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Log 1806

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: July 2, 1985

Forwarded to:

Honorable Donald D. Engen
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-85-35 through -49

The National Transportation Safety Board has reviewed the current Federal Aviation Regulations related to the equipment and procedures for air carrier water contact accidents; previous Safety Recommendations made by the Board and the Federal Aviation Administration's (FAA's) response to them; the FAA's 1984 Water Survival Staff Study: Inadvertent, Survivable Air Carrier Water Accidents; and a number of related issues raised by concerned safety organizations. A full presentation of the Safety Board's review of these matters is set out in the recent Board Safety Study, Air Carrier Overwater Emergency Equipment and Procedures (NTSB/SS-85/02). The Safety Board found a number of ways in which the FAA could and should improve requirements for equipment and procedures related to air carrier water contact accidents.

Of the two types of water contact accidents--ditchings and inadvertent water impacts--the latter present the more difficult survival problems. Unlike ditchings, inadvertent water impacts allow no time for crew and passenger preparation--taking seats, fastening seat belts, donning life preservers, bracing for impact, readying liferafts (if available), etc. Accident data show that in these crashes, the aircraft (particularly the fuselage) is likely to be severely damaged; the cabin is likely to flood rapidly and the aircraft to sink within minutes. The occupants will probably have to contend with injuries, panic, rising water, unfamiliar and possibly inaccessible water survival equipment, possibly jammed exits and, often, darkness. The crewmembers may be incapacitated; those occupants who succeed in getting out of the aircraft face the dangers of drowning and hypothermia.

Not only are inadvertent water impacts more dangerous than ditchings, they are far more common: of the 16 survivable air carrier water contact accidents worldwide between 1959 and 1979, all but one were inadvertent. However, the current water survival-related regulations focus primarily on ditchings, particularly in connection with "extended overwater" operation. In doing so, the regulations fail to provide sufficient protection for the more dangerous and probable situation--inadvertent water impact during takeoff or landing, close to an airport (not 50 nautical miles out to sea, perhaps on a flight not classified as "overwater," extended or otherwise).

SS-85-2

The collective standards and regulations dealing with air carrier water contact accidents should be reoriented to provide appropriate attention to the several types of accidents possible. Several steps should be taken to accomplish this basic reorientation.

First, basic water survival equipment--life preservers and flotation seat cushions--should be provided on all air carrier aircraft being operated under 14 CFR 121, 125, and 135. Such a requirement would eliminate the current unjustified differences in basic water survival protection among these types of operations; it would also eliminate the unwarranted (and poorly defined) distinctions between "any overwater" operations and those not classified as "overwater" at all. Inadvertent water impacts typically occur close to an airport; virtually all aircraft being operated under 14 CFR 121, 125, or 135 are likely to use one or more of the 179 fully-certificated airports located within 5 miles of a significant body of water.

This requirement would serve two other purposes: it would reduce the possibility of confusion and uncertainty among crew and passengers concerning what equipment is actually on board, and it would eliminate the possibility that inflatable "individual flotation devices" (IFD) (TSO-C69a) or flotation seat cushions could be provided in place of life preservers (TSO-C13d). The greater buoyancy of life preservers makes them far more desirable than the inflatable IFDs. Flotation seat cushions, since they may float free after an inadvertent water impact and provide a ready means of flotation while life preservers or slide/raft combinations are being deployed, are desirable as a supplement to life preservers and other flotation aids; they should not, however, be permitted to be the sole flotation aid on any air carrier aircraft, as is now the case.

In conjunction with this change, the requirements in 14 CFR 121, 125, and 135 for passenger briefings should be amended to include a requirement for life preserver donning demonstrations (now required only on extended overwater flights).

For "extended overwater" operations, the Board believes supplemental equipment is needed, primarily to provide greater (ideally, complete) protection from hypothermia. The current requirements for the carriage of "life rafts" (a requirement met by the use of "slide/raft combinations" on most wide-body aircraft today) on all extended overwater flights are acceptable for this purpose. However, the FAA should address three areas: the need for immediate revision of the standards for emergency evacuation slides to require "quick-release girts" and handholds (to increase the slides' usefulness as flotation aids); the need to redesign emergency evacuation slides to provide immersion protection in water impact accidents; and the need to bring the requirements for survival tools on "life rafts" and "slide/raft combinations" (now variously specified in two Technical Standard Orders (TSO) and three sets of operating rules) into conformity. The desirability and feasibility of quick-release girts and handholds on slides have been demonstrated by the FAA's Civil Aeromedical Institute (CAMI) researchers. Some experimentation in redesigning slides to provide immersion protection has begun at CAMI and was reported in the FAA staff study. Deciding what survival tools are really needed on liferafts and slide/raft combinations and conforming the various requirements for them have not been attempted by the FAA, so far as the Board is aware.

Life preservers are an important flotation aid for water impact survivors, yet their usefulness at time of need is seriously undermined by several longstanding problems. Both repeated accident experience and research testing demonstrate that ordinary people typically find it difficult, if not impossible, to retrieve preservers from their stowage compartment, unpackage them, and don them correctly. Furthermore, stowage compartments under the seats are vulnerable to water impact damage, seat collapse, and post-impact flooding of the cabin; the compartment may be inaccessible due to the presence of too many items of carry-on baggage. (See the Board's Safety Study, Air Carrier Overwater Emergency Equipment and Procedures, for details of all these problems and discussion of past Board Safety Recommendations in these areas.)

Federal regulations concerning life preserver stowage should preclude locations that are vulnerable to crash damage and flooding, both of which are common in inadvertent water impacts. Furthermore, to provide the needed incentive for manufacturers to simplify the package opening process, the current TSO requirement for a timed donning test should be amended to begin with the packaged preserver in hand, not the unpackaged preserver (as is now the case).

As for donning, CAMI has demonstrated the far superior donnability of modified "angler's vests." Additionally, problems with the instructions on traditional life preservers (they are often printed so that they are either in back or upside down when the preserver is donned) would be obviated by the use of angler's vests, since instructions would likely not even be needed on these devices. Assuming that any remaining sizing problems with these devices can be resolved, the Board believes the life preserver TSO should be revised not only to permit but to encourage the use of these, rather than traditional life preservers. At the least, the TSO should not preclude the use of single inflation chambers (such as on the angler's vest). Furthermore, TSO-C13d should be modified to require that donning and use instructions printed on the life preserver should be readable when the preserver is donned.

The TSO specifications for a timed donning test should be more detailed than they now are. Currently, a manufacturer may certify compliance with the donning test criteria if "an adult" dons the preserver in 15 seconds, unassisted and while seated, and "an adult" puts it on another adult, or a child, or an infant in 30 seconds, unassisted. Such specifications are wholly inadequate for demonstrating that a life preserver is reasonably easy for typical air carrier passengers to unpackage and don correctly and quickly, and to ensure that its donnability for children is acceptable. Besides beginning the test with a packaged preserver in hand, the specifications should: state the minimum number of naive subjects to be tested in each group test; the minimum and maximum number of group tests that must be performed; the minimum percent of persons in each group who must "pass" the test to count the group test a success; and the minimum percent (or number) of group tests that must be successful to demonstrate life preserver compliance with the TSO's standard for donnability. The TSO should also describe the required composition of the groups used in these tests, in terms of age and sex, including at least one child and one infant in the tests.

Life preservers need to be designed to require a minimum of thought and manipulation; designers of these devices should strive to create a life preserver whose correct donning is self-evident. Experience shows that many passengers ignore or pay little attention to flight attendants' pre-flight oral briefings and life preserver demonstrations, do not read safety cards, and do not watch videotaped safety briefings. Even those who pay careful attention to these instructions may not be able to remember the instructions when they need them, particularly under the real conditions of an accident and the severe stress that most people experience in those circumstances. In several accidents the Board has investigated, passengers needed extensive "hands-on" help from the flight attendants, in some cases despite repeated donning demonstrations. The evidence is that, in the real world, a substantial proportion of the people who need to put a life preserver on will have to do so without benefit of much instruction.

The Board believes that the best single way to provide to life preserver manufacturers the needed incentive to maximize simplicity of design and reduce the need for instruction is to require that the TSO-C13 timed donning test be performed without the use of an information card, a donning demonstration, or any other instruction in correct donning procedure. Although this concept may at first appear unduly rigorous, the Board believes that this stipulation would in fact only partially balance the enormous advantage enjoyed by donning test participants over people in actual water accidents. Donning test participants perform under minimal, if any, stress; they are unhurt, not in imminent danger of drowning or immersion in frigid water, not surrounded by injured and frightened fellow passengers. They are working in a well-lighted area. The life preserver is not hopelessly jammed under the seat by excess carry-on baggage or a collapsed seat. Importantly, they are given correct donning procedures only moments before undertaking the task of donning -- little time elapses in which to begin to forget the instructions.

People faced with the task of donning a life preserver after a real accident are not so fortunate. Since the conditions of a timed donning test cannot begin to simulate the difficult conditions of a water impact accident, it is necessary to use surrogate measures that may help to balance the unrealistically positive conditions of the test. The best single surrogate measure for this purpose is the elimination of donning instruction. If this is a condition of the certification test, manufacturers will find it necessary to move toward life preserver designs whose correct donning is readily apparent. This one feature will substantially enhance the usefulness and effectiveness of life preservers.

Current FAA regulations do not ensure provision of adequate individual flotation aids for infants. Infants are extremely susceptible to hypothermia, so that requirements for infant flotation aids should address the need to protect them from both drowning and hypothermia. CAMI has experimented with prototype infant flotation devices designed with both these requirements in mind; the Board believes the FAA should vigorously pursue these possibilities and set TSO requirements for whole body protection for infants and amend Federal Aviation Regulations to require provision of such devices.

The life preserver TSO should require that all life preservers be equipped with an automatically activated survivor locator light. Currently, this requirement depends on the relevant operating rule requiring such a light. Since the Board is recommending that all aircraft being operated under 14 CFR 121, 125, and 135 carry life preservers, the Board believes the locator light requirement should be made a part of the life preserver TSO.

The actions of the crew in handling a ditching, or in the immediate aftermath of an inadvertent water impact, can have a significant effect on the chances for survival of those passengers (and other crew members) not killed by the water impact. In its report on the 1970 Overseas National Airways (ONA) ditching off St. Croix, the Safety Board stated, "The most important single factor in occupant survival during ditchings is proper preparation and control of the passengers by the crew." However, in that crash, the Board found "the passengers were prepared inadequately. . .due to insufficient. . .time, inadequate briefings, insufficient [crew] training, and lack of proper crew coordination." The FAA's staff study in 1984 concluded that crew training in quick response procedures following inadvertent water contacts is needed, "in addition to, or in place of, the planned ditching training given by most carriers."

As a result of the ONA crash, the Board recommended that the FAA require periodic crew training in evacuation and wet ditching drills and that all air carriers review their crew training practices and materials to expand their training in crash survival and crew leadership. (A-72-71 and A-72-73).

As recently as 1983, during the Eastern Airlines L-1011 near ditching near Miami, Florida, the Board found poor coordination between the cockpit and cabin crews. The Board recommended (A-84-18) that the FAA require its operations inspectors to review and require modification as needed of all air carriers' flight and flight attendant manuals and of their training programs, to preclude similar communication problems in other carriers' operations.

The Board believes that improvements in crew training and procedures manuals are needed to ensure that both cockpit and cabin crew are thoroughly versed in the location and operation of all water survival equipment to be found on aircraft operable under 14 CFR 121, 125, or 135. Crewmembers should be effectively trained and required to demonstrate initially and periodically throughout their careers, that they are knowledgeable in the use and proficient in the handling of all such equipment. The FAA should identify and require the additional emergency procedures and training needed by crewmembers so they may perform well in an inadvertent water accident.

Finally, the FAA should expedite its revisions of 14 CFR 139 to require development and approval of water rescue plans at all certificated airports near significant bodies of water. After the Air Florida crash into the Potomac River in January 1982, the Safety Board recommended (A-82-88) that the FAA review the adequacy

of water rescue capabilities at certificated airports having approach and departure flightpaths over water and make recommendations for improvement as necessary to appropriate airport authorities. The Board also recommended (A-82-89) that the FAA amend Part 139 to require adequate water rescue capabilities at certificated airports having approach and departure flightpaths over water and ensure that these capabilities are compatible with the range of weather conditions which can be expected. In a February 1985 letter to the Safety Board, the FAA reported that it had completed the review called for in A-82-88; publication of proposed revisions of Part 139, delayed several times since 1982, is now anticipated in "early 1985," according to the same FAA letter.

The Board urges the FAA to publish promptly the proposed revisions of Part 139. The revisions should define a "significant" body of water and a perimeter around an airport within which the presence of such bodies of water will require the development of a water rescue plan. Furthermore, the revisions should take into account the Safety Board's finding in its report on the January 1982 World Airways runway overrun at Logan International Airport that the FAA should "make mandatory" the guidelines on emergency plans, facilities, and equipment at airports set forth in Advisory Circular (AC) 150/5210-13. Additionally, the recommendations of the FAA's staff study should be addressed, particularly those calling for semi-annual evaluation by airport operators of the water rescue capability, including staging of a simulated disaster to evaluate "typical winter and summer [water rescue] conditions," and the promulgation of an AC to address non-certificated airports.

As a result of its Safety Study on Air Carrier Overwater Emergency Equipment and Procedures, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Amend 14 CFR 121 to require that all passenger-carrying air carrier aircraft operating under this Part be equipped with approved life preservers meeting the requirements of the most current revision of TSO-C13 within a reasonable time after the adoption of the current revision of the TSO; ensure that 14 CFR 25 is consistent with the amendments to Part 121. (Class II, Priority Action)(A-85-35)

Amend 14 CFR 125 to require that all passenger-carrying air carrier aircraft operating under this Part be equipped with approved life preservers meeting the requirements of the most current revision of TSO-C13 within a reasonable time after the adoption of the current revision of the TSO; amend Part 125 to require approved flotation-type seat cushions (TSO-C72) on all such aircraft; ensure that 14 CFR 25 is consistent with the amendments of Part 125. (Class II, Priority Action)(A-85-36)

Amend 14 CFR 135 to require that all passenger-carrying air carrier aircraft operating under this Part be equipped with approved life preservers meeting the requirements of the most current revision of TSO-C13 within a reasonable time after the adoption of the current revision of the TSO; amend Part 135 to require approved flotation-type seat cushions (TSO-C72) on all such aircraft; ensure that 14 CFR SFAR No. 23 is consistent with the amendments to Part 135. (Class II, Priority Action)(A-85-37)

Amend 14 CFR 25 and SFAR No. 23 to require that the stowage compartment for life preservers be located where the life preserver will not be susceptible to water impact crash damage or to cabin flooding; amend 14 CFR 121, 125, and 135 to be consistent with the amendments to Part 25 and SFAR No. 23 and to require compliance within a reasonable time after adoption of the amendments to Part 25 and SFAR No. 23. (Class II, Priority Action)(A-85-38)

Amend the relevant sections of 14 CFR 121, 125, and 135 to require that all pre-departure briefings include a full demonstration of correct life preserver donning procedures. (Class II, Priority Action)(A-85-39)

Determine the items of equipment, including survival tools, needed on liferafts and slide/raft combinations, and standardize the now-differing requirements for these items variously specified in 14 CFR 121.339, 125.209, 135.167, TSO-C70a, and TSO-C69a. (Class II, Priority Action)(A-85-40)

Amend TSO-C69a to require quick-release girts and handholds on emergency evacuation slides; amend 14 CFR 121 and 125 to specify a reasonable time from the adoption of the revision of the TSO by which all transport passenger air carrier aircraft being operated under these Parts must be equipped with slides conforming to the revised TSO. (Class II, Priority Action)(A-85-41)

Amend TSO-C13d to require that the timed donning tests include the time to extract the life preserver from an unopened package. (Class II, Priority Action)(A-85-42)

Amend TSO-C13d to establish specific donning test performance requirements and compliance criteria, based on accepted statistical sampling practices that, at a minimum, set a lower limit on the number of persons to be used in each group test; upper and lower limits on the number of group tests that may be performed; the minimum percentage of persons in

each group who must pass the test in order to count the group test a success; the minimum number of group tests that must be successful; and the composition of each group, including a requirement that only naive subjects be used. (Class II, Priority Action)(A-85-43)

Amend TSO-C13d to require that the timed donning tests be performed without the use of a briefing card or a donning demonstration. (Class II, Priority Action)(A-85-44)

Amend TSO-C13d so that it does not preclude the use of single inflation chamber life preserver designs that otherwise meet the requirements of the TSO. (Class II, Priority Action)(A-85-45)

Amend TSO-C13d to require an automatically activated survivor locator light. (Class II, Priority Action)(A-85-46)

Amend TSO-C13d to require that donning and/or use instructions printed on life preservers must be demonstrated to be readable when the preserver is donned. (Class II, Priority Action)(A-85-47)

Amend TSO-C13d to provide specific minimum performance standards for flotation devices designed to meet the needs of infants, including whole body protection from hypothermia; amend 14 CFR 121, 125, and 135 to require that a specific number of approved infant flotation devices, meeting the requirements of TSO-C13 as amended, be carried within a reasonable time on all passenger-carrying air carrier aircraft operating under these Parts. (Class II, Priority Action)(A-85-48)

Amend relevant emergency training sections of 14 CFR 121, 125, and 135 to require the cockpit and cabin crewmembers on aircraft being operated under these Parts be given periodic training, including "hands-on" "wet" drills, in the skills relevant to inadvertent water impact which may increase the chances of post-crash survival. (Class II, Priority Action)(A-85-49)

The Safety Board reiterates the following recommendation to the Federal Aviation Administration:

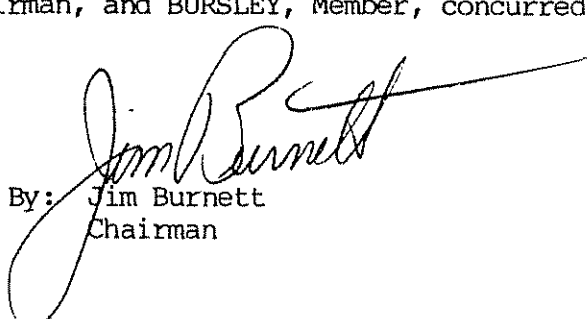
Amend 14 CFR 121.340 to require that all passenger-carrying air carrier aircraft be equipped with approved flotation-type seat cushions. (A-79-36)

The Safety Board places the following recommendations to the Federal Aviation Administration in a "Closed--Superseded" status:

Amend 14 CFR 135 to require that all aircraft conducting passenger service under Part 135 in any overwater operation be equipped with approved flotation-type seat cushions, and to require aircraft conducting extended overwater operations to also be equipped with an approved life preserver equipped with an approved survivor locator light. (A-79-67)

Revise 14 CFR 121 to require the installation of TSO-C13d life vests on all carrier aircraft within 12 months of the effective date of TSO-C13d. (A-84-20)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and BURSLEY, Member, concurred in these recommendations.


By: Jim Burnett
Chairman