National Transportation Safety Board - Aircraft Accident/Incident Database

Accident Rpt# DCA16CA089 02/14/2016 1635 CST	**Regis# N827AW**	**Minneapolis, MN**	**Apt: N/a**
Acft Mk/Mdl AIRBUS INDUSTRIE A319 132-132	**Acft SN 1547**	**Acft Dmg: NONE**	**Rpt Status: Prelim Prob Caus: Pending**
		Fatal 0 Ser Inj 1	**Flt Conducted Under: FAR 121**
Opr Name: AMERICAN AIRLINES	**Opr dba:**		**Aircraft Fire: NONE**

an airsafety.com e-product
Prepared From Official Records of the NTSB By:
Air Data Research
9865 Tower View, Helotes, Texas 78023
210-695-2204 - info@airsafety.com - www.airsafety.com

Accident Rpt# GAA17CA495	**08/20/2017 1230 PDT**	**Regis# N6259C**	**Minden, NV**	**Apt: Minden-tahoe MEV**
Acft Mk/Mdl BELL 206-B		**Acft SN 703**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Factual Prob Caus: Pending**
Eng Mk/Mdl ROLLS ROYCE 250-C20B		**Acft TT 22237**	**Fatal 0 Ser Inj 0**	**Flt Conducted Under: FAR 091**
Opr Name: HELICOPTER PARTS INTERNATIONAL INC		**Opr dba:**		**Aircraft Fire: NONE**
				AW Cert: STN

Summary

The pilot of the helicopter reported that, during landing, the helicopter "encountered LTE [loss of tail rotor effectiveness]." He added that he maneuvered the helicopter to an open field adjacent to the intended helipad and that the tail rotor impacted a barbed wire fence.

The helicopter sustained substantial damage to the empennage.

The pilot reported that there were no preaccident mechanical failures or malfunctions with the helicopter that would have precluded normal operation.

The Federal Aviation Administration's Helicopter Flying Handbook, FAA-H-8083-21A, contained a section titled "Loss of Tail Rotor Effectiveness (LTE)," which stated:

Loss of tail rotor effectiveness (LTE) or an unanticipated yaw is defined as an uncommanded, rapid yaw towards the advancing blade which does not subside of its own accord. It can result in the loss of the aircraft if left unchecked. It is very important for pilots to understand that LTE is caused by an aerodynamic interaction between the main rotor and tail rotor and not caused from a mechanical failure. Some helicopter types are more likely to encounter LTE due to the normal certification thrust produced by having a tail rotor that, although meeting certification standards, is not always able to produce the additional thrust demanded by the pilot.

Cause Narrative

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: The pilot's failure to maintain helicopter control during landing due to a loss of tail rotor effectiveness.

Events

1. Landing - Loss of tail rotor effectiveness
2. Landing - Attempted remediation/recovery
3. Landing - Collision with terr/obj (non-CFIT)

Findings - Cause/Factor

1. Personnel issues-Task performance-Use of equip/info-Aircraft control-Pilot - C
2. Aircraft-Aircraft oper/perf/capability-Performance/control parameters-Prop/rotor parameters-Not attained/maintained - C
3. Environmental issues-Physical environment-Object/animal/substance-Fence/fence post-Contributed to outcome

Narrative

The pilot of the helicopter reported that, during landing, the helicopter "encountered LTE [loss of tail rotor effectiveness]". He added that he maneuvered the helicopter to an open field adjacent to the intended helipad and the tail rotor impacted a barbed wire fence.

The helicopter sustained substantial damage to the empennage.

The pilot reported that there were no preaccident mechanical failures or malfunctions with the helicopter that would have precluded normal operation.

Federal Aviation Administration's Helicopter Flying Handbook, FAA-H-8083-21A, contains a section titled "Loss of Tail Rotor Effectiveness (LTE)" which states:

Loss of tail rotor effectiveness (LTE) or an unanticipated yaw is defined as an uncommanded, rapid yaw towards the advancing blade which does not subside of its own accord. It can result in the loss of the aircraft if left unchecked. It is very important for pilots to understand that LTE is caused by an aerodynamic interaction between the main rotor and tail rotor and not caused from a mechanical failure. Some helicopter types are more likely to encounter LTE due to the normal certification thrust produced by having a tail rotor that, although meeting certification standards, is not always able to produce the additional thrust demanded by the pilot.

Accident Rpt# ERA18LA020	**11/08/2017 1140 CST**	**Regis# N275AE**	**Union City, TN**	**Apt: None LAWN**
Acft Mk/Mdl BELL 206-L3		**Acft SN 51186**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Prelim** **Prob Caus: Pending**
Eng Mk/Mdl ROLLS ROYCE M250-C30P		**Acft TT 13103**	**Fatal 0** **Ser Inj 0**	**Flt Conducted Under: FAR 091**
Opr Name: AIR EVAC EMS INC		**Opr dba:**		**Aircraft Fire: NONE**
				AW Cert: STN

Events

2. Landing - Abnormal runway contact

Narrative

On November 8, 2017, about 1140 central standard time, a Bell 206-L3 helicopter, N275AE, operated by Air Evac EMS Inc., was substantially damaged during landing in Union City, Tennessee. The commercial pilot, flight nurse, and flight paramedic sustained minor injuries. Visual meteorological conditions prevailed, and a company visual flight rules flight plan was filed for the positioning flight, conducted under the provisions of 14 Code of Federal Regulations Part 91, which departed Troy, Tennessee, about 1133.

According to the operator, the helicopter was flown to Union City, Tennessee, for a public relations event that was to take place at the Obion County Emergency Communications District 911 Center. Prior to the accident flight, the pilot was shown the requested landing zone (LZ), which was across the street from the center, next to a church and was previously utilized as a landing site by other helicopter pilots.

A company employee, equipped with a portable radio notified the crew that the LZ was secure and asked them to launch at 1124. At approximately 1135, he heard the pilot transmit his flight plan, which was acknowledged and read back. Approximately 3 minutes later, the helicopter flew overhead the LZ. The company employee transmitted that he was directly underneath the helicopter, and asked the pilot if he saw his "red truck," which was parked where he wanted him to land. He did not receive a response. He observed the helicopter flying a high and low "recon" utilizing left hand turns, and then watched the helicopter turn onto a final approach to the church parking lot adjacent to where he was located. He advised the pilot that he was clear of wires and again received no response.

The helicopter subsequently descended onto a steep grassy slope, and the front one-third of the upslope skid contacted the ground. As more weight was placed on the skids, the tailboom rapidly descended toward the ground. The stinger embedded into soft mud and tail rotor struck the ground. The sound of the engine changed, and the tailboom rose into the air at what the company employee estimated to be 60ø. There was an "explosively loud bang" and the airframe slammed violently back down onto the slope. The helicopter then began to shake violently, and the main rotor separated from the mast.

According to the pilot, he had discussed the LZ with the company employee as he was unfamiliar with the LZ. The company employee described to him where there were powerlines along the road bordering the LZ and showed him where other pilots had landed in the past. He also thought he understood him to say that the parking lot at the LZ could be used as well.

As the helicopter approached the LZ, the pilot made radio contact with the company employee, who advised that the LZ was clear. The helicopter was on final approach to the parking lot, and had already passed the LZ that the company employee reported was utilized by other pilots when the pilot saw electrical wires running from poles on the lot. He called out wires, stopped the descent, and then decided that he could land on the grass just south of the lot, on what appeared to be flat terrain.

As the helicopter settled to the ground, the pilot felt the skids touch the sod and he began to lower the collective. Suddenly the helicopter's tail continued to fall, and the nose rose. He began to increase collective to stabilize the helicopter; however, the tail continued downward, and he felt the helicopter sliding backwards. He added more collective and felt two "thumps." Realizing his tail rotor had contacted something, he added forward cyclic and began to reduce power. The tail of the helicopter came up rapidly. He then applied aft cyclic and the tail came back down. The helicopter began shaking violently and rocking back and forth. He shut-off the fuel. A few seconds later the helicopter came to a stop and all occupants egressed.

According to Federal Aviation Administration (FAA) airman records and pilot records, the pilot held a commercial pilot certificate with ratings for airplane single-engine land, rotorcraft-helicopter, and instrument helicopter. His most recent FAA second-class medical certificate was issued on December 14, 2016. He reported that he had accrued about 2,687 total hours of flight experience, about 2,327 of which was in the accident helicopter make and model.

According to FAA airworthiness and maintenance records, the helicopter was manufactured in 1986. Its most recent approved aircraft inspection program

inspection was completed on October 24, 2017. At the time of the inspection, the helicopter had accrued about 13,103 total hours of operation, and the engine had accrued about 6,361 total hours of operation.

Accident Rpt# CEN18FA033	**11/19/2017 1855 CST**	**Regis# N620PA**	**Stuttgart, AR**	**Apt: N/a**	
Acft Mk/Mdl BELL HELICOPTER TEXTRON CANADA		**Acft SN 54610**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Prelim**	**Prob Caus: Pending**
Eng Mk/Mdl ROLLS-ROYCE 250-C47B			**Fatal 3** **Ser Inj 0**	**Flt Conducted Under: FAR 091**	
Opr Name: AIR METHODS CORP		**Opr dba:**		**Aircraft Fire: GRD**	

Events

1. Enroute-cruise - Birdstrike

Narrative

On November 19, 2017, about 1855 central standard time, a Bell 407 helicopter, N620PA, impacted terrain near Stuttgart, Arkansas. The pilot and two medical crew members were fatally injured, and the helicopter was substantially damaged. The helicopter was registered to and operated by Air Methods under the provisions of 14 Code of Federal Regulations Part 91 as a positioning flight. Night visual meteorological conditions prevailed for the flight, which operated on a company visual flight rules flight plan. The flight originated from Pines Bluff, Arkansas, and was en route to pick up a patient in Helena, Arkansas.

Residents near the accident site reported hearing a boom and seeing a fire plume. Local law enforcement located the wreckage on private property on the bank of a reservoir. A post impact fire consumed a majority of the fuselage. All major helicopter components were located at the accident site. Several bird carcasses were located in the wreckage of the helicopter.

The helicopter was retained for further examination.

Accident Rpt# DCA16CA094B 02/17/2016 545 EST	**Regis# N784SW**	**Detroit, MI**	**Apt: Detroit Metropolitan Wayne Cou DTW**
Acft Mk/Mdl BOEING 737 7H4-7H4	**Acft SN 29810**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Prelim Prob Caus: Pending**
		Fatal 0 Ser Inj 0	**Flt Conducted Under: FAR 121**
Opr Name: SOUTHWEST AIRLINES	**Opr dba:**		**Aircraft Fire: NONE**

an airsafety.com e-product
Prepared From Official Records of the NTSB By:
Air Data Research
9865 Tower View, Helotes, Texas 78023
210-695-2204 - info@airsafety.com - www.airsafety.com

Accident Rpt# DCA16CA094A 02/17/2016 545 EST	**Regis# N925NN**	**Detroit, MI**	**Apt: Detroit Metropolitan Wayne Cou DTW**
Acft Mk/Mdl BOEING 737-823	**Acft SN 31169**	**Acft Dmg: MINOR**	**Rpt Status: Prelim Prob Caus: Pending**
	Acft TT 9518	**Fatal 0 Ser Inj 0**	**Flt Conducted Under: FAR 121**
Opr Name: AMERICAN AIRLINES	**Opr dba:**		**Aircraft Fire: NONE**

an airsafety.com e-product
Prepared From Official Records of the NTSB By:
Air Data Research
9865 Tower View, Helotes, Texas 78023
210-695-2204 - info@airsafety.com - www.airsafety.com

Accident Rpt# ERA15LA140	**03/01/2015 1615 EST**	**Regis# N600NP**	**Marco Island, FL**	**Apt: Marco Island Airport MKY**
Acft Mk/Mdl BOMBARDIER CANADAIR CL600-2A12-601		**Acft SN 3002**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Factual Prob Caus: Pending**
Eng Mk/Mdl GE CF34-3A		**Acft TT 15771**	**Fatal 0 Ser Inj 1**	**Flt Conducted Under: FAR 091**
Opr Name: SIX HUNDRED NP LLC		**Opr dba:**		**Aircraft Fire: NONE**
				AW Cert: STT

Summary

Earlier on the day of the accident, the pilot-in-command (PIC) and second-in-command (SIC) had landed the airplane on a 5,008-ft-long, asphalt-grooved runway. After touchdown with the flaps fully extended, the ground spoilers and thrust reversers were deployed, and normal braking occurred. The PIC, who was the flying pilot, and the SIC subsequently departed on an executive/corporate flight with a flight attendant, the airplane owner, and five passengers onboard. The PIC reported that he flew a visual approach to the dry, 5,000-ft-long runway while maintaining a normal glidepath at Vref plus 4 or 5 knots at the runway threshold with the flaps fully extended. He added that the touchdown was "firm" and between about 300 to 500 ft beyond the aiming point marking. After touchdown, the PIC tried unsuccessfully to deploy the ground spoilers. He applied "moderate" brake pressure when the nose landing gear (NLG) contacted the runway, but felt no deceleration. He also attempted to deploy the thrust reversers without success.♂♂The PIC then informed the SIC that there was no braking energy, released the brakes, and turned off the antiskid system. He then reapplied heavy braking but did not feel any deceleration, and he again tried to deploy the thrust reversers without success. He maintained directional control using the nosewheel steering and manually modulated the brakes. However, the airplane did not slow as expected. While approaching the runway end and realizing that he was not going to be able to stop the airplane on the runway, the PIC intentionally veered the airplane right to avoid water ahead. However, the airplane exited the runway end into sand, and the NLG collapsed. The airplane then came to rest about 250 ft past the departure end of the runway. The passengers exited the airplane, and shortly after, airport personnel arrived and rendered assistance. The airplane owner, who was a passenger in the cabin, stated that he left his seat and moved toward the cabin door when he realized that the airplane would not stop on the runway, and he sustained serious injuries.♂♂Examination of the airplane revealed that there was minimal pressure at the No. 2 (left inboard) brake due to failure of a spring in the upper brake control valve (BCV), and the coupling subassembly of the No. 1 wheel speed sensor (WSS) was fractured. A representative from the airplane manufacturer reported that, during certification of the brake system, the failure of the BCV spring was considered acceptably low and would be evident to flight crewmembers within five landings of the failure. Because the airplane did not pull while braking during the previous landing earlier that day to a similar length runway, the spring likely failed during the accident landing.♂♂Although the PIC was unable to manually deploy the ground spoilers and thrust reversers during the landing roll, they functioned normally during the landing earlier that day and during postaccident operational testing and examination, with no systems failures or malfunctions noted. Additionally, there were no malfunctions or failures with the weight-on-wheels system found during postaccident examinations that would have precluded normal operation. Therefore, the PIC's unsuccessful attempts to deploy the ground spoilers and thrust reversers were likely due to errors made while multitasking when presented with an unexpected situation (inadequate deceleration) with little runway remaining.♂♂Airplane stopping distance calculations based on the airplane's reported weight, weather conditions, calculated and PIC-reported Vref speed, flap extension, and estimated touchdown point (300 to 500 ft beyond the aiming point marking as reported by the PIC and SIC and corroborated by security camera footage) and assuming the nonuse of the ground spoilers and thrust reversers, operational antiskid and steering systems, and the loss of one brake per side (symmetric half braking) showed that the airplane would have required 690 ft of additional runway; under the same conditions but with thrust reversers used, the airplane still would have required 27 ft of additional runway. Even though there were no antiskid failure annunciations, the PIC switched off the antiskid system, which led to the rupture of the Nos. 1, 3, and 4 tires and likely fractured the No. 1 WSS's coupling subassembly, both of which would have further contributed to the loss of braking action. Therefore, the combination of the failure of a spring in the No. 2 brake's upper BCV and the fracture of the coupling subassembly of the No. 1 WSS, the pilot's failure to attain the proper touchdown point, the slightly excess speed, and the subsequent failure of three of the tires resulted in there being insufficient runway remaining to avoid a runway overrun.♂♂Although the BCV manufacturer reported that there was 1 previous case involving a failed BCV spring and 43 instances of units with relaxed springs within the BCVs, none of these failed or relaxed springs would have been detected by maintenance personnel because a focused inspection of the BCV was not required.

Cause Narrative

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: The failure of a spring inside the No. 2 brake's upper brake control valve and the fracture of the coupling subassembly of the No. 1 wheel speed sensor during landing, which resulted in the loss of braking action, and the pilot-in-command's (PIC) deactivation of the antiskid system even though there were no antiskid failure annunciations, which resulted in the rupture of the Nos. 1, 3, and 4 tires, further loss of braking action, and subsequent landing overrun. Contributing to accident were the PIC's improper landing flare, which resulted in landing several hundred feet beyond the aiming point marking, and his unsuccessful attempts to deploy the thrust reversers for reasons that could not be determined because postaccident operational testing did not reveal any anomalies that would have precluded normal operation. Contributing to the passenger's injury was his leaving his seat intentionally while the airplane was in motion.

Events

1. Landing-landing roll - Miscellaneous/other

Findings - Cause/Factor

1. Aircraft-Aircraft systems-Landing gear system-Landing gear brakes system-Malfunction - C
2. Aircraft-Aircraft systems-Landing gear system-Anti-skid section-Incorrect use/operation - C
3. Personnel issues-Action/decision-Action-Incorrect action selection-Pilot - C
4. Personnel issues-Task performance-Use of equip/info-Use of equip/system-Pilot - C
5. Aircraft-Aircraft oper/perf/capability-Performance/control parameters-Landing flare-Not attained/maintained - F
6. Not determined-Not determined-(general)-(general)-Unknown/Not determined - F
7. Personnel issues-Action/decision-Info processing/decision-Decision making/judgment-Passenger - F

Narrative

HISTORY OF FLIGHT

On March 1, 2015, about 1615 eastern standard time, a Bombardier Canadair CL-600-2A12 airplane, N600NP, experienced a landing overrun and subsequent collapse of the nose landing gear at Marco Island Airport (MKY), Marco Island, Florida. The two pilots, one flight attendant, and four passengers were not injured; one passenger sustained serious injuries; and one passenger sustained minor injuries. The airplane was substantially damaged. The airplane was being operated as a 14 Code of Federal Regulations (CFR) Part 91 executive/corporate flight. An instrument flight rules flight plan was filed, and visual meteorological conditions prevailed at MKY about the time of the accident. The flight originated about 1554 from Florida Keys Marathon Airport (MTH), Marathon, Florida.

Earlier on the day of the accident, the pilot-in-command (PIC) and second-in-command (SIC) landed the airplane on a 5,008-ft-long, asphalt-grooved runway at MTH. After touchdown with the flaps fully extended, the ground spoilers and thrust reversers were deployed, and normal braking occurred. The flight crewmembers reported no discrepancies pertaining to the normal brake system, antiskid system, thrust reversers, or ground spoilers.

The PIC, who was seated in the left seat, stated that, after takeoff from MTH, they proceeded to MKY and obtained information from the automated weather observing station (AWOS), which indicated the wind was from 250ø at 5 knots. Before the approach, the pilots reviewed the speeds and landing distance; the calculated required landing distance assuming a Vref of 133 knots was 3,166 ft for a dry runway and 4,166 ft for a wet runway; runway 17 was 5,000 ft long. About 10 miles south of MKY, they had the runway in sight and then requested and were approved for a visual approach from Fort Myers Approach Control. The airplane then entered the downwind leg of the airport traffic pattern from the south while slowing; the flaps were extended to 20ø. The PIC noted that there was rain about 2 to 3 miles east of MKY but that the runway appeared to be dry. Because of the rain, the PIC chose to fly the traffic pattern closer to the runway (0.5 mile) on the downwind leg, which he extended 1 mile to avoid the rain. When the airplane was abeam the approach end of runway 17, the SIC extended the landing gear and the flaps to 30ø. The pilots then performed the Landing checklist and the antiskid test, which was normal. The PIC then armed the thrust reversers and made a "teardrop turn" to the final approach leg of the airport traffic pattern. The airplane owner, who was pilot-rated and seated in the cabin, recalled a greater bank angle on the turn from downwind to final.

During the approach, the flaps were extended to 45ø, and while flying Vref plus 10 knots, the airplane encountered a couple of wind gusts. The SIC checked the AWOS again, but the wind information was the same. The flight did not encounter rain during the approach, and at 50 ft above ground level (agl), the automated callout occurred. The PIC maintained a normal glidepath at Vref plus 4 or 5 knots at the runway threshold, at which point, he placed the thrust levers in the" idle" position. The owner later reported that, while over the runway, it felt like they were floating slightly longer than normal.

The PIC reported that the touchdown was "firm" occurring between 300 and 500 ft beyond the "aiming point marking." After touchdown, he tried to extend the ground spoilers without success. He later attributed that to the complex process requiring the lever to be pulled up then moved rearward through an integral gate. When the nose landing gear (NLG) contacted the runway, he applied forward control yoke pressure and brake pressure but felt no deceleration. He indicated that he also attempted to deploy the thrust reversers but did not believe they deployed and did not see any thrust reverser deploy lights. He further stated that each piggyback lever never unlocked and that he could not get the levers into the reverse position. The owner later reported that he heard what he thought was a "tire go" during the landing roll, that he felt "heavy braking," and that he became concerned when he did not feel or hear the thrust reversers deploy.

The PIC added that he applied "moderate" brake pressure but did not feel any deceleration, which the SIC characterized the landing roll as similar to skidding on ice. The PIC informed the SIC there was no braking energy, released the brakes, turned off the antiskid, and then "re-applied the brakes pressing hard." The SIC also reported he too applied the brakes because he felt no deceleration. The PIC reported he did not feel any deceleration and again tried to deploy the thrust reversers without success. He maintained the runway centerline using the nosewheel steering and began modulating the brakes. However, the airplane

did not slow as expected. After the PIC realized that he was not going to be able to stop the airplane on the runway and because there was water beyond the runway end, he intentionally veered the airplane to the right. The SIC reported the airplane departed the runway travelling about 35 knots, and rolled about 250 ft into sand. The airplane owner, who had stood up to go to the cabin entry door when it became clear to him that the airplane was not going to stop on the runway, was bounced against the sidewall between the Nos. 1 and 2 seats on the airplane's left side and sustained serious injuries.

The PIC ordered an emergency evacuation and secured the engines. At that time, the piggyback levers were still up; he then pushed them down, pulled the firewall shutoff valves, and secured the auxiliary power unit. The passengers exited the airplane, and power was secured. Shortly after, airport personnel arrived and rendered assistance. Subsequently, a passenger occupying the cockpit jumpseat complained of back pain and was taken to a hospital for treatment. The PIC later confirmed that he used nosewheel steering to maintain the runway centerline, and that, during the landing roll, he did not detect any abnormal issues with the nosewheel steering.

The SIC later reported that there was no antiskid or weight-on-wheels (WOW) annunciations or failed lights and no warnings from the enhanced ground proximity warning system (EGPWS). He indicated that he and the PIC did not discuss whether to go-around because the problem became evident when the airplane was too far down the runway.

PERSONNEL INFORMATION

PIC

The PIC held a Federal Aviation Administration (FAA) airline transport pilot certificate with a multiengine airplane rating and type ratings in several aircraft, including the CL-600. He also held a commercial pilot certificate with an airplane single-engine land rating and a flight instructor certificate with airplane single-engine, airplane multiengine, and instrument airplane ratings. He was issued a first-class medical certificate on January 15, 2015, with the limitation that he "must wear corrective lenses," which he was wearing at the time of the accident.

The PIC's total flight time was 8,988 hours, 840 hours of which were in the accident airplane make and model, 625 hours of which were as PIC in the accident airplane. In the 90 days before the accident, his total flight time was 65 hours, 25 hours of which were as PIC and 40 hours of which were as SIC.

He obtained his initial type rating in the CL-600 in March 2011 from CAE SimuFlite (CAE), Fort Worth, Texas. His last 14 CFR 135.297 check was performed in a Level D simulator at CAE on February 3, 2015, and his last 14 CFR 135.293 check in a CL600 was performed at CAE in August 2014.

The operator hired the PIC in February 2009 as a captain. After obtaining his PIC type rating in the CL-600 in March 2011, he flew a rotation of different aircraft for 2 years. From May 2013 to the accident date, he only flew the CL-600.

SIC

The SIC held an FAA airline transport pilot certificate with an airplane multiengine land rating and type ratings in several aircraft, including the CL-600. He also held a commercial pilot certificate with an airplane single-engine land rating.

The SIC estimated that his total flight time was more than 17,000 hours, about 1,500 hours of which were in the accident airplane make and model and 10 hours of which were in the 90 days before the accident. He obtained his type rating in the CL600 in December 2008 from CAE, and his last 14 CFR 61.58 check in the CL600 was performed at CAE in June 2014.

The operator hired the SIC in 2007 as the chief pilot. He had flown with the captain for years. In July 2014, he took a Director of Operations position for another company but continued to be a contract pilot for the operator.

AIRCRAFT INFORMATION

The airplane, serial number (S/N) 3002, was manufactured in 1983 by Canadair Ltd. A Certificate for Airworthiness for Export was issued on September 9, 1983, and 20 days later, the FAA issued a transport-category Standard Airworthiness Certificate. The airplane was powered by two General Electric CF34-3A engines.

The airplane was equipped with steer-by-wire nosewheel system, which was controlled by an electronic control module that operated a hydraulic steering control valve (SCV) in response to the commands via either the handwheel and/or rudder pedals. The SCV controlled an actuator, which through a rack-and-pinion arrangement, rotated a steering cuff. The steering cuff in turn rotated the nosewheels through torque links (or scissors). The steering system was normally switched on continuously during flight and was enabled only when the aircraft was on the ground with WOW input. With no WOW input, the NLG was free castoring.

The airplane was equipped with a normal brake system, and each four-wheel brake system provided one-quarter of the total stopping force in the four-tire set (Nos. 1 and 2 on the left main landing gear [MLG] and Nos. 3 and 4 on the right MLG). Each pilot had a left and right brake pedal, which were mechanically linked at the brake control assembly located beneath the cockpit floor. The brake control assembly contained two brake control valves (BCV) that manipulated hydraulic valves via mechanical inputs. Each of the four BCVs regulated the amount of hydraulic pressure provided to each of the four-wheel brake systems through the antiskid braking system and hydraulic fuses. There were two BCV assemblies installed in the nose hydraulics compartment as a part of the brake control mechanism assembly. The upper BCV controlled the inboard brakes, and hydraulic pressure was supplied by the No. 3 hydraulic system; the lower BCV controlled the outboard brakes, and hydraulic pressure was supplied by the No. 2 hydraulic system. The BCVs were considered on-condition components.

The airplane was equipped with an antiskid braking system that consisted of a skid control unit and two dual antiskid control valves and wheel speed sensors (WSS) located in the axle of each main wheel. The system independently controlled the braking of each main wheel by automatically varying the hydraulic pressure output of each dual BCV before these outputs reached the brakes. WSSs were considered on-condition components. An arming switch on the antiskid panel controlled power to the antiskid valves from the 28-volt direct current main bus via the inboard and outboard antiskid relays and the parking brake microswitch. Therefore, the system cannot be armed when the parking brake is on (parking brake shutoff valve closed). When the parking brake is applied, the INBD FAIL and OUTBD FAIL antiskid warning lights illuminated.

The antiskid system had the following features: (1) modulated skid protection of each wheel via the primary antiskid circuits; (2) locked-wheel protection, which provided a pressure dump signal in the event of a deep skid or failure of a wheel to spin up at touchdown and a coarse backup circuit in the event of a primary antiskid circuit failure; (3) pretouchdown protection which, via input from the WOW circuitry, dumped all the wheels' brake pressure while the airplane was still airborne, but the protection was overridden as soon as the wheels have spun up to allow normal skid-controlled braking; (4) built-in test equipment to provide a check of virtually all the system circuits, both on the ground (before takeoff) and in the air (before landing); and (5) spin-up relays to inhibit thrust reverser deployment until after touchdown.

The airplane was equipped with ground spoilers that were controlled electrically via a control unit located in the underfloor avionics bay, which received electrical signals from the ground spoilers on/off/test switch, spoiler control lever, landing gear control unit, antiskid control unit, and throttle levers. Upon receiving all required signals concurrently, the spoiler control unit transmitted a signal to energize the solenoid valves of a manifold assembly located in each MLG wheel well, which, in turn, directed hydraulic pressure to the extend port of each ground spoiler actuator to extend the spoilers. The ground spoilers are armed for deployment at touchdown by setting the ground spoilers switch to the "on" position and moving the spoiler control lever to the "extend" position. The lever must be pulled up, then moved rearward through an integral gate to achieve the required position. In addition to the lever selection, the throttle levers must be set at idle and the aircraft weight must be on the landing gear (and/or wheels spin-up) before the ground spoilers can deploy.

The airplane was equipped with thrust reversers that redirected engine fan air flow forward over the nose cowl assembly. Thrust reverser selection and control are accomplished primarily by a throttle-quadrant-mounted thrust lever for each engine. Each lever is held in the stow position by a thrust reverser lever stop, which is released by lifting the stop release latch. A deploy switch for each thrust reverser was mounted in the throttle quadrant and was operated by moving the appropriate thrust reverser lever to the "deploy" position.

The airplane was maintained in accordance with the manufacturer's maintenance steering group (MSG) 3 program since January 30, 2009, which consisted of hours- or months-interval inspections of systems or components. Review of the program revealed no requirement to periodically perform an operational test of the antiskid system; however, it contained a general zonal visual inspection every 120 months of the lower internal left nose compartment, which contained the upper and lower BCVs. The zonal inspection did not require inspection of either the upper or lower BCVs input rods extension lengths. The last inspection of that zone was completed on January 18, 2013, at an airframe total time of 15,155.5 hours and 9,303 cycles.

Review of the maintenance records revealed that the airplane's last 800-hour inspection was completed on January 14, 2015, at an airplane total time of 15,737.0 hours and 9,684 cycles. The 800-hour inspection included an operational test of the nosewheel steering electronic control module and the landing gear

control unit.

A review of the Aircraft Reporting Form (used by flight crewmembers to report discrepancies) for the 90 days before the accident revealed no discrepancies regarding the brakes, antiskid system, ground spoilers, or thrust reversers.

According to the current status document provided by the operator, there was no record that the upper BCV or No. 1 WSS had been removed, replaced, or repaired since the airplane was manufactured. Maintenance record entries indicated that the No. 1 tire, part number (P/N) 256K43-3, S/N 33097507, was installed on November 10, 2014, at an airframe total time of 15,699.7 hours and 9,657 cycles. At the time of the accident, the airplane had a total time of 15,771.2 and 9,705 cycles.

METEOROLOGICAL INFORMATION

The MKY AWOS reported about the time of the accident wind from 250ø at 8 knots, visibility 10 statute miles, few clouds at 9,000 ft, temperature 27øC, dewpoint 20øC, and altimeter setting 30.22 inches of mercury.

The Weather Surveillance Radar 0.5ø-elevation scan depicted the conditions from between 3,740 and 10,990 ft over the accident site. The scan images for 1611 and 1626, which were 4 minutes before and 11 minutes after the accident, respectively, depicted an area of echoes with maximum intensities from 45 to 50 dBZ immediately east of MKY. Plotting of the approach path to MKY onto the weather images showed that the airplane flew under the leading edge of the echoes as it entered the traffic pattern turning onto final approach. The main area of the echoes began to move over the accident site about 7 minutes after the accident with echoes of 35 to 40 dBZ, which are associated with moderate-to-heavy rain. No strong outflows or divergent signatures with the area of echoes were noted, indicating that no strong winds, gust fronts, or microbursts were associated with the echoes. Additionally, no lightning was detected, indicating that the strong echoes were only associated with rain showers and not thunderstorms during the period.

No pilot reports were made in the area surrounding the accident time nor were any Convective SIGMETs, Severe Weather Forecast Alerts, or Center Weather Advisories issued along the accident route.

Airport security cameras captured portions of the approach, landing, landing roll, and accident sequence. A review of the footage revealed that it began raining about 10 minutes after the accident.

AIRPORT INFORMATION

MKY was a public airport with a single, grooved asphalt runway, 17/35, which was 5,000 ft long by 100 ft wide and reported to be in "fair condition." Left traffic was specified for runway 17, which was a slight upsloping runway.

FLIGHT RECORDERS

The airplane was equipped with an L-3 Communications/Fairchild A100A Cockpit Voice Recorder (CVR); it was not equipped nor was it required to be equipped with a flight data recorder. Audio was extracted from the CVR normally and without difficulty; however, the accident flight was not recorded. Further examination of the CVR revealed that the drive mechanism's mylar belt was broken.

According to the CVR manufacturer, the broken drive belt rendered the unit incapable of recording and would not have passed the operational test required by the flight crewmembers before flight and by maintenance personnel every 800 hours. Maintenance records revealed that maintenance personnel's last operational check of the CVR occurred on January 14, 2015, about 34 hours before the accident.

The airplane was also equipped with a Honeywell Mark VII EGPWS. Examination of the unit revealed that the terrain inhibit was not active, and there were no warnings associated with the accident flight. The landing record occurred when the flight was about 800 ft before the runway threshold, which, according to the EGPWS manufacturer, occurred when the radio altimeter indicated the airplane passed below 50 ft and the landing gear were down.

WRECKAGE AND IMPACT INFORMATION

The airplane reportedly came to rest about 250 ft past the departure end of runway 17. Examination of the runway revealed that the first identified skid mark associated with the No.1 tire was about 2,094 ft from the approach end of the runway. Alternating light and dark skid marks with rain grooves and gaps continued for about 780 ft, at which point a dark skid mark continued for about 128 ft. At the end of the dark skid mark from the No. 1 main tire, or about 3,002 ft from the approach end of the runway, the skid mark was distorted. Along the dark skid mark associated with the No. 1 tire, minor skid marks from the No. 2 tire were noted. Dark skid marks from the Nos. 3 and 4 tires were noted 3 ft right of the runway centerline beginning just beyond the heavy skid mark from the No. 1 main tire, or about 2,900 ft from the approach end of the runway. The skid marks made on the runway by the Nos. 3 and 4 tires changed direction multiple times, which continued to the end of the runway. At the departure end of the runway, a rubber transfer skid mark associated with the NLG tire was noted inboard of the skid mark from the No. 3 tire.

Beyond the departure end of the runway, marks from all landing gear tires were noted; however, the mark from the NLG stopped about 81 ft 10 inches before the resting position of the left MLG, which was consistent with the collapse of the NLG.

Examination of the airplane revealed a hole in the lower portion of a bulkhead, a tear in the skin and frame from the right NLG trunnion attachment, a buckle in the right NLG wall, and displacement of the left NLG wall. The NLG was separated from its attachment point but remained partially attached by two flexible hydraulic hoses. The P62 and P63 connections associated with the WOW harness in the NLG area were tightly secured.

The NLG WOW harness, NLG steering harness, and hydraulic lines were disconnected due to partial separation of the NLG. The WOW harness was properly secured to the NLG, and the WOW sensors were tightly secured and safety wired. Although the gap of the NLG WOW sensors was not measured before the WOW harness was removed, according to the mechanic who removed it, the gap appeared normal. Further, a review of a picture provided by Bombardier revealed some overlap of one WOW sensor, although the strut was not compressed. The left and right NLG tires were within 2 and 1 pound per square inch (psi) of the specified limit, and the NLG strut pressure was within limits. The No. 3 system hydraulic return lines in the NLG wheel well, which were damaged, were removed, and the lines were capped.

Examination of the left wing revealed that the wing tip fairing was crushed upward. The inboard flap fairing of the inboard flap was damaged by the left MLG door, and the outboard flap fairing of the outboard flap was damaged. The thrust reverser was fully stowed. There was no observed damage to the right wing, vertical stabilizer, horizontal stabilizer, or engines; the right thrust reverser was also fully stowed.

Examination of the cockpit revealed that the nosewheel steering switch was in the "arm" position and that the ground spoiler and the antiskid switches were in the "off" position. The thrust levers were in the "cutoff" position, and the thrust reverser levers were stowed.

With electrical power applied, the WOW annunciator illuminated, and both thrust reverser switches "arm" lights illuminated. The Nos. 1, 2, and 3 quantity indicators were in the green arc range. With momentary activation of the Nos. 1, 2, and 3 hydraulic systems, the pressure in each increased to 3,000 psi, and the quantity in each indicated 60, 40, and 50%, respectively. The brake inboard and outboard pressures indicated 3,000 psi due to momentary activation of the Nos. 2 and 3 system hydraulic pumps.

Examination of the left MLG revealed that the Nos. 1 and 2 tires remained on the wheel assembly but that the No. 1 tire was on the inboard wheel half. The No. 1 tire showed evidence of flat spotting and a rupture tear, whereas the No. 2 tire pressure was within limits, but the tire was worn. The gaps of both WOW switches were within limits, and both were properly secured and safety wired. With about 1,300 lbs of fuel onboard and the airplane fully resting on the MLG, the forward end of the inboard and outboard WOW switches was flush with the forward end of the target. No defects were noted in the WOW wiring harness in the MLG area. Both WSSs were properly installed; however, the No. 1 WSS coupling subassembly, P/N 6002286, was fractured near the base. The No. 1 WSS and tire assembly were retained for further examination.

Examination of the right MLG revealed that the Nos. 3 and 4 tires and wheel halves exhibited flat spotting. The gaps of both WOW switches were within limits, and both were properly secured and safety wired. With about 1,300 lbs of fuel onboard and the airplane fully resting on the MLG, the forward end of the inboard and outboard WOW switches was 3/4 overlapped with the forward end of the target. No defects were noted in the WOW wiring harness in the MLG area. The Nos. 3 and 4 WSSs externally appeared normal, but the No. 3 WSS back shell was completely unscrewed. There was no damage to the threads.

To facilitate operational testing, the NLG WOW electrical harness was spliced back into the airplane's wiring harness, and hydraulic lines in the NLG area were capped. The airplane was configured to allow for testing without the engines operating and was then simulated being in the air. It was configured per the Approach checklist used by the flight crewmembers, which consisted of the following conditions: a) all hydraulic B pumps on, b) nosewheel steering switch

armed, c) ground spoilers switch on, d) thrust reverser switches armed, and e) flaps extended 45ø. Under these conditions, the antiskid was armed and tested satisfactorily, which included wheel spin-up. In the same configuration, the airplane was then simulated being on the ground with both thrust levers at idle; the ground spoilers were manually deployed 10 times satisfactorily; no discrepancies were noted.

While the airplane was simulated being on the ground, one engine was operated at a time only to idle thrust and with each thrust reverser armed, each thrust reverser solenoid on the throttle quadrant released, and each thrust reverser was deployed three times followed by a slight increase in power. Safety concerns prevented full reverse thrust application. No discrepancies were noted with either thrust reverser.

Operational testing of the brakes revealed extensive leakage from the damaged Nos. 3 and 4 brakes, which precluded further testing; they were removed for further examination, and exemplar brakes were installed. Subsequent testing revealed normal pressures at the No. 1 (left outboard), No. 3 (right inboard), and No. 4 (right outboard) brakes (between 1,850 and 2,000 pounds per square inch, gauge [psig]); however, only 150 psig was noted at the No. 2 (left inboard) brake. The issue was associated with the upper BCV. The No. 2 brake line was repositioned to the No. 3 position at the BCV, and normal pressure was noted at the No. 2 brake. The BCV assembly was retained for further examination.

Operational testing of the antiskid system was conducted at 2,000 rpm, which approximately correlated to the airplane's reported touchdown speed. Because of damage to the No. 1 WSS, no in-situ testing was performed. The Nos. 3 and 4 positions tested satisfactorily. Because the No. 1 WSS was not tested, the No. 3 WSS, which tested satisfactorily, was installed to the No. 1 wheel position and tested satisfactorily. Because of reduced brake pressure at the No. 2 brake, the No. 2 WSS was installed to the No. 3 wheel position and tested satisfactorily.

MEDICAL AND PATHOLOGICAL INFORMATION

Following the accident, the PIC, SIC, and flight attendant submitted specimens for testing. The testing results for all of them were negative for drugs of abuse; testing for alcohol was not performed.

TESTS AND RESEARCH

Additional Examinations

Examination of the No. 1 tire revealed that it exhibited flat spots through the tread and a cross-shaped tear through the inner-most plies, consistent with sudden depressurization due to the rupture of the inner bladder. Detailed examination of the tire revealed no evidence of operation at low-pressure, preexisting damage, or manufacturing defects. The tire also had a tear/cut that extended to a hole at the edge of the flat-spotted area. A sharp-edged circular hole slightly more than 1/4-inch in diameter was found at the end of the cross-shaped tear. The wheel flange was found to have about the same lateral distance from center, straightness of cut/tear toward cross-shaped damage, parallel nature of the cut/tear with the wheel flange, and approximate diameter of the hole. No evidence of blue tinted rubber or reverted rubber on the interior, exterior, or in the bead areas nor of bead movement or damage was found. The interior liner exhibited no evidence of operation at low-pressure or with the sidewall collapsed. The flat-spotted and torn areas revealed the internal construction of the tire, and no design or construction anomalies were noted in these areas. The plies were straight and parallel in orientation. No loss of adhesion was found between the plies or between the tread construction and loss of tread. No evidence of repair-related damage was found.

Examination of the Nos. 3 and 4 brakes and No. 1 WSS was performed at the manufacturer's facility. Damage to both brake assemblies precluded operational testing; however, visual examination revealed no evidence of preimpact failure or malfunction.

Operational testing of the No. 1 WSS revealed that, even without the coupler installed (it was removed for National Transportation Safety Board [NTSB] metallurgical examination), it produced a constant sinusoidal wave. The WSS manufacturer reported that, since 2010, 57 sensors had been returned but that no coupling failures had been reported. Metallurgical examination of the No. 1 WSS coupler revealed hackles and rib markings on the injection-molded polymer, consistent with overstress fracture. A shrinkage void was noted on the fracture surface. The fracture initiated in bending overstress at the corner with very small radii and reinitiated at the void.

Visual examination of the upper BCV at the manufacturer's facility revealed that the input pushrod for the No. 2 (left inboard) brake was displaced inward compared to the input pushrod for the No. 3 (right inboard) brake and was not in contact with the roller of its associated input linkage; no visible damage to the unit was noted. The upper BCV was placed on a test bench for operational testing, which confirmed the low pressure at the No. 2 (left inboard brake).

Disassembly of the upper BCV revealed that the left power brake spring was fractured. Examination of the fractured spring by the NTSB Materials Laboratory revealed generally rounded and equiaxed-shaped dimple rupture features, consistent with tensile overstress, with little to no shear or torsional component. The spring composition and microstructure were consistent with the prescribed material.

Previous BCV Failures

The current BCV manufacturer reported to the NTSB that in the 385 BCVs that they repaired or overhauled between July 1992 and October 2016, excluding the accident unit, there was 1 other identified spring failure, and about 11%, or 43 units, had relaxed springs. The manufacturer did not report this information to the FAA through the service difficulty reporting (SDR) system. At the suggestion of the NTSB postaccident, the BCV manufacturer's Repair Station and Quality Control Manual were updated regarding SDR submissions.

A review of FAA SDRs concerning brakes and BCVs with the accident BCV P/N revealed no reports describing asymmetric braking or failure or malfunction of a BCV.

Bombardier reported that, since October 2003, excluding the accident airplane, operators of Challenger 600/601/3A/3R airplanes reported 142 instances in which the BCVs were removed from the airplane for various reasons (scheduled, unscheduled, etc.). In most of the 142 reports, the operator provided Bombardier with a description of the issue or reason for removal. Four of the reports noted asymmetric braking; three of these BCVs were sent to Tactair, the current manufacturer; however, all three of these BCVs had been modified without inbound evaluation; therefore, the reason for the reported asymmetric braking could not be determined.

Airplane Performance Study

The NTSB conducted a performance study using ASR-11 radar from Southwest Florida International Airport and from a tethered aerostat radar station located about 80 nautical miles from the accident site. According to the study, based on EGPWS altitude and location and shifting of radar data to align with the runway centerline, the final descent angle was 2.6ø. The calculated groundspeed based on radar returns indicated that the airplane did not touch down faster than recommended. The study also indicated that, based on the security camera footage, the airplane touched down just past the 1,000 ft mark, which corroborated the flight crewmembers' statements.

Landing and Stopping Distance Information

The airplane flight manual (AFM) did not contain nor was it required to contain landing distance increases if one brake became inoperative.

The airplane manufacturer conducted stopping distance calculations based on the airplane's reported weight, weather conditions, calculated and PIC-reported Vref speed, flap extension, and estimated touchdown point and included nonuse of the ground spoilers and thrust reversers, operational antiskid and steering systems, and braking delay. The calculations showed that, with all four brakes functional, the airplane would stop on the runway with 959 ft of runway remaining. Calculations assuming the same parameters with loss of one brake per side (symmetric half braking), the airplane would have required 690 ft of additional runway; under the same conditions but with thrust reversers used, the airplane would have required 27 ft of additional runway. The calculations could not be conducted to determine the effect of the loss of two brakes on the same side (asymmetric half braking).

Brake Certification

A representative from the airplane manufacturer reported that, during certification of the brake system, the failure of the BCV power brake spring was considered acceptably low and would be evident to pilots within five landings of the failure. The airplane manufacturer representative also indicated that, during certification, the loss of two brakes on the same side was considered to be extremely remote and a low-risk condition. Failure of either the upper or lower BCV is not annunciated to the flight crewmembers.

Accident Rpt# DCA16CA139	**04/28/2016 2250 PST**	**Regis# N961SW**	**San Francisco, CA**	
Acft Mk/Mdl BOMBARDIER INC CL 600 2B19-100		**Acft SN 7857**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Prelim** **Prob Caus: Pending**
			Fatal 0 **Ser Inj 0**	**Flt Conducted Under: FAR 121**
Opr Name:		**Opr dba:**		**Aircraft Fire:**

an airsafety.com e-product
Prepared From Official Records of the NTSB By:
Air Data Research
9865 Tower View, Helotes, Texas 78023
210-695-2204 - info@airsafety.com - www.airsafety.com

Accident Rpt# GAA17CA520 09/03/2017 1804 EDT	**Regis# N378QS**	**Wilmington, DE**	**Apt: New Castle ILG**
Acft Mk/Mdl CESSNA 680-NO SERIES	**Acft SN 680-0103**	**Acft Dmg: NONE**	**Rpt Status: Factual Prob Caus: Pending**
Eng Mk/Mdl P&W CANADA PW-306C	**Acft TT 9410**	**Fatal 0 Ser Inj 1**	**Flt Conducted Under: FAR 091K**
Opr Name: NETJETS AVIATION INC	**Opr dba:**		**Aircraft Fire: NONE**
			AW Cert: STT

Summary

The director of aviation safety for the operator reported that, after landing, while parked at the ramp, the pilot-in-command exited the flight deck to open the cabin door. He added that the pilot "found the lead passenger standing in front of the main cabin door waiting to exit the aircraft." He further added that ".[the pilot] was able to open the door from this position, but did not have room to exit the aircraft ahead of the passenger," and as the passenger started down the airplane's air stairs, her foot slipped, she landed on her knees, and she caught her balance by grabbing onto the hand rails.

A subsequent medical examination revealed that the passenger had broken her ankle.

The director of aviation safety reported that there were no preaccident mechanical malfunctions or failures with the airplane that would have precluded normal operation.

Cause Narrative

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: The passenger's inadvertent slip on the airplane's air stairs during deplaning, which resulted in a broken ankle.

Events

Findings - Cause/Factor

1. Personnel issues-Miscellaneous-(general)-(general)-Passenger - C

Narrative

The director of aviation safety for the operator reported that after landing, while parked at the ramp, the pilot in command exited the flight deck to open the cabin door. He added that the pilot "found the lead passenger standing in front of the main cabin door waiting to exit the aircraft." He further added that, "he [the pilot] was able to open the door from this position, but did not have room to exit the aircraft ahead of the passenger," and as the passenger started down the airplane's air stairs, her foot slipped, she landed on her knees, and caught her balance by grabbing onto the hand rails.

A subsequent medical examination revealed the passenger broke her ankle.

The director of aviation safety did not report that there were any preaccident mechanical malfunctions or failures with the airplane that would have precluded normal operation.

Accident Rpt# DCA14CA031	**11/24/2013 1940 EST**	**Regis# N808EX**	**Philadelphia, PA**	**Apt: Philadelphia International Air KPHL**
Acft Mk/Mdl DE HAVILLAND DHC8 - 102-102		**Acft SN 299**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Prelim Prob Caus: Pending**
		Acft TT 53120	**Fatal 0 Ser Inj 0**	**Flt Conducted Under: FAR 121**
Opr Name: PIEDMONT AIRLINES		**Opr dba: US AIRWAYS EXPRESS**		**Aircraft Fire: NONE**

an airsafety.com e-product
Prepared From Official Records of the NTSB By:
Air Data Research
9865 Tower View, Helotes, Texas 78023
210-695-2204 - info@airsafety.com - www.airsafety.com

Accident Rpt# DCA16LA100 02/23/2016 2325 CST	**Regis# N856HK**	**St Louis, MO**	**Apt: Lambert-st Louis Intl KSTL**	
Acft Mk/Mdl EMBRAER EMB145-MP	**Acft SN 145441**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Prelim**	**Prob Caus: Pending**
Eng Mk/Mdl ROLLS-ROYC AE 3007A1		**Fatal 0 Ser Inj 0**	**Flt Conducted Under: FAR 121**	
Opr Name: TRANS STATES AIRLINES INC	**Opr dba:**		**Aircraft Fire: NONE**	
			AW Cert: STT	

Events

1. Approach - Unknown or undetermined

Narrative

On February 23, 2016, at about 2325 central standard time, TranStates flight 4615, an Embraer EMB-145, N856HK, encountered strong gusting cross winds during its initial approach into Lambert-St. Louis International Airport (KSTL), St. Louis, Missouri, and the flight crew conducted a go around followed by an uneventful landing on the second approach. During post flight inspection, the flight crew found damage to both wing tips. The airplane was substantially damaged and there were no injuries to the 33 passengers and crew members onboard. The flight was operating under the provisions of 14 Code of Federal Regulations Part 121 as a scheduled domestic passenger flight from Chicago O'Hare International Airport (KORD), Chicago, Illinois, to KSTL.

Accident Rpt# DCA14CA093 05/12/2014 1930 EDT	**Regis# N933DN**	**Boston, MA**	**Apt: Boston Logan International KBOS**
Acft Mk/Mdl MCDONNELL DOUGLAS MD90 - 30-30	**Acft SN 53543**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Prelim Prob Caus: Pending**
	Acft TT 31006	**Fatal 0 Ser Inj 0**	**Flt Conducted Under: FAR 121**
Opr Name: DRELAT AIR LINES, INC.	**Opr dba:**		**Aircraft Fire: NONE**

an airsafety.com e-product
Prepared From Official Records of the NTSB By:
Air Data Research
9865 Tower View, Helotes, Texas 78023
210-695-2204 - info@airsafety.com - www.airsafety.com

Accident Rpt# WPR16FA064 02/05/2016 1157 MST	**Regis# N551JP**	**Maricopa, AZ**	**Apt: N/a**
Acft Mk/Mdl NORTH AMERICAN F51-D	**Acft SN 44-85634**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Factual Prob Caus: Pending**
Eng Mk/Mdl PACKARD ROLLS ROYCE V 1650-7		**Fatal 2 Ser Inj 0**	**Flt Conducted Under: FAR 091**
Opr Name: JEFFREY PINO	**Opr dba:**		**Aircraft Fire: NONE**
			AW Cert: SPL

Summary

The commercial pilot and pilot-rated passenger took off during the morning for a personal flight to perform aerobatic maneuvers in the World War II fighter airplane. Witnesses reported seeing the airplane performing acrobatic maneuvers. The airplane was last observed by the witnesses descending in a nose-down spiral until it impacted the ground, where a postimpact fire ensued. All the witnesses that commented about the airplane's engine stated that they heard the engine running during the nose-down spiraling descent, and some of the witnesses stated that they heard a change indicating that the engine was going from full power to a lower power setting. Postaccident examination of the airplane revealed no evidence of mechanical malfunctions or failures that would have precluded normal operation.ÿ

A performance study based on radar data indicated that the airplane climbed rapidly from 5,700 to 7,700 ft mean sea level (msl), which required a significant nose-up attitude and a climb rate of over 8,000 ft per minute. It is likely that the airplane's airspeed slowed at the top of the climb and that the airplane experienced an accelerated stall and entered a spin.

According to the airplane flight manual (AFM), power-on spins should never be intentionally performed in this airplane and recovery from a power-on spin required that the pilot close the throttle completely and apply controls for recovery. The manual stated that "after the rudder is applied for recovery, between 9,000 to 10,000 ft of altitude is lost." However, the maximum radar recorded altitude of 7,700 ft msl was about 6,426 ft above ground level; therefore, there was insufficient altitude available to recover the airplane from a spin. Further, the change in engine sound heard by some of the witnesses was consistent with the closing of the airplane's throttle during a power-on spin recovery as called for by the AFM.

Although ethanol was detected in the pilot's tissue samples, the levels detected were not consistent with levels expected from ingestion, which suggests that the ethanol may have been from postmortem production. Further, the level detected in the liver was below that generally considered impairing. Therefore, given the low levels of ethanol detected, some or all which may have resulted from postmortem production, it is unlikely the ethanol detected impaired the pilot at the time of the accident.

The pilot's medical records indicated that he had a history of atrial fibrillation that resulted in an embolic stroke about 4 years before the accident. The neurological deficits from the stoke had resolved, and his heart disease had been effectively treated with no evidence of recurrence. Therefore, there was no evidence that the pilot's medical condition contributed to the accident.

Cause Narrative

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: The pilot's failure to maintain airplane control while performing an acrobatic maneuver and his subsequent failure to recover from an inadvertent spin due to insufficient altitude.

Events

1. Maneuvering-aerobatics - Aerodynamic stall/spin
2. Uncontrolled descent - Collision with terr/obj (non-CFIT)

Findings - Cause/Factor

1. Personnel issues-Task performance-Use of equip/info-Aircraft control-Pilot - C
2. Aircraft-Aircraft oper/perf/capability-Performance/control parameters-Altitude-Not specified - C
3. Aircraft-Aircraft oper/perf/capability-Performance/control parameters-(general)-Not attained/maintained - C
4. Personnel issues-Task performance-Planning/preparation-Performance calculations-Pilot

Narrative

HISTORY OF FLIGHT

On February 5, 2016, about 1157 mountain standard time, a North American F-51D, N551JP, sustained substantial damage when it impacted terrain about 6 miles southwest of Maricopa, Arizona. The commercial pilot and the pilot-rated passenger were fatally injured. The airplane was registered to and operated by the pilot under the provisions of 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed, and no flight plan had been filed. The local personal flight departed Stellar Airpark, Chandler, Arizona, earlier that morning, at an unknown time.

Several witnesses, located between about 1/2 to 1 mile from the accident site, reported observing the airplane performing acrobatic-type maneuvers. One witness, described the maneuver as a "regular loop." The witness stated that, during the last half of the maneuver, the airplane never pulled up. He estimated the height of the airplane to be about 2,500 ft above ground level, at the top of the maneuver, and said that the airplane may have rotated during the dive.

Several other witnesses reported seeing the airplane descending in a nose-down spiral until it impacted the ground. Further, all of the witnesses that commented on the airplane's engine, stated that they heard the engine running during the nose down spiraling descent. Some of the witnesses described the engine sounding like it was going from full power to a lower power setting.

PERSONNEL INFORMATION

The pilot held a commercial pilot certificate with airplane multi-engine land and single-engine land, rotorcraft-helicopter, and instrument airplane and helicopter ratings. He also held a flight instructor certificate with airplane single-engine and helicopter ratings. The pilot was issued a third-class airman medical certificate on March 10, 2015, with the limitation that it was not valid for any class after March 31, 2016. The pilot reported on his most recent medical certificate application that he had accumulated 6,700 total flight hours, and had flown 105 hours in the last 6 months.

AIRCRAFT INFORMATION

The dual-seat, low-wing, retractable gear, tail wheel airplane, serial number 44-85634, was manufactured in 1944. The airplane was a type of American fighter used during World War II. A review of the maintenance logbooks revealed that the last annual inspection was accomplished on August 10, 2015, at an airplane hour meter time of 1,882 hours. The engine was given a 100 hour conditional check on August 10, 2015, at an hour meter time of 1,882 hours and 2.4 hours since overhaul.

The airplane's current weight and balance form could not be located and the investigation was unable to determine the weight and balance condition at the time of the accident.

METEOROLOGICAL INFORMATION

A review of recorded data from the Casa Grande Municipal Airport, Case Grande, Arizona, automated weather observation station, located about 21 miles east of the accident site, revealed that at 1155 conditions were wind from 010ø at 6 knots, visibility 10 statute miles, clear sky, temperature 15ø C, dew point -7ø C, and an altimeter setting of 30.36 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

Examination of the accident site by the National Transportation Safety Board (NTSB) investigator-in-charge revealed that the airplane impacted terrain at an elevation of about 1,274 ft. All major components of the airplane were contained within the main wreckage site. Wreckage debris of mostly broken canopy pieces and small metal fragments was scattered about 150 ft in front of the main wreckage. The first identified point of contact was a large area of disturbed dirt, about 4 ft by 3 ft in size and 6 inches deep, located about 5 ft aft of the wreckage. The airplane was partially buried in dirt, and two of the four propellers blades were completely buried in the dirt. The two propellers blades that were visible, had about 1/3 of their blades in the ground.

The airplane came to rest perpendicular to the edge of a road and partially buried in a crater. Across the road, an area of light vegetation of about 25 ft by 150 ft was scorched by the post-impact fire. A majority of the fuselage structure and wings were consumed by fire. The power lines located adjacent to the main wreckage were not damaged.

The fuselage came to rest upright on a heading of about 180ø magnetic. The wings remained partially attached to the main fuselage. The empennage was partially attached to the main fuselage.

Flight control continuity was established from the individual flight controls to the center portion of the cabin.

The wings sustained thermal damage, and leading-edge compression damage was observed on both wings. The left aileron was attached at all its respective mounts. The left aileron's trim tab was located behind the main wreckage. The left flap was separated but located near its normal position, in the main wreckage. The right aileron was attached at all its respective mounts and sustained thermal damage. The right flap and portions of the right aileron trim tab were separated and were located near the main wreckage.

The empennage was crushed and sustained thermal damage. The vertical stabilizer was attached to all its respective attachment points, and its leading edge

was crushed aft throughout its entire vertical span. The rudder was separated, and portions of it were located on top of the engine and on the right wing. The horizontal stabilizers and right elevator remained attached to all their respective attachment points. The left elevator was separated but located near its normal position behind the left horizontal stabilizer. The damage sustained to the left elevator was consistent with impact damage. Both elevator trim tabs were intact and remained attached at all their respective attach points.

The instrument control panel and cabin area were mostly consumed by the post-impact fire. The mounts to a video recording system were found in the wreckage but the recording devices were located, at a later date, in the airplane's hanger. Following the on scene examination, the airplane wreckage was recovered to a secure facility for further examination.

MEDICAL AND PATHOLOGICAL INFORMATION

The Pima County, Office of Medical Examiner, conducted an autopsy on the pilot. The medical examiner determined that the cause of death was "multiple blunt force injuries."

The FAA's Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed toxicological testing on the pilot. Testing was negative for carbon monoxide, cyanide, volatiles, and tested-for drugs. Ethanol was detected in the muscle and liver. Ethanol is primarily a central nervous system depressant commonly found in beer, wine, and liquor. After ingestion and absorption, ethanol is quickly distributed uniformly throughout the body's tissues and fluids. Ethanol is also produced after death by microbial activity.

Review of the pilot's FAA medical records found that they included multiple cardiology evaluations performed as part of special issue requirements because of the pilot's history of an arrhythmia and stroke. The pilot suffered a cardioembolic stroke in March 2012, because of a blood clot that resulted from atrial fibrillation. The atrial fibrillation was successful ablated in June 2012. At the time of his last FAA medical exam, he reported using rivaroxaban, a blood thinner use to decrease the risk of clots commonly marked as Xarelto.

The most recent cardiology evaluation in the pilot's FAA records, dated February 2015, found no evidence of recurrent atrial fibrillation and no significant cardiovascular abnormalities. Additionally, the pilot's FAA records included multiple neurological evaluations, the most recent of which was from August 2013, which found no significant motor or cognitive impairment.

The pilot's cardiology records from his treating cardiologist for the period from January 2014 to February 2016, were also reviewed. The most recent visit was dated February 5, 2016, the day of the accident. The visit was to follow up on the pilot's annual Holter monitor study (a 24-hour ambulatory electrocardiogram [EKG]). The physician documented that the pilot had done very well in the past year and had not sustained palpitations to indicate atrial fibrillation. The examination documented a normal cardiovascular examination and a normal EKG. The 24-hour monitor showed no evidence of atrial fibrillation. The cardiologist stated that from a cardiovascular standpoint, the pilot was fit for a third-class medical certificate.

TESTS AND RESEARCH

Engine and Airframe Examination

On April 11 and 12, 2016, at the facilities of Air Transport, in Phoenix, Arizona, the airframe and engine were examined.

A majority of the fuselage was extremely fragmented. Some remains of the airplane's instruments and engine controls were located in the recovered wreckage. The airspeed indicator displayed about 530 miles per hour. The left and right wing leading edges, exhibited compression, aft to the wing spar, throughout their entire span.

The forward and aft control stick assembly was located. The forward control stick remained attached; however, it was separated into multiple sections. The aft control stick was bent forward near the base and aft near the upper portion of the stick. The forward and aft control sticks were removed and sent to the NTSB Materials Laboratory for further examination. The examination revealed that both control sticks exhibited ductile overload fractures, and no corrosion or cracks were present.

The engine was mostly intact. Visual continuity of the crankshaft, connecting rods, and pistons was established throughout the entire engine. One of the four

propeller blades had separated. The separated blade exhibited "S" bending signatures, leading edge gouges, and chordwise scratches. Two of the attached blades were slightly bent and exhibited leading edge damage and chordwise striations. The other attached blade exhibited slight bending and chordwise striations.

Examination of the airframe and engine revealed no pre-impact anomalies that would have precluded normal operation of the airplane.

A performance study was conducted by the NTSB Office of Research and Engineering. The study used airport surveillance radar to determine the accident airplane's ground track, altitude, and speed. The radar data used in the study began at 1154:59 when the airplane was northwest of Maricopa, Arizona. The airplane climbed from an initial altitude of 5,400 ft to 6,100 ft mean sea level (msl), and, at 1156:45, it descended to 5,700 ft msl. The airplane's airspeeds were calculated and revealed that, during this portion of the flight, airspeed was increasing from 180 kts to 250 kts. The descent and airspeed increase were consistent with maneuvering to enter a climbing acrobatic-type maneuver. The study determined that the airplane's maneuvering and speed during the period from the beginning of the radar data to 1156:45 were well within the airplane's flight envelope.

The secondary set of radar data started after 1156:45, when the airplane was about 5 miles southwest of Maricopa. Ten more radar returns were recorded, but only one recorded an altitude. The point that recorded the altitude was the fifth data point, at 1156:59, and it indicated 7,700 ft msl. Several of the data points were very closely grouped together with no associated altitude information recorded. Acrobatic maneuvering could account for the loss of the altitude information, as the airplane's transponder may not have been properly positioned, relative to the radar antenna.

By 1156:59, the airspeed had slowed to about 100 kts. Additionally, climbing to 7,700 ft, would have required a significant nose-up pitch attitude and a rate of climb of over 8,000 ft/min from the previously known radar point at 1156:45. The last secondary radar return was located about 2,600 ft from the airplane wreckage location.

ADDITIONAL INFORMATION

The F-51D Aircraft Flight Manual states that "no intentional power-on spins or snap rolls are permitted, as it is impossible to do a good snap roll and most attempts end up in a power spin." The manual further states that "no intentional power-off spins are permitted below 12,000 ft."

The manual also states that "power-on spins should never be intentionally performed in this airplane. In a power-on spin, the nose of the airplane remains 10 to 20 degrees above the horizon, and recovery control has no effect upon the airplane until the throttle is completely retarded." In the "Power-On Spin Recovery" section, the manual states if you should ever get into a power spin: "close the throttle completely and apply controls as for the power-off spin recovery.As many as 5 or 6 turns are made after the rudder is applied for recovery, and 9,000 to 10,000 ft of altitude is lost." Additionally, the manual warns that "power-on spins are extremely dangerous in this airplane."

Subtracting the accident site elevation from the airplane's highest altitude recorded (7,700 ft msl), would allow for about 6,426 ft of altitude for a spin recovery.

According to the manual, the airplane's estimated stall speeds at a gross weight of 9,000 lbs, with gear and flaps up, are 101 mph level, 109 mph at 30ø of bank, and 121 mph at 45ø of bank. At a gross weight of 10,000 lbs, with gear and flaps up, the stall speeds are 106 mph level, 115 mph at 30ø of bank, and 128 mph at 45ø of bank.

Accident Rpt# WPR15LA165 05/16/2015 1548 PDT	**Regis# N505SP**	**Carlsbad, CA**	**Apt: Mc Clellan-palomar CRQ**
Acft Mk/Mdl RAYTHEON AIRCRAFT COMPANY	**Acft SN BB-1538**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Factual Prob Caus: Pending**
Eng Mk/Mdl PRATT & WHITNEY PT6A-52	**Acft TT 3962**	**Fatal 0 Ser Inj 0**	**Flt Conducted Under: FAR 091**
Opr Name: JAMES P PREVITI	**Opr dba:**		**Aircraft Fire: NONE**
			AW Cert: STN

Summary

The commercial pilot reported that, about 10 minutes after takeoff for a cross-country flight, the airplane experienced a loss of electrical power and that he lost contact with air traffic control (ATC). The pilot proceeded on a westerly course and then proceeded southbound. Partial electrical power was restored, and he tried to re-establish radio contact with ATC with no success. The pilot subsequently diverted to an airport for landing. After he received a green light signal from control tower personnel, the pilot extended the landing gear and flaps. When the airplane touched down, the pilot realized that the landing gear had not extended.

During initial postaccident interviews, the pilot stated that, when he departed, the generators were on and that, after the loss of electrical power, he did not perform any emergency procedures or attempt to reset the generators because the checklist was in a cabinet that he could not reach. In a subsequent interview, the pilot stated that he may have accidently turned on the starter switches while on the ground at the departure airport, which would have turned off the generators and led to the loss of electrical power.

After the accident, a mechanic entered the cockpit, and he reported that he found the landing gear handle in the "down" position and the flap handle in the "full-up" position. The battery switch was in the "off" position with the battery gang bar down, which turned off the battery, generator 1, and generator 2. After lifting the gang bar and turning on the battery switch, he saw nothing on the cockpit displays but heard the airplane power up. After about 30 minutes, he turned on the electrical power, and the cockpit displays illuminated, and he heard the landing gear trying to extend.

During recovery, the airplane was lifted off the ground, and the landing gear were successfully extended to the down-and-locked position using the emergency gear extension hand pump.

It is likely that the pilot inadvertently turned on the starter switches, which turned off the generators, at the departure airport, and that this led to the depletion of the battery and loss of electrical power to the airplane's systems. If the pilot had the emergency checklist available and followed the emergency procedures for a loss of electrical power, which required resetting the generators, or if he had attempted to manually extend the landing gear, he likely could have lowered the landing gear.

Cause Narrative

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: The pilot's inadvertently turning on the starter switches, which turned off the generators and resulted in a loss of electrical power and gear-up landing. Contributing to the accident was the pilot's failure to follow the emergency procedures for a loss of electrical power or to manually extend the landing gear.

Events

1. Prior to flight - Preflight or dispatch event
2. Enroute-climb to cruise - Electrical system malf/failure

Findings - Cause/Factor

1. Aircraft-Aircraft systems-Electrical power system-Starter-generator-Unintentional use/operation - C
2. Personnel issues-Action/decision-Action-Lack of action-Pilot - F
3. Personnel issues-Task performance-Use of equip/info-Use of policy/procedure-Pilot - F

Narrative

HISTORY OF FLIGHT

On May 16, 2015, at 1548, Pacific daylight time, a Beech King Air B200, N505SP, was substantially damaged when the airplane landed with the landing gear retracted at Mc Clellan-Palomar Airport (CRQ), Carlsbad, California. The airplane was registered to and operated by the commercial pilot under the provisions of 14 Code of Federal Regulations Part 91. The pilot was not injured. The cross-country personal flight departed Palm Springs (PSP), California, about 1515 with a planned destination of Santa Ana, California. Visual meteorological conditions prevailed, and no flight plan had been filed.

The pilot reported that 10 minutes into the flight, he received an instrument flight rules flight plan from air traffic control (ATC). The cloud tops were at 8,500 feet and he was cleared to 6,000 ft, which put him in the clouds.

Within minutes of entering the clouds, the airplane lost all electrical power, and the pilot lost contact with ATC. He climbed back out of the clouds and proceeded to the west; he found a hole in the clouds over the Pacific Ocean, descended, and turned southbound. He said partial electrical power was restored,

and he tried to advise ATC of his problems. His transmissions were not understood, but he flew to CRQ, and received a green light from the tower personnel. He extended the landing gear and flaps but had no airspeed indicator. When the airplane touched down, the pilot realized that his landing gear had not extended.

Witnesses reported that the airplane approached the runway and was faster than a normal landing, and the gear was still retracted.

The pilot reported during an initial telephone interview with the National Transportation Safety Board investigator-in-charge, that after the loss of electrical power he did not perform any emergency procedures as the checklist was in a cabinet and not reachable; he was just trying to fly the airplane. The pilot stated that when he departed from PSP, the generators were on. When asked if he attempted to reset the generators, he again stated that he did not do any emergency procedures except to fly the airplane. In a later interview, the pilot stated that he may have accidently turned on the starter switches, which would have turned off the generators and accounted for the loss of electrical power.

A mechanic was dispatched to help defuel the airplane about 30 minutes after the accident. He reported that fuel was leaking from the right wing so he disconnected the battery. He opened an access panel but was unable to mechanically turn off the fuel selector valve (FSV). He reconnected the battery and went into the cockpit. He saw that the landing gear handle was in the down position, and the flap handle was in the full up position. The battery switch was in the OFF position with the battery gang bar down, which turned off the battery, generator 1, and generator 2. After lifting up the gang bar and turning on the battery switch, he saw nothing on the cockpit displays but heard the airplane power up. He located the FSV, turned it off, and confirmed with a firefighter that the solenoid in the wing audibly closed. The mechanic turned the electrical power off and disconnected the battery. The fuel leak from the right engine filter bowl stopped.

It took the mechanic about 30 minutes to gather the equipment needed to defuel the airplane, and he decided to start with the right side by connecting to the engine supply line. He reconnected the battery and entered the cockpit to turn on the electrical power. With power on, the cockpit displays illuminated, and he heard the landing gear try to operate to the down position. After another mechanic pulled the circuit breaker for the avionics, he defueled the airplane.

During recovery, the airplane was lifted off the ground, and the landing gear were successfully extended to the down and locked position.

ADDITIONAL INFORMATION

The pilot checklist emergency procedures for a dual generator failure identifies the first step to reset the generators, then on.

If the generators do not reset, the checklist identifies for landing, to extend the landing gear manually.

Accident Rpt# WPR16FA130	**06/23/2016 1425 MST**	**Regis# N117TW**	**Wikieup, AZ**		**Apt: N/a**		
Acft Mk/Mdl ROBINSON HELICOPTER CO R66		**Acft SN 0042**	**Acft Dmg: DESTROYED**		**Rpt Status: Factual**		**Prob Caus: Pending**
Eng Mk/Mdl ROLLS ROYCE 250-C300A1		**Acft TT 662**	**Fatal 2**	**Ser Inj 0**	**Flt Conducted Under: FAR 091**		
Opr Name: GUIDANCE AIR SERVICES LLC		**Opr dba: GUIDANCE AIR SERVICES**			**Aircraft Fire: GRD**		
					AW Cert: STN		

Summary

The commercial pilot and the pilot-rated passenger departed on a cross-country positioning flight. The helicopter was reported overdue when it did not arrive at the destination, and the wreckage was located the following morning. There were no witnesses to the accident, no recorded radar data, and no recorded radio transmissions from the pilot.

Examination of the wreckage revealed no evidence of any preexisting anomalies that would have precluded normal operation of the helicopter. There was evidence that a mast bumping event had occurred and that the main rotor blades had contacted the airframe, which resulted in an in-flight break-up. There was no recorded information available that could be used to determine the helicopter's airspeed, altitude, or the pilot's control inputs.

A weather study indicated that conditions were conducive to the development of significant updrafts or thermals of rising air and dust devils, and people near the accident site reported that there were numerous dust devils in the area.

It is likely that the helicopter encountered turbulence due to updrafts and/or dust devils, and the pilot lost control of the helicopter, which resulted in mast bumping.

Cause Narrative

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE CAUSE OF THIS OCCURRENCE WAS: An encounter with turbulence due to updrafts and/or dust devils that resulted in mast bumping and an in-flight break-up.

Events

1. Enroute-cruise - Turbulence encounter
2. Enroute-cruise - Mast bumping

Findings - Cause/Factor

1. Aircraft-Aircraft propeller/rotor-Main rotor system-Main rotor mast/swashplate-Related operating info - C
2. Environmental issues-Conditions/weather/phenomena-Turbulence-Convective turbulence-Effect on operation - C
3. Environmental issues-Conditions/weather/phenomena-Turbulence-Terrain induced turbulence-Effect on operation - C

Narrative

HISTORY OF FLIGHT

On June 23, 2016, about 1425 mountain standard time, a Robinson Helicopter Company R66, N117TW, broke up in flight near Wikieup, Arizona. The commercial pilot and the pilot-rated passenger sustained fatal injuries; the helicopter was destroyed. Guidance Air Service LLC was operating the helicopter under the provisions of 14 Code of Federal Regulations Part 91. The cross-country positioning flight departed Prescott, Arizona, about 1338 with a planned destination of Riverside, California. Visual meteorological conditions prevailed, and no flight plan had been filed.

According to the operator, the pilot, who was seated in the right seat, was going to Riverside to take a Part 135.293 check ride with an inspector from the Federal Aviation Administration (FAA) Flight Standards District Office located there. The pilot-rated passenger, who was seated in the left seat, was the operator's Part 141 chief pilot.

The helicopter was reported overdue when it did not arrive at the destination, and the wreckage was located about 0430 on June 24. There were no witnesses to the accident, no recorded radar data, and no recorded radio transmissions from the pilot.

A SPOT device, which is a handheld GPS tracking device that uses a satellite network enabling text messaging and GPS tracking services, was present on the helicopter. Records provided by the operator listed 19 location fixes beginning at Prescott at 1338 and proceeding on a southwesterly heading. The last data point at 1425 was in the vicinity of the accident site.

PERSONNEL INFORMATION

AIRCRAFT INFORMATION

METEOROLOGICAL CONDITIONS

The southwest section of the National Weather Service surface analysis chart depicted a thermal low pressure system west of the accident site. The closest upper air sounding from Yuma, Arizona, about 90 miles south of the accident site, depicted thermal profiles that supported strong thermals through 8,500 ft. The lifted index (a common measure of atmospheric instability) and the K-index (a measure of thunderstorm potential) indicated conditions conducive to development of significant updrafts or thermals of rising air and dust devils. Other weather products supported strong thermals to 11,000 ft.

Two people near the accident site reported seeing numerous large dust devils. One person was an airframe and powerplant mechanic driving on a highway, and he saw as many as five dust devils simultaneously. The other person was the pilot of an R44 who was performing aerial survey work immediately north of the accident site. He stated that beginning at 1130 the winds became stronger and gustier. Over the next couple of hours, he observed numerous dust devils, and experienced a significant updraft in excess of 1,000 ft per minute. About 1515, he decided to discontinue operations and encountered a significant wind shift while returning to his base.

A dust devil is a strong, well-formed whirlwind that can range from a few feet to hundreds of feet wide, and can reach heights of several hundred feet. In the United States, dust devils have been reported in every state with Arizona reporting the highest frequencies of occurrence, and they are most frequent between June and August. They have been implicated as a cause or contributing factor in about 50 aircraft accidents between 2000 and 2015 according to the NTSB database.

WRECKAGE AND IMPACT INFORMATION

The helicopter came to rest in hilly desert terrain. The debris field was about 750 yards long and 150 yards wide. One of the first pieces identified was the outboard 5 ft of a main rotor blade afterbody that had separated from the leading edge spar and displayed black paint transfer marks near the tip. It was located on the top of a small ridgeline. The inboard section of this main rotor blade was about 600 yards into the debris field and 85 yards left of the debris path centerline.

The left side of the helicopter was more fragmented than the right; left side cabin pieces and instruments were distributed throughout the early part of the debris field. The tail boom was about midway into the debris field. The left side/nose cabin, which was located near the tail boom had a straight separation line or slice across one side, and some floor panels at the aft end of the slice were crushed in an accordion pattern. The cabin came to rest inverted about 600 yards into the debris field, and was destroyed by a postcrash fire. The engine remained attached to the cabin.

The transmission, mast, and second main rotor blade separated as a unit, and were about 100 yards past the cabin area in the direction of the centerline of the debris field. The coning bolt of the separated blade was bent, and the teeter stops for both blades had impact marks across their centers. The attached blade was bent midspan about 10ø to 20ø opposite the direction of rotation. The main rotor driveshaft was bent about 15ø at the swashplate.

MEDICAL AND PATHOLOGICAL INFORMATION

Pilot

The Mohave County Medical Examiner's Office completed an external exam autopsy of the pilot. The cause of death was determined to be multiple injuries due to a helicopter crash.

Toxicology testing of the specimens from the pilot by the FAA's Bioaeronautical Science's Research Laboratory, Oklahoma, City, Oklahoma, were negative for ethanol and tested drugs in the muscle.

Pilot-Rated Passenger

The Mohave County Medical Examiner's Office completed an autopsy of the pilot-rated passenger. The cause of death was determined to be multiple injuries due to a helicopter crash.

Toxicology testing of the specimens from the pilot-rated passenger by the FAA's Bioaeronautical Science's Research Laboratory were negative for tested drugs in the liver.

The testing detected 80 (mg/dL, mg/hg) ethanol in muscle, and Propanol (N-) was detected in muscle; no ethanol was detected in the brain. The report noted that putrefaction of the specimens had occurred.

ADDITIONAL INFORMATION

Robinson Safety Notice SN-32 discusses flight in high winds and turbulence and explains how improper application of control inputs in response to turbulence can increase the likelihood of a mast bumping accident. It recommends that pilots reduce airspeed below normal cruise speed to 60 to 70 knots for flight in significant turbulence. It suggests techniques to avoid overcontrol of the helicopter, and says to avoid flying on the downwind side of hills and ridges.

Accident Rpt# ANC18LA005 10/21/2017 536 AKD	**Regis# N363JH**	**Anchorage, AK**	**Apt: Ted Stevens Anchorage Intl ANC**
Acft Mk/Mdl TEXTRON AVIATION B200	**Acft SN BB-1799**	**Acft Dmg: SUBSTANTIAL**	**Rpt Status: Prelim Prob Caus: Pending**
Eng Mk/Mdl PRATT & WHITNEY CANADA PT6A-41		**Fatal 0 Ser Inj 0**	**Flt Conducted Under: FAR 135**
Opr Name: BERING AIR, INC.	**Opr dba:**		**Aircraft Fire: NONE**
			AW Cert: STN

Events

1. Landing - Landing gear not configured

Narrative

On October 21, 2017, about 0536 Alaska daylight time, a Textron Aviation (formerly Raytheon Aircraft Company) Beech B200 airplane, N363JH, sustained substantial damage following an unintentional gear-up landing at the Ted Stevens Anchorage International Airport (PANC), Anchorage, Alaska. The certificated airline transport pilot, 2 flight medics, and one patient sustained no injuries. The airplane was registered to and was operated by Bering Air, Inc., Nome, Alaska as a 14 Code of Federal Regulations Part 135 instrument flight rules air ambulance flight, operating as Medevac 363JH. Dark night, visual meteorological conditions were present at the time of the accident and flight following procedures were utilized by the operator. The airplane departed from the Nome Airport, Nome, Alaska, about 0320.

The pilot reported that the purpose of the flight was to transport a patient to a medical treatment facility in Anchorage. He said that as the flight approached Anchorage, the Anchorage Air Route Traffic Control Center specialist on duty handed the flight over to Anchorage Approach Control, which cleared him to descend to 6,000 ft mean sea level (msl) followed with a vector heading and a descent clearance to 2,000 ft msl. As the flight descended through about 4,000 feet msl, he visually confirmed that the airport was in sight, and requested a visual approach. He reported the air traffic controller didn't respond to his initial request, and he requested a visual approach again. The controller responded back with a vector for the instrument landing system (ILS) runway 7R approach. The pilot reported his groundspeed was about 210 knots indicated, he joined the final approach course, and was cleared to land. He reported he believes he was given a vector heading that was too close to the final approach fix and the airplane went through the final approach fix. The pilot then received another heading and he re-established himself on the final approach course.

According to the pilot, as the airplane continued on the ILS 7R approach, he began to configure the airplane for landing by selecting the appropriate approach wing flaps setting, and he believed he selected the landing gear selector to the down position. However, he failed to confirm that the landing gear position-indicator lights showed "three green" indicting the landing gear was down, locked, and safe for landing. The pilot said that during touchdown with the landing gear not extended, the airplane's belly-mounted cargo pod contacted the runway, and the airplane began to veer to the right of the runway centerline. The 4 blade Hartzell propeller assemblies for each engine separated about midspan due to runway impact damage. The left side forward fuselage sustained minor damage from various separated propeller blade debris impacts. The airplane came to rest on the right side of the runway, and the occupants egressed without further incident.

A National Transportation Safety Board air safety investigator responded to the accident site, arriving about 1 hour after the accident. During a postaccident on scene inspection of the accident airplane, the landing gear selector was found in the down position.

The pilot reported in a written statement on October 24, that fatigue played a role with the landing gear up accident as he felt clear and alert at the beginning of the flight, but his alertness began to diminish at the beginning of the arrival phase of the flight.

The pilot reported that there were no preimpact mechanical failures or malfunctions with the airframe or engine that would have precluded normal operation.

The airplane was recovered and transported to secure location for a comprehensive damage assessment. The airplane sustained substantial damage to the right engine mount system. Both Pratt & Whitney Canada PT6A-41 turboprop engines are pending disassembly for an internal damage assessment.

The airplane was not equipped with a cockpit voice recorder system or a flight data recorder system, nor were either required.

The closest official weather observation station is the PANC. At 0553, a METAR was reporting, in part, wind 360ø at 7 knots; visibility 10 statute miles; clouds and ceiling 5,500 ft few, 7,500 ft broken; temperature 23ø F; dew point 10ø F; altimeter 29.28 inches of Mercury.