Aviation Investigation Final Report

Location:	Manteo, North Carolina	**Accident Number:**	ERA18LA010
Date & Time:	October 18, 2017, 10:00 Local	**Registration:**	N400LE
Aircraft:	Beech A24	**Aircraft Damage:**	Substantial
Defining Event:	Electrical system malf/failure	**Injuries:**	1 Serious, 1 Minor
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

Shortly after takeoff on the instructional flight, the pilot receiving instruction heard a "pop" sound; the flight instructor saw smoke coming from the right lower portion of the instrument panel and felt a melted wire contact her leg. The pilot receiving instruction continued to fly the airplane briefly, then the flight instructor took the controls. With inadequate runway remaining ahead on which to land, the instructor initiated a turn to return to the runway. The airplane impacted the ground and slid about 500 ft, coming to rest upright and resulting in substantial damage to the airframe.

Postaccident examination of the cockpit revealed that electrical wires of a recently-installed avionics switch had arced against the top aft edge of the adjacent autopilot control unit and also at the edge of a vertical support member. The wires did not have circuit protection, nor was there any mechanical protection or supports present along the length of the wires to prevent chafing, contrary to FAA guidance. The pilots' failure to secure the electrical system from memory in response to the cockpit smoke would not have mitigated the hard landing, but may have decreased the smoke in the cockpit and lessened the urgency to land.

Probable Cause and Findings

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

The failure of maintenance personnel to properly secure wiring during an electrical component installation, which resulted in arcing and smoke in the cockpit. Contributing to the outcome was the flight instructor's failure to attain a proper descent rate during the forced landing.

Findings

Aircraft	Electrical pwr sys wiring - Incorrect service/maintenance
Personnel issues	Installation - Maintenance personnel
Aircraft	Descent rate - Not attained/maintained
Personnel issues	Aircraft control - Instructor/check pilot

Factual Information

History of Flight

Initial climb	Electrical system malf/failure (Defining event)
Emergency descent	Abrupt maneuver
Landing-flare/touchdown	Hard landing

On October 18, 2017, about 1000 eastern daylight time, a Beech A24R, N400LE, was substantially damaged when it was involved in an accident near Manteo, North Carolina. The private pilot undergoing instruction (PUI) sustained serious injuries while the flight instructor sustained minor injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 instructional flight.

The flight instructor, who was seated in the right seat, stated that there were no discrepancies with the airplane during the preflight inspection or engine run-up before takeoff. The PUI stated that that about 3 seconds after rotation when the flight was about 1/2 way down the runway at no more than 10 to 15 ft above the runway with the landing gear extended, he heard a "pop" sound from inside the airplane that was not over the intercom. He attributed the sound to be consistent with the tripping of a circuit breaker, though he did not look at the circuit breakers. He did not change the landing gear position and continued flying the airplane. There was no discussion at that time about landing straight ahead, though that would not have been possible based on the airplane's location, and speed.

The flight instructor further stated that the flight was at 100 ft and at that time the cockpit filled with smoke and electrical wires on her side of the cockpit were on fire and contacting her leg. The PUI verbalized fire 3 times, which she agreed, and he reportedly asked if she wanted him to secure the battery and alternator switches, to which she verbalized aloud yes because they lost the capability to communicate on the intercom. She indicated that he initially turned off the battery, then later turned off the alternator switches, while the PUI indicated that the battery, alternator and avionics switches remained on until he secured them postaccident because she did not reply to his hand motions on the battery switch. She took the controls from the PUI and when near the VOR antenna executed a 180° turn to return to the runway. The PUI indicated that she was not rolled out of the turn and did not arrest the rate of descent impacting the ground while in a slight left wing and nose low attitude, which the flight instructor characterized as a hard landing. She had previously experienced smoke in a cockpit before and wanted to get the airplane on the ground. She also indicated that it happened quickly which did not allow enough time to complete any checklist, adding that the emergency procedures section of the Pilot's Operating Handbook did not contain a checklist for an "electrical in-flight fire." Neither she or the PUI felt airframe buffet or recalled hearing the stall warning system.

Examination of the accident site by several Federal Aviation Administration (FAA) inspectors revealed the airplane first impacted on airport property east of runway 17 near the approach end of the runway. The airplane came to rest upright about 500 ft and 212° from the initial impact location. Examination of the cockpit by a FAA airworthiness inspector revealed a wire with melted insulation hanging from under the right side of the instrument panel. The airplane was recovered and secured for further examination.

Postaccident examination of the airplane following recovery was performed by a representative of the airframe manufacturer with oversight from the Federal Aviation Administration. Examination of the cockpit revealed an avionics switch and associated electrical wiring was located at the top center portion of the instrument panel above the autopilot control unit. The electrical wires from the switch were 14 gauge and the markings were different from the airplane's original wires consistent with installation of the switch on April 12, 2017. Following removal of the instrument glare shield, no evidence of fire was noted behind the instrument panel.

Further examination of the avionics switch revealed one attached electrical wire connected to the electrical bus bar which was co-located with the landing gear circuit breaker. The other attached electrical wire connected to the "COM 2" circuit breaker. Both electrical wires exhibited evidence of electrical arcing where both crossed over the top aft edge of the autopilot control unit and also at the edge of a vertical support member. The majority of insulation of the electrical wire from the bus bar to the avionics switch was melted or completely missing, while portions of insulation of the electrical wire from the "COM 2" circuit breaker to the avionics switch exhibited melting where it was located in proximity to the other electrical wire. Further examination of the electrical wires associated with the avionics master switch revealed they were tie wrapped together at various places and were also tie wrapped to a larger wire bundle near the bus bar, but there was no mechanical protection or supports present along the length of the wires. Additionally, no circuit protection was observed between the bus bar and the avionics switch. Following removal of the switch and wires from the airplane, the wires had a distinct bend where they passed around the vertical support member.

Since installation of the switch, the airplane had accrued about 96 hours.

Paragraph 11-47 of Advisory Circular (AC) 43.13-1B specifies that all electrical wires must be provided with some means of circuit protection (circuit breakers or fuses) located as close as possible to the electrical power source bus. Paragraph 11-96(b) of the same AC indicated that metal stand-offs must be used to maintain clearance between wires and structure, while (q) of the same paragraph indicated "Ensure that wires and cables are routed in such a manner that chafing will not occur against the airframe or other components."

Flight instructor Information

Certificate:	Commercial; Flight instructor	**Age:**	32,Female
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	Lap only
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane single-engine; Instrument airplane	**Toxicology Performed:**	No
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	August 25, 2017
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	April 30, 2017
Flight Time:	7000 hours (Total, all aircraft), 100 hours (Total, this make and model), 6800 hours (Pilot In Command, all aircraft), 250 hours (Last 90 days, all aircraft), 70 hours (Last 30 days, all aircraft)		

Student pilot Information

Certificate:	Private	**Age:**	23,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Lap only
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 With waivers/limitations	**Last FAA Medical Exam:**	June 29, 2017
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 260 hours (Total, all aircraft), 11 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N400LE
Model/Series:	A24 R	**Aircraft Category:**	Airplane
Year of Manufacture:	1971	**Amateur Built:**	
Airworthiness Certificate:	Normal; Utility	**Serial Number:**	MC-72
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	October 6, 2017 Annual	**Certified Max Gross Wt.:**	2750 lbs
Time Since Last Inspection:	3 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	3970.6 Hrs as of last inspection	**Engine Manufacturer:**	LYCOMING
ELT:	C91A installed, not activated	**Engine Model/Series:**	IO-360-A1B
Registered Owner:	On file	**Rated Power:**	200 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	MQI,13 ft msl	**Distance from Accident Site:**	
Observation Time:	10:05 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	13 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	70°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.36 inches Hg	**Temperature/Dew Point:**	
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Manteo, NC (MQI)	**Type of Flight Plan Filed:**	None
Destination:	Manteo, NC (MQI)	**Type of Clearance:**	None
Departure Time:	09:59 Local	**Type of Airspace:**	

Airport Information

Airport:	Dare County Regional MQI	**Runway Surface Type:**	Asphalt
Airport Elevation:	13 ft msl	**Runway Surface Condition:**	Unknown
Runway Used:	05	**IFR Approach:**	None
Runway Length/Width:	4305 ft / 100 ft	**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Serious, 1 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Serious, 1 Minor	**Latitude, Longitude:**	35.923053,-75.695831

Administrative Information

Investigator In Charge (IIC):	Monville, Timothy
Additional Participating Persons:	David M Hintz; FAA/FSDO; Greensboro, NC Ricardo J Asensio; Textron Aviation; Wichita, KS Henry J Soderlund; Textron Aviation; Wichita, KS
Original Publish Date:	December 3, 2020
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=96206