NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: April 13, 1978

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)
A-78-27 through 29

reiteration to Columbia Pacific Airlines

The National Transportation Safety Board is concerned about the number of accidents involving complex fixed wing, multiengine aircraft in air taxi and corporate/executive operations in which the accident circumstances remain unknown. Of the 194 fatal accidents in these operations from 1970 to 1977, cause has not been determined for 34 of the accidents. (See Attachment 1.) In addition to the accidents reflected in the data in Attachment 1, the Safety Board has recently investigated or is investigating five other accidents in the corporate/executive fleet alone[1]/ in which there appears to be little hope of determining definitive cause. These accidents, which have occurred within the past 18 months, have resulted in 26 fatalities.

With the continued growth in the numbers of complex multiengine aircraft in general aviation, particularly in corporate/executive operations and air taxi/commuter service, and the frequent operation in unfavorable

1/ Accidents under recent investigation:

Grumman Gulfstream II (G1159), N500J, Johnson & Johnson, Inc., Hot Springs, Virginia, September 26, 1976.

Lear 23, N332PC, Jet Avia Limited, Flint, Michigan, January 6, 1977.

Falcon 10, N60MB, Mountain Bell Co., near Denver, Colorado, April 3, 1977.

BH 125-600A, N40PC, Southern Company Services, Inc., McLean, VA, April 28, 1977.

Lear 25, N999HG, Champion Homes, near Sanford, NC, September 8, 1977.

environments, we believe that recorders are urgently needed. In fact, we believe that these recorders are as justified as those installed in the air carrier fleet in 1959. At that time, high speed, increased reliance on avionic equipment, and lack of eye witnesses combined to limit the investigative evidence and often eliminated chances of determining cause. These same factors are hindering today's investigations of accidents involving complex multiengine aircraft in air taxi and corporate executive operations.

Accident investigation experience with air carrier aircraft has proven that cockpit voice recorders (CVR) and flight data recorders (FDR) have been invaluable tools in identifying aircraft design deficiencies, common operational problems, shortcomings in the air traffic control system, and the effects of meteorological phenomena on aircraft performance. In almost every accident investigation involving these aircraft during the past 10 years, one or both of these recorders provided investigators with the clues necessary to piece together the circumstances of the accident. To its credit, the aviation community has always responded to these accident findings by instituting immediate remedial actions, or at the very least, by researching identified problem areas. The result has been continued improvement in aviation safety.

The value of the FDR, and in particular of the digital FDR, has become evident in the investigation of a number of air carrier accidents in which wind shear was a primary causal factor. The recorded data have provided a means for accurately determining the flight profiles and the direction and magnitude of winds. They have also provided sufficient information for programming aircraft simulators so that the condition encountered by the pilots could be reproduced in real time. Simulation based on FDR data has made it possible to explore human factors such as restricted visual cues which hinder prompt recognition of a developing descent rate and accurate assessment of the pitch attitude change required to arrest the descent before impact.

At least one manufacturer of corporate/executive aircraft has recognized the long-term value of the FDR and CVR and is providing space and power for the FDR and installing a CVR in every aircraft of this category manufactured. As corporate flying becomes an ever-increasing part of the transportation system, corporate operators are also discovering that it is to everyone's advantage to install CVR's and FDR's aboard their aircraft. A corporate flight department's operation is invariably suspect in the eyes of general aviation antagonists after an accident for which the precise cause is unknown.

The economic benefits of the FDR and CVR are becoming apparent as well. The inability to properly determine the cause of an accident can be costly, not only because of the failure to determine proper preventive measures, but also because of liability of the manufacturers, the operator, and the Government.

In addition, corporations and air taxi operators are providing transportation in lieu of available Part 121 air carrier transportation. These passengers are not being afforded a level of safety equivalent to that of air carriers. The Safety Board believes an equivalent level can only be effected in the long term by the installation of flight recorders.

The Safety Board believes that an industry which has made the micro-computer a household tool could develop a reasonably priced, light weight, small-volume, solid state digital flight data recorder and an equally inexpensive cassette type cockpit voice recorder which would serve the intent of the flight recorder requirement. In fact, one manufacturer is developing a very small digital flight data recorder under contract for the U.S. Army which will employ the latest electronic technology and will be capable of recording over 30 minutes of data for more than 15 parameters.

This system is to use a microprocessor to decide which data should be stored and when, and a nonvolatile solid-state memory instead of recording tape. Because no recording tape is used, the system will be virtually maintenance free. Whereas, current FDR's of the scribed metal foil variety record only four variable parameters, cost $15,000 to $20,000 to install, and weigh 40 pounds, the U.S. Army plans for their new unit to cost $10,000, including installation, on a limited production schedule and weigh about 7 pounds.

Although the unit being developed under this contract does not have voice recording capability, discussions with equipment suppliers indicate that the technology is available to produce a similar recorder capable of recording both voices and digital data on aircraft performance.

In addition to new flight recorder standards for certain aircraft operating under 14 CFR 91 and 14 CFR 135, the Safety Board believes that the current standards for aircraft operating under 14 CFR 121 should be revised and updated to reflect modern needs and the technological state of the art. Although the data that they presently provide are extremely valuable, FDR's could record additional parameters with more useful accuracy and CVR's could produce better quality voice recordings at minimal cost if modern technology were employed. A list of requirements which we believe to be feasible is attached. (See Attachment 2)

In view of the above, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Develop, in cooperation with industry, flight recorder standards (FDR/CVR) for complex aircraft which are predicated upon intended aircraft usage. (Class II, Priority Action) (A-78-27)

Draft specifications and fund research and development for a low cost FDR, CVR, and composite recorder which can be used on complex general aviation aircraft. Establish guidelines for these recorders, such as maximum cost, compatible with the cost of the airplane on which they will be installed and with the use for which the airplane is intended. (Class II, Priority Action) (A-78-28)

In the interim, amend 14 CFR to require that no operation (except for maintenance ferry flights) may be conducted with turbine-powered aircraft certificated to carry six passengers or more, which require two pilots by their certificate, without an operable CVR capable of retaining at least 10 minutes of intracockpit conversation when power is interrupted. Such requirements can be met with available equipment to facilitate rapid implementation of this requirement. (Class II, Priority Action) (A-78-29)

KING, Chairman, McADAMS, HOGUE, and DRIVER, Members, concurred in the above recommendations.

By: James B. King
Chairman

ATTACHMENT 1

FATAL ACCIDENTS
U.S. GENERAL AVIATION
MULTI-ENGINE FIXED WING
1970-1977

EXCLUDES ACCIDENTS WITH NO CAUSAL ASSIGNMENT
AS OF 3/14/78

BROAD Cause/Factor	FATAL ACCIDENTS Cause	Factor	Total
Pilot	766	169	779
Personnel	76	37	111
Airframe	19	3	22
Landing Gear	1	1	2
Powerplant	110	15	120
Systems	20	6	26
Instruments/ Equipment & Accessories	3	7	10
Airport/Airways/Facilities	3	10	13
Weather	37	416	442
Terrain	24	160	184
Miscellaneous	22	9	31
Undetermined	91	0	91

Total No.
Fatal Accidents 917

FATAL ACCIDENTS
OF
UNDETERMINED CAUSE
GENERAL AVIATION
MULTI-ENGINE FIXED WING
1970-1977

Category	Number of Undetermined Accidents	Number of Fatalities
Air Taxi	21	80
Corporate/Executive	13	47
Business	16	37
Pleasure/ Personal Transport	28	79
Miscellaneous (Ferry/Instruction/Unknown)	13	36
Total	91	279

ATTACHMENT 2

FLIGHT RECORDER STANDARDS VIEWED AS FEASIBLE
BY NATIONAL TRANSPORTATION SAFETY BOARD

COCKPIT VOICE RECORDER to record intra-cockpit voice communications with retention of at least 10 and preferrably 15 minutes of recorded data at time of power interruption.

-- Require on turbine-powered aircraft carrying 6 passengers or more, certificated for two-pilot operation that are in present service operating under 14CFR91 or 14CFR135.

MINI FLIGHT DATA RECORDER to record at least 5 variable parameters and one binary signal as a function of time. The minimum parameters are: Indicated Airspeed, Pressure Altitude, Magnetic Heading, Vertical Acceleration, Longitudinal Acceleration and the keying of any air/ground communication equipment. Recording media or memory should retain the last 10 minutes of data at time of power interruption.

-- Require on newly manufactured multi-engine aircraft certificated to carry 6 to 9 passengers and single-pilot operation under 14 CFR91 or 14CFR135.

-- Require on newly manufactured multi-engine aircraft certificated to carry 10 passengers or more and single-pilot operation under 14CFR91.

COMPOSITE FLIGHT DATA and COCKPIT VOICE RECORDER or individual installation of Cockpit Voice Recorder and Mini Flight Data Recorder which will satisfy the requirements for both equipment as described above.

-- Require on newly manufactured turbojet aircraft certificated to carry 6 passengers or more and two pilot operation under 14CFR91 or 14CFR135.

-- Require on all multi-engine aircraft, including those presently in service, certificated to carry 10 passengers or more and operating under 14CFR121, 14CFR127, or 14CFR135, except for those larger air carrier aircraft required to have recorders by the present rule 14CFR121.343.

BASIC EXPANDED PARAMETER FLIGHT DATA RECORDER as described in 14CFR 121.343 paragraph (a)(2), and COCKPIT VOICE RECORDER as described in 14CFR121.359.

-- Require on all newly manufactured large aircraft certificated for operations above 25,000 feet altitude or that are turbine engine powered regardless of the date of issue of the aircraft's type certificate that operate under 14CFR121.

EXPANDED PARAMETER FLIGHT DATA RECORDER recording parameters described in Enclosure 1 to Safety Recommendations A74-15 thru 17 dated March 1, 1974, plus any dedicated parameters which may be desirable because of unique features of the specific aircraft configuration and type design, and COCKPIT VOICE RECORDER as described in 14CFR 121.359.

-- Require on all large aircraft certificated for operations above 25,000 feet altitude or that are turbine engine powered for which a new type certificate is issued that operate under 14CFR121.

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Safety Recommendation Reiteration List

SR Number	Reiteration Number	Report Number	Report Date	Accident Description	Accident City	Accident State	Accident Date
A-78-027	1	AAR-79-15	9/20/1979	Champion Home Builders, Company, Gates Learjet 25B, N99HG	Sanford	NC	9/8/1977
A-78-027	2	AAR-79-18	12/13/1979	Inlet Marine, Inc., Gates Learjet, N77RS, Century 111, Model 25C	Anchorage	AK	12/4/1978
A-78-027	3	AAR-80-08	5/28/1980	Comair, Inc., Piper PA 31, N6642L	Covington	KY	10/8/1979
A-78-027	4	AAS-80-02	7/22/1980	Special study of commuter airline safety from 1970-1979. The Board published this study on 7/22/1980	N/A	N/A	N/A
A-78-027	5	AAR-81-13	8/19/1981	Texasgulf Aviation, Inc., Lockheed Jetstar N520S	White Plains	NY	2/11/1981

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A-78-028	2	ARR-79-18	12/13/1979	Inlet Marine, Inc., Gates Learjet, N77RS, Century 111, Model 25C	Anchorage	AK	12/4/1978
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