NATIONAL TRANSPORTATION SAFETY BOARD
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Forwarded to:

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

SAFETY RECOMMENDATION(S)

A-82-152 through -169

On January 23, 1982, World Airways, Inc., Flight 30H, a McDonnell Douglas DC-10-30, was a regularly scheduled passenger flight from Oakland, California, to Boston, Massachusetts, 1/ with an en route stop at Newark, New Jersey. Following a nonprecision instrument approach to runway 15R at Boston-Logan International Airport, the airplane touched down about 2,500 feet beyond the displaced threshold of the runway, leaving 6,691 feet remaining on which to stop. About 1936:40, the airplane veered to avoid the approach light pier at the departure end of the runway and slid into the shallow water of Boston Harbor. The nose section separated from the forward fuselage after the airplane dropped onto the shore embankment. Of the 212 persons on board, 2 are missing and presumed dead. The others evacuated the airplane safely, but with some injuries. The reported weather was a measured 800-foot overcast, 2 1/2-mile visibility, light rain and fog, temperature 35°, and wind 165° at 3 kns. The wet runway was covered with hard-packed snow and a coating of rain and/or glazed ice.

The National Transportation Safety Board's investigation of the accident showed that when the flight departed Newark, the flightcrew was aware of the poor weather conditions that would be encountered at Boston. As the flight approached the Boston area, the flightcrew was advised by the Automatic Terminal Information Service (ATIS) report that braking action was "fair to poor." They received no further braking action advisories from air traffic control (ATC). In preparing for the approach, the pilot chose to use the autothrottle speed control (AT/SC) system for airspeed control, a normal World Airways, Inc, procedure. When he attempted to insert the flight manual reference speed into the AT/SC controller, he noted that the minimum speed acceptable to the system, which is programmed to provide a 30-percent airspeed margin above stall, was about 10 kns higher than that calculated by the flightcrew. He was using the airplane's No. 2 AT/SC and because the No. 1 system was inoperable, the flightcrew had no means of crosschecking the AT/SC computers. Nevertheless, the pilot accepted the higher approach speed (as permitted by the flight manual) and continued to use the AT/SC for the approach and landing. He configured the airplane with 35° trailing edge flaps, made a

1/ For more detailed information see: Aircraft Accident Report: World Airways Inc., Flight 30H, N113WA McDonnell Douglas DC-10-30, Boston-Logan International Airport, Boston, Massachusetts, January 23, 1982. (NTSB-AAR-82-15.)

descent below the ceiling on the nonprecision approach, leveled, intercepted the 2-bar visual approach slope indicater (VASI) glide slope, and stabilized the descent. About 120 feet above the runway, the pilot took the airplane above the VASI glidepath as he adjusted for a safe touchdown aiming point as prescribed in wide-bodied airplane procedures. The airplane crossed the displaced threshold at a normal height; however, the landing flare was extended as the airspeed dissipated, leading to the extended touchdown point. The pilot used all of the airplane's decelerative devices, but he was not able to stop the airplane on the runway. About 43 seconds after touchdown, while still moving about 49 kns, the airplane was veered left to avoid collision with the approach light pier at the departure end of the runway and slid into the harbor. The nose section separated from the forward fuselage after the airplane went over a seawall and dropped onto the shore embankment.

The Boston area had had subfreezing temperatures for 2 days before the accident. On January 23, the temperature had risen from 6° F at midnight to 35° F at the time of the accident. Light snow had fallen in the morning hours and had changed to light rain in the late afternoon. Because of these conditions the Massachusetts Port Authority's snow plan had been implemented. In accordance with this plan, runway 15R had been closed periodically during the day for plowing and sanding. The runway had been reopened for flight operations at 1736, 2 hours before the accident. At that time, an inspection by vehicle prompted the airport snow committee to assess the runway braking action as "fair to poor." The drizzle and light rain continued to fall and 14 airplanes landed on runway 15R during the 2 hours before Flight 30H landed. Only 5 of the 14 flightcrews volunteered braking action reports to the tower or ground controllers, and 1 crew provided a report upon request. One pilot, who had landed a DC-8 38 minutes before Flight 30H landed, had reported braking as "poor to nil." Two other pilots, who landed 8 and 11 minutes before Flight 30H, respectively, including the pilot of a DC-10-40 airplane, reported braking action as "poor." Several of the landing flights were unable to slow as necessary to turn off of the runway at an intersection 7,300 feet from the displaced threshold. The DC-10-40 airplane encountered compressor stalls on one engine as continued reverse thrust was applied as the airplane proceeded.

The Safety Board's analysis of the digital flight data recorder (DFDR) of the DC-10-40 flight on which the pilot reported "poor" braking action and the analysis of the DFDR from Flight 30H indicated that the effective braking coefficient along runway 15R was about 0.08 or less for both flights. Braking coefficients of this magnitude are typically representative of wet, icy surfaces. An analysis of the theoretical stopping performance of Flight 30H, a DC-10-30 loaded to 365,000 pounds, indicated that the airplane would possibly have needed as much as 7,460 feet remaining after touchdown on which to stop with the effective braking coefficient achievable even if the airplane had been landed at the normal touchdown speed and with rapid deployment of ground spoilers and maximum use of reverse thrust. For comparison, the FAA-approved landing distance on a wet runway for the airplane is 6,753 feet, including the air segment from threshold to touchdown. If one allows for a minimum air run segment of 1,131 feet, as established during the airplane's certification, the FAA criterion allows a distance of 5,622 feet for stopping.

The Safety Board concluded that the World Airways accident exemplifies a problem which has been of continuing concern to it: under existing criteria heavy airplanes are permitted to land on runways known to be slippery and on which the braking coefficient may be so low that the airplane cannot be stopped, and as to which pilots may not be provided adequate guidance for making a knowledgable decision to land.

As a result of this accident and others involving operations on contaminated runways, the Safety Board convened a public hearing in Washington, D.C., May 3 to 5, 1982, to examine further the problem of runway surface conditions and their effects on airplane takeoff and landing performance. All segments of the aviation industry participated in the hearing.

The information developed during the hearing reinforced the Safety Board's belief that the many positive actions taken during the past 10 to 15 years by airport operators, airplane manufacturers, airlines, and Government research and regulatory agencies to enhance the safety of airplane takeoff and landing operations during periods of inclement weather have not been sufficient. The installation of precision approach aids, grooving of runways, improvements in airplane brake systems, improvements in tire design, more effective engine thrust reversers, automatic deployment of ground spoilers, and better pilot training programs have undoubtedly contributed to the prevention of many accidents. This nothwithstanding, the Safety Board views the World Airways DC-10 accident at Boston-Logan International Airport on January 23, 1982, as evidence that the potential for serious and catastrophic runway overrun accidents will remain as long as takeoffs and landings must be made on slippery runways which provide, at best, minimum safety margins beyond the airplane's stopping performance.

The ideal solution to preventing accidents is to assure that runway surfaces are kept in a condition which provides for braking coefficients of friction compatible with airplanes' demonstrated performance and, when this is not possible, to prohibit flight operations to or from that runway. Unfortunately, this solution may not be completely feasible, particularly during winter storm conditions. Therefore, acceptable alternatives must be sought. The Safety Board views the alternatives as consisting of the following:

1) Require that runway surfaces be maintained in the best possible condition through effective certification and inspection requirements, and require programs which will result in timely removal of contaminants.

2) Refine communications between pilots, ATC, and airport management to keep all parties informed promptly when runway surface conditions change, particularly when braking performance is degraded.

3) Develop a means of quantifying pilot assessments and ground vehicle measurements of runway surface conditions in terms that will allow pilots to relate the reported conditions to their airplane's performance.

4) Provide pilots with sufficient information about their airplane's performance to enable them to make better decisions regarding takeoff and landing operations upon receipt of reports of contaminated runway conditions and;

5) Establish the extreme limits, based on runway surface condition and airplane performance, at which increased runway length safety margins are needed or at which flight operations should be suspended by airport management.

The foregoing alternatives are a continuum in which the roles of the pilot, ATC, and airport management closely relate. Although airport management is responsible for maintaining the runways, it depends upon pilots and ATC to provide timely information on rapidly changing conditions during winter weather. The Board believes that more guidance to airport management, more accurate and timely runway condition reports, and the development of economical, reliable runway friction measuring devices would assist airport management in carrying out its responsibilities.

The Safety Board believes that airport management should be required to address the criteria for contaminant removal from runways in specific terms in the airport operations manual. The Board believes that rigid, uniform specifications should not be imposed by regulation. Rather, 14 CFR 139 should require that each airport operations manual specifically include the limits of snow, slush, or ice above which inspection and/or removal are required before operations at that airport can be continued.

The Board recognizes the subjectivity of current pilot braking action reports; however, in the absence of a better means of assessing runway surface condition, the Board believes that airport management should respond affirmatively to such reports. The judgment by a pilot that braking action is "poor" or "nil" is sufficient reason for airport management to take positive action to determine whether actual runway conditions are unsafe, particularly for heavier airplanes. Therefore, the Safety Board believes that 14 CFR 139 should require airport management to close, inspect, and improve as needed operational runways after receipt of "poor" or "nil" braking reports from pilots.

Amendment of 14 CFR 139, as recommended above, with a view to attaining improvements which should result in better runway conditions during inclement weather will not be fully effective if the FAA does not undertake positive measures to promote a program of measuring dry runway friction coefficients and monitoring to assure that dry runways are not degraded by contaminants, primarily rubber deposits. In this regard, the Safety Board issued two safety recommendations on November 18, 1976. These recommendations were directed to requiring airport operators to adhere to the guideline material contained in Advisory Circular 150/5320-12. In its latest response to these recommendations, dated December 9, 1982, the FAA stated that it planned no further action because: "Under the circumstances, we conclude that the imposition of the regulatory requirement recommended by NTSB would be neither appropriate nor justified." The FAA's contention was based on the premise that the accuracy and repeatability of the reported friction values are highly dependent on the calibration of the equipment, the training and qualifications of personnel, and strict adherence to recommended operating procedures.

The Safety Board believes that testimony at its public hearing by National Aeronautics and Space Administration (NASA) personnel and those airport managers who use friction measuring devices on a regular basis, as well as representatives from Canada and Sweden tends to refute the FAA's contention that such devices cannot be used to produce reliable readings. The means expressed by the FAA are valid, but they can be overcome. As a matter of fact, the FAA's own national program to measure runway slipperiness and its followup series of more closely controlled runway friction measurements clearly demonstrated that reliable and repeatable readings can be achieved. Therefore, the Safety Board believes that friction data can be developed and applied to formulate a universal standard so that objective evaluations of the braking quality of a runway surface can be made. In view of this fact, it is appropriate that the FAA measure runway friction at all full-certificate airports during the annual inspection of the airport. The friction measurements could be made either by the FAA with FAA equipment or by airport personnel using airport equipment under the supervision of the FAA. Such a program would lead to the upgrading of the overall quality of runway friction measurement at certificated air carrier airports. Moreover, a continuing program of measurements would promote standardization of methodology and provide the needed experience to enhance the reliability of equipment and qualifications of airport personnel to operate and calibrate the equipment.

The Safety Board recognizes that further research is needed to establish the value of devices to measure runway friction for operational purposes when the runway is covered with contaminants and to establish a correlation of measured values with airplane stopping performance. However, the Safety Board believes that the development of reliable equipment to determine runway condition in quantitative terms for advisory purposes is a realistic objective. Further, the Safety Board believes that runway friction data thus determined could be related to airplane weight and performance. As a consequence, the Safety Board urges NASA and the FAA to continue research in the measurement of runway friction coefficients for correlation to airplane stopping performance so that stopping distances on contaminated runways can be predicted with substantial accuracy.

Since pilot braking action reports likely will continue to be a primary source of runway condition information at large airports, pending the development and general acceptance of runway friction measuring equipment for operational purposes, and at smaller airports well into the future, action is needed to improve the quality of these reports and to reduce their subjectivity. The Board believes that many pilot braking reports probably are based on the pilot's perception of his total ability to slow the airplane on the landing runway rather than the actual braking attained through tire-to-runway friction. If the airplane is light and the runway is considerably longer than that normally required for landing, the pilot may perceive little or no problem in slowing the airplane to a safe turnoff speed. Actually, under these conditions, most of the decelerative force may be provided by aerodynamic drag and reverse thrust with little augmentation by wheel brakes. Consequently, the pilot may report braking condition as "fair" or "fair to poor" when the actual braking conditions are worse. The pilot of a heavier airplane landing on the same runway will have a lesser margin and will need considerably greater braking force from the wheel brakes; consequently, he could be misled about the actual braking conditions by reliance on these pilot reports.

The Safety Board believes that immediate action should be taken by the FAA to convene an industry-government group to develop standardized terminology and criteria for pilot braking reports, with the view that more guidance should be incorporated into certificated air carrier and commuter air carrier flight manuals and pilot training programs concerning the quality and accuracy of braking reports.

Additionally, the Safety Board believes that the NASA and FAA programs should be broadened to determine whether existing systems on an airplane can be redesigned or modified to present quantitative indications of effective braking coefficients to flightcrews. For example, antiskid system modulating pressures or cycling frequencies might be used in conjunction with prescribed pilot braking techniques to calculate and display a quantitative braking coefficient. Also, the potential for using inertial navigation systems to measure deceleration and to provide a quantitative braking coefficient for those airplanes so configured should be explored. Such quantitive pilot reports would allow airport management to monitor deteriorating runway conditions more closely.

The FAA should also address the problems of communicating essential runway surface information to pilots. The existing two principal methods of relaying information to pilots are ATIS and individual controller reports. The Board has found that, for various reasons, these methods sometime are not effective, particularly in heavy workload situations. The investigations of the World Airway's accident at Boston-Logan International Airport and the Air Florida Boeing 737 accident at Washington National

Airport on January 13, 1982, 2/ revealed two examples where the ATIS reports did not reflect the most current runway conditions during changing weather conditions. ATIS can effectively provide general information about airport conditions; however, when airport conditions change rapidly, controllers cannot update the ATIS rapidly enough to provide the most current information. Moreover, under these circumstances, the controller may not have time to volunteer the most recent information and the pilot may rely on outdated ATIS information rather than ask for more current information. As a result, the whole system may fail to provide essential information to pilots during critical phases of flight.

At the Safety Board's public hearing, one witness stated that the transmission of runway condition reports would be more effective

> ". . . if, during periods of runway contamination, when braking action reports are 'poor or nil,' or conditions are changing rapidly, the FAA would state on the ATIS that 'braking action advisories are in effect,' and then issue the latest braking action reports at the time that final landing clearance is given; we believe this would do two things:
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> (1) The pilot would realize there are braking action problems and that he should obtain a braking action report before landing;
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> (2) It would require the FAA to issue the most up-to-date braking action reports when landing clearance is given, and to keep to a minimum the chances that a pilot will receive an outdated braking action report."

The Safety Board agrees that such a notice on the ATIS would alert pilots to runway contamination problems and would establish a specific consciousness in pilots and controllers of the runway conditions. Moreover, it could result in additional and more descriptive braking reports from pilots. Most importantly, however, it would assure that pilots would have the latest runway information in sufficient time to plan the landing or the takeoff. Although longer radio transmissions between pilots and controllers would be required, the Board believes that the need for critical runway information to more positively assure safety during takeoff and landing on contaminated runways warrants the increased controller and flightcrew workloads.

For runway condition information to be totally effective, flightcrews must have more data regarding the stopping performance of their airplanes. The Safety Board is aware that, although airplane manufacturers are not required to demonstrate landing performance on runways other than dry, hard-surface runways for U.S. certification, the manufacturers of some airplanes have demonstrated performance and have provided data for wet runway performance to meet United Kingdom certification requirements. Furthermore, some manufacturers provide operators estimated stopping performance data for low braking coefficients and for no-brake conditions. For example, such data are provided for the DC-10, and some operators use these data to derive tables or graphs of increased stopping distances required for various reported braking action conditions for use by flightcrews. The Safety Board's review of some major operators' manuals disclosed that the presentations of such data are not standardized and, in some cases, the landing distances for similar airplane weights and runway conditions derived by various

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2/ For more information see: Aircraft Accident Report: Air Florida, Inc., Boeing 737-222, N62F, Collision with 14th Street Bridge, Near Washington National Airport, Washington, D.C., January 13, 1982. (NTSB-AAR-82-8.)

operators differed significantly. The Safety Board recognizes that actual demonstration of airplane stopping performance as a function of runway surface friction coefficient is not practical. However, we believe that manufacturers can extrapolate data from dry runway stopping performance to produce theoretical stopping performance for the lesser braking coefficients representative of typical wet and icy runway surface conditions. We believe that such data is needed by flightcrews and should be required. Further, the FAA should assure that the analytical assumptions used in the derivation of such data reflect consideration for antiskid brake system efficiency or any other landing gear or brake characteristics which can affect stopping performance on slippery surfaces. To accomplish this, the FAA should require manufacturers to demonstrate antiskid brake system performance by actual flight test or laboratory simulations.

The Safety Board believes that the inclusion of analytically derived stopping performance data in present airplane performance manuals is less helpful than it could be because the data are not available to flightcrews for quick reference when needed for takeoff and landing decisions. The FAA should, therefore, require that the data be presented to flightcrews in a form which allows correlation to runway friction coefficients obtainable from ground measuring devices. In the interim, the data should be categorized in accordance with accepted braking action terminology -- good, fair, poor, and nil -- and in any event additional guidance should be provided regarding the meaning of these terms.

Furthermore, the Safety Board believes that it is feasible to use analytically derived airplane stopping performance data to establish airplane weight limitations for operations on slippery runways for which friction measurements are available. The Safety Board is not convinced of the airplane manufacturers' and airlines' view that such requirements would impose severe economic penalties since only those scheduled flights which operate from slippery runways at or near maximum allowable gross weight limits would be affected.

The Safety Board believes that to enhance the safety margin during takeoff on contaminated runways flightcrews should be provided data for the lowest V_1 speed which would produce the existing accelerate-go safety margin (35 feet end of runway crossing height) during "unbalanced field" takeoffs. The Safety Board, however, does not view an allowable reduced end of runway crossing height with a further reduced V_1 speed as an alternative to an increased runway length safety margin under slippery conditions. The Board is concerned that the reduced margin would present a hazard during a continued takeoff following an engine power loss at or just after V_1 because takeoff positioning variations or subnormal takeoff acceleration due to slow thrust application, contaminant retardation drag, or tire failure could not be predicted adequately.

The accelerate-stop performance and thus the field length and decision speed computations are based upon the demonstrated and theoretical acceleration of the airplane using normal takeoff power. If, for any reason, the airplane acceleration is less than that used for the computation, the runway distance used to achieve V_1 will be increased and the length of runway available for stopping will be decreased. Thus, with subnormal acceleration, such as during the takeoff of Air Florida Flight 90, there is no assurance that from V_1 the airplane can stop on the remaining runway even if the runway surface is clean and dry. Consequently, a takeoff may have to be rejected at an airspeed much lower than V_1 -- when airplane acceleration is subnormal -- to assure adequate stopping distance, and the pilot must be able to recognize the subnormal acceleration rates early in a takeoff roll. There was extensive testimony at the public hearing about the development and use of takeoff performance monitoring systems. The doubts and concerns about the technical feasibility and complexity of a takeoff performance monitoring system are well founded. But the Safety Board is not convinced that they are insurmountable with today's technology and with industry's engineering and development capability. Instead, the Board believes that a concerted effort by various elements of the aviation community could overcome the technical hurdles involved and would lead to the implementation of a takeoff performance monitoring system that could make a significant contribution to flight safety. The Board believes that a joint government-industry task force should be formed under the leadership of the FAA at an early date to establish a program and guidelines for the development of a takeoff performance monitoring system. Moreover, this effort should be coordinated with other development and evaluation efforts pertaining to heads-up displays, flight guidance and control systems, and other related avionics systems in order to take advantage of advances in these areas and to assure integration of all takeoff performance monitor functions.

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

> Amend 14 CFR 139.31 and 14 CFR 139.33 to require that airports certificated under 14 CFR 139 and located in areas subject to snow or freezing precipitation have an adequate snow removal plan, which includes criteria for closing, inspecting, and clearing contaminated runways following receipt of "poor" or "nil" braking action reports and to define the maximum snow or slush depth permissible for continued flight operations. (Class II, Priority Action) (A-82-152)

> Use a mechanical friction measuring device to measure the dry runway coefficient of friction during annual certification inspections at full certificate airports and require that a Notice to Airmen (NOTAM) be issued when the coefficient of friction falls below the minimum value reflected in Advisory Circular 150/5320-12, Chapter 2. (Class III, Longer-Term Action) (A-82-153)

> Require that full certificate airports have a plan for periodic inspection of dry runway surface condition which includes friction measuring operations by airport personnel or by contracted services and which addresses the training and qualification of operators, calibration and maintenance of the equipment, and procedures for the use of the friction measuring equipment. (Class III, Longer-Term Action) (A-82-154)

> Convene an industry-government group to develop standardized criteria for pilot braking action assessments and guidance for pilot braking action reports for incorporation into pilot training programs and operations manuals. (Class II, Priority Action) (A-82-155)

> Amend air traffic control procedures to require that controllers make frequent requests for pilot braking action reports which include an assessment of braking action along the length of the runway whenever weather conditions are conducive to deteriorating braking conditions and that the requests be made well before the pilot lands. (Class II, Priority Action) (A-82-156)

> Amend air traffic control procedures to require that controllers disseminate "poor" and "nil" braking action reports promptly to airport management and to all departing and arriving flights until airport management reports that the braking action is "good". (Class II, Priority Action) (A-82-157)

Stress in initial and recurrent air traffic controller training programs, the importance of transmitting all known contaminated runway condition information to departing and arriving flights, that a "fair" or "poor" braking report from a pilot may indicate conditions which are hazardous for a heavier airplane, and that departing and arriving pilots should be informed when no recent landing by a comparable airplane has been made. (Class II, Priority Action) (A-82-158)

Amend air traffic control procedures to require that Automatic Terminal Information Service broadcasts: (1) be updated promptly after receipt of reports of braking conditions worse than those reported in the current broadcast, and (2) when conditions are conducive to deteriorating braking action, include a statement that braking action advisories are in effect. (Class II, Priority Action) (A-82-159)

At such time as air traffic control procedures are amended to require Automatic Terminal Information Service (ATIS) broadcasts to be modified, amend the Airman's Information Manual to alert pilots that when advised on ATIS that braking action advisories are in effect they should be prepared for deteriorating braking conditions, that they should request current runway condition information if not volunteered by controllers, and that they should be prepared to provide a descriptive runway condition report to controllers after landing. (Class II, Priority Action) (A-82-160)

Require that air carrier principal operations inspectors review the operating procedures and advisory information provided to flightcrews for landing on slippery runways to verify that the procedures and information are consistent with providing minimum airplane stopping distance. (Class II, Priority Action) (A-82-161)

Require that airplane manufacturers and air carriers provide advisory information and recommended procedures for flightcrew use during a landing approach with the autothrottle speed control system engaged when there is a disparity between the minimum speed the autothrottle speed control system will accept and the flight manual reference speed. (Class II, Priority Action) (A-82-162)

Amend 14 CFR 25.107, 25.111, and 25.113 to require that manufacturers of transport category airplanes provide sufficient data for operators to determine the lowest decision speed (V_1) for airplane takeoff weight, ambient conditions, and departure runway length which will comply with existing takeoff criteria in the event of an engine power loss at or after reaching V_1. (Class III, Longer-Term Action) (A-82-163)

Amend 14 CFR 121.189 and 14 CFR 135.379 to require that operators of turbine engine-powered, large transport category airplanes provide flightcrews with data from which the lowest V_1 speed complying with specified takeoff criteria can be determined. (Class III, Longer-Term Action) (A-82-164)

Amend 14 CFR 25.109 and 14 CFR 25.125 to require that manufacturers of transport category airplanes provide data extrapolated from demonstrated dry runway performance regarding the stopping performance of the airplane on surfaces having low friction coefficients representative of wet and icy runways and assure that such data give proper consideration to pilot reaction times and brake antiskid control system performance. (Class III, Longer-Term Action) (A-82-165)

Amend 14 CFR 25.735 to require that manufacturers of transport category airplanes determine and demonstrate the efficiency of brake control systems on surfaces with low friction coefficients representative of wet and icy runways by using simulation techniques incorporating dynamometer tests and actual brake system components, or by actual flight test. (Class II, Longer-Term Action) (A-82-166)

Amend 14 CFR 121.135 to require that air carriers and other commercial operators of large transport category airplanes include in flightcrew operations manuals takeoff acceleration retardation data in accordance with guidance provided in Advisory Circular 91-6A and stopping performance data on surfaces having low friction coefficients, beginning immediately when such data are available from airplane manufacturers. (Class II, Priority Action) (A-82-167)

In coordination with the National Aeronautics and Space Administration, expand the current research program to evaluate runway friction measuring devices which correlate friction measurements with airplane stopping performance to examine the use of airplane systems such as antiskid brake and inertial navigation systems to calculate and display in the cockpit measurements of actual effective braking coefficients attained. (Class III, Longer-Term Action) (A-82-168)

Convene an industry-government group which includes the National Aeronautics and Space Administration to define a program for the development of a reliable takeoff acceleration monitoring system. (Class II, Priority Action) (A-82-169)

On January 3, 1972, the Safety Board issued Safety Recommendation A-72-3 which was reiterated following the Air Florida, Inc., Flight 90 accident. The Safety Board recommended that the Federal Aviation Administration: "Require the installation of runway distance markers at all airports where air carrier aircraft are authorized to operate." The objective of the recommendation, which has not been implemented, was to provide flightcrews with a means to measure takeoff acceleration performance. The recommendation was reiterated after the Air Florida accident because the accident might have been prevented had the Air Florida flightcrew used some means to better assess the substantially subnormal takeoff acceleration. Although the runway marker system is not intended as a substitute for the installation of a takeoff performance monitoring system in the cockpit, the Safety Board believes that, pending development and installation of the latter system, the runway marker system would provide flightcrews with an interim means for assessing takeoff performance. Further, the Safety Board believes that the runway marker system would provide valuable information to flightcrews of landing airplanes because it would provide quick recognition of the touchdown point with respect to the length of runway remaining, enabling the flightcrews to modulate stopping performance as necessary. Further, this system would provide a means for flightcrews to compare actual stopping performance on contaminated runways with the published performance for dry runways; this comparison could be used as a more objective basis for identification of the braking conditions on contaminated runways.

Given the existing lack of any means to measure takeoff performance or to predict stopping performance on contaminated runways, the Safety Board again urges the Federal Aviation Administration to implement Safety Recommendation A-72-3.

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

Jim Burnett

By: Jim Burnett
Chairman