Aviation Investigation Final Report

Location:	Burgaw, North Carolina	**Accident Number:**	ERA16LA162
Date & Time:	April 16, 2016, 16:50 Local	**Registration:**	N588TA
Aircraft:	COSTRUZIONI AERONAUTICHE TECNA P2008	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (total)	**Injuries:**	1 Minor
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The airplane was in cruise flight when, according to the pilot, the electronic flight display system "went out." About 10 minutes later, the engine sputtered and lost power. The pilot switched fuel tanks and attempted to restart the engine unsuccessfully then made a forced landing to a field. During the landing rollout, the airplane's nose landing gear struck a ditch and it nosed over, resulting in substantial damage to the wings, vertical stabilizer, and rudder.

Review of recorded data from the airplane’s instrument panel-mounted display system indicated that electrical bus voltage started at 12.6 volts when the system was powered on, decreased for the entirety of the recording, decreasing more rapidly near the end of the flight. The alternator electrical current was zero for the entire recording. Postaccident examination and testing of the airplane’s electrical system revealed that the system was functioning normally; all cautions and warnings, including the “ALT OUT” message, were displayed by the system as required. Additionally, testing of the airplane’s engine and fuel pumps showed they also operated normally.

Given this information, it is likely that for the entirety of the accident flight, electrical power was being supplied by the airplane’s battery alone and was not being replenished by the alternator. While the airplane was equipped with two fuel pumps, both required electrical power for operation. One fuel pump was likely not operating at all for the flight, as it required electrical power solely from the alternator for operation. The remaining fuel pump, which was powered by the battery, likely ceased operation as the battery voltage decreased to a level below that required to sustain it. With both fuel pumps offline, the engine was subsequently starved of fuel, and lost total power.

An abbreviated, 6-page checklist was found in the accident airplane. Comparison of the checklist to the published flight manual revealed differences from the Normal Procedures

section in the flight manual, including no mention of checking the position of the alternator side of the split master switch on the checklist. It is likely that as the pilot began the flight, he did not activate the airplane's alternator, nor did he notice the warning messages and voltage highlights that were called out by the airplane's electronic flight display system during the flight that would have warned him of this omission.

Probable Cause and Findings

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

The pilot's failure to activate the airplane's alternator, which resulted in an eventual loss of electrical power to the engine's fuel pumps, fuel starvation, and a total loss of engine power. Contributing was the pilot's use of an incomplete checklist.

Findings

Personnel issues	Use of checklist - Pilot
Aircraft	Alternator-generator drive sys - Not used/operated
Aircraft	Fuel pumps - Inoperative
Aircraft	Battery/charger - Capability exceeded

Factual Information

History of Flight

Standing-engine(s) not oper	Preflight or dispatch event
Enroute-cruise	Loss of engine power (total) (Defining event)
Emergency descent	Off-field or emergency landing
Landing-landing roll	Collision with terr/obj (non-CFIT)
Landing-landing roll	Nose over/nose down

On April 16, 2016, about 1650 eastern daylight time, a Costruzioni Aeronautiche Tecnam P2008 airplane, N588TA, was substantially damaged when it was involved in an accident near Burgaw, North Carolina. The pilot sustained minor injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* (*CFR*) Part 91 personal flight.

The flight departed Henderson Field Airport (ACZ), Wallace, North Carolina, and was originally destined for Cape Fear Regional Jetport (SUT), Oak Island, North Carolina. According to the pilot, when he was in cruise flight en route to SUT, the air was “bumpy.” He decided to return to ACZ, and shortly thereafter the electronic flight display system "went out." About 10 minutes later, the engine sputtered and experienced a total loss of power. The pilot switched fuel tanks and attempted to restart the engine unsuccessfully, then made a forced landing to a farmer's field. During the landing rollout, the airplane's nose landing gear struck a ditch, and about 20 yards later, the airplane nosed over, coming to rest on its back.

The accident airplane was equipped with an electronic flight display system that also recorded parametric data. Review of the data showed that when the system was initially powered on, about 1637, the electrical system bus voltage was 12.6 volts. The voltage gradually decreased for about 10 minutes, then about 1647, it began decreasing at an even greater rate. Data recording ceased at 1650:24, when the electrical system bus voltage was 7.5 volts. The alternator electrical current was zero for the duration of the recording.

The airplane was powered by a turbocharged, Rotax 914 UL Engine that produced 114 horsepower, and was equipped with a 3-bladed, composite, ground- pitch- adjustable, propeller. The engine was supplied fuel by two electric fuel pumps, with one fuel pump being powered directly by the alternator, and the other fuel pump being powered by the battery. The airplane’s electrical system consisted of a 12-volt, direct current circuit controlled by a split rocker type master switch located on the instrument panel. It was powered by a 12-volt, 18-ampere-hour battery and an 18-ampere alternator. An “ALT OUT” (alternator out) warning would illuminate for a faulty alternator or when its voltage output exceeded 16 volts and the alternator was automatically shut down. All the electric circuits were protected by fuses, circuit breakers, or both. According to the airframe manufacturer, the battery could

support operation of the airplane's electrical system under a nominal load for about 20 minutes after loss of the alternator.

Postaccident examination of the wreckage by a Federal Aviation Administration inspector revealed that the nose landing gear had partially separated from its mounts during the impact with the ditch, and the airplane had sustained substantial damage to the wings, vertical stabilizer, and rudder when it nosed over.

Examination of the accident airplane's engine, fuel lines, pumps, and filters was performed and revealed no evidence of preaccident failures or malfunctions that would have precluded normal operation of the engine.

Postaccident testing of the fuel pump power supply with a main bus electrical short or loss of alternator power revealed that the fuel pump power supply and warning horn functioned as designed. Testing of the voltage regulator showed that it charged the system and the battery as designed. The display warning for low and critically low voltage on the battery bus was yellow at 12.3 volts and red and blinking at 10.9 volts, as designed.

Testing of the alternator side of the split master switch with the engine running revealed that the "ALT OUT" warning illuminated on the primary flight display (PFD) when the alternator side of the split master was off; the warning extinguished when the alternator side was on. Testing of the "ALT" circuit breaker also revealed that the "ALT OUT" warning illuminated on the PFD in the pulled (open) breaker position and extinguished in the pushed in (closed) position.

The battery of the accident airplane was found to have a voltage of 0.297 volts. The battery was charged using ground power. The battery held the charge and was used for both starting the accident airplane's engine during testing and was used during voltage rundown testing (battery on with the engine running and the alternator switch off).

Testing of the accident airplane's display warning for low and critically low voltage on the battery bus was also accomplished. The airplane was started with its own battery and with the engine running, the alternator side of the split master switch was switched to off, to stop charging the battery, and current was verified by multimeter to be sourced only from the battery. Voltage was then constantly monitored by both multimeter and the engine page and engine strip. At 12.3 volts, the voltage display was highlighted in yellow on both the engine page and the engine strip. A red blinking highlight illuminated on both the engine page and on the engine strip at 10.9 volts. Additionally, in this state, the "ALT OUT" warning message was on the PFD caution area indicating that the battery was not being charged and the voltage warnings on the multi-function display for low and critical voltage all appeared.

The airplane's total power draw on the battery supply in an "all on" flight condition matched with the design numbers supplied by the airframe manufacturer. With the engine running, scenarios simulating electrical shorts using the circuit breakers were performed, and all performed as designed, including the warning horn, the avionics backups, and fuel pump failover.

With the engine running and all other electronics on, the avionics took 57 minutes after the alternator switch was placed into the off position to completely shut down, between 9.1 and 9.9 volts. At full load, and beginning with the battery fully charged, the engine ran normally for 1 hour 39 minutes, surged for about 5 minutes, and stopped running with a charge of 2.67 volts. Follow-on testing of the voltage regulator revealed that it met the manufacturers specifications, producing 13.9 volts during normal operation and 13.1 volts when a 15-amp load was introduced.

During the examination and testing of the electrical system, an abbreviated, 6-page checklist that had been created by the pilot was discovered in the accident airplane. Comparison of the checklist to the published flight manual revealed differences between the pilot's checklist and the Normal Procedures section in the flight manual, and there was no mention of checking the position of the alternator side of the split master switch on the checklist. The checklist also did not mention checking for the "ALT OUT" message on the PFD caution and warning area before engine start.

Pilot Information

Certificate:	Sport Pilot	**Age:**	79,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Sport pilot None	**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	March 9, 2016
Flight Time:	352 hours (Total, all aircraft), 30 hours (Total, this make and model), 200 hours (Pilot In Command, all aircraft), 15 hours (Last 90 days, all aircraft), 10 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	COSTRUZIONI AERONAUTICHE TECNA	**Registration:**	N588TA
Model/Series:	P2008	**Aircraft Category:**	Airplane
Year of Manufacture:	2014	**Amateur Built:**	
Airworthiness Certificate:	Special light-sport (Special)	**Serial Number:**	088
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	February 15, 2016 Condition	**Certified Max Gross Wt.:**	1320 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	41.1 Hrs as of last inspection	**Engine Manufacturer:**	Rotax
ELT:	C126 installed, not activated	**Engine Model/Series:**	914UL2
Registered Owner:	On file	**Rated Power:**	115 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:	ILM,32 ft msl	**Distance from Accident Site:**	16 Nautical Miles
Observation Time:	13:53 Local	**Direction from Accident Site:**	180°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	14 knots / 21 knots	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	40°	**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	30.32 inches Hg	**Temperature/Dew Point:**	21°C / 1°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Wallace, NC (ACZ)	**Type of Flight Plan Filed:**	None
Destination:	Oak Island, NC (SUT)	**Type of Clearance:**	None
Departure Time:	16:37 Local	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	1 Minor	**Latitude, Longitude:**	34.580001,-77.944999(est)

Administrative Information

Investigator In Charge (IIC):	Gunther, Todd
Additional Participating Persons:	Tim Haley; FAA / FSDO; Greensboro, NC Jordan Paskevich; Rotech Flight Safety; Vernon Shannon Yeager; Tecnam US Inc.; Sebring, FL
Original Publish Date:	May 6, 2021
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=93028