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# National Transportation Safety Board

Washington, D.C. 20594

## Safety Recommendation

**Date:** October 9, 1986

**In reply refer to:** A-86-98 through -118

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

The investigations of three recent commuter air carrier accidents have prompted the National Transportation Safety Board's concern about several significant safety issues.

— On August 25, 1985, Bar Harbor Airlines Flight 1808, a Beech Model 99, crashed during an Instrument Landing System (ILS) approach to Auburn-Lewiston Airport, Auburn, Maine. The airplane struck trees at an elevation of 345 feet mean sea level (msl) in a wings level attitude 4,000 feet from the end of the runway threshold and 440 feet to the right of the extended runway centerline; all eight persons aboard were fatally injured. 1/

— On September 23, 1985, Henson Airlines Flight 1517, a Beech B99, crashed during an ILS approach to Shenandoah Valley Airport, Weyers Cave, Virginia. The airplane struck trees at an elevation of 2,400 feet msl in a wings level attitude about 6 miles east of the airport; all 14 persons aboard were fatally injured. 2/

— On March 13, 1986, Simmons Airlines Flight 1746, an Embraer EMB-110P1, crashed during an ILS approach to Phelps Collins Airport, Alpena, Michigan. The airplane struck trees at an elevation of 725 feet msl in a wings level attitude about 1.5 miles from the end of the runway threshold and about 300 feet to the left of the extended runway centerline; three of the nine airplane occupants were fatally injured. 3/

1/ For more detailed information, read Aircraft Accident Report--"Bar Harbor Airlines Flight 1808, Beech B-99, N300WP, Auburn-Lewiston Airport, Auburn, Maine, August 25, 1985" (NTSB/AAR-86/06).
2/ For more detailed information, read Aircraft Accident Report--"Henson Airlines Flight 1517, Beech B-99, N339HA, Shenandoah Valley Airport, Grottoes, Virginia, September 23, 1985" (NTSB/AAR-86/07).
3/ The investigation has not been completed.

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All three accidents were scheduled domestic passenger flights operating under 14 CFR 135. The airplanes were in controlled flight at the time of the accidents. All three accidents occurred while the flightcrews were attempting to complete precision instrument approaches in instrument meteorological conditions. None of the flightcrews, all of whom had been in radio contact with an air traffic control facility, indicated that they were experiencing an airplane or equipment problem, and none of the postaccident examinations disclosed airplane or equipment problems which would explain the accidents. Thus, the investigations focused on the performance of the flightcrews, their experience and training, the Federal Aviation Administration's (FAA) oversight of the carriers' training programs, the operating procedures used, the human performance issues of the cockpit environment, the potential safety enhancement provided by ground proximity warning devices, and other safety issues.

Training and Testing Standards

The investigation disclosed that two of the airlines permitted their pilots to continue an actual line ILS approach even though they had deviated a greater distance from the glideslope or localizer centerline than would be considered satisfactory during a training or check flight. At Bar Harbor Airlines, performance criteria were established for ILS approaches conducted during training, and different criteria were established for flight checks; senior instructor pilots, however, were unable to relate the training or flight check criteria to the limits prescribed for line operations. Henson Airlines officials said that they would expect a pilot to execute a missed approach if the glideslope or localizer needles deflected full scale "in accordance with Federal regulations." Title 14 CFR 135 requires that the Pilot in Command (PIC) hold an Airline Transport Pilot (ATP) Certificate; the ATP Flight Test Guide (AC 61-77) prescribes that the glideslope and localizer needles be kept within a "one dot" deflection throughout the conduct of an ILS approach. However, an FAA Principal Operations Inspector (POI) for Henson Airlines stated that he was guided by the criteria found in the Instrument Pilot Airplane Flight Test Guide (AC 61-56A); the guide specifies that a glideslope or localizer deviation resulting in a full scale needle deflection is disqualifying on an instrument rating flight check. The POI believed that he could not impose more stringent criteria on the airline.

The Safety Board believes that airlines operating under the provisions of 14 CFR 135 should require their Pilots in Command to demonstrate the instrument flying precision required for an ATP rating during all competency and instrument proficiency checks; that is, an ILS approach, to be considered acceptable shall be conducted so that glideslope and localizer indicators do not exceed one dot deviation. Further, the Safety Board believes that commuter airlines should specify in their Operations and Training Manuals that a missed approach is required any time that a glideslope or localizer deviation of more than one dot needle deflection occurs after initial stabilization on the ILS approach.

Chapter 4, paragraph 72c(4) and (5) of the Air Carrier Operations Inspector's Handbook-Part 135 (8430.1D) describes the instrument experience requirements for a Second in Command (SIC) pilot. Section (5) states: "The instrument proficiency check requirements in section 135.297 are only required for PIC's under Part 135. However, under the provision of Section 135.293(b), "The competency check may include any of the maneuvers and procedures currently required for original issuance of the particular pilot certificate required for the operations authorized. . . . " Section (5) further states that, "the person conducting a check under Section 135.293 may require demonstration of instrument competency . . . ."

The Safety Board interprets Sections (4) and (5) of the Handbook to mean that it is entirely at the discretion of flight check airmen to require that SICs demonstrate instrument competency. In fact, as long as SICs meet the recent instrument experience requirements of 14 CFR 61.57(e)(1), that is 6 hours of actual or simulated instrument time and six instrument approaches during the preceding 6 months, they may never be required to demonstrate instrument proficiency until they qualify for upgrading to a PIC position. The Safety Board believes that SICs should be required periodically to demonstrate instrument proficiency and to pass a proficiency check to the standards prescribed for the certificate held by that pilot.

Flight Check Standards

Title 14 CFR 135.297(c), with regard to the instrument proficiency check required by paragraph (1), states that a flight check must be performed ". . . under simulated or actual IFR conditions."

Following the Henson Airlines accident, the Safety Board learned that instrument training and proficiency checks were conducted in airplanes in visual meteorological conditions without the use of a vision-restricting device or a hood. The Safety Board is concerned that this practice may not be confined to Henson Airlines alone.

Instrument training should be conducted in a manner closely simulating actual instrument meteorological conditions. In the absence of an approved simulator or an advanced training device (ATD), training in the airplane should be conducted in a manner that will prevent pilots from obtaining visual cues. The practice at Henson Airlines allowed pilots who were receiving instruction or who were being tested to lower their seats rather than to use a vision restricting device. Since significant visual cues are provided to the pilot by peripheral vision, even if forward vision is somewhat restricted by this practice, this type of training environment is inappropriate and cannot provide an adequate opportunity either to develop instrument flying skills or to demonstrate instrument flying proficiency. Because the POI was aware of and accepted this practice, the Safety Board believes that the FAA should advise POIs to review air carrier training programs to verify that instrument flight training and checks are conducted in a properly simulated manner. Where approved simulators or ATDs are not available, appropriate vision restricting devices should be required.

In its special study 4/ on commuter airline safety, the Safety Board noted:

> . . . pilot training would benefit greatly from increased use of flight simulation. While the number of suitable simulators is limited, they are generally available at aircraft manufacturers' training locations. The Board believes that training at manufacturers' training facilities will provide the most up-to-date simulator flight training. The Board urges the FAA and the commuter industry to encourage the development of sufficient numbers and types of aircraft flight simulators needed to upgrade the quality and scope of commuter airline training.

In light of the three accidents discussed in this letter in which training and pilot competency were issues, the need for the development of flight simulators is becoming increasingly more important so that the quality and scope of commuter airline pilot training may be upgraded.

4/ For more detailed information, read Special Study "Commuter Airline Safety 1970-1979" (NTSB-AAS-80-1).

In part, at the instigation of the Regional Airline Association, the FAA has initiated efforts through its Proposed Advisory Circular, AC No. 120-XX, in proposing standards for the procedures and criteria for use and evaluation of aircraft flight simulators (Advanced Training Devices) under 14 CFR 135. The Safety Board strongly supported the FAA's efforts in its letter dated May 23, 1986 and cautioned that, "the use of Advanced Training Devices (ATD) alone may not result in improved regional airline pilot capabilities. Rather, the use of these devices must be augmented by a comprehensive training program for Part 135 operators." The Safety Board urges the FAA to expedite its program to introduce comprehensive standards on the use of aircraft flight simulators and to work with the industry in acquiring such training devices.

Cockpit Instrumentation and Equipment Standardization

Nonstandardization in cockpit instrumentation and equipment may have had an adverse effect on the performance of the fightcrew in two of the three accidents under discussion.

In the case of Henson Airlines, the company operated eight Beech 99 airplanes. Each was equipped with two fully functional VHF navigation radios, consisting of a receiver, a control head with frequency selector located in the center of the instrument panel, and a navigational display located on the captain's instrument panel. 5/ Five airplanes were equipped with a third completely independent VHF navigation radio with a navigational display, receiver, control head, and frequency selector located on the first officer's instrument panel; however, three airplanes were equipped with slaved, or partially slaved third very high frequency (VHF) navigational displays located on the first officer's instrument panel. The VHF radios were not identical and the navigational displays were not uniformly positioned on the flight instrument panels. More specifically, three airplanes, including the accident airplane, were equipped with two fully functional King radios with the navigational displays on the left side of the captain's panel and one completely independent Narco radio on the lower right side of the first officer's instrument panel. Two other airplanes were similarly equipped, with the exception that the independent Narco radios were on the lower left side of the first officer's panel. Two airplanes were equipped with two fully functional Narco navigation radios with navigational displays on the left side of the captain's instrument panel and one slaved navigational display on the lower left side of the first officer's instrument panel, which was a repeater of the No. 1 Narco radio. One other airplane was equipped with two King radios on the left side of the captain's panel and one partially independent Narco radio with its navigational display on the lower left side of the first officer's panel. The partially independent Narco radio had an independent very high frequency omnirange station (VOR) and localizer, but it had a slaved glideslope which was a repeater from the No. 1 King radio. Furthermore, on six airplanes the independent Narco radios on the first officer's side were incapable of receiving aural station identification.

In the case of Bar Harbor Airlines, the operator equipped its Beech 99 fleet with different ILS equipment. Most of the displays (King KI 204s) depicted a five-dot graduation for localizer and glideslope deviations. Some airplanes had installed the KI 214 ILS displays which have a five-dot graduation for localizer deviation but only a three-dot

5/ Navigational displays consist of omnibearing selector (OBS), course deviation indicator (CDI), glideslope (GS), TO/FROM indicators, ON/OFF flags, and a scale to indicate the degree of deflection from the centerline of the selected VOR radial or the localizer and the glideslope.

graduation for glideslope deviation. The localizer and glideslope needles of the KI 204 displays move laterally and vertically, respectively, through the instrument face. On the KI 214 display, the localizer needle pivots left or right from the top of the instrument while the glideslope needle pivots up or down from the left side of the instrument. Other airplanes operated by this airline were equipped with Collins navigation radios.

In its investigation of the Henson accident, the Safety Board attached great significance to the fact that some of Henson's Beech 99s had VOR/ILS navigational displays on the first officer's panel that were slaved off the captain's No. 1 radio while others were independent. Thus, the first officer may have thought that she was flying the ILS from the slaved indication off the captain's No. 1 radio, while, in fact, the navigation radio on her side was an independent unit.

Similarly, the different VOR/ILS displays installed in the Bar Harbor fleet, with different graduations and visual characteristics, could have caused confusion with respect to the ILS deviation limits. Since the displacement of the needles of the different displays were not comparable, it is conceivable that the pilot may have been misled to believe that he was closer to the centerline of the localizer and the glideslope parameters than was actually the case.

Major air carriers, pilot groups, and large aircraft manufacturers have been aware of the problems brought about by nonstandard cockpit displays and equipment. Over the years, the emphasis in Part 121 air carrier operations has been to achieve standardization of cockpits throughout a major air carrier's fleet. Many commuter air carriers, however, often are confronted with having to purchase airplanes for their operations as they become available from other operators within the general aviation community or from different airplane manufacturers which have different concepts of and solutions to the human engineering problems presented in the design of airplane cockpits. The Safety Board realizes that total standardization of an air carrier's fleet could present significant, if not prohibitive, economic penalties. Nevertheless, the Board believes that the lack of cockpit standardization is a hazard to flight safety and must be addressed by the FAA and the commuter industry. The Board also believes that the FAA should provide guidance to commuter air carrier operators regarding the benefits to be derived from cockpit standardization and with respect to flight safety and should require that pilots be trained in the differences in cockpit instrumentation and equipment and the human performane problems associated with nonstandard cockpit design.

Availability of Navigational and Approach Charts

In the Henson Airlines accident aircraft, only one set of approach and en route charts was provided in the cockpit. Procedures called for the pilot who was flying to have custody of the approach chart. Therefore, the PIC of the flight had no immediate reference to check the accuracy of the approach flown by the first officer. In the Simmons Airlines accident aircraft, both pilots had approach charts in their possession, but the PIC's charts were found in his closed flight bag. The surviving pilot stated, "It did not matter if only one approach chart was used while conducting an approach—as long as it was current." Only one chart was in use at the time of the accident; that chart was in the possession of the nonflying pilot.

The Safety Board believes that pilots at the controls should have their own set of pertinent navigational charts in their possession and accessible at all times. Also, if the nonflying pilots are to fulfill their duties in monitoring flight and navigation instruments, making radio calls, and calling out altitudes, it is necessary for those pilots also to have

the continuous use of a set of charts. If a single chart has to be passed back and forth, or if one pilot has to move out of position to see a chart which is in the possession of the other pilot, confusion, poor flight monitoring, and inadequate cockpit coordination can occur.

Pilot Experience, Cockpit Coordination, and Pilot Scheduling

In all three accidents, the pilots were relatively new to their positions in the cockpit. In the Henson and the Simmons accidents, the captains had been with the company for about a year and had been upgraded only recently to captain; both first officers had been with the company less than 2 months. In the Bar Harbor accident, the captain had been with the company for about 15 months, a captain for about 1 year, and in his position as captain of a Beech 99 for about 3 months; the first officer had joined the carrier only 3 months before the accident.

The Safety Board believes that the safe conduct of these three flights may have been compromised by a lack of coordination in the cockpit. Little time was devoted to cockpit coordination during training. In fact, most "training" occurred on the job. Consequently, compromises in the decision making processes and in cockpit coordination may have been factors in all three accidents because of the low-time experience of at least five of the six pilots.

Title 14 CFR 135.225(d) states:

> The [minimum descent altitude] or [decision height] and visibility landing minimums prescribed in Part 97 of this chapter or in the operator's operations specifications are increased by 100 feet and 1/2 mile respectively, but not to exceed the ceiling and visibility minimums for that airport when used as an alternate airport, for each pilot in command of a turbine-powered airplane who has not served at least 100 hours as pilot in command in that type of airplane.

In the current era of rapid pilot turnover and the hiring of less experienced pilots in the commuter industry, a solution to problems related to inexperience could be to request commuter airlines to schedule flightcrews so that relatively inexperienced captains are teamed with experienced first officers and that inexperienced first officers only be scheduled to fly with senior captains. The Board believes, however, that the underlying problem with respect to pilot experience may be found in the FAA's check airman program and its surveillance thereof. The Safety Board's findings of less than desirable knowledge by senior instructor pilots about standards for line flying at Bar Harbor Airlines, the less than adequate instrument training methods used at Henson Airlines, and the sudden surge in checkride failures of pilots at Henson Airlines is indicative of inadequate training or of compromises being made in the check airman program. The Board's investigations of these accidents revealed that the POI at Henson Airlines had not monitored any Beech 99 check rides for 3 months, and that the POI at Bar Harbor Airlines had not monitored any Beech 99 check rides for at least 5 months. Therefore, the Safety Board believes that pilot training may have suffered due to the absence of FAA oversight of the check airman program and that this lack of oversight prevented the detection of the less than adequate pilot surpervision in line flying and the failure of crewmembers to adhere to established procedures and company standards. The Safety Board believes that the FAA should strengthen its oversight of the check airman program and ensure that both training and check rides by designated check airmen are performed to the highest standards and in a standardized manner.

Ground Proximity Warning Devices

In all three accidents, the airplane was flown into trees under controlled flight conditions, fatally injuring 25 persons. The Safety Board is convinced that each of these accidents could have been prevented if the flightcrew had been alerted to their proximity to the ground in sufficient time to have initiated missed approach procedures.

Between 1975 and 1985, scheduled domestic passenger flights operating under 14 CFR 135 were involved in 31 controlled flight into terrain (CFIT) accidents which resulted in 79 fatalities. Most of these accidents might have been prevented if a ground proximity warning device had been available.

In December 1974, the FAA adopted a rule requiring that large turbine-powered airplanes be equipped with Ground Proximity Warning Systems (GPWS) by December 1, 1975. Ample evidence indicates that the GPWS fulfilled its intended function. Safety Board statistics indicate that CFIT accidents in Part 121 air carrier operations have steadily decreased since the introduction in 1975 of the GPWS. From 1975 to 1978, CFIT accidents decreased by 75 percent from the pre-1975 era. Since then, CFIT accidents have become a rare event in Part 121 operations.

In 1985, the commuter fleet consisted of 1,745 aircraft. That number has increased from 1,047 since deregulation in 1978 and is forecast to reach 2,300 aircraft in 1995. Currently, about 179 commuter air carriers operating under 14 CFR 135 may carry up to 30 passengers in their airplanes. Under the provisions of 14 CFR 135.153, no persons may operate a turbojet airplane with a passenger seating configuration, excluding any pilot seat, of 10 seats or more, unless it is equipped with a GPWS. This protection is not afforded those passengers on turboprop airplanes with 30 seats or less. Thus, this regulation does not apply to most of the commuter fleet.

As an example of the terrain protection afforded by the GPWS, the Safety Board examined the alerting features of a GPWS product and applied the specifications to the flightpaths of the three accident airplanes. In the Henson accident, the GPWS would have activated approximately 29 seconds before impact. The same GPWS would have activated at least 10 seconds—and possibly as much as 17 seconds—before impact in both the Bar Harbor and Simmons Airlines accidents.

The Safety Board realizes that a full GPWS, such as those installed in large turbojet airplanes, may be prohibitively expensive to retrofit into Part 135 type airplanes. However, other devices are available which could provide viable alternatives to a full GPWS. The Safety Board believes that the FAA and the commuter industry must address the installation of ground proximity warning devices in turbine-powered airplanes used by commuter air carriers for the commercial transport of 30 or fewer passengers.

Adequacy of Surveillance

In all three accidents, the time available to the POI to maintain effective surveillance was severely curtailed. In the case of Henson and Simmons Airlines, the POIs had been occupied for a number of months with preparations for the addition of a new airplane to the airlines' fleet. The POI for Simmons estimated that well over 90 percent of her time was spent with the new airplane. The POI for Bar Harbor Airlines testified that he did not have time to carry out his surveillance and inspection tasks effectively because of the increased workload required to surveil 20 other certificate holders.

Surveillance of the air carrier industry has been a long standing concern of the Safety Board. Since 1978, the Safety Board has conducted 15 air carrier accident investigations in which deficiencies in FAA surveillance were cited. The Board has maintained that a sufficient margin of safety in an air carrier operation can only be achieved through sustained and discerning surveillance by the FAA. In its 1980 special study on commuter airline safety, the Safety Board concluded that:

(1) Sufficient indicators existed before 1979 which should have caused the FAA to strengthen commuter surveillance programs.

(2) The FAA has been slow to recognize that FAA inspector workloads and GADO staffing levels do not allow adequate surveillance of the commuter industry.

While the FAA has responded positively in many instances to numerous safety recommendations on the subject of surveillance, these three accidents are evidence that the same problems continue to exist.

The Safety Board appreciates the latest efforts of the FAA to alleviate the surveillance problems of the commuter airline industry. The hiring of additional well trained inspection personnel and the objectives of the FAA's Safety Activity Functional Evaluation (SAFE) program will assist in providing adequate surveillance. However, these measures, in many instances, are still in their infancy and consequently will require a period of time before measurable benefits can be derived and validated. The Safety Board believes that the continued dynamic growth of the commuter industry and these latest accident findings warrant the development of more timely interim measures, procedures, and guidelines. The Safety Board believes that a minimum level of direct surveillance should be established in terms of periodic assistance visits, maintenance inspections, airplane checkrides, etc., to oversee commuter air carrier operations and that the required level of personnel to execute such a program should be identified for each Air Carrier District Office having oversight responsibilities of commuter air carriers. Additionally, guidelines should be developed and issued to provide for continued surveillance of commuter air carriers during periods when the POI is unable to fulfill these duties because of other work exigencies.

Cockpit Noise Levels and Crew Coordination

In the two accidents involving Beech 99 airplanes, inadequate flightcrew coordination procedures may have been a factor. Also, excessive cockpit noise levels probably adversely affected the ability of the flightcrews to communicate.

Both flights were operated under the provisions of 14 CFR Part 135.99 which require the use of two pilots. Further, the flight manuals of both carriers require specific flightcrew coordination procedures. However, neither airplane had an interphone system and such a communication system was not required by regulation. The Safety Board found that the flightcrews of both Henson and Bar Harbor Airlines used hand signals to communicate certain routine information. Although the single hand signal (to reduce power after takeoff) used by Henson pilots was not sanctioned by the operations manual, it was taught in flight training. Bar Harbor pilots used hand signals to identify altitudes but these were not officially acknowledged in the operations manual.

In 1981, as a result of a Cascade Airways Beech 99 accident in Spokane, Washington, 6/ in which the cockpit's noise level was an issue, the Safety Board recommended that the FAA establish maximum cockpit noise levels which will permit adequate direct voice communication between flightcrews (Safety Recommendation A-81-75). The Safety Board also recommended that the FAA require the installation and use of crew interphone systems in the cockpits of those aircraft in which noise levels reach or exceed the maximum established noise levels (Safety Recommendation A-81-76).

In response to Safety Recommendation A-81-75, the FAA issued a report 7/ on July 19, 1982, in which a preferred frequency speech interference level (PSIL) 8/ of 78 was cited as the preferred maximum noise level in commercial transport cockpits. The FAA stated in its response to the Safety Board that it would issue an Advisory Circular (AC) on this issue. The Safety Board placed Safety Recommendation A-81-75 in an "Open-Acceptable Alternate Action" status. To date, no such AC has been issued, although the Safety Board is aware that a draft AC has been in circulation for almost a year.

In its response to Safety Recommendation A-81-76, the FAA stated, "We have been unable to locate a significant historical data base where cockpit noise interference with crew duties was a probable cause. Therefore, we believe that any economic burden placed on the aviation community in this regard cannot be justified on a cost-benefit basis." Safety Recommendation A-81-76 also was placed in an "Open-Acceptable Alternate Action" status.

As a result of its investigation of the Henson and the Bar Harbor accidents, the Safety Board has reevaluated its position on the FAA's response to Safety Recommendations A-81-75 and -76. The Board believes that excessive Beech 99 cockpit noise levels precluded effective oral communication and contributed to a reduction in communications between the flightcrews in these accidents. Consequently, the noise levels interfered with proper and timely crew coordination.

In a full-mission simulation study conducted at the National Aeronautics and Space Administration, researchers found that, "when more information was transferred regarding aspects of flight status, few errors appeared which were related to systems operation (e.g., . . . misreading and missetting of instruments . . . Overall there was a tendency for crews who did not perform as well to communicate less--a finding which underscores the importance of the information transfer process." 9/

The Safety Board agrees with this assessment. Consequently, the Safety Board finds that the FAA's proposal to issue an AC on cockpit noise levels is no longer an acceptable response to Safety Recommendations A-81-75 and -76, although it still believes the issuance of the AC to be an appropriate action. Therefore, the Board has classified Safety Recommendations A-81-75 and -76 as "Closed—Unacceptable Action/Superseded,"

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6/ For more detailed information, read Aircraft Accident Report—"Cascade Airways, Inc., Beechcraft 99A, N390CA, Spokane, Washington, January 20, 1981" (NTSB-AAR-81-11).

7/ Tobias, J. V., "Cockpit Communication Interference," Industrial Audiology, Norman, Oklahoma, FAA-DTFA01-82-P-81561, July 19, 1982.

8/ PSIL is the mean of the sound pressure levels of three octave bands (500, 1000, and 2000 Hz) and is considered meaningful to speech communication.

9/ Foushee, H. C. and Manos, K. L. "Cockpit Communication Patterns and the Performance of Flight Crews", ISASI Forum, Spring 1981, pp. 19-20.

and it has issued two new recommendations to the FAA based on the maximum cockpit noise level of 78 PSIL recommended in the FAA contract report. The Safety Board believes also that the FAA should not allow flights to be dispatched without a functioning interphone system. Therefore, the Board believes that the interphone system, when installed, should be removed from the Master Minimum Equipment List.

Nighttime Runway Visibility Markers

In the Bar Harbor investigation, the Safety Board noted that there were no lighted visibility markers or lights available as visibility markers in the direction of the approach end of runway 4, the main instrument runway and the one in use at the time of the accident. In addition, one of the certified weather observers working for Bar Harbor Airlines noted that fog was more likely to form off the approach end of runway 4 than in other areas on and around the airport.

Present FAA regulations concerning the minimum weather conditions for the initiation of an instrument approach to an airport rely almost entirely on the observed or measured visibility or runway visual range. This makes the accurate observation of visibility critical in the safety of terminal operations.

It is an accepted fact that surface visibility frequently differs in different directions around an airport. The reasons for these differences include industrial sources of smoke, fog due to bodies of water or variability of terrain height, and areas of blowing dust or snow. Prevailing visibility is defined as the greatest visibility equaled or exceeded throughout at least half the horizon circle. When the visibility is not uniform, sectors of reduced visibility are reported when they are less than 3 miles or operationally significant such as in the direction of a duty runway.

The Safety Board believes that pilots need accurate visibility information. In the case of the Auburn-Lewiston Airport, there were insufficient visibility markers for the observer to adequately determine either the prevailing visibility or, if required, the sector visibility in the direction of the approach end of runway 4. This situation exists at many airports throughout the United States.

The Safety Board previously made recommendations to the FAA concerning the establishment of guidelines in the placement and location of nighttime visibility markers at airports (Safety Recommendations A-80-22 and -23). The FAA's response to both recommendations was that the present methods of determining visibility were adequate considering the problems that would be encountered in installing lighted visibility markers, and that the FAA planned no action on the recommendations. The Safety Board classified both recommendations as "Closed—Unacceptable Action."

Most weather observing instruments are required to be certified for use in making aviation observations and frequently are calibrated to assure that their measurements are accurate. This includes transmissometers where they are used to establish a visibility reference. The Safety Board believes that the measurement of visibility, particularly considering its importance in instrument flight rules (IFR) terminal operations, deserves the same consideration. Therefore, the Safety Board reiterates the intent of Safety Recommendations A-80-22 and -23 and again urges the FAA to establish guidelines for placing nighttime visibility markers at airports.

Air Traffic Control Services and Procedure

In the Bar Harbor accident, Portland Approach Control had IFR jurisdiction of the airspace surrounding the Auburn-Lewiston Airport. The radar controller who handled flight 1808 had cleared the flight for an ILS approach to runway 4 when the airplane was about 12 miles south of the outer marker. About 3 minutes later, the controller, noting that flight 1808 was about a mile to the right of the localizer course, asked if it was receiving the Lewiston localizer. The captain replied, "Not yet, we haven't intercepted." The controller then stated, "Roger, turn left heading three four zero, show you slightly right of it."

The turn to a 340° heading would have placed the airplane on a 60° intercept angle to the final approach course when it was only 1 mile from the outer marker. The controller testified that, ". . . this was just a turn, a correction to assist the pilot to intercept Lewie." Although flight 1808 only turned left to a heading of about 355° in response to the controller's directions, it overshot the final approach course inside the outer marker and never intercepted the localizer until shortly before it crashed.

The Safety Board notes that, although the flight was in radar contact with Portland Approach, it had not been given radar vectors to the final approach course nor were they required. Instead, based on their previous clearance, the flightcrew was navigating to the final approach course by way of the transition depicted on the instrument approach chart. The controller's supervisor testified that the radar arrival section of the Air Traffic Control (ATC) Handbook (7110.65D) did not apply to flight 1808 because the flight was a nonradar arrival, and that he believed that the intercept angle limits specified in the radar arrival section did not apply in this instance. The nonradar chapter of the handbook does not contain any criteria for handling an aircraft in radar contact; however, the Safety Board believes that an aircraft in radar contact should not be handled under a chapter of the handbook that was designed and intended for nonradar operations.

Paragraph 5-121, "Final Approach Course Interception," Section 9, Radar Arrivals, in Chapter 5 of the ATC Handbook instructs the controller to "assign headings that will permit final approach course interception on a track that does not exceed the interception angles specified in the Table." The Table states that if the distance from interception point to the approach gate 10/ is less than 2 miles, the maximum intercept angle is 20°; if the distance from interception point to the approach gate is 2 miles or more, the maximum interception angle is 30°.

The Safety Board recognizes that the intent of paragraph 5-121 is to provide the pilot with an opportunity to make a smooth transition from a radar vector to a final approach course. However, the Board notes that this paragraph could provide guidance to a controller in assisting a flight when it deviates from a final approach course, as was the case in this accident. The key distinction between a radar arrival and a nonradar arrival at the present time is whether or not an aircraft is given radar vectors. The definition of a nonradar arrival is confusing because an aircraft would never be given radar vectors in a nonradar environment.

10/ The approach gate is the point on the final approach course which is 1 mile from the final approach fix on the side away from the airport or 5 miles from landing threshold, whichever is farther from the landing threshold. This is an imaginary point used within ATC as a basis for final approach course interception for aircraft being vectored to the final approach course.

In an accident involving Trans World Airlines at Berryville, Virginia on December 1, 1974, 11/ the controller issued an approach clearance without an altitude restriction and the airplane struck a hill during its descent while the flightcrew was navigating to the final approach course. The FAA maintained that a pilot on final approach or transition to final approach, providing his own navigation while in radar contact, but not given radar vectors, was a nonradar arrival. At that time, the radar arrival section in the ATC Handbook dealt with the procedures of radar control for arriving aircraft, but the handbook did not define the term "radar arrival." The term, "nonradar arrival," did not exist in the manual at that time.

In its report, the Board stated that the flight should have been classified and handled as a radar arrival. ATC had radar contact with the flight, and there were no procedures in the manual on how to handle the flight using nonradar procedures when, in fact, the airplane was in radar contact. The Board recommended on July 24, 1975, that the FAA:

A-75-58

> Define the term "radar arrival" and assign an equal weight of controller responsibility to all arrivals receiving radar service, regardless of the kind of radar service.

The FAA responded on August 18, 1975, that it concurred with the recommendation and that it was part of a study to review terms and phrases used in the ATC system for the purpose of determining whether they needed to be defined and would take whatever corrective action would be needed. As a result, the FAA included the pilot/controller glossary of ATC terms in both the ATC handbook and in the Airman's Information Manual. The Safety Board classified Safety Recommendation A-75-58 "Closed--Acceptable Action."

Appendix A, Pilot/Controller Glossary, of the handbook now states the following:

> Radar Arrival - An arriving aircraft which is being vectored to the final approach course for an instrument approach or toward the airport for a visual approach.
>
> Non-Radar Arrival - An arriving aircraft that is not being vectored to the final approach course for an instrument approach or towards the airport for a visual approach. The aircraft may or may not be in a radar environment and may or may not be receiving radar separation, radar monitoring or other services provided by ATC.

The Safety Board believes that the definitions are confusing and somewhat inconsistent considering the environment under which an aircraft may be operating. Also, a standard for guidance should exist regardless of whether or not a pilot is receiving radar vectors. Appropriate material should be in the ATC handbook that addresses the situation when a pilot deviates from course in a radar environment. If the pilot cannot return to course using the standard criteria for an intercept then the pilot should be informed that he appears to be too far right or left of course for a safe approach, and he should be asked his intentions. An aircraft in radar contact should not be handled under a chapter of the handbook that was designed and intended for nonradar operations.

11/ For more detailed information, read Aircraft Accident Report—"Trans World Airlines, Inc., Boeing 727-231, N54328, Berryville, Virginia, December 1, 1984" (NTSB-AAR-75-16).

In the case involving Bar Harbor flight 1808, the off-course flightpath was identified by radar, the correction issued to the pilot was based on radar information, and the position report given to the flightcrew with respect to the outer marker (Lewie) was accomplished using radar. Therefore, the Safety Board believes that the flight should have been treated as a radar arrival and the controller should not have provided the large heading change when he attempted to assist the flight. He should have asked the pilot his intentions after providing the position report and should have offered to provide radar vectors. The procedures for handling the flight should have been those governing radar operations and not those governing nonradar operations. Therefore, the Safety Board believes that the definition for radar arrivals should be amended to include all IFR arrivals under radar contact, and the definition of nonradar arrivals should be amended to include only arrival aircraft not in radar contact. The procedures for assisting a flight to return to course using radar should be added to the radar arrival section of the ATC Handbook.

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

Amend 14 CFR 135 to require periodic instrument proficiency checks for all Second in Command pilots required in commuter air carrier operations. (Class II, Priority Action) (A-86-98)

Issue an Air Carrier Operations Bulletin-Part 135 directing all Principal Operations Inspectors to require that Pilots in Command, as well as Second in Command pilots, be tested and be required to demonstrate proficiency in flying instrument approach procedures to the standards that are commensurate with the pilot certificate required for their respective pilot positions. (Class II, Priority Action) (A-86-99)

Issue an Air Carrier Operations Bulletin-Part 135 directing all Principal Operations Inspectors to require commuter air carrier operators to delineate in their Operations and Training Manuals missed approach procedures commensurate with Pilot in Command standards. (Class II, Priority Action) (A-86-100)

Revise Paragraph 72 of the Air Carrier Operations Inspector's Handbook Part 135 (8430.1D) to include guidance to Principal Operations Inspectors regarding the standards and level of precision to which Pilots in Command and Second in Command pilots should be tested during instrument proficiency checks. (Class II, Priority Action) (A-86-101)

Issue an Air Carrier Operations Bulletin-Part 135, to verify that commuter air carrier operators use appropriate vision-restricting devices for their pilots during initial and recurrent flight instrument training. (Class II, Priority Action) (A-86-102)

Expedite the program which proposes standards for the use and evaluation of aircraft flight simulator devices to be used in training programs of 14 CFR 135 operators and in cooperation with the Regional Airline Association, encourage and assist operators to acquire flight simulator devices. (Class II, Priority Action) (A-86-103)

Issue an Air Carrier Maintenance Bulletin-Part 135, directing all Principal Maintenance Inspectors (PMI) to be alert to significant deviations in cockpit instrumentation and equipment installations of commuter air carriers. The maintenance bulletin should provide guidance with respect to the human engineering principles which are desirable in achieving cockpit standardization and which would tend to eliminate pilot errors in the interpretation of cockpit instruments and the operation of equipment. The bulletin should direct PMIs to encourage commuter operators to provide standardization of cockpit instrumentation and equipment in their airplane fleet to the greatest extent possible. (Class II, Priority Action) (A-86-104)

Issue an Air Carrier Operations Bulletin-Part 135, directing Principal Operations Inspectors to ensure that commuter air carrier training programs specifically emphasize the differences existing in cockpit instrumentation and equipment in the fleet of their commuter operators and that these training programs cover the human engineering aspects of these differences and the human performance problems associated with these differences. (Class II, Priority Action) (A-86-105)

Amend 14 CFR 135.83 to require that all required crewmembers have access to and use their own set of pertinent instrument approach charts. (Class II, Priority Action) (A-86-106)

Issue an Air Carrier Operations Bulletin-Part 135, directing all Principal Operations Inspectors to caution commuter air carrier operators that have instrument flight rules authorization not to schedule on the same flight crewmembers with limited experience in their respective positions. (Class II, Priority Action) (A-86-107)

Issue an Air Carrier Operations Bulletin-Part 135, requesting Principal Operations Inspectors to put special emphasis on their check airmen program to assure that company pilots are evaluated properly and that check airmen apply the training and check ride standards in a strict and standardized manner. (Class II, Priority Action) (A-86-108)

Amend 14 CFR 135.153 to require after a specified date the installation and use of ground proximity warning devices in all multiengine, turbine-powered fixed wing airplanes, certificated to carry 10 or more passengers. (Class II, Priority Action) (A-86-109)

Until the objectives and goals of the Safety Activity Functional Evaluation program are fully realized, establish and require, as an interim measure, a minimum level of direct surveillance, in terms of required tasks as well as personnel levels, to adequately oversee commuter air carrier operations. (Class II, Priority Action) (A-86-110)

Develop and issue guidelines to Air Carrier District Offices to provide for a minimum level of continued direct surveillance of commuter air carrier operators when the Principal Operations Inspector is occupied with other duties for extended periods of time. (Class II, Priority Action) (A-86-111)

Conduct noise measurement surveys of all makes and models of aircraft used in 14 CFR 135 passenger-carrying operations which are now not equipped with functioning crew interphone systems. (Class II, Priority Action) (A-86-112)

Require the installation and use of crew interphone systems in the cockpits of those aircraft which are used in 14 CFR 135 passenger-carrying operations and in which the noise levels exceed a preferred frequency speech interference level of 78 at any power setting and flight condition, and remove the crew interphone system as an item on the Master Minimum Equipment List. (Class II, Priority Action) (A-86-113)

Establish specific requirements for the placement of nighttime visibility markers at airports where preexisting markers are not available and transmissometers are not utilized with special consideration for accurately measuring the surface visibility in the vicinity of the approach end of instrument runways to assure that the published visibility minimums for an airport are met. (Class II, Priority Action) (A-86-114)

Amend the definition of radar arrival in Air Traffic Control Handbook 7110.65D to include all instrument flight rules arrivals under radar contract. (Class II, Priority Action) (A-86-115)

Amend the definition of nonradar arrival in Air Traffic Control Handbook 7110.65D to include only arrival aircraft that are not in radar contact. (Class II, Priority Action) (A-86-116)

Amend Section 9, Radar Arrivals, of Air Traffic Control Handbook 7110.65D to require that, when deviations from the localizer course by instrument flight rules arrivals are noted and the controller elects to vector the aircraft back to the localizer course, the intercept criteria of paragraph 5-121 be applied. (Class II, Priority Action) (A-86-117)

Amend Section 9, Radar Arrivals, of Air Traffic Control Handbook 7110.65D, to require that when a deviation occurs from the localizer course by an instrument flight rules arrivals and the aircraft cannot be vectored back on course within the parameters of paragraph 5-121, the pilot be informed that he appears to be too far off course for a safe approach and be asked his intentions. (Class II, Priority Action) (A-86-118)

Also, the Safety Board issued Safety Recommendations A-86-119 through -122 to the Regional Airline Association.

BURNETT, Chairman, GOLDMAN, Vice Chairman, and LAUBER and NALL, Members, concurred in these recommendations.

By: Jim Burnett
Chairman

Safety Recommendation Reiteration List

| SR Number | Reiteration Number | Report Number | Report Date | Accident Description | Accident City | Accident State | Accident Date |
|---|---|---|---|---|---|---|---|
| A-89-109 | 1 | AAR-87-02 | 2/18/1987 | Simmons Airlines, Flight 1746 Embraer Bandeirante EMB-110P1, N1356P | Alpena | Michigan | 3/13/1986 |
| A-89-109 | 2 | AAR-90-05 | 9/25/1990 | Aloha lslandAir, Inc., Flight 1712, De Havilland Twin Otter, . DHC-6-300, N707PV, Halawa Point, Molokai, HI. | Halawa Point Molokai | HI | 10/28/1989 |
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