

DEPARTMENT OF TRANSPORTATION
NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20591

July 11, 1967

IN REPLY
REFER TO: SB-1-96

- Honorable William F. McKee
Administrator
Federal Aviation Administration
Department of Transportation
Washington, D. C. 20590

Dear General McKee:

The Board's investigation of an accident involving a Lake Central Airlines, Inc., Allison Prop-Jet Convair Model 340 aircraft, N73130, brought to light a condition which, although not related to the causal area, is considered to be potentially hazardous. This relates to the electrical system installation which, in this aircraft, has been modified from the original basic DC system in the Convair Model 340 aircraft to a combination AC-DC system designed and installed by Pac Aero Engineering Corporation.

The investigation disclosed that a blade from the right engine propeller penetrated the fuselage, severing certain electrical wiring bundles. One of these was an aluminum conduit containing three No. 10 stranded cables running beneath the cabin floor on the fuselage right side. These cables are the sole means of supplying electrical power to the 28 volt Essential DC Bus.

A study of the wiring diagrams for this installation disclosed that failure of all three Essential DC Bus feeder cables through electrical, environmental or mechanical faults would result in complete loss of all DC and AC electrical power on the aircraft. This would include loss of the inverter, the AC transformer rectifier and the battery as emergency sources of electrical power. This will occur because the Essential DC Bus power is utilized to control the coils of the main power contactor relays for both the DC and AC engine-driven generators. Loss of this power will cause the contactors to open, disconnecting the four generators from their respective bus systems. This, in turn, will delete the functions of the standby inverter and the AC transformer rectifier because their operation depends on available power from the Main DC Bus and the Left or Right Hand Essential AC Buses respectively. In addition, the Essential DC Bus controls the Main DC Distribution Bus Disconnect Relay. Loss of power will cause this relay to open, preventing Battery Bus power from reaching any other DC Bus.

Honorable William F. McKee (2)

It is evident that an energized 28 volt Essential DC Bus is necessary for a functioning electrical system in this aircraft. Therefore, its ability to supply essential power continuously and under adverse conditions would be of prime consideration in accordance with recommended good design principles and practices. In fact, such consideration is required under the airworthiness regulations.

All normal and emergency sources of the DC electrical power, i.e., the DC generators, the AC transformer rectifier and the battery, are connected to the Essential Distribution Bus. The three feeder cables, each protected by 30 ampere limiters, carry the power from this point to the Essential DC Bus. Any one of the three cables can safely carry the full load of this Bus, thus providing double redundancy. However, the Board believes that this redundancy is compromised by routing all three feeder cables in the same conduit. Reliability is further compromised by connecting all normal and emergency power sources to a single distribution bus.

A somewhat similar situation existed for some time in the Fairchild Model F-27 aircraft electrical system wherein both of its inverters were connected to a common ground, the failure of which would result in complete loss of AC electrical power. This condition was rectified by Airworthiness Directive No. 66-13-3. Another case involved the electrical system of the BAC 1-11 aircraft. Analysis of this system by the British Aircraft Corporation resulted in a modification to provide two alternate sources of power to the Essential DC Bus in case of failure. The British ARB made this modification mandatory on all British-owned aircraft and it was subsequently required on BAC 1-11 aircraft of United States registry by Airworthiness Directive No. 67-10-2.

The Board believes that the basic electrical system as installed on Allison Prop-Jet Convair aircraft constitutes a potential hazard to safe operation. Therefore, the Board recommends that the Federal Aviation Administration conduct an analysis of this electrical system and require such modifications as may be indicated to correct this condition.

This matter has been the subject of discussion between Mr. Billy M. Hopper of our Engineering Division, Bureau of Aviation Safety and Messrs. Duncan Salmond and Everett Morris of your Systems and Equipment Branch, FS-130. The personnel of our Engineering Division will be available for any assistance your staff may desire in this matter.

Sincerely yours,

/s/Joseph J. O'Connell, Jr.

Joseph J. O'Connell, Jr.
Chairman