

VIII. RECOMMENDATIONS:

The Cessna 310R aircraft involved in this accident, manufactured in 1977, is not unusual in that it represents the approximate average age of all general aviation aircraft presently operating in the United States. The aircraft manufacturer, Cessna, upon initial manufacture equipped many of those aircraft, like the accident aircraft, with electrical wiring insulated with PVC material. This insulating material is susceptible to burning, and this tendency increases as the wire ages¹. This burning, in turn, creates fumes that, in the enclosed space of a general aviation aircraft cabin, can quickly incapacitate the flight crew by the production of toxic fumes .

The FAA recently substantially revised 14 CFR Part 25, to address these hazards in larger transport category airplanes. These revised rules require holders of type certificates for those aircraft to conduct analyses of their airplanes and to develop Instructions for Continued Airworthiness (ICA) to improve maintenance procedures for wire systems.² Although the hazards to aircraft crew, and the risk to operators, is similar in the general aviation realm,³ these revisions do not apply to smaller general aviation airplanes such as the accident airplane. Therefore, maintainers and operators of smaller general aviation aircraft are left with insufficient guidance on these issues. We recommend that these hazards in general aviation aircraft be approached as follows:

- Require manufacturers and type certificate holders to revise or supplement maintenance publications to provide guidance to owners, operators, and maintainers in assessing hazards posed by deteriorating electrical wiring consistent with the recent FAA Rule released on November 8, 2007 for 14 CFR Part 25 aircraft. Presently, these materials only, at best, generally advise maintainers to “inspect” wiring periodically, with no guidance given as to the criteria to be applied to that inspection, and with no description given of conditions which should be considered to be unacceptable if found in that inspection;⁴

¹ Polymeric wire insulation has been demonstrated to become more stiff and brittle with age, leading to increased propensity to crack. *See, e.g.,* Bai, T., Brinson, L.C., Carr, S.H., Mason, T.O., Nunalee, F.N., Ramanathan, T., Shull, K.R., *Aging Characterization of Polymeric Insulation in Aircraft Wiring*, Departments of Mechanical Engineering and Materials Science and Engineering, Northwestern University;; *see also*, Federal Register: November 8, 2007 (Volume 72, No. 216), Section I (Executive Summary) noting that one of the “common conditions” found upon inspection of transport aircraft was “deteriorated wiring”.

² Federal Register: November 8, 2007 (Volume 72, No. 216), pp. 63363-63414.

³ In adopting its November 2007 rule revisions relating to transport category aircraft, the FAA noted that “Smaller transport airplanes do, and will continue to, exhibit the same EWIS [electrical wiring interconnection system] degradation issues found in larger transports...” *Id.* at Section H (Regulatory Evaluation). The same principle should apply to general aviation aircraft, the wiring of which carries similar electrical current through similar materials, and which is subject to the same hazards of degradation.

⁴ “Deteriorated wiring, corrosion, improper wire installation and repairs, and contamination of wire bundles with metal shavings, dust, and fluids (which would provide fuel for fire) were common conditions in representative examples of the ‘aging fleet of transport airplanes.’ The FAA has concluded that current

- Require maintenance references, including both advisory circulars and those references prepared by the aircraft manufacturer, to warn that the fumes generated by smoldering or burning electrical wiring can quickly incapacitate the occupants of a small general aviation airplane cockpit. Those references should be updated and amended to provide this information;
- Require that the FAA include 14CFR Part 23 aircraft in the Advisory Circular 120-94 (December 20, 2007), which directs operators of transport category airplanes to improve wiring maintenance. This Circular provides guidance to operators of those larger aircraft in developing training programs to assist their operating and maintenance personnel in inspecting aircraft wiring to ensure adequate recognition and repair of potentially unsafe wiring conditions. (See, specifically, Module C of AC120-94).
- Require manufacturers and type certificate holders of general aviation aircraft to supplement or amend pilot operating handbooks (POH) to provide clear guidance on flight crew procedures for responding to evidence of an electrical fire in flight⁵. The NTSB has made a similar recommendation to the FAA regarding the operation of larger transport aircraft⁶;
- Require manufacturers and type certificate holders of general aviation aircraft to supplement or amend the aircraft POH to warn of the danger of fumes emitted by an electrical fire, as well as the fact that those fumes can quickly incapacitate occupants of a small general aviation aircraft cabin.

maintenance practices do not adequately address wiring components, wiring inspection criteria are too general, and maintenance instructions do not describe unacceptable conditions, such as improper repairs and installations, in enough detail.” *Id.* at Section 1 (Executive Summary).

⁵ The POH for the accident aircraft gave the crew no advice beyond: (a) to “reduce” electrical load, (b) to “attempt to isolate the source of fire or smoke”, (c) to open vents; and (d) to “land and evacuate airplane as soon as practical.” The accident flight crew followed this advice, but were still overcome by fumes within several minutes from the inception of the fire. In this case, interruption of electrical power to all aircraft circuits consistent with POH advice did not extinguish the electrical fire.

⁶ See Section 4.1 of the National Transportation Safety Board’s accident report concerning the February 7, 2006 inflight cargo fire of United Parcel Service Flight 1307 involving a McDonnell Douglas DC-8-71F, N748UP.