Aviation Investigation Final Report

Location:	Thomson, Georgia	**Accident Number:**	ERA22FA004
Date & Time:	October 5, 2021, 05:44 Local	**Registration:**	N283SA
Aircraft:	Dassault Falcon 20	**Aircraft Damage:**	Destroyed
Defining Event:	Miscellaneous/other	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled		

Analysis

The captain and first officer were assigned a two-leg overnight on-demand cargo flight. The flight crew were accustomed to flying night cargo flights, had regularly flown together, and were experienced pilots. The first leg of the trip was uneventful and was flown by the captain; however, their trip was delayed 2 hours and 20 minutes at the intermediate stop due to a delay in the freight arriving. The flight subsequently departed with the first officer as the pilot flying.

While enroute, about forty minutes from the destination, the flight crew asked the air traffic controller about the NOTAMs for the instrument landing system (ILS) instrument approach procedure at the destination. The controller informed the flight crew of two NOTAMs: the first pertained to the ILS glidepath being unserviceable and the second applied to the localizer being unserviceable. When the controller read the first NOTAM, he stated he did not know what “GP” meant, which was the abbreviation for the glideslope/glidepath on the approach. The controller also informed the flight crew that the localizer NOTAM was not in effect until later in the morning after their expected arrival, which was consistent with the published NOTAM.

The flight crew subsequently requested the ILS approach and when the flight was about 15 miles from the final approach fix, the controller cleared the flight for the ILS or localizer approach, to which the captain read back that they were cleared for the ILS approach. As the flight neared the final approach fix, the captain reported that they had the airport in sight; he cancelled the instrument flight rules flight plan, and the flight continued flying towards the runway. The airplane crossed the final approach fix off course, high, and fast.

The cockpit voice recorder (CVR) transcript revealed that the captain repeatedly instructed the first officer to correct for the approach path deviations. Furthermore, the majority of the

approach was conducted with a flight-idle power setting and no standard altitude callouts were made during the final approach.

Instead of performing a go-around and acknowledging the unstable approach conditions, the captain instructed the first officer to use the air brakes on final approach to reduce the altitude and airspeed. Shortly after this comment was made, the captain announced that they were low on the approach and a few seconds later the captain announced that trees were observed in their flight path. The CVR captured sounds consistent with power increasing; however, the audible stall warning tone was also heard. Subsequently, the airplane continued its descent and impacted terrain about .70 nautical mile from the runway.

Airport surveillance video captured the final 2 minutes of flight. Although low clouds and visibility were reported in the area of the airport, it is unlikely that the airplane entered instrument meteorological conditions in the flight's final 2 minutes given that the airplane's landing light was continuously in view until the airplane's impact with trees and terrain. Furthermore, the video revealed that about the time the air brake comment was made by the captain, the airplane's descent rate was observed to increase.

Examination of the airplane revealed no evidence of preimpact mechanical malfunctions or failures with the airplane or its engines. The air brakes and their actuators were found in an extended position, the landing gear were down, and the flaps were stated by the captain to be set to full. The airplane flight manual (AFM) prohibited the use of air brakes during the approach unless anti-ice was used; however, there was no indication that anti-ice was used.

It is likely that after the captain instructed the first officer to use the air brakes, the flight entered a descent that could not be recovered from, despite the rapid increase in power in the final moments of the flight. The flight profile of idle power, air brakes deployed, landing gear down, and full flaps was not a configuration that the airplane manufacturer possessed data for given that it was not an AFM approved approach configuration.

The captain advised the first officer to fly the ILS approach and to follow the glideslope, despite the glideslope being out of service per the NOTAM. It was not possible to determine whether the high and low comments from the flight crew were in reference to precision approach path indicator lights, cockpit instrumentation, or a visual glidepath assessment based upon the crew's perception of the lighted but dark night runway environment.

The glideslope portion of the ILS was not broadcasting a signal due to the equipment being removed for maintenance. The investigation was unable to determine what the glideslope indications displayed in the cockpit were due to impact-related damage to the instrumentation. The approach was being conducted during dark night conditions, which likely further exacerbated the flight crew's inability to establish a proper glide path and see the approaching trees and terrain.

The controller did not state that the glideslope was out of service when he cleared the airplane for the ILS localizer approach procedure, nor was there a requirement to do so when an ILS or

localizer approach was to be flown. Furthermore, when the airplane was near the final approach fix, the captain reported that they had the airport in sight, and he cancelled the instrument flight rules flight plan. The decision by the flight crew to continue straight in to land, rather than flying the procedure turn, contributed to the airplane being high for the majority of the final approach.

The CVR revealed that throughout the enroute descent and approach, the captain repeatedly instructed the first officer on how to fly the airplane, reprimanding and yelling at him about basic airmanship tasks such as heading and altitude control. The captain also took control of the airplane multiple times before the final approach. The captain had ample indications that the first officer was not performing adequately to continue the flight as the pilot flying. The captain could have demonstrated leadership and positive crew resource management by relieving the first officer of flying duties well before the final approach commenced, given the challenging nature of the dark night approach that was ahead.

The operator reported the first officer had not received an upgrade to captain, even after multiple years of experience on the accident airplane, due to his lack of aeronautical decision making and airmanship necessary to become a captain. This assessment was consistent with his performance during the accident flight. Furthermore, the captain's training record showed multiple deficiencies during training.

Had the operator had a flight data monitoring program (FDM) and safety management system (SMS), they could have had additional methods of identifying and monitoring the poor performing flight crew and made proactive decisions, rather than waiting for an accident to occur to discover the flight crew's procedural non-compliance. The National Transportation Safety Board has standing recommendations to Part 135 operators to implement SMS and FDM, and for the Federal Aviation Administration to require SMS and FDM in Part 135 operations.

Both pilots had cardiovascular disease that placed them at increased risk of a sudden impairing or incapacitating medical event such as heart attack or abnormal heartbeat; however, based upon the totality of the investigation's findings, it is unlikely that the captain's or first officer's cardiovascular disease contributed to the accident. Furthermore, the toxicology reports for the flight crew revealed no conditions or findings that would have contributed to the accident.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The flight crew’s continuation of an unstable dark night visual approach and the captain’s instruction to use air brakes during the approach contrary to airplane operating limitations, which resulted in a descent below the glide path, and a collision with terrain. Contributing to the accident was the captain’s poor crew resource management and failure to take over pilot flying responsibilities after the first officer repeatedly demonstrated deficiencies in flying the airplane, and the operator’s lack of safety management system and flight data monitoring program to proactively identify procedural non-compliance and unstable approaches.

Findings

Personnel issues	Incorrect action performance - Flight crew
Aircraft	Descent/approach/glide path - Capability exceeded
Aircraft	Drag control system - Incorrect use/operation
Environmental issues	Dark - Contributed to outcome
Organizational issues	(general) - Operator

Factual Information

History of Flight

Approach-VFR pattern final	Altitude deviation
Approach-VFR pattern final	Miscellaneous/other (Defining event)
Approach-VFR pattern final	Stall warn/stick-shaker/pusher
Approach-VFR pattern final	Collision with terr/obj (non-CFIT)

On October 5, 2021, at 0544 eastern daylight time, a Dassault Falcon 20C airplane, N283SA, was destroyed when it impacted terrain near the Thomson-McDuffie County Airport (HQU), Thomson, Georgia. The captain and first officer were fatally injured. The airplane was operated as Pak West Airlines Flight 887 *dba* Sierra West Airlines, as an on-demand cargo flight under the provisions of Title 14 *Code of Federal Regulations* (*CFR*) Part 135.

The flight crew initiated the first flight of the night which was about 1 hour in duration at 2132 mountain daylight time from their home base of El Paso International Airport (ELP), El Paso, Texas, to Lubbock Preston Smith International Airport (LBB), Lubbock, Texas. After about a 2 hour and 20-minute delay waiting for the freight on the ground, the accident flight was initiated from LBB to HQU.

Review of air traffic control communications provided by the Federal Aviation Administration (FAA) revealed that the flight was in contact with Atlanta Air Route Traffic Control Center (ATL Center) for about the final 40 minutes of flight. At 0503 eastern daylight time, Pak West Flight 887 (PKW887) requested information about the NOTAM for the ILS localizer runway 10 instrument approach procedure at HQU. ATL Center informed the flight crew of two NOTAMs; the first pertained to the ILS runway 10 glidepath being unserviceable. When the controller advised the pilot of the glidepath NOTAM, the controller stated that he did not know what “GP” meant, which was the abbreviation for the glideslope/glidepath on the approach.

The second NOTAM applied to the localizer being unserviceable. The controller informed the flight crew that the localizer NOTAM was not in effect until later in the morning after their expected arrival, which was consistent with the published NOTAM.

About 0525, ATL Center asked PKW887 which approach they would like, to which they responded with the “ILS runway one zero approach.” The controller responded, “roger, standby for that.” (Note: the glidepath/glideslope was out of service at the time of the accident). At 0526, ATL Center cleared PKW887 to CEDAR intersection, which was the initial approach fix for the ILS or localizer/non-directional beacon (NDB) runway 10 approach.

About 0537, ATL Center informed PKW887 that they were 15 miles southwest from CEDAR and to “cross CEDAR at or above 3,000 cleared ILS localizer one zero into Thomson McDuffie.” PKW887 read back the clearance and the controller stated it was a “good readback” and to

report when established on the “procedure.” About 1 minute later, the controller advised PKW887 of a telephone number to call to cancel their instrument flight rules (IFR) clearance once on the ground; however, about 0543, PKW887 was near CEDAR and requested to cancel their IFR clearance. The controller advised PKW887 to squawk “vfr” and no further communications were received.

Surveillance video located at HQU airport showed that about 0539 the airport and runway lights were activated from off to on. About 0542 the airplane’s landing lights came into view in the pitch-black horizon and were subsequently steadily visible for about 2 minutes. The video showed the airplane approaching runway 10 in a relatively constant descent and heading. About 25 seconds before the airplane’s landing lights disappeared, a momentary right turn, followed by a left turn and increased descent rate was observed. No explosion was observed when the landing lights disappeared about 0544.

About 0518, the CVR revealed that during the enroute descent while the airplane was flying through an area of storms, the captain repeatedly made comments related to the first officer’s performance as the pilot flying. He sternly stated to the first officer to “fly the airplane” multiple times and the captain subsequently stated, “I’ve got the airplane.” About 1 minute later, the captain issued raised-voice instructions to the first officer on appropriate headings to fly. About 0521, the captain read back a heading clearance from ATC, and the captain stated, “you fly the damn airplane.” A few minutes later, the captain made comments consistent with reading portions of the ILS or Localizer Runway 10 approach chart; however, the comments were interrupted when the captain again made more heading instructions to the first officer.

About 0527, as the airplane was approaching an assigned altitude during the descent, the captain exclaimed “altitude” and then shouted, “I’ll get that, you fly the damn airplane. I don’t want you to kill me.”

About 0532, the flight crew was attempting to load and navigate to the CEDAR intersection and the captain said that he would fly the airplane while the first officer loaded the waypoint. About 1 minute later, the captain stated to the first officer “you got the airplane.” For the next 3 minutes the captain made repeated comments on what headings, speed, and altitudes the first officer needed to fly, and instructed him to adjust the trim wheel.

At 0539:28, as the flight was nearing the final approach fix and attempting to activate the pilot-controlled lighting, the captain stated in a frustrated tone, “would you fly the airplane- man-uhh man- I’ve been doing everything else.” A few seconds later, the captain stated, “here it is right over.” The captain subsequently stated, “fly the ILS approach.” The captain also noted that air brakes were stowed, flaps were set to 40°, and the before landing checklist was complete.

At 0541:15, the captain stated, “follow the glideslope without that” and about 30 seconds later stated that the localizer was alive. At 0542:20, the captain stated, “I want you to- I want you to fly the airplane.” A few seconds later, the captain stated that landing flaps were selected, and he reported to ATC that they had joined the localizer, had a “visual” on the runway, and canceled the IFR clearance.

At 0543:22, the captain made repeated comments that they were high and fast and that they needed to lose 20 kts. A few seconds later, the captain stated, “let’s use your air brakes again.” At 0543:51, the captain stated, “you’re way high,” and the first officer responded, “no I’m not.” The captain responded with “look” and “you’re fifteen knots fast we got a short runway.” About 0544, the captain again stated, “use your air brake” and about 4 seconds later, the captain stated, “now you’re low.” About 6 seconds later, the captain stated in an elevated voice, “you got trees.” Power was heard to increase rapidly, the audible electronic pulsating stall warning activated, and at 0544:07, the sound of impact was heard.

An automatic dependent surveillance – broadcast (ADS-B) performance study conducted by the National Transportation Safety Board’s (NTSB) Vehicle Performance Division found that the airplane crossed CEDAR (the final approach fix) at 2,600 ft mean sea level (msl) and 500 ft to the left of the extended runway centerline. After CEDAR, the flight track continued toward the runway and continued to be about 600 ft above the 3° visual glide path and further deviated to the left of the runway heading until about 3 nautical miles from the threshold, when the descent rate increased. The airplane’s airspeed at that time was about 150 kts. ADS-B coverage ended at 05:43:54, about 3,000 ft short of the first recorded tree strike. The final recorded altitude was 900 ft msl (400 ft above ground level [agl]) and the calculated airspeed was 137 kts. Figures 1 and 2 provide an overview of the flight track data, expected approach path, and summary CVR comments related to the approach.

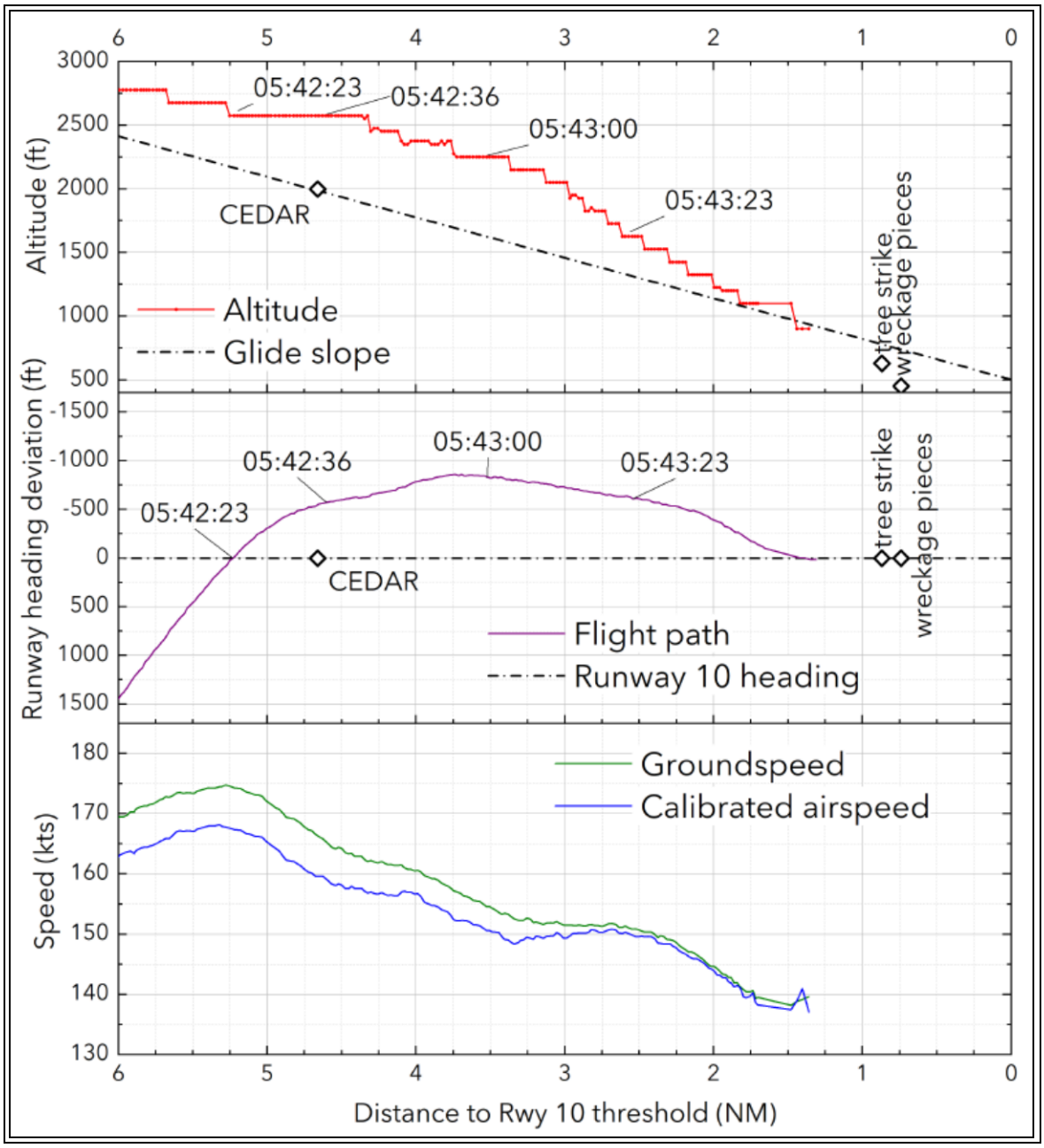

Figure 1: Altitude compared to 3° visual glide slope, flight path compared to runway heading, and calculated ground and airspeeds for final 6 NM of the approach.

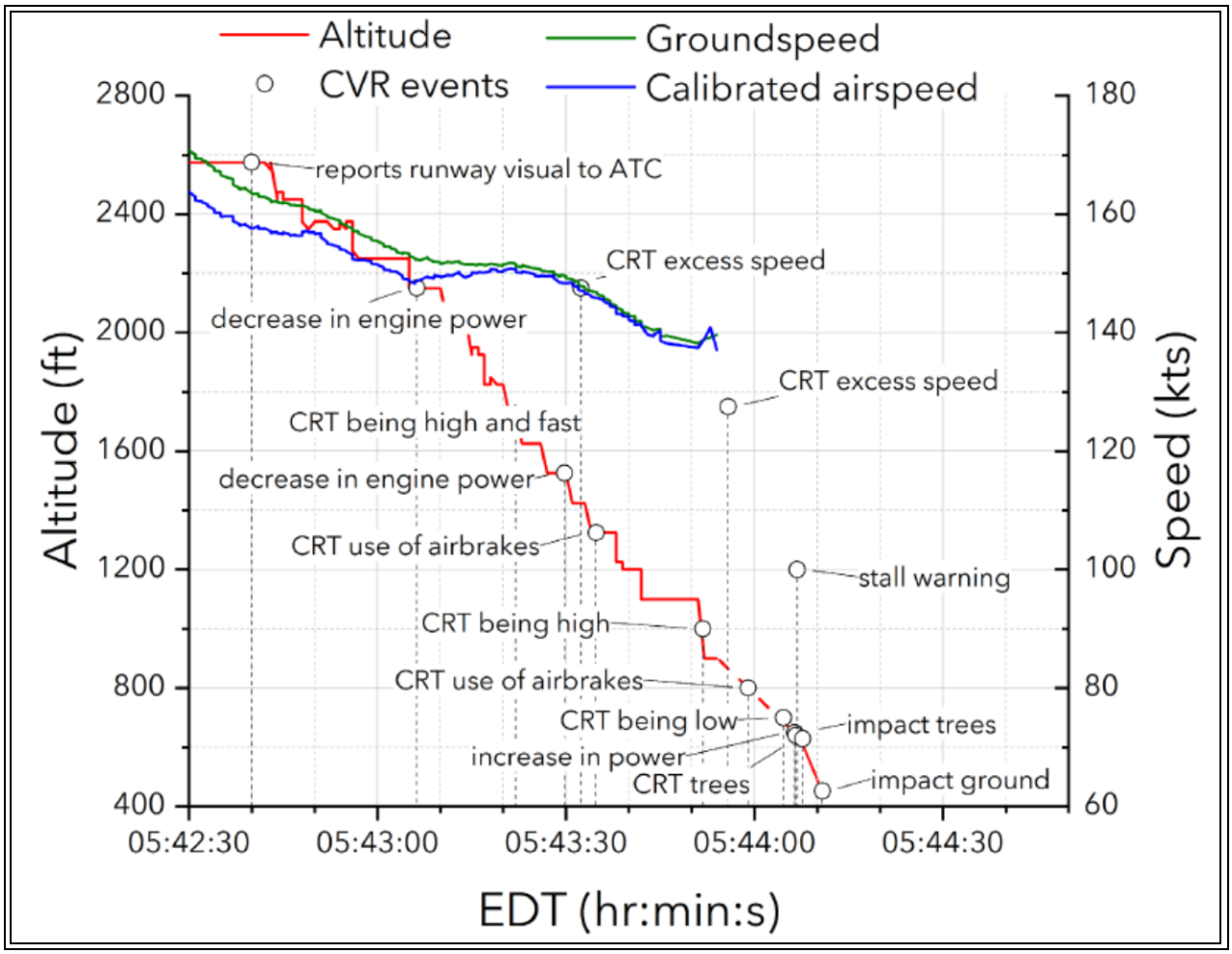

Figure 2: Altitude, calibrated airspeed, and groundspeed with selected end of flight CVR events. "CRT" is "Comment related to –". Red dotted line shows estimated altitude trend. ADS-B data ended at 05:43:54.

The recorded CVR audio from the cockpit area microphone channel was evaluated in an attempt to determine the engines' N1 operating speeds during the final approach phase of the accident flight. The sound spectrum study found that for about the last minute of the flight the engine N1 speeds were near flight idle, and further decreased to flight idle for the final 30 seconds before the initial impact with trees. After the initial impact was heard, both N1 speeds were observed to rise rapidly before the recording ended.

Pilot Information

Certificate:	Airline transport	**Age:**	73,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 With waivers/limitations	**Last FAA Medical Exam:**	March 10, 2021
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	July 29, 2021
Flight Time:	11955 hours (Total, all aircraft), 1665 hours (Total, this make and model), 8177 hours (Pilot In Command, all aircraft), 167 hours (Last 90 days, all aircraft), 56 hours (Last 30 days, all aircraft)		

Co-pilot Information

Certificate:	Commercial	**Age:**	63,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	March 10, 2021
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	December 30, 2021
Flight Time:	10908 hours (Total, all aircraft), 1248 hours (Total, this make and model), 109 hours (Last 90 days, all aircraft), 11 hours (Last 30 days, all aircraft)		

Captain

According to the operator's training and employment records, in September 2019 the captain satisfactorily completed indoctrination training and ground training and was subsequently assigned to the DA20 as a pilot in command. The captain completed multiple airman competency/proficiency checks from 2019 through 2021. Each check was ultimately completed satisfactorily; however, multiple line checks required retraining and testing due to unsatisfactory performance of required task items. Some example areas that were required to be retrained and tested were circling approaches and steep turns.

According to the captain's resumé and records from his former employer Ameristar Jetcharter Inc. (Ameristar), he was employed by the operator as a pilot from June 2017 through August 2019.

On December 22, 2017, an airman competency/proficiency check (14 *CFR* 135.293 and 135.297 checks) in a DA20 simulator was marked as disapproved. The remarks from the check airman stated in part that during instrument procedures the captain was "cleared for

right turn by ATC, mis-set hdg bug resulting in left turn. Distraction resulted in loss of airspeed to full stall condition." A few days later, the pilot satisfactorily completed the check. He served as SIC through mid-January 2018 and was subsequently upgraded to PIC.

First Officer

According to operator training and employment records, on August 20, 2009, the first officer was hired and assigned to the DA20 as an SIC after satisfactorily completing indoctrination training and ground and flight training. The pilot left the operator for 5 years, returned in 2019, and was reassigned again as an SIC DA20 flight crewmember.

On December 30, 2020, an airman competency/proficiency check (14 *CFR* 135.293) was completed satisfactorily with remarks that stated, "SIC Only." The operator reported that the first officer was designated as a SIC only due to pilot performance and a lack of aeronautical decision making and airmanship necessary to become a PIC/captain.

Aircraft and Owner/Operator Information

Aircraft Make:	Dassault	**Registration:**	N283SA
Model/Series:	Falcon 20 C	**Aircraft Category:**	Airplane
Year of Manufacture:	1967	**Amateur Built:**	
Airworthiness Certificate:	Transport	**Serial Number:**	83
Landing Gear Type:	Retractable - Tricycle	**Seats:**	2
Date/Type of Last Inspection:	September 22, 2021 Continuous airworthiness	**Certified Max Gross Wt.:**	28660 lbs
Time Since Last Inspection:	12 Hrs	**Engines:**	2 Turbo fan
Airframe Total Time:	18798 Hrs at time of accident	**Engine Manufacturer:**	GE
ELT:	C126 installed, activated, aided in locating accident	**Engine Model/Series:**	CF700-2D-2
Registered Owner:	CAREER AVIATION CO	**Rated Power:**	4200 Lbs thrust
Operator:	Pak West Airlines Inc.	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:	Sierra West Airlines	**Operator Designator Code:**	VPOA

Approach Speed

The airplane's landing reference speed, Vref, for flaps 40° (which was indicated in the CVR transcript), 20,000 lbs, and no airbrakes was 113 kts. This speed was consistent with what was

found set with the speed bugs on both the pilot and co-pilot airspeed indicators (115, 110 knots, respectively).

Air Brakes

According to the DA20 maintenance manual and operating manual, the air brakes are electro-hydraulic devices on both wings situated on the upper surface that permits aerodynamic braking of the airplane in flight. The maximum deflection is 70° and they are held in place by hydraulic pressure. The airbrakes are deployed through the use of a handle located on the center console of the cockpit closer to the left seat pilot. The air brakes operate in a deployed or stowed configuration. The time to extend the air brakes is 2 to 3 seconds and retraction is 3 to 4 seconds. There were two annunciator lights associated with the deployment of the airbrakes.

The DA20 AFM stated in part that the airbrakes were to be checked IN during the approach. The manual further states that, “In approach with flaps extended, the airbrakes must be retracted. If the approach is made with the anti-ice on, the airbrakes may be extended down to 500 ft above the ground.” Furthermore, the approach speed must be increased by 10 kts as long as the air brakes are out. Based upon a review of the CVR transcript, an engine sound spectrum study, and review of meteorological information, there was no evidence that the anti-ice system was on during the approach.

Aerodynamic Stall Speed and Systems Information

Based upon an expected landing weight of 20,280 lbs and the airplane’s equipped instrumentation, the aerodynamic stall speed was likely about 91 KIAS (Flaps 40°) and 95 KIAS (Flaps 25°). The AFM airspeed limitations stated:

> CAUTION: DO NOT INTENTIONALLY FLY THE AIRPLANE SLOWER THAN INITIAL STALL WARNING ONSET

According to Dassault Aviation representatives, there was no data that existed as to what flight characteristics the airplane would demonstrate in an idle power, full landing flaps, landing gear down, and air brakes deployed configuration.

The airplane was equipped with a multi-faceted stall warning system. According to the operations manual, the stall warning system was designed to inform the pilot of a forthcoming stall by sounding an aural warning. When the airplane is approaching stalling conditions a modulated medium pitch will sound 2/3 seconds on, 1/3 seconds off.

Operator Information

The operator, Pak West Airlines, dba Sierra West Airlines (SWA), held a Title 14 *CFR* Part 135 air operator certificate with the FAA. According to SWA records, the accident flight crew flew together routinely and commonly performed overnight flights. The flight crew schedules, and duty day were consistent with Part 135 regulations.

The SWA DA20 standard operating procedures stated that during visual approaches the PNF (pilot not flying) was to announce 1,000 ft, 500 ft, 100 ft, and 50 ft agl altitude callouts. The CVR transcript revealed that none of these altitude callouts were made by the captain, who was the pilot not flying.

The SWA General Operations Manual (GOM) defined “stabilizing approach concept” as the procedure by which the crew maintains a stable speed, configuration, descent rate, vertical flight path, and engines spooled.

The GOM further outlined that both pilots were responsible for ensuring the approach was stabilized before continuing below minimum altitudes that varied dependent upon the type of approach being flown. The minimum altitude for visual approaches was 500 ft agl. The GOM further provided a warning that that the flight crew was responsible for taking “immediate action” of a go-around or missed approach if “stabilized conditions” are not met.

The GOM stated that it was critical to flight safety that either pilot had the ability to call for a go-around if they believe an unsafe condition exists. The go-around action was required to be associated with immediate action of executing a missed approach, without question, because of the immediacy of the situation.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night/dark
Observation Facility, Elevation:	HQU,500 ft msl	**Distance from Accident Site:**	0.64 Nautical Miles
Observation Time:	05:50 Local	**Direction from Accident Site:**	280°
Lowest Cloud Condition:	Scattered / 1200 ft AGL	**Visibility**	7 miles
Lowest Ceiling:	Overcast / 9000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:		**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30.04 inches Hg	**Temperature/Dew Point:**	20°C
Precipitation and Obscuration:	In the vicinity - None - Haze		
Departure Point:	Lubbock, TX (LBB)	**Type of Flight Plan Filed:**	IFR
Destination:	Thomson, GA (HQU)	**Type of Clearance:**	IFR
Departure Time:	02:08 Local	**Type of Airspace:**	Class G

An NTSB weather study found that low clouds, drizzle and rain, and low visibility likely persisted along the approach path. Dark nighttime conditions existed at the time of the accident with both the sun and the moon below the horizon.

Review of a surveillance video at the airport revealed that the airplane's landing light came into view about 2 minutes before disappearing into the trees. The view of the landing light was steady and continuous, and there was no indication that the airplane entered clouds in the viewable 2 minutes.

There were inflight advisories current for the area for thunderstorms west and north of the destination, and for IFR conditions over the region.

Airport Information

Airport:	THOMSON-MCDUFFIE COUNTY HQU	**Runway Surface Type:**	Asphalt
Airport Elevation:	500 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	10/28	**IFR Approach:**	ILS;Localizer only;Visual
Runway Length/Width:	5514 ft / 100 ft	**VFR Approach/Landing:**	None

The HQU airport had one runway (10-28) that was 5,514 ft in total length and 100 ft wide. The usable length when landing on runway 10 from the glideslope was 4,433 ft.

The only ILS or localizer approach to HQU was to runway 10. The approach required automatic direction finding (ADF) equipment for the procedure entry. The approach published a minimum altitude of 2,000 ft msl at the final approach fix CEDAR. The published procedure entry required that the airplane fly outbound on a 277° heading and complete a procedure turn back to the final approach course of 097°. The minimum descent altitude was 960 ft msl (492 ft agl), with the glideslope out of service and the local altimeter setting. The approach plate stated that a precision approach path indicator (PAPI) was available on the left side of the runway.

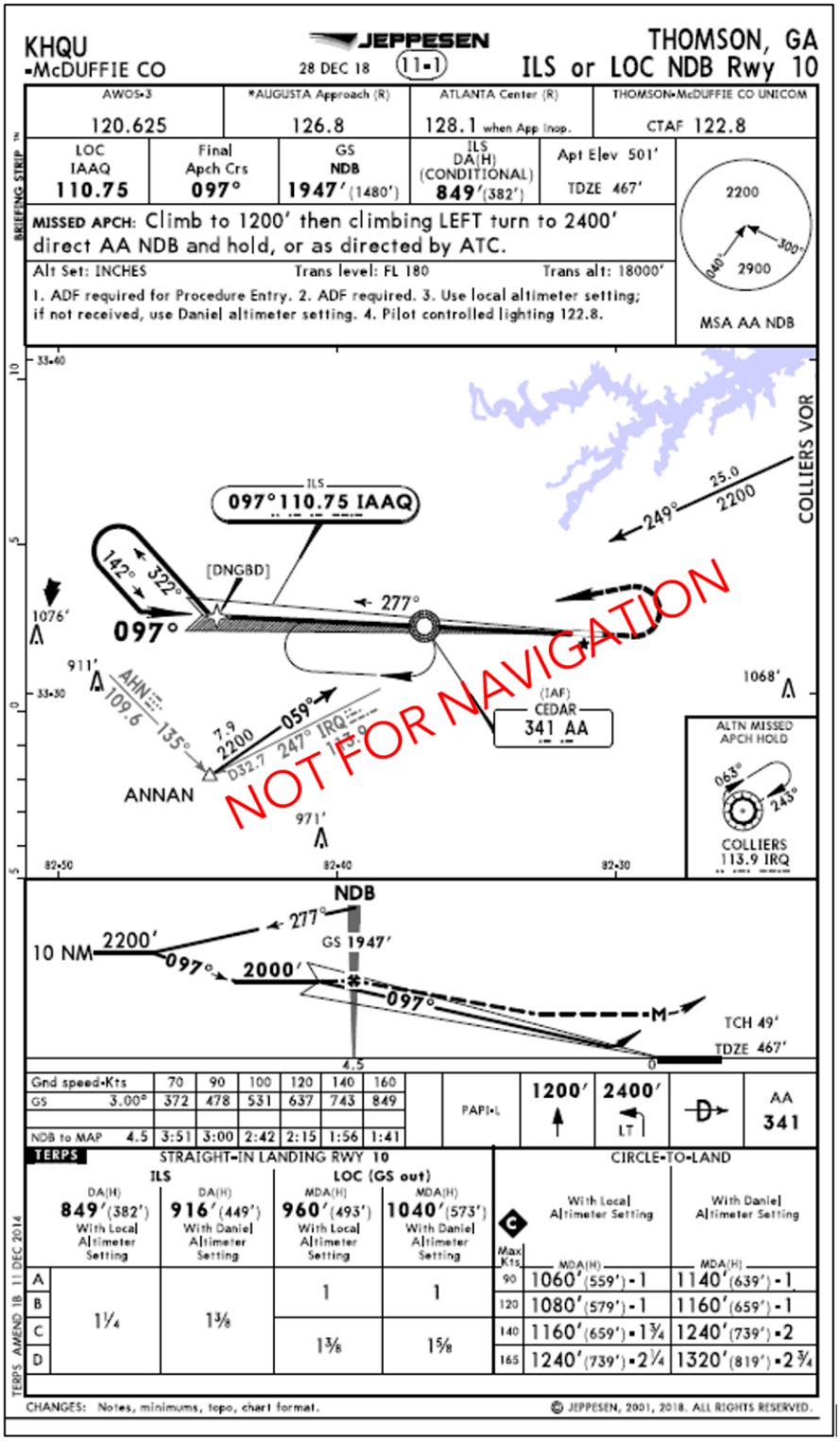

Figure 3: Instrument approach procedure chart for the ILS or LOC NDB Runway 10 Approach

NOTAM Information

Several NOTAMs were published for HQU at the time of the accident. A NOTAM was issued for the ILS runway 10 glidepath, noting it was unserviceable (out of service) from September 27, 2021, 1104 UTC, to October 11, 2021, 2000 UTC estimated. This NOTAM was in effect at the time of the accident. According to FAA Technical Operations, the glideslope was turned off and not radiating at the time of the accident and was scheduled for maintenance later in the month.

A NOTAM was issued for the PAPI denoting it was unserviceable (out of service) from October 5, 2021, 1418 UTC to October 12, 2021, 2000 UTC estimated. This NOTAM was published; however, it was not in effect at the time of the accident.

An operational ground test of the PAPI for runway 10 was performed after the accident and no anomalies were discovered.

A NOTAM was issued for the ILS runway 10 localizer, noting it was unserviceable (out of service) from October 5, 2021, 1200 UTC to October 5, 2021, 1800 UTC estimated. This NOTAM was published; however, it was not in effect at the time of the accident. There were several additional obstruction-related NOTAMs also published for HQU.

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	N/A	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	33.530483,-82.539617

The initial impact point coincided with broken pine tree branches among a forest where the trees were about 150 ft tall. The debris path was oriented on a heading of about 100° and spanned about 880 ft from the initial impact to the main wreckage area. The airplane was heavily fragmented; however, there was no evidence of fire. The largest fragments of wreckage were concentrated in three primary areas overviewed in Figure 4. The figure shows the initial impact point and a pop-out drone image that describes the three areas.

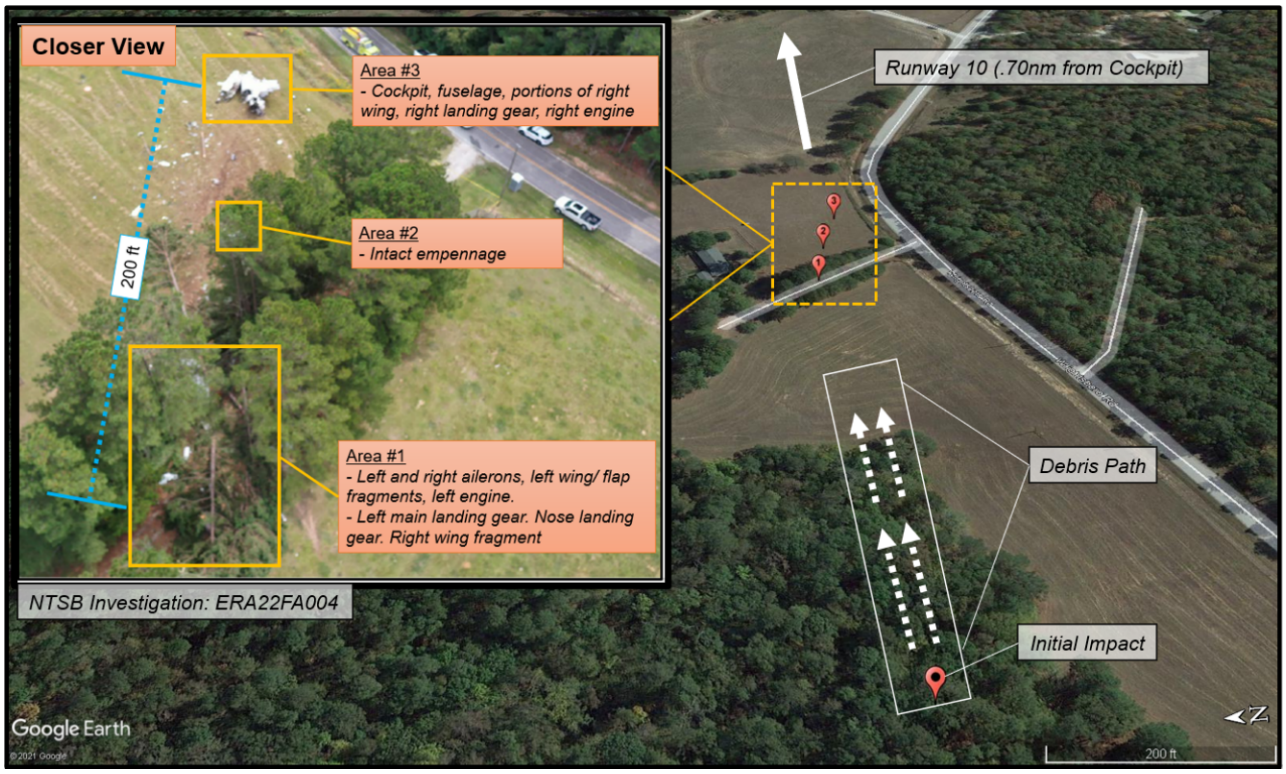

Figure 4: Overview of the wreckage path and concentrated areas of wreckage (Drone image courtesy of Georgia Bureau of Investigations)

All major components of the airplane were located in the debris path. Flight control continuity could not be determined from the control surface to the cockpit due to the heavy fragmentation; however, within the fragmented flight control areas continuity was observed.

Examination of the cockpit found the flap selector in the full flaps 40° position and the landing gear handle was selected down. The left airspeed speed bug was set to 115 kts and the right side was set to 110 kts. The left and right primary attitude indicators, which contained vertical glideslope indicators, were damaged during the impact and multiple fail flags were visible within the units.

The flap surface position, based upon review of their respective jackscrews, was near the 25° position as found. The landing gear were extended.

The left air brake surface was found partially extended. It's actuator was found in a position that corresponded to a near full deployment position. The right air brake surface was found nearly fully extended, which was consistent with the position of its actuator. The horizontal stabilizer and its jackscrew were found to be within a normal envelope.

Both engines exhibited impact damage and varying degrees of foreign object debris ingestion that had the appearance of wood chips and green vegetation in the center core of the engine. Several fan blades exhibited leading edge gouging, knicks, and torsional twisting.

Communications

Air traffic control (ATC) services were provided by Atlanta Air Route Traffic Control Center (ZTL ARTCC). The controller cleared the airplane to “cross CEDAR at or above 3,000 cleared ILS localizer one zero into Thomson McDuffie” and informed the flight crew to report back when established on the procedure. Subsequently, the captain cancelled the IFR flight plan near CEDAR.

FAA Order JO 7110.65Z, Air Traffic Control, prescribed information required when issuing an approach clearance to an aircraft conducting an instrument approach. Chapter 4, section 8, paragraph 4-8-1 stated in part:

4-8-1. APPROACH CLEARANCE

a. Clear aircraft for “standard” or “special” instrument approach procedures only.

1. To require an aircraft to execute a particular instrument approach procedure, specify in the approach clearance the name of the approach as published on the approach chart. Where more than one procedure is published on a single chart and a specific procedure is to be flown, amend the approach clearance to specify execution of the specific approach to be flown. If only one instrument approach of a particular type is published, the approach needs not be identified by the runway reference.

2. An aircraft conducting an ILS or LDA approach must be advised at the time an approach clearance is issued when the glideslope is reported out of service, unless the title of the published approach procedure allows (for example, ILS or LOC Rwy 05).

3. Standard instrument approach procedures (SIAP) must begin at an initial approach fix (IAF) or an intermediate fix (IF) if there is not an IAF.

4. Clearances authorizing instrument approaches are issued on the basis that, if visual contact with the ground is made before the approach is completed, the entire approach procedure will be followed unless the pilot receives approval for a contact approach, is cleared for a visual approach, or cancels their IFR flight plan.

Medical and Pathological Information

The Georgia Bureau of Investigation, Division of Forensic Sciences, performed the captain's autopsy. According to the autopsy report, the captain's cause of death was generalized blunt force trauma, and his manner of death was accident. His heart was enlarged, weighing 600 grams (the upper limit of normal is roughly 510 grams for a male of the captain's body weight). There was moderate-to-severe atherosclerotic disease of his coronary arteries. Visual examination of his heart was otherwise unremarkable for natural disease. There was focally severe atherosclerosis of his aorta. Examination of his brain was limited due to the severity of injury. The autopsy did not identify any other significant natural disease.

The FAA Forensic Sciences laboratory performed toxicological testing of postmortem specimens from the captain. No tested-for substances were detected.

The Georgia Bureau of Investigation, Division of Forensic Sciences, performed the first officer's autopsy. According to the autopsy report, his cause of death was generalized blunt force trauma, and his manner of death was accident. He had severe atherosclerotic disease of his coronary arteries. Visual examination of his heart was otherwise unremarkable for natural disease. He had focally severe atherosclerosis of his aorta. The autopsy did not identify any other significant natural disease.

The FAA Forensic Sciences laboratory performed toxicological testing of postmortem specimens from the first officer. Losartan, rosuvastatin, and acetaminophen were detected in cardiac blood and urine. The glucose levels in vitreous and urine were measured to be 13 mg/dL and 5 mg/dL, respectively.

Organizational and Management Information

According to the SWA GOM, the Director of Operations was responsible for operational control and had the authority to direct all operational functions. It stated the following personnel were also authorized to exercise operational control: The President, Vice President, Chief Pilot, Director of Maintenance for maintenance matters, flight control manager, and flight followers.

The Director of Operations reported that SWA, at the time of the accident, did not have an aviation safety action program (ASAP) or a FDM program. He reported that their formal SMS was at the development stage.

Additional Information

The NTSB has outstanding recommendations for Part 135 operators to implement SMS and FDM programs. In 2019-2020, the NTSB published a fact sheet as part of the Most Wanted List of Transportation Safety Improvements titled, Improve the Safety of Part 135 Aircraft Flight Operations. The fact sheet stated in part:

What can be done?

We know that SMS, FDM, and CFIT [controlled flight into terrain] *programs can improve safety and prevent crashes. We currently have 21 open safety recommendations addressing the safety gap in Part 135 operations. Operators must be proactive about safety; they should not wait for regulations or an accident to move them to action. Some operators have already incorporated SMS, FDM, and CFIT programs and are seeing tremendous safety returns.*

To increase use of SMS, FDM, and CFIT programs in Part 135 aircraft, the following actions should be taken:

Operators/Industry

- *Implement an SMS and FDM, appropriately scaled to the size of your operation, to detect and correct unsafe deviations from company procedures before an accident occurs.*
- *An SMS is an effective way to establish and reinforce a positive safety culture and identify deviations from standard operating procedures so that they can be corrected.*
- *Collect data through an FDM over the entirety of the operation; this is the only means an operator has to consistently and proactively monitor its line operations. FDM should be a nonpunitive system.*
- *Use analysis tools provided by associations and the FAA's InfoShare to identify safety trends.*
- *Incorporate a CFIT-avoidance training program that addresses current TAWS technologies relevant to your operational environment.*

Regulators

Require all Part 135 operators to install flight data recording devices capable of supporting an FDM program and to establish SMS programs. Work with Part 135 operators to improve voluntarily implemented training programs aimed at reducing the risk of CFIT accidents involving continuing flight under visual flight rules into instrument meteorological conditions, paying special attention to human factors issues.

As of the publication of this report, the FAA had no requirement for the operator to implement an SMS or FDM program.

On January 11, 2023, the FAA issued a Notice of Proposed Rule Making (NPRM) that may expand SMS requirements to certain on-demand commercial operators. The NPRM summary stated in part:

The FAA proposes to update and expand the requirements for safety management systems (SMS) and require certain certificate holders and commercial air tour operators to develop and implement an SMS. This proposed rule would extend the requirement for an SMS to all certificate holders operating under the rules for commuter and on-demand operations, commercial air tour operators, production certificate (PC) holders that are holders or licensees of a type certificate (TC) for the same product, and holders of a TC who license out that TC for production.

The FAA also proposes this rule in part to address a Congressional mandate as well as recommendations from the National Transportation Safety Board (NTSB) and two Aviation Rulemaking Committees (ARCs). Additionally, the proposed rule would more closely align the United States with Annex 19 to the Convention on International Civil Aviation. This proposed rule is intended to improve aviation safety by requiring organizations to implement a proactive approach to managing safety.

Administrative Information

Investigator In Charge (IIC):	Gerhardt, Adam
Additional Participating Persons:	John Pless; FAA/ FSDO; Atlanta, GA Yan Torres; Bureau d'Enquêtes et d'Analyses (BEA); Paris, OF Laurent Merlier; Dassault Aviation; Paris, OF David Gridley; GE Commercial Flight Safety; Cincinnati, OH Herve Camelin; Sierra West Airlines; Oakdale, CA
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