minutes after the start of smoking. Concentrations of both analytes decline rapidly and are often < 0.005 ug/mL at 3 hours."

Additional Information

Aircraft Performance and Cockpit Visibility Study

Automatic Dependent Surveillance—Broadcast (ADS-B) and Traffic Information Services—Broadcast (TIS-B) data were reviewed to calculate the position and orientation of each airplane during the minutes preceding the collision. The information was then used to estimate the approximate location of each airplane in the other airplane's windows and to simulate the traffic information that could have been presented to the pilots had the airplanes been equipped with a cockpit display of traffic information (CDTI) (neither was so equipped).

The study revealed that the Piper and the Cessna would have remained relatively small, slow-moving objects in each other's windows until about 12 seconds before the collision, and subsequently grown in size suddenly. About 18.5 seconds before the collision, the Cessna would have been obscured from the Piper pilot's (nominal) field of view by the Piper's instrument panel, though the Cessna would have remained unobscured in the Piper DPE's (nominal) field of view.

Simulation of CDTI displays for both airplanes indicated that both pilots could have been made aware of the presence of the other airplane at least as soon as the Piper became airborne, that is, about 6 minutes and 10 seconds before the collision. However, given the numerous traffic targets near TMB at the time of the accident, there would have been little reason for the pilots of each airplane to pay particular attention to the target representing the other until the airplanes drew much closer to each other. About 39.5 seconds before the collision, each airplane would have received an aural and visual ADS-B Traffic Advisory System (ATAS) alert of the other as they penetrated each other's protected airspace zone. The Cessna would also have received a second ATAS alert 30.5 seconds before the collision, as the ATAS algorithm predicted it would penetrate the Piper's collision airspace zone. The CDTI displays on both aircraft would have depicted the airplanes in alert status (solid yellow arrowheads enclosed in a yellow circle), converging on each other up until the collision occurred.

For more information, see Aircraft Performance & Cockpit Visibility Study in the NTSB public docket for this accident.

Administrative Information

Investigator In Charge (IIC):	Gretz, Robert
Additional Participating Persons:	Tony Saavedra; FAA/FSDO; Miramar, FL Jonathon Hirsch; Piper Aircraft; Vero Beach, FL Ricardo Asensio; Textron; Wichita, KS
Original Publish Date:	November 6, 2019
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=97806