

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



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AIRFRAME AND ENGINE EXAM REPORT

February 27, 2024

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A. ACCIDENT

Location: Camarillo, California
Date: January 30, 2024
Time: 13:17 Pacific standard time
Airplane: N906CR, Raptor Junior 540

B. AIRFRAME AND ENGINE EXAM REPORT

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C. SUMMARY

Examination of the recovered wreckage was conducted on February 27, 2024, at the facilities of South West Aircraft Recovery in Chino, California.

D. DETAILS OF THE INVESTIGATION

1.0 Systems Description

The airplane was equipped with an electronic fuel injection and ignition system, manufactured by EFII Systems. It is a management system which is comprised of an automotive style computer control module, throttle body, fuel injection, and redundant dual ignition. The electronic ignition portion of the system utilizes high energy inductive ignition coils instead of magnetos to deliver spark to each spark plug.

The airplane was designed with a main electrical bus and essential electrical bus, powered by a conventional alternator, and dual batteries. The EFII system is powered through an essential bus by an EFII bus manager module.

Electrical system redundancy is accomplished by use of both a main and auxiliary battery system, connected to the main bus. (Fig. 1 and 2)

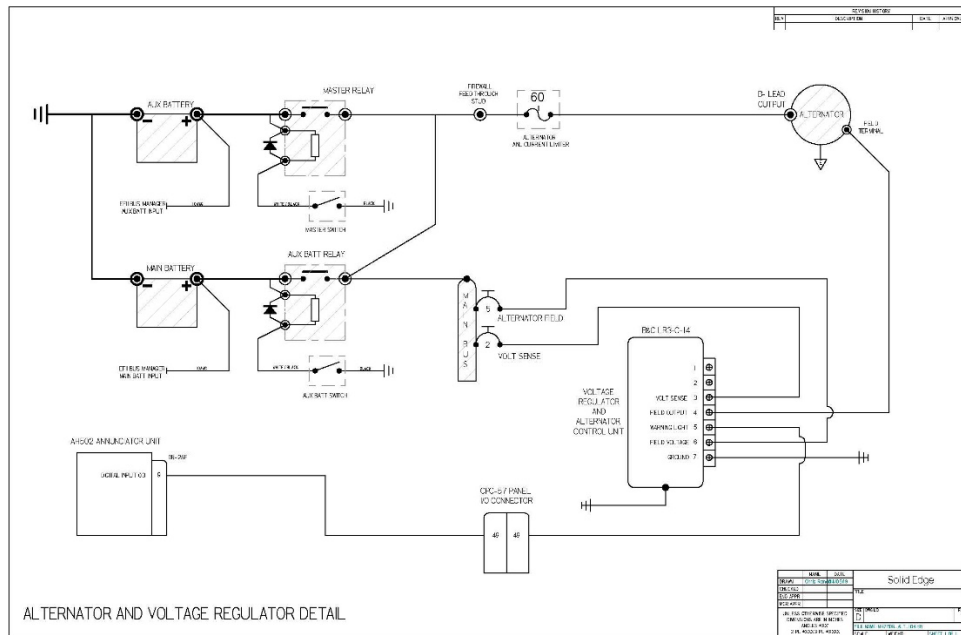


Figure 1. Diagram of main electrical bus and essential electrical bus, powered by an alternator and dual batteries.

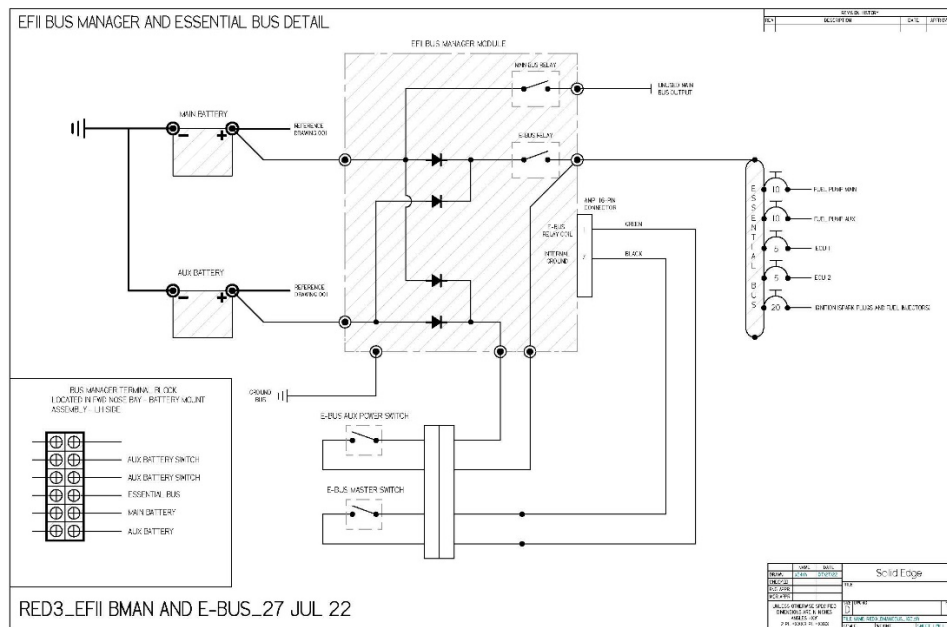


Figure 2. Diagram of EFII bus manager and essential bus.

As configured in the airplane, the system shared a common ground that connected the negative terminals for both batteries. It was routed through a common battery ground bus located behind the nose cone bulkhead, to the engine compartment and engine crankcase.

2.0 Electrical System Examination

The forward fuselage and cabin area were impact damaged. The nose cone was separated from the forward fuselage. Impact and crush damage prevented an accurate assessment of cockpit circuit breakers and switches. All instruments and avionics systems were impact damaged.



Figure 3. Forward fuselage area.

The main auxiliary and master power positive crossover cable was continuous between both relays. The positive power cable was continuous through the fuselage and to the firewall feed through stud. From there, it was continuous to the alternator via the ANL current limiter. All associated connections were tight and in place, and electrical continuity was confirmed throughout, using a multimeter.

The main and auxiliary batteries remained mounted in the nose cone, which had separated from the airframe and was still connected via multiple electrical cables. The main battery case was split, and 8.1 volts were measured across its terminals. The auxiliary battery was intact, and 10.9 volts were measured across its terminals.

Within the nose cone, the negative terminals of both batteries remained connected via their common ground line, however, the common ground feed through stud was loosely connected to the ground bus on the nose cone bulkhead.



Figure 4. Common ground feed through stud loosely connected to the ground bus.

Examination revealed that the feed through nut was 3.5 turns loose, which corresponded to approximately 3.5 threads of the feed through stud. Disassembly of the feed through stud assembly revealed that a single tooth lock washer had been used, rather than both a tooth lock washer and spring lock washer as had been found with all other primary electrical connections.



Figure 5. Disassembled feed through stud assembly.

Additionally, the EFII ground bus had an ABS plastic backing of 1/8 inch thick (as seen in Figure 4), and the stud was not equipped with a secondary locking nut, as had been consistent throughout the entire electrical system. All electrical ground spade connectors had pulled away from the ground bus.

Aft of the loose ground bus connection, the ground cable was continuous through to the fuselage and to the firewall feed through stud. The ground cable was continuous to the engine crankcase. All associated connections aft of the loose ground bus connection were tight and in place, and electrical continuity was confirmed throughout, using a multimeter.

3.0 Airframe Examination

Impact damage and crushing was found throughout the fuselage. The fuselage sidewalls and floor of the forward cockpit were torn away. The forward cabin seat frame and structure was displaced. The avionics panel and associated display was torn away and displaced.

Both wings were impact damaged and had been partially removed by recovery personnel. Both left and right wing fuel caps were found in place and secure. Fuel samples from both left and right fuel tanks were found to contain blue liquid consistent with 100LL aviation fuel, were free of debris, and no traces of water were found when tested with water-detecting paste.

4.0 Engine Examination

No engine data plate was located.

The engine remained attached to the airframe via the engine mount. No notable impact damage was observed. The propeller was rotated by hand and rotational continuity was observed throughout the valvetrain. "Thumb" compression was obtained on all cylinders. The engine was equipped with Iridium BR8EIX automotive spark plugs. Each spark plug electrode was light grey in color and exhibited minimal wear.

5.0 Propeller Examination

Make: McCauley

Model: B3D32C417 Catto Pusher

SR#: 01218484-1, 01218484-2, 01218484-3

The airplane was equipped with a three bladed Catto propeller. The propeller hub remained attached at the flange. All three blades remained attached to the hub. Blade A was splintered and bent aft about mid span, with spanwise and chordwise striations throughout. Blade B had chordwise striations over the inboard half and gouging along the trailing edge. Blade C was splintered and bent slightly aft about midspan, with gouging along the leading and trailing edges.

Submitted by:

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Air Safety Investigator