- Establish an international methodology whereby a common indication of runway conditions could be established worldwide; and
- Study the operational performance of aircraft on contaminated surfaces and establish a relationship with the harmonized IRFI.

In contrast to the CRFI, which used only DECs in measuring friction values, the IRFI was designed to use readings from a variety of friction testing devices (DEC and continuous friction measurement equipment [CFME] from multiple manufacturers). The results of this study were incorporated into American Society for Testing and Materials report 2100-02, "Standard Practice for Calculating the International Runway Friction Index," which prescribed methods for calculating the IRFI for winter surfaces and produced a harmonized scale for expressing pavement friction characteristics, regardless of the friction measurement equipment used. The IRFI obtained by using this practice has not been extended to address the braking performance of an aircraft; therefore, no tables of recommended landing distances based on the IRFI exist at this time.

Several FAA publications[66] indicate that the FAA does not believe that it is possible to predict aircraft braking performance from MU values obtained from runway friction surveys. Further, according to the FAA's *Aeronautical Information Manual*, "no correlation has been established between MU values and the descriptive terms 'good,' 'fair,' 'poor,' and 'nil' used in braking action reports."

1.18.2.3 Previous Contaminated Runway-Related Safety Recommendations

In 1982, the Safety Board conducted a special investigation to examine commercial airplane operations on contaminated runways.[67] As a result of this investigation, the Board issued several contaminated runway-related safety recommendations to the FAA. Safety Recommendation A-82-152 asked that the FAA do the following:

> Amend 14 CFR 139.31 and ... 139.33 to require that airports certified under 14 CFR Part 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.

On November 18, 1987, the FAA issued Amendment 139-14 to Part 139, requiring snow and ice control plans in ACMs at airports where snow and icing conditions regularly occur. As a result of this action, the Safety Board classified Safety Recommendation A-82-152 "Closed—Acceptable Action."

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[66] These FAA publications include AC 150/5200-31A, CertAlert 95-06, CertAlert 05-01, and the FAA's *Aeronautical Information Manual*.

[67] National Transportation Safety Board, *Large Airplane Operations on Contaminated Runways*, Special Investigation Report NTSB/SIR-83/02 (Washington, DC: NTSB, 1983).

Safety Recommendation A-82-155 asked that the FAA do the following:

> Convene an industry-government group to develop standardized criteria for pilot braking assessments and guidance for pilot braking action reports for incorporation into pilot training programs and operations manuals.

The FAA formed the Joint Aviation/Industry Landing and Takeoff Performance task group to review this recommendation, among others. The task group included representatives from Aerospace Industries Association, Air Line Pilots Association, Air Transport Association of America, Flight Safety Foundation, Inc., National Air Carrier Association, Inc., and the Regional Airline Association. However, because the FAA provided no evidence of progress in this area after 4 years, the Safety Board classified Safety Recommendation A-82-155 "Closed -- Unacceptable Action."

Safety Recommendation A-82-168 asked that the FAA do the following:

> In coordination with the National Aeronautics and Space Administration [NASA], 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.

In a response letter dated April 1, 1983, the FAA indicated that it was working with NASA to form a runway braking action test program. In a January 1984 letter, the FAA indicated that it was involved with NASA in efforts to develop a method for obtaining runway braking condition information with a more quantitative basis than subjective pilot reports. However, in a May 5, 1987, letter, the FAA expressed concern that such a system would encourage operations from a runway with a very low friction coefficient and, further, that it would be of little value because of the differences in braking performance between dissimilar aircraft models.

In response, the Safety Board stated that it did not believe that the FAA and NASA had conducted sufficient research to conclude that objective measurements taken from dissimilar airplanes would not be meaningful and that "such reports would be very useful to airport operators as a means of detecting the degradation of runway conditions in winter weather and would provide a basis upon which the pilots of large airplanes could make better decisions." Therefore, in April 1988, the Board classified Safety Recommendation A-82-168 "Closed -- Unacceptable Action."

As a result of the December 20, 1995, accident involving a Tower Air 747 at John F. Kennedy International Airport,[68] the Safety Board issued Safety Recommendation A-96-164, which asked that the FAA do the following:

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[68] National Transportation Safety Board, *Runway Departure During Attempted Takeoff, Tower Air Flight 41, Boeing 747-136, N605FF, JFK International Airport, December 20, 1995.* Aircraft Accident Report NTSB/AAR-96-04 (Washington, DC: NTSB, 1996).

> Require the appropriate Aviation Rulemaking and Advisory Committee to establish runway friction measurements that are operationally meaningful to pilots and air carriers for their slippery runway operations (including a table correlating friction values measured by various types of industry equipment), and minimum coefficient of friction levels for specific airplane types below which airplane operations will be suspended.

In its response, the FAA stated that it did not consider it technologically feasible to establish runway friction measurements that were operationally meaningful to pilots and air carriers for slippery runway operations. The FAA noted its participation in the JWRFMP, which had a goal of developing the IRFI and correlating it with airplane stopping capability. However, the FAA maintained that there were serious shortcomings in several operationally significant aspects of the IRFI standard, in addition to the historical record of failures attempting to correlate ground friction measurements with airplane performance. The FAA did not expect any new developments related to this recommendation.

In June 2002, the Safety Board responded that, although the FAA's effort to develop an operationally meaningful runway friction measurement tool was unsuccessful, it did result in the development of an international standard for determining a runway friction index. The Board also stated that proposed testing might yield more meaningful tools and encouraged the FAA to continue its efforts in this area. However, the Board acknowledged that the technology to convert the runway friction index into an operational tool did not exist at the time and, therefore, classified Safety Recommendation A-96-164 "Closed – Reconsidered."

As a result of the June 1, 1999, accident involving an American Airlines MD-82 at Little Rock National Airport in Little Rock, Arkansas,[69] the Safety Board issued Safety Recommendation A-01-54, which asked that the FAA do the following:

> For all 14 CFR Part 121 and 135 operators, require the use of automatic brakes, if available and operative, for landings during wet, slippery, or high crosswind conditions, and verify that these operators include this procedure in their flight manuals, checklists, and training programs.

On June 21, 2004, the FAA issued a notice (N8400.68) to its POIs, recommending the use of autobrakes for landings in adverse conditions caused by weather and directing POIs to convey the information in N8400.68 to their respective certificate holders. Because issuance of this notice met the intent of the recommendation, the Safety Board classified Safety Recommendation A-01-54 "Closed – Acceptable Alternate Action." According to SWA representatives, the company's efforts to equip its airplanes with autobrakes and develop and implement related procedures stemmed, in part, from these actions.

[69] National Transportation Safety Board, *Runway Overrun During Landing, American Airlines Flight 1420, McDonnell Douglas MD-82, N215AA, Little Rock, Arkansas, June 1, 1999*. Aircraft Accident Report NTSB/AAR-01-02 (Washington, DC: NTSB, 2001).

1.18.3 Previous Runway Safety Area Safety Recommendations

As a result of its investigation of the May 6, 2003, accident involving a Southwest Airlines airplane that overran the end of the runway after landing at Burbank, California,[70] the Safety Board issued Safety Recommendations A-03-11 and -12, which addressed RSAs and asked that the FAA do the following:

> Require all 14 *Code of Federal Regulations* Part 139 certificated airports to upgrade all runway safety areas that could, with feasible improvements, be made to meet the minimum standards established by Advisory Circular 150/5300-13. These upgrades should be made proactively, not only as part of other runway improvement projects. (A-03-11)
>
> Require all 14 *Code of Federal Regulations* Part 139 certificated airports to install engineered materials arresting systems in each runway safety area available for air carrier use that could not, with feasible improvements, be made to meet the minimum standards established by Advisory Circular 150/5300-13, "Airport Design." The systems should be installed proactively, not only as part of other runway improvement projects. (A-03-12)

In an August 7, 2003, letter, the FAA indicated that it agreed with the intent of these recommendations and stated that FAA Order 5200.8, "Runway Safety Area Program," established a program to bring all RSAs up to current standards, whenever possible. The letter stated that the FAA's goal was to upgrade 456 RSAs by 2007 and that such improvements "may be initiated at any time." The FAA stated that its goal was to upgrade at least 65 RSAs per year through 2007 and that 71, 68, and 74 RSAs were upgraded in fiscal years 2000, 2001, and 2002, respectively. The FAA also noted that eight EMAS beds had already been installed and that several more installations were planned. The Board asked the FAA to provide annual updates on RSAs that could not meet the standards and the specific alternatives that would be used to improve the safety of these RSAs.

The issue of RSA improvements was discussed at the Safety Board's June 2006 public hearing that was held for the accident involving SWA flight 1248. In response to questioning during this hearing, FAA personnel indicated that, under current FAA policy, it is possible that some RSAs will not meet the dimensional standards or have arrester beds installed even after the FAA considers its improvement projects successfully completed. In a July 7, 2006, letter, the FAA indicated that 208 RSA upgrades and 15 EMAS installations had been completed though fiscal year 2005. The letter further stated that more than 90 percent of the RSA upgrades would be completed by 2010, and all RSA

[70] For additional information, see National Transportation Safety Board, Aircraft Accident Brief NTSB/AAB-02/04 (Washington, DC: NTSB, 2002).

upgrades would be completed by 2015. A recent update from FAA personnel indicated that 303 RSA improvement projects were completed. The update further indicated that 37 RSA upgrades and 5 EMAS installations were completed in fiscal year 2006 and that 20 RSA upgrades and 1 EMAS installation had been accomplished to date in fiscal year 2007. Safety Recommendations A-03-11 and -12 are currently classified "Open—Acceptable Response."