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National Transportation Safety Board

Washington, D. C. 20594

Safety Recommendation

Date: June 27, 1988

In reply to refer to: A-88-64 through -70

Honorable T. Allan McArtor
Administrator
Federal Aviation Administration
Washington, D.C. 20591

About 2046 eastern daylight time on August 16, 1987, Northwest Airlines, Inc., flight 255 crashed shortly after taking off from runway 3 center at the Detroit Metropolitan Wayne County Airport (Detroit-Metro), Romulus, Michigan. Flight 255, a McDonnell Douglas DC-9-82, U.S. Registry N312RC, was a regularly scheduled passenger flight and was en route to Phoenix, Arizona. According to witnesses, flight 255 began its takeoff rotation about 1,200 to 1,500 feet from the end of the runway and lifted off near the end of the runway. After liftoff, the wings of the airplane rolled to the left and the right about 35° in each direction. The airplane collided with obstacles northeast of the runway when the left wing struck a light pole located 2,760 feet beyond the end of the runway. Thereafter the airplane struck other light poles, the roof of a rental car facility, and then the ground. It continued to slide along a path aligned generally with the extended centerline of the takeoff runway. The airplane broke up as it slid across the ground and postimpact fires erupted along the wreckage path. Three occupied vehicles on a road adjacent to the airport and numerous vacant vehicles in a rental car parking lot along the airplane's path were destroyed by impact forces and/or fire. Of the persons on board flight 255, 148 passengers and 6 crewmembers were killed; 1 passenger, a 4-year-old child, was injured seriously. On the ground, two persons were killed, one person was injured seriously, and four persons suffered minor injuries. 1/

The cockpit voice recorder (CVR) transcript showed that the takeoff warning system, which was designed to warn the flightcrew that the airplane was not configured properly for takeoff, failed to provide the proper warning to the crew. A fail light is mounted on the front of the central aural warning system (CAWS) unit which will illuminate when the unit's self-monitor detects an internal failure. The fail light is operated by a latching-type relay and once lit, the relay latches and the light remains lit until the unit is removed, opened, and the relay reset. The CAWS unit was virtually undamaged when it was recovered. The latchable relay fault light

1/ For more detailed information, read Aircraft Accident Report--"Northwest Airlines, Inc., McDonnell Douglas DC-9-82, N312RC, Detroit Metropolitan Wayne County Airport, Romulus, Michigan, August 16, 1987" (NTSB/AAR-88/05).

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on the front face of the unit was not latched, indicating that the unit had not failed any portion of its internal self-monitoring test before the accident. The testimony of a Northwest first officer who rode in the jump seat from Detroit, Michigan, to Saginaw, Michigan, indicated that the takeoff warning system had functioned after the airplane landed at Saginaw.

The sound spectrum analysis testing conducted in the National Transportation Safety Board's audio laboratory permitted the Safety Board to identify the takeoff warning's failure mode. Of primary importance to this analysis was the fact that the two supplemental stall recognition system (SSRS) alarms are connected to different power supplies in the CAWS unit: SSRS-2, the first officer's alarm, was connected to CAWS power supply-3; and SSRS-1, the captain's alarm, was connected to CAWS power supply-2. The takeoff warning system also was connected to power supply-2.

When both SSRSs operate, an echo effect will be heard. The sound spectrum analysis of the actual warning generated by the accident airplane's CAWS unit showed that there was no echo effects; that only one SSRS had provided the alarm; and that, based on the frequency components of the word, SSRS-2 provided the alarm recorded by the CVR. This conclusion was further corroborated by the facts that no significant damage was noted on the filaments of either of the captain's bulbs; however, stretching, typical of an impact while the bulb filament is hot, was found on both bulbs of the first officer's warning light.

The evidence showed that the stall alarm was generated from power supply-3 of the CAWS unit, and that, based on the facts that the takeoff warning system and SSRS-1 did not operate, power supply-2 of the unit was inoperative. Had the output from power supply-2 failed while the 28V d.c. input power from the airplane's electrical system was still available, the fail light on the CAWS unit would have illuminated, and, more importantly, its internal relay would have latched and remained latched until released by maintenance personnel; this relay was found not latched after the accident. Therefore, the Safety Board concludes that the loss of the takeoff warning system was caused by the lack of 28V d.c. input power from the airplane to power supply-2.

Power supply-2 of the CAWS unit receives power from the left 28V d.c. bus through the P-40 circuit breaker. Loss of the airplane's left 28V d.c. bus must be ruled out as the source of the loss of power to power supply-2 because its loss would have been readily apparent to the flightcrew. Numerous indicating lights and gauges would have been lost. The loss of the bus would have been annunciated on the cockpit's overhead annunciator panel, the master caution light would have illuminated, and the loss of the bus would have caused failures which would have affected information recorded by the digital flight data recorder (DFDR). The fact that the DFDR did not record any information indicative of these types of failure further confirms that the left 28V d.c. bus was powered throughout the flight. Since the bus was powered and the wiring from the P-40 circuit breaker to the CAWS unit was intact, but power supply-2 of the CAWS unit was not functioning, the process of elimination leads to the only remaining component in the input circuit where a power interruption most logically could occur--the P-40 circuit breaker.

Because the P-40 circuit breaker was badly damaged during the accident, it was impossible for the Safety Board to determine positively its preimpact condition. There were three possible conditions that would have caused power to be interrupted at the P-40 circuit breaker: the circuit breaker was intentionally opened by either the flightcrew or maintenance personnel, the circuit breaker tripped because of a transient overload and the flightcrew did not detect the open circuit breaker, or the circuit breaker did not allow current to flow to the CAWS power supply and did not annunciate the condition by tripping.

The Safety Board considered the possibility that the system was disabled by operating the P-40 circuit breaker as a switch and opening it intentionally. This might occur if any of the warnings operated by power supply-2 were producing nuisance warnings that annoyed or distracted the flightcrew. The testimony of the Northwest first officer who rode in the cockpit jumpseat from Detroit to Saginaw indicated that power supply-2 was operational at Saginaw when he heard the words "flaps, flaps" annunciate. Also, no nuisance warning was recorded by the CVR between the beginning of the recording at 2013:27 and its end at 2045:24.7. The DFDR recording showed that both engines were operating during the taxi from the gate at Saginaw and to the gate at Detroit-Metro. Therefore, not only was it unlikely that a nuisance takeoff warning would have been generated by a prolonged high engine power setting, but power settings of this magnitude were not recorded. However the SSRS-1, landing gear, auto-pilot disconnect, cabin altitude, and speedbrake warnings also are generated by power supply-2. Thus, it was possible that the power supply could have been disabled by the flightcrew for a nuisance warning other than the takeoff warning. The Safety Board cannot rule out this possibility. In addition, there was no evidence that any person who would have reason to open or close the circuit breaker had done so between the time the airplane landed at Saginaw and departed the gate at Detroit-Metro.

The second possibility considered was that the circuit breaker opened electrically due to an undetermined transient overload condition and that the crew did not detect the tripped circuit breaker. In this case, there would be no warning that such a condition existed, and the location of the circuit breaker is such that a tripped breaker might not be visually detected, especially in low ambient light conditions. Although flightcrew members normally check the circuit breaker panels on entering the cockpit, the sixth item on the BEFORE START checklist requires a circuit breaker inspection and both crewmembers are required to accomplish this step and are required to respond to the challenge.

The P-40 circuit breaker, as well as the other two circuit breakers on the input power circuits to the CAWS power supplies, are located directly behind the captain's seat and can best be inspected by the first officer. At 2029:28, the first officer said "Circuit breakers, are ah . . . ." At 2029:30, the captain responded, "Checked," and, at 2029:31, the first officer said, "Auto-land is checked radio altimeters and flight director."

The CVR showed that the first officer, with regard to the circuit breakers, did not respond properly to the challenge and response aspects of the checklist and that his inspection of the upper and lower circuit breaker panels behind the captain was completed within 2 seconds. Given the time expended by the first officer, the thoroughness of his check of the circuit breaker panels had to have been limited. In addition, the P-40 circuit breaker might have opened after the check while the airplane was being taxied. Under those circumstances, it was very likely that its condition would have gone undetected.

The third possibility examined was that the P-40 circuit breaker, for undetermined reasons, did not allow current to flow even though the latch appeared mechanically closed to the flightcrew. Typically, this anomaly occurs when the breaker is cycled open and is subsequently closed, such as might occur if a crewmember closes a breaker that has tripped open. In this case, foreign objects may lodge between the breaker contacts preventing full closure, as was evidenced by the examination of two of the circuit breakers at the Klixon Division of the Texas Instruments Corporation (Klixon). Another means by which current could be impeded is the formation of a dielectric film that could build up on the contact surfaces through airborne contaminants flowing into the vented circuit breaker case. When the contacts are closed, the contact make-point may rest on the surface of the film, preventing current flow. These films are typically tenuous in nature, and the behavior of the two circuit breakers that originally were open and then were metered after little or no disturbance suggests that the presence of such a film was responsible for the open circuit displayed by these devices.

The stationary contacts of the two circuit breakers mentioned above were similar in conductivity to those of the bus bar stationary contact of the P-40 circuit breaker from flight 255, i.e., these contacts exhibited random areas of intermittency about the outer periphery of the contacts when continuity was tested with 1.5 volts. The bus bar contact of the P-40 breaker had been exposed to the environment for several weeks after the accident; thus, the possibility existed that the silver sulfide layer resulted from this exposure. However, other contacts on the same bus, which were similarly exposed to the environment, did not exhibit the silver sulfide tarnish. In addition, the contacts from about 70 circuit breakers in the accident airplane were examined and silver sulfide tarnish was found on contacts that were not exposed to the environment. Silver sulfide tarnish also was present on the stationary contacts of the two breakers that were analyzed at Klixon and were suspected of not conducting current due to the presence of a dielectric film. The silver sulfide tarnish buildup on the P-40 contact from flight 255 appeared among the heaviest encountered during the examination. Therefore, the Safety Board concludes that much, if not all, of the silver sulfide tarnish existed on the contact before the accident. The evidence makes it impossible for the Safety Board to rule out that the current flow through the P-40 circuit breaker was inhibited by the presence of a dielectric film on the bus bar contact.

Personnel at Klixon stated that they are unaware of an instance where a closed and conducting circuit breaker suddenly stopped conducting and did not annunciate the condition to the flightcrew by tripping. The Safety Board agrees that this possibility seems remote given the design of the circuit breaker. Further, there is no information currently available regarding the in-service reliability of the devices, since service difficulties encountered regarding circuit breakers are seldom reported. However, testimony at the public hearing by nearly every pilot witness disclosed that periodically throughout their careers, they had regained the use of a system or component by opening and resetting the applicable circuit breaker. Possible failure modes for this scenario remain unidentified since the anomaly disappears once the circuit breaker is reset. Naturally, the type of system involved has some bearing on this behavior, and it may be in some cases that the circuit breaker is not responsible for the loss of the system. Nonetheless, the existing evidence suggests that circuit breakers may occasionally disable functioning systems for reasons that are not clear. Since this type of failure may not be readily apparent to flightcrews and may occur in critical systems, the Safety Board believes that the Federal Aviation Administration (FAA) should conduct a directed safety investigation to determine the reliability of circuit breakers and the mechanisms by which failures internal to the circuit breakers can disable operating systems and to identify corrective actions as necessary.

The evidence did not permit the Safety Board to determine which of the three possible reasons interrupted the flow of current and caused the failure of the P-40 circuit breaker to power supply-2 of the CAWS unit.

The Safety Board supports the change to the MD-80 checklist contained in the telex issued by McDonnell Douglas on September 1, 1987, to all DC-9-80 operators, as well as the efforts of the FAA to include flightcrew procedures in airplane checklists that will allow crewmembers to validate the operational capability of takeoff warning systems. Until such time as warning systems can, through the operation of internal self-testing equipment, furnish notice to a flightcrew that they are inoperative, these checklist procedures will enhance the flightcrew's ability to detect and deal with a failed takeoff warning system.

The evidence developed by the Safety Board during its investigation of the loss of power to the P-40 circuit breaker illuminated another area of concern. The evidence showed that the CAWS fail light was installed on the DC-9-82 to facilitate maintenance. The manufacturer believed that an increased level of dispatch reliability could be achieved if the flightcrew were made aware of in-flight CAWS anomalies and could notify maintenance personnel before landing. Maintenance could then meet the airplane with a replacement CAWS unit and facilitate airplane turn-around procedures. It was for this reason that the self-monitoring capability was built into the unit.

The CAWS unit's self-monitoring capability was also the reason that the CAWS fail light was not designed to annunciate the loss of 28V d.c. input power. Trouble-shooting can be limited to replacement of the CAWS unit if the only discrepancy that will illuminate the light is internal to the unit. However, from a safety viewpoint, this feature could be improved by modifying the design so that the CAWS fail light will illuminate not only with an internal failure, but with the loss of input power to the unit. This modification would change the behavior of the system so that it would perform in the manner reflected by the original failure mode and effects analysis that was approved by the FAA during the original certification of the airplane and system. The Safety Board believes that this type of warning is important to the concept of centralized aural warning since the loss of one power supply results in a number of disabled warnings, some of which may not be immediately recognizable to the crew.

As the number of required warnings is likely to increase in the future due to increasing complexity and automation, and the concept of centralized aural warnings is likely to be employed to a greater degree, a standardized approach to the design and certification of these systems should be developed. This should also include a standardized approach to the determination of the type of warning to be provided and the criticality of these warnings, such that similar systems in different jet transport category airplanes are afforded the same degree of self-monitoring and failure annunciations. Currently, there is no structured method by which to approach these evaluations, with the final outcome often determined through negotiation between the manufacturer and the FAA. Consequently, there is a wide variation in the results of these evaluations, not only from manufacturer to manufacturer, but between a single manufacturer's product lines. No regulations exist addressing the concept of the CAWS or the level of criticality of warning systems. The Safety Board believes that the determination and dissemination of guidance for the design of CAWS would be beneficial in the certification and operation of future transport airplanes.

It was clearly evident in this accident that the flightcrew did not perform checklist procedures in the manner prescribed in the company's Airplane Pilots Handbook. There are two avenues of approach in analyzing the crew's nonstandard application of checklist procedures. Either the crew was acting in a totally anomalous fashion or their performance was consistent with their routine behavior.

The captain gave no indication that he was uncomfortable with, or disapproved of, the first officer initiating checklists without his command or without first inquiring whether the captain was ready to start a particular checklist. The first officer's actions did not seem to generate any confusion on the part of either man and tends to indicate the checklists were being operated in a manner familiar to both of them and accepted by both as a proper alternative to standard company procedure. Had either been uncomfortable with this manner of operation, one would assume that the aberrant actions by either crewmember would have been brought to the other's attention and corrected. This performance by two crewmembers whose performance was described by peers as standard, meticulous, and professional seems to indicate that this manner of checklist performance was one to which each had been exposed and become familiar with over a lengthy period. For the flightcrew to gain the level of comfort and acceptance which was demonstrated indicates that this manner of application was accepted and used by other crewmembers with whom they had flown.

The Safety Board could not positively conclude that the performance of the accident crew was representative of the standards of performance used by a significant number of the carrier's flightcrews. Nor does the Safety Board have direct evidence to support the contention that this type of nonstandard performance is an industry-wide problem. Nevertheless, the Safety Board recognizes there are similarities between Northwest and the published operational procedures, aircraft, and checklist concept used by many air carriers. Therefore, the Safety Board believes that the FAA should require its operations inspectors and designated check airmen to emphasize the importance of disciplined application of operating procedures and rigorous adherence to prescribed checklist procedures.

The Safety Board believes that the use of company check airmen has advantages in that it expands the surveillance of the FAA and, as structured within the former Republic Airlines organization, serves as quality control to the training department. Check airmen are selected by management based upon their high level of professional performance and are given ground school and specialized training before designation by the FAA. Evidence indicates that the company had established a program to address standardization of crew performance. The Safety Board believes, however, that check airmen are also susceptible to erosion of standardization. Procedural differences that are subtle and that demonstrate no readily apparent flaw may lead to a check airman's loss of sensitivity to the relaxation of adherence to standards or at least prompt hesitancy in correcting such crew performance. While this loss of sensitivity may have existed within the check airmen of the company, the Safety Board does not view this as an indictment of the concept of the check airman program. The Safety Board believes that the program is necessary and is successful because of air carriers' self interest in conducting safety operations.

While the applicable regulations require that carriers furnish checklists to their flightcrews and establish procedures for using the checklist, the regulations do not establish how the information contained on the checklist is to be presented. Some carriers present their checklists on an 8- by 11-inch laminated card; each side of the card contains several sections of the checklist. The U.S. Air Force presents the checklists of its Lockheed C-141s and C-5s on scrolls. After completing the items in view on a lubber line in the window of the scroll case, the user rotates the scroll to position the next checklist item on the lubber line for accomplishment. One U.S. carrier uses the laminated card to present all but its before takeoff and landing checklists; the carrier presents these two checklists on a mechanical slide checklist. As each item on the mechanical checklist is completed, a slide is moved over and covers the completed item. In later model airplanes, the checklist is displayed electrically. When the desired checklist is selected, all items on the list are illuminated. As the checklist item is completed, a switch is moved and the light beneath the completed item is extinguished. Both the mechanical and electrical checklists are affixed permanently to the cockpit structure.

The Northwest DC-9-82 checklist is printed on a 6 3/4- by 11-inch card which is divided into thirds by dashed lines. When folded, one section of the card includes the TAXI, DELAYED ENGINE START, BEFORE TAKEOFF, CLIMB, and IN RANGE checklists. During the accident flight operational sequence, after completing the AFTER START checklist, the flightcrew would have had to turn over the card and would have had to affix it to the control wheel to expose the TAXI checklist.

The presentation and organization of the checklist card does not, of itself, allow visual differentiation between accomplished and nonaccomplished checklists. The TAXI and BEFORE TAKEOFF checklists are arranged in sequential order of operations and, as such, the checklist card requires no manual manipulation to transfer attention from one checklist to the other. Also, the checklist card does not provide a visual alert to a nonaccomplished checklist.

The presentation on the Northwest checklist does not differ in any substantial degree from the checklist presentations by other carriers on 8- by 11-inch laminated cards. Both presentations require some manipulation because all of the checklists cannot be presented legibly on one side of the card. Although the places where manual manipulation on each chart is required may differ, neither presentation requires manual manipulation to transfer attention from each individual checklist segment to another and neither provides a visual alert to a nonaccomplished checklist.

The evidence developed during the Safety Board's investigation showed that adherence to flightcrew procedures is paramount in accomplishing a checklist properly. The testimony of a National Aeronautics and Space Administration (NASA) psychologist corroborated this conclusion as did that of a management sciences professor.

However, the management sciences professor testified that he "did not know of any human factors research on how a checklist should be designed and he could not find anything in his library on the subject." The Safety Board believes that the facts and circumstances of this accident contain compelling reasons for conducting human performance research on checklist presentation. The Safety Board believes that the FAA should convene a human performance research group of personnel from NASA, industry, and pilot groups to determine if there is any type or method of presenting a checklist which produces better performance on the part of user personnel.

The Safety Board notes that both crewmembers received single-crewmember training during their last simulator training and proficiency checks. When such training is performed, the instructor occupies the other pilot seat and also operates the simulator. The Safety Board believes this manner of training significantly limits the opportunity for the instructor to observe and to critique nonstandard practices because he is part of the operating process. The Safety Board realizes that providing recurrent training to captains and first officers separately was not the policy of the Northwest Airlines DC-9-82 training department. Rather, the single-crewmember training sessions for the captain and first officer of flight 255 occurred as a result of nonroutine scheduling difficulties or other unforeseen circumstances. When training is conducted using a complete crew, the instructor is able to observe the manner in which the two crewmembers perform their duties. By observing the interaction of the crew, the instructor is better able to identify problems relating to communication, checklist usage, and standardization.

Historically, the industry in general, and Federal aviation regulations in particular, have emphasized during training and proficiency checks individual piloting skills as a measure of performance. This emphasis on individual performance pays insufficient attention to the importance of the crew functioning as a team. The Safety Board believes that training individuals to an individual level of performance does not necessarily provide for an effective, coordinated cockpit team.

The Safety Board believes line-oriented flight training (LOFT) and training in the management of crew-coordinated activities provides the opportunity to more fully train flightcrews in a team-oriented manner. LOFT focuses the training environment on the conduct of the entire crew; as such, it expands the training incorporated during the performance of individual maneuvers. Training crewmembers in management and communication skills will expand the crew's ability to more effectively coordinate information processing requirements.

Since 1968, the Safety Board has issued 22 recommendations to the FAA which addressed, in varying degrees, cockpit resource management (CRM). On April 15, 1985, the Safety Board recommended that the FAA:

> <u>A-85-27</u>
>
> Conduct research to determine the most effective means to train all flightcrew members in cockpit resource management, and require air carriers to apply the findings of the research to pilot training programs.

The FAA, in its December 1986 response to Safety Recommendation A-85-27, stated it had:

> Initiated a program in the area of Aviation Behaviorial Technology which is intended to develop and apply advanced behaviorial analysis and technology to improve flight safety. The program includes projects on optimized line-oriented training to enhance cockpit resource management, improve cockpit/cabin communication and coordination, and improved pilot decision making training program.

The FAA further commented that this program would be a "long-term effort."

The Safety Board supports these efforts of the FAA and hopes that a priority will be given to this program that will allow its benefits to be incorporated in air carrier training programs as expeditiously as possible.

All DC-9 series airplanes that have leading edge wing slat systems are equipped with an SSRS. The SSRS system is unique in that it provides an indication of the stall angle of attack; therefore, it may lead to over-confidence while operating above the normally accepted upper limit of stick shaker angle of attack. The Safety Board found that some DC-9-82 captains expressed no concern about operating at the SSRS angle of attack. Only one captain who was interviewed stated that "he would not try to go into the supplementary stall warning area." It appears that some captains did not recognize the SSRS as an announcement of stall. They viewed the SSRS alarm as a warning with some margin as is the case with the stick shaker where there is a margin. In addition, these captains expressed no concern about the loss of lateral control at SSRS and the resultant degradation of climb performance procedure taught by most airlines for windshear. Actually, the crew was maintaining pitch at or near the SSRS and should have been maintaining a lower angle at stick shaker.

The possible reasons for these beliefs about the SSRS are either that training is inadequate or that the simulators do not accurately model the decreased roll stability at angles near to or greater than the SSRS angle of attack, thus giving a false sense of security. MD-80 flightcrews should be trained on the lateral control hazards that exist while operating at the SSRS angle of attack and the fact that the additional climb performance capability that exists above the stick shaker angle of attack is minimal and easily negated when small roll oscillations commence. MD-80 pilots should be trained to operate at or below the onset of stick shaker activation and to avoid the activation of the SSRS except in those conditions beyond their control.

Therefore, as a result of its investigation, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Conduct a directed safety investigation to determine the reliability of circuit breakers and the mechanisms by which failures internal to the circuit breakers can disable operating systems and to identify appropriate corrective actions as necessary. (Class II, Priority Action) (A-88-64)
>
> Require the modification of the DC-9-80 series airplanes to illuminate the existing central aural warning system (CAWS) fail light on the overhead annunciator panel in the event of CAWS input circuit power loss so that the airplane conforms to the original certification configuration. (Class II, Priority Action) (A-88-65)
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> Develop and disseminate guidelines for the design of central aural warning systems to include a determination of the warning to be provided, the criticality of the provided warning, and the degree of system self-monitoring. (Class II, Priority Action) (A-88-66)
>
> Require that all Parts 121 and 135 operators and principal operations inspectors emphasize the importance of disciplined application of standard operating procedures and, in particular, emphasize rigorous adherence to prescribed checklist procedures. (Class II, Priority Action) (A-88-67)

Convene a human performance research group of personnel from the National Aeronautics and Space Administration, industry, and pilot groups to determine if there is any type or method of presenting a checklist which produces better performance on the part of user personnel. (Class II, Priority Action) (A-88-68)

Expedite the issuance of guidance materials for use by Parts 121 and 135 operators in the implementation of team-oriented flightcrew training techniques, such as cockpit resources management, line-oriented flight training, or other techniques which emphasize crew coordination and management principles. (Class II, Priority Action) (A-88-69)

Issue an Air Carrier Operations Bulletin-Part 121 directing all principal operations inspectors to emphasize in MD-80 initial and recurrent training programs on stall and windshear recovery the airplane's lateral control characteristics, potential loss of climb capability, simulator limitations, and flight guidance system limitations when operating near the supplemental stall recognition system activation point (stall angle of attack). (Class II, Priority Action) (A-88-70)

Also, the Safety Board issued Safety Recommendation A-88-71 to all Part 121 air carriers.

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

By: Jim Burnett
Chairman