

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

Log 1487

ISSUED: August 18, 1982

Forwarded to:

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-82-91 through -93

About 11:27 P.s.t., on January 20, 1981, a Cascade Airways, Inc., Beech 99A aircraft en route from Moses Lake, Washington, to Spokane, Washington, crashed about 4.5 miles southwest of Spokane International Airport. The accident occurred while the pilot was making a localizer instrument approach to Runway 3. Seven persons including the flightcrew were killed, and two passengers were injured seriously.

The localizer course Runway 3 approach at Spokane International Airport is served by two navigational aids which provide distance information: the Spokane VORTAC 1/and the localizer distance measuring equipment (IOLJ DME). During its investigation, the Safety Board interviewed several pilots who stated that they had experienced confusion which resulted in procedural errors during the approach procedure into Spokane. The pilots indicated that they had reviewed the approach procedure and had used the Spokane VORTAC, mistakenly believing that it was the correct distance information facility to use for the localizer approach; whereas, IOLJ DME was the correct facility. However, by using the Spokane VORTAC, they had flown at too low an altitude which was not corrected until they were advised by an air traffic controller or an instructor pilot who had visual contact with the terrain. Two of the pilots further stated that they had reviewed the approach with other pilots, most of whom indicated that they would have been prone to make the same mistake.

As a result of the investigation of the January 20, 1981, accident, the Safety Board recommended that the FAA add a precautionary note on approach charts for procedures involving two DME facilities on the final approach course. (Safety Recommendations A-81-40 and -41.)

The Safety Board has investigated other accidents involving approach procedures and the approach charts design. The following is a brief summary of some of those investigations:

1/ A collocated very high frequency omni-directional range station (VOR) and ultra-high frequency tactical air navigation aid (TACAN).

- o On October 24, 1971, a Monmouth Airlines, Inc., scheduled Air Taxi, Beech 99, descended prematurely and struck a mountain while executing a VOR instrument approach to the Allentown-Bethlehem-Easton Airport, Allentown, Pennsylvania. Four persons were killed and four persons were injured seriously. The Allentown area is served by two airports: the Bethlehem-Easton Airport and the Queen City Municipal Airport. Both airports have a VOR-1 published approach but use different VOR's. The Safety Board believes that the crew of the accident aircraft may have read the minimum altitude at the final approach fix from the wrong approach chart. Because of the similarity of the two approach plates for the contiguous airports, the Safety Board recommended that the Federal Aviation Administration (FAA): (1) require conspicuous and distinctive markings be affixed to the two approach plates so that pilots could identify the plates more readily and quickly; and (2) review all approach charts for potential misidentification. (Safety Recommendations A-71-61 and -62.)
- o On September 4, 1971, an Alaska Airlines, Inc., Boeing 727, crashed while attempting a nonprecision instrument approach to the Juneau Municipal Airport, Juneau, Alaska. All 104 passengers and 7 crewmembers were fatally injured. The investigation revealed that the published localizer directed approach (LDA) procedure had not been amended to reflect the commissioning of the DME associated with the localizer. The Safety Board recommended that the FAA amend this approach chart to include the localizer DME. (Safety Recommendation A-72-14.)
- o On September 8, 1973, a World Airways, Inc., DC-8-63F, Military Airlift Command contract cargo flight crashed into a mountain (3,500 feet) near King Cove, Alaska, about 15.5 miles east of the airport. The flight had been cleared for an approach 125 miles east of Cold Bay Airport. The three crewmembers and three passengers were killed, and the aircraft was destroyed. As a result of its investigation, the Safety Board recommended that the FAA modify the approach chart to reflect altitude restrictions and potential hazards associated with this approach procedure. (Safety Recommendation A-74-53.)
- o On December 1, 1974, a Trans World Airlines, Inc., B-727, crashed into a mountain ridge while descending for a VOR/DME approach to Runway 12 at Dulles International Airport, Washington, D.C. The 85 passengers and 7 crewmembers were killed, and the aircraft was destroyed. The Safety Board determined that a contributing factor in the accident was the inadequate depiction of altitude restrictions on the profile view of the approach chart for the VOR/DME approach to runway 12 at the airport. The Safety Board issued four recommendations to the FAA which addressed the need for uniformity and standardization of cartographic techniques and specifications in the design of approach charts. (Safety Recommendations A-75-74 through -77.)
- o On February 21, 1975, a Beechcraft BE-55 aircraft crashed during the hours of darkness while on an unauthorized instrument approach to the Lawrenceburg Municipal Airport, Lawrenceburg, Tennessee, which was not approved for night operations. As a result of its investigation, the

Safety Board recommended that the FAA clarify the wording of the restriction on approach charts for locations where night approaches are not authorized so that the restrictions are clearly understood. (Safety Recommendation A-75-70.)

- o On May 8, 1978, a National Airlines, B-727, crashed while executing an airport surveillance radar (ASR) approach to runway 25 at Pensacola Regional Airport, Pensacola, Florida. Three passengers were killed. As a result of its investigation, the Safety Board recommended that the FAA develop requirements for depicting final approach fixes or minimum altitudes for each mile on the final approaches for ASR instrument procedures. (Safety Recommendation A-79-10.)
- o On October 31, 1979, a Western Airlines, Inc., DC-10-10, crashed while making an instrument landing system (ILS) approach to the Mexico City International Airport. Sixty-one passengers and 11 crewmembers were fatally injured; 13 passengers and 2 crewmembers were seriously injured; and one person on the ground was fatally injured. The aircraft was destroyed. The aircraft was cleared to land by means of a sidestep maneuver which was not performed by the pilot. As a result of the investigation, the Safety Board recommended that the FAA require separate standardized instrument approach charts for sidestep maneuver approaches. (Safety Recommendation A-80-59.)
- o On October 24, 1980, a Beechcraft BE-18S, crashed while executing a missed approach from the Gainesville, Florida, Regional Airport. The pilot had been advised by the air traffic controller to execute the published missed approach procedure after he had reported that he had missed the approach. However, the aircraft continued straight ahead and collided with a TV antenna tower. All three occupants of the aircraft were killed. As a result of the investigation, the Safety Board recommended that the Inter-Agency Air Cartographic Committee amend the depiction of the missed approach track on approach charts. (Safety Recommendation A-81-34.)

All of the foregoing recommendations addressed two basic issues--our belief that insufficient attention is given to human performance criteria in the development of approach procedures and in the process for reviewing the approach procedure depiction on the approach charts--both of which are deficiencies that can lead to confusion and mistakes by the pilot users. Pilots have been criticized for misinterpreting approach charts and approach procedures, with little consideration given to the operating environment in which the procedures and charts are used and the degree to which these procedures and charts themselves may be conducive to error. The Safety Board believes that it is the obligation of the developers of approach procedures and charts to incorporate human factors considerations into their design so that the possibility for pilot confusion, misinterpretation, or error is eliminated.

In the public hearing convened by the Safety Board regarding the January 21, 1981, accident, testimony by spokesmen for the FAA revealed that there are no specific human performance criteria for developing approach procedures, or formal human performance checklists or guidelines for the procedures specialist or flight inspection pilot who flies and evaluates the approach procedure. The Safety Board believes that factors, such as user/pilot intelligibility, workload, attention demands, human memory limitations, and other sensory, perceptual, and cognitive restrictions, must be considered when designing approach procedures.

Also, the hearing testimony revealed that the FAA does not formally review the approach charts designed by the National Ocean Survey and Jeppesen Company with the above issues in mind. The Safety Board believes that human performance standards should include design criteria for presentation of information and chart configuration to promote user/pilot interpretability and usability, as well as such issues as visual detection, identification, coding, attention-getting characteristics, and human memory considerations.

On July 2, 1981, the President's Task Force on Aircraft Crew Complement said "Enroute, terminal area, and approach charts are frequently designed in a way that makes them difficult to use." Further, the Task Force said, "The design and content of these charts should be improved."

Currently, two committees address the charting and flight information issues: the Inter-Agency Air Cartographic (IACC) Committee and the Intra-Agency Committee for Flight Information (IACFI). The IACC Committee consists of members from the Department of Defense, the Department of Commerce, and the FAA; its function is to develop specifications for acceptable cartographic means of depicting aeronautical information. The FAA's role on this committee is directed to the civil aviation user requirements. The IACFI is an in-house FAA multidimensional technical group that addresses particular issues relating to aviation information and standards. No member of the IACFI is specifically trained in the human performance area.

As a result of past Safety Board recommendations, the FAA has taken action to modify specific procedures on a case-by-case basis; however, an attack on the aggregate problem by alleviating individual approach procedure problems on a post-accident basis is not satisfactory. A better, more efficient method would be to incorporate human factors design considerations into the development, design, and evaluation of all approach procedures and approach charts before accidents occur.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Establish formal human performance criteria for the development and evaluation of instrument approach procedures and instrument approach charts. (Class II, Priority Action) (A-82-91)

Establish human performance checklists or guidelines for use by procedures specialists and flight inspection pilots when evaluating new approach procedures. (Class II, Priority Action) (A-82-92)

Assign personnel trained in human engineering and human performance to the Interagency Air Cartographic Committee and the Intra-Agency Committee for Flight Information. (Class II, Priority Action) (A-82-93)

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

By: Jim Burnett
Chairman

