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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

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Forwarded to:
Honorable John L. McLucas
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A 76-20 through 28

Several rapid decompression mishaps involving DC-10 and L-1011 aircraft have disclosed problems with chemically generated passenger supplemental oxygen systems. The National Transportation Safety Board's special study, "Chemically Generated Supplemental Oxygen Systems in DC-10 and L-1011 Aircraft"^{1/} indicates that these problems are primarily the result of a lack of understanding of the system by both passengers and flight attendants.

The Safety Board is concerned about the potential dangers in the misuse of these emergency systems. The Safety Board's study pinpoints the more frequent problems encountered by both passengers and flight attendants. The scope of the problems is illustrated by four recent decompression incidents involving three DC-10 and one L-1011 aircraft.

In the four decompression cases passengers and flight attendants were concerned that oxygen equipment was malfunctioning because they had no indication of oxygen flow. Although the reservoir bags on the oxygen masks should inflate at higher altitudes when oxygen is being delivered, they do not always. Low temperatures and changes in the characteristics of the vinyl plastic material can prevent inflation. Since inflation of the reservoir bag is the only indication that oxygen is being delivered, passengers and some flight attendants concluded erroneously that the equipment was defective.

In addition, the incidents illustrated a related problem -- flight attendants and passengers were not aware that 10 to 15 seconds must elapse after the generator is activated before 1 liter per minute oxygen flow can be attained. This time lag and the fact that the reservoir bag normally may take up to 30 seconds to fill, led flight attendants and passengers to believe that oxygen was not being delivered to the mask.

^{1/} National Transportation Safety Board Special Study No. 76-1.

In three incidents on DC-10's, passengers failed to pull the mask to their faces; such action is required to activate the system. Instead, they leaned forward and attempted to breathe into the mask without fully removing it from the stowed position. In another case, some passengers placed the mask over only the mouth or the nose instead of properly locating it over both nose and mouth.

Reports also were received that passengers did not use the oxygen mask headband or could not find the adjustment strap which must be used to tighten the headband and to hold the oxygen mask firmly against the nose and mouth.

The Safety Board believes that the difficulties encountered in the DC-10 and to a lesser extent in the L-1011 stem from two basic deficiencies -- (1) lack of design guidance for supplemental oxygen systems, and (2) the absence of system demonstration requirements.

In the design of the DC-10 supplemental oxygen system, insufficient attention was devoted to user considerations. The system requires excessive passenger involvement and responses. The passenger must remove the oxygen mask from stowage, activate the system, and use it properly. The Safety Board believes that guidelines should be developed for use by designers of such systems to ensure that all human factors are considered before systems are put into operation.

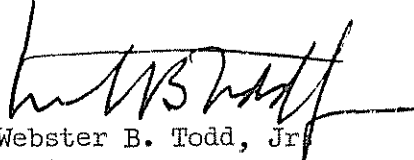
Secondly, before a system is installed, it should be clearly demonstrated that the user will have minimal difficulty with it. Actual demonstrations would help designers to make early design changes when problems are discovered. The Safety Board believes that a demonstration test should be developed to show that passengers will understand the operation of the supplemental oxygen system and will respond adequately to it.

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

1. Require, after a certain date, that passenger emergency supplemental oxygen systems have readily discernible means to indicate that oxygen is flowing. (Class II - Priority Followup)
2. Amend 14 CFR 37.169 "Oxygen Mask Assembly, Continuous Flow, Passenger (for Air Carrier Aircraft) - TSO-C64," to require adjustment tabs on oxygen mask headbands, which can be easily recognized by distinctive shape and color. (Class II - Priority Followup)
3. Issue an Airworthiness Directive, requiring installation of adjustment tabs on in-service and in-stock passengers' supplemental oxygen mask headbands. (Class II - Priority Followup)

4. Establish service life and periodic inspection requirements for oxygen mask reservoir bags. (Class II - Priority Followup)
5. Require that operators of aircraft having the chemically generated passenger supplemental oxygen systems include detailed information regarding the operational characteristics of these systems in the training programs for their cockpit and cabin crewmembers. Such information should include flow rates and the time and volume lag in the delivery of oxygen. (Class II - Priority Followup)
6. Issue an Advisory Circular (AC) to all Part 121, 123, and 135.2 certificate holders to provide guidelines for improved passenger briefings and printed instructions for the use of chemical supplemental oxygen systems. (Class II - Priority Followup)
7. Issue an Operations Bulletin for a review of oral briefings and passenger safety cards for each Part 121, 123, and 135.2 certificate holder to assure that briefings and printed instructions for the use of the passenger chemical supplemental oxygen system are factual and unambiguous and conform to the guidelines of the above AC. (Class II - Priority Followup)
8. Develop standards for the use of accepted human factors engineering principles and system design concepts in the design of passenger supplemental oxygen systems. (Class III - Longer-term Followup)
9. Develop standards for type certification demonstration tests of passenger supplemental oxygen systems. (Class III - Longer-term Followup)

TODD, Chairman, McADAMS, THAYER, BURGESS, and HALEY, Members, concurred in the above recommendations.


By: Webster B. Todd, Jr.
Chairman

THESE RECOMMENDATIONS WILL BE RELEASED TO THE PUBLIC ON THE ISSUE DATE SHOWN ABOVE. NO PUBLIC DISSEMINATION OF THE CONTENTS OF THIS DOCUMENT SHOULD BE MADE PRIOR TO THAT DATE.