National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: May 6, 2003

In reply refer to: A-03-11 and -12

Honorable Marion C. Blakey
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On March 5, 2000, about 1811 Pacific standard time, Southwest Airlines, Inc., flight 1455, a Boeing 737-300, N668SW, overran the departure end of runway 8 after landing at Burbank-Glendale-Pasadena Airport (BUR), Burbank, California. The airplane touched down at approximately 182 knots, and about 20 seconds later, at approximately 32 knots, collided with a metal blast fence and an airport perimeter wall. The airplane came to rest on a city street near a gas station off of the airport property. Of the 142 persons on board, 2 passengers sustained serious injuries; 41 passengers and the captain sustained minor injuries; and 94 passengers, 3 flight attendants, and the first officer sustained no injuries. The airplane sustained extensive exterior damage and some internal damage to the passenger cabin. The flight, which was operating on an instrument flight rules flight plan, was conducted under 14 *Code of Federal Regulations* (CFR) Part 121. Visual meteorological conditions prevailed at the time of the accident.

BUR has two asphalt transverse-grooved runways, 8/26 and 15/33. The National Transportation Safety Board's investigation of the accident has revealed that the runway safety areas (RSA)[1] for these runways, the design and constructions standards of which are defined in Advisory Circular (AC) 150/5300-13, "Airport Design," are significantly smaller than prescribed. Specifically, AC 150/5300-13 indicates that the lateral dimensions of an RSA should extend 250 feet both left and right of the runway centerline and for the full length of the longitudinal RSA. The AC further indicates that the longitudinal dimensions of an RSA should extend for the full length of the runway and 1,000 feet beyond the physical threshold of each

[1] Title 14 CFR 139.3 defines a safety area as "a designated area abutting the edges of a runway or taxiway intended to reduce the risk of damage to an aircraft inadvertently leaving the runway or taxiway." Safety areas also provide greater accessibility for emergency equipment in the event of an overrun accident.

runway end. The lateral dimensions of the runway 8/26 RSA measure 250 feet on each side of the runway centerline, except along its southern edge, which measures 125 feet and is marked with a movement/nonmovement area delineator line. The eastern edge of runway 15/33's lateral RSA also measures 125 feet.[2] No significant longitudinal RSAs exist at the departure ends of runways 8, 15, or 33, and the longitudinal RSA at the departure end of runway 26 measures only 200 feet.

In a March 16, 2000, letter to the Safety Board,[3] the BUR Airport Authority stated, "the close proximity of the passenger terminal and the close proximity of parked and taxiing aircraft adjacent to both runways" creates a safety problem. On August 14, 2000, the airport authority submitted an application to the city of Burbank to construct a replacement passenger terminal that would be located 1/2 mile north of the existing terminal.[4]

In the March 16, 2000, letter to the Safety Board, the BUR Airport Authority further stated that there are "a number of financial, political, and legal impediments which may preclude further extensions of the [longitudinal] RSA." Subsequently, BUR shortened the departure end of runway 8 by 230 feet and, in December 2000, began installation of an engineered materials arresting system (EMAS)[5] in that location, which was completed in February 2002. No other EMAS is projected to be installed at BUR. The Board recognizes the safety benefits that the EMAS will provide at the departure end of runway 8 at BUR; however, the Board notes that the substandard longitudinal RSAs at the departure ends of runways 26, 15, and 33 at BUR will remain unchanged.

The Safety Board has a long history of advocating the provision of sufficient RSAs. On April 4, 1977, in response to the November 16, 1976, Texas International Airlines flight 987 accident in which a McDonnell Douglas DC-9-14 ran off the end of runway 8R at Stapleton International Airport, Denver, Colorado, the Board issued Safety Recommendation A-77-16, which asked the Federal Aviation Administration (FAA) to "amend [Part 139 of the *Federal Aviation Regulations*] to require, after a reasonable date, that the extended runway safety area criteria[6] be applied retroactively to all certificated airports." In its July 11, 1977, response letter, the FAA stated, "Extended safety areas at all existing airports would be impractical and

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[2] The substandard lateral RSAs are necessitated by the proximity of the passenger terminal and an airplane parking area to the southern edge of runway 8 and the eastern edge of runway 15.

[3] For the complete text of this letter, see the Airport and Emergency Response Group Chairman's Factual Report, attachment 3, in the public docket for this accident.

[4] However, in an April 10, 2002, letter, the BUR Airport Authority Executive Director informed the Safety Board that "58% of the voters of Burbank approved an initiative [in October 2001] that deprives the Burbank City Council of its power to approve any terminal project agreement with the Airport Authority unless and until a lengthy series of conditions is met." As a result of this initiative, on December 4, 2001, the City of Burbank "imposed a moratorium on the issuance of building permits for any and all activities at the airport that would require permits…[which] has effectively halted all development activity at the airport."

[5] An EMAS is designed to slow an aircraft that overruns a runway by exerting reliable and predictable deceleration forces on its landing gear as its wheels roll through high-energy absorbing material. For more information about the standards for the planning, design, and installation of EMASs, see AC 150/5220-22, "Engineered Materials Arresting Systems (EMAS) for Aircraft Overruns."

[6] At the time the Safety Board issued Safety Recommendation A-77-16, 14 CFR Part 139 did not specify dimensions for RSAs. The first RSA criteria were established by AC 150/5300-12, effective February 28, 1983. AC 150/5300-12 specified that an RSA should be at least 500 feet wide and should extend 1,000 feet beyond each runway end. (AC 150/5300-12 was superseded by AC 150/5300-13 on September 29, 1989.)

infeasible. [The] FAA will propose an amendment to 14 CFR Part 139 that will require extended safety areas concurrently with construction of new airports, new runways, and major runway extensions at existing airports."

On October 23, 1985, the FAA published Notice of Proposed Rulemaking (NPRM) 85-22, "Revision of Airport Certification Rule," which proposed changes to 14 CFR Part 139 that would require extended RSAs concurrent with the construction of new airports and runways and with major runway extensions at existing airports. On February 5, 1986, the Safety Board commented on the NPRM, stating, "we continue to believe that criteria for runway safety areas should be made mandatory at all certificated airports regardless of the date of construction." On January 1, 1988, the final rule became effective and stated the following:

> (a) To the extent practicable, each certificate holder shall provide and maintain for each runway and taxiway which is available for air carrier use—
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> (1) If the runway or taxiway had a safety area on December 31, 1987, and if no reconstruction or significant expansion of the runway or taxiway was begun on or after January 1, 1988, a safety area of at least the dimensions that existed on December 31, 1987; or
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> (2) If construction, reconstruction, or significant expansion of the runway or taxiway began on or after January 1, 1988, a safety area which conforms to the dimensions acceptable to the Administrator at the time the construction, reconstruction, or expansion began.

Because the final rule did not require the retroactive upgrade of RSAs to the standard criteria at existing runways or taxiways, on March 29, 1990, the Safety Board classified Safety Recommendation A-77-16 "Closed—Unacceptable Action."

On January 5, 1995, in response to the April 27, 1994, Action Air Charters flight 990 accident in which a Piper PA-31-350 Navajo Chieftain crashed into a blast fence at the end of runway 6 at Sikorsky Memorial Airport, Stratford, Connecticut, the Safety Board issued Safety Recommendation A-94-211, which asked the FAA to inspect all 14 CFR Part 139 certificated airports for adequate RSAs and nonfrangible objects, such as blast fences, and require that substandard RSAs be upgraded to the minimum standards set forth in AC 150/5300-13, "Airport Design," wherever possible. In its October 15, 1997, response, the FAA indicated that 25 percent of the runways at 14 CFR Part 139 certificated airports have RSAs that do not meet the minimum standards established by AC 150/5300-13 but that could meet those standards if feasible improvements were made. The FAA further indicated that 17 percent of the runways at 14 CFR Part 139 certificated airports have RSAs that do not meet the minimum standards and that could not be made to meet those standards with feasible improvements.[7] The FAA added that because of the cost of RSA improvements and the infrequency of aircraft overruns and undershoots, any improvements to the runways that could be made to meet the standards would be made only as part of overall runway improvement projects. Because the delay in RSA

[7] A complete inventory of CFR Part 139 RSAs, including those that meet, those that do not meet but could with feasible improvements be made to meet, and those that could not be made to meet the minimum standard established in AC 150/5300-13, can be found in the FAA publication titled *Runway Safety Areas at Certificated Airports.*

improvements would allow substandard conditions to continue, on February 10, 1999, the Safety Board classified Safety Recommendation A-94-211 "Closed—Unacceptable Action."

On October 1, 1999, the FAA issued Order 5200.8, which established its Runway Safety Area Program. The order stated that the objective of the program was that "all RSAs at federally obligated airports and all RSAs at airports certificated under 14 [CFR] Part 139 shall conform to the standards contained in AC 150/5300-13, *Airport Design*, to the extent practicable." However, Order 5200.8, Paragraph 10, "Implementation of RSA Improvements," states the following:

> a. A project to improve an RSA in accordance with the determination made in Paragraph 8[8] may be initiated at any time.
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> b. Whenever a project for a runway involves construction, reconstruction (includes overlays), or significant expansion, the project shall also provide for improving the RSA in accordance with the determination made in Paragraph 8.

The Safety Board notes that FAA Order 5200.8 restates the FAA's original plan to require improvements to substandard RSAs only as part of overall runway improvement projects and does not require RSAs to be proactively upgraded to the minimum standards established in AC 150/5300-13. Although the FAA has stated that it agrees with the intent of Board recommendations to upgrade RSAs, it concluded that it is not necessary to require upgrades to existing nonstandard RSAs except as part of runway improvement projects. However, the Board remains convinced that the FAA's policy is a serious safety concern. Therefore, the Safety Board believes that the FAA should require all 14 CFR Part 139 certificated airports to upgrade all RSAs that could, with feasible improvements, be made to meet the minimum standards established by AC 150/5300-13, "Airport Design." The upgrades should be made proactively, not only as part of other runway improvement projects.

As indicated by the FAA in its response to Safety Recommendation A-94-211, and in its November 2000 document titled *Runway Safety Areas at Certificated Airports*, some airports have RSAs that could not, with feasible improvements, be made to meet the minimum standards established by AC 150/5300-13.[9] In a 1984 safety study titled *Airport Certification and Operations*, the Safety Board noted that "the continual problem of encroachment on airports by the surrounding community, which is the result of geographical barriers and conflicting interests and improper land use planning, renders unlikely any substantial increase in the size of runway

[8] The determination made in accordance with Paragraph 8, "RSA Determinations," was to be made based on information gathered in accordance with Paragraph 7, "RSA Inventory," which required that "each regional airports division shall collect and maintain data on the RSA for each runway at federally obligated airports and airports certificated under Part 139 within their geographic purview." The results of the inventory were found in a November 2000 FAA document titled *Runway Safety Areas at Certificated Airports*. According to the document, 55 percent of RSAs met the minimum standards established by AC 150/5300-13, 31 percent of RSAs did not meet the minimum standards but could meet those standards if feasible improvements were made, and 14 percent of RSAs did not meet minimum standards and could not be made to meet those standards with feasible improvements.

[9] Further, according to AC 150/5220-22, "Engineered Materials Arresting Systems (EMAS) for Aircraft Overruns," the following factors could make construction of a standard RSA impracticable: natural obstacles (bodies of water or sharp drop-offs), local development (roads and railroads), or environmental constraints (wetland encroachment).

end safety areas at most airports."[10] To address this problem, the Board issued Safety Recommendation A-84-37, which asked the FAA to "initiate research and development activities to establish the feasibility of soft-ground aircraft arresting systems and promulgate a design standard, if the systems are found practical." On June 21, 1997, on the basis of the FAA's and industry's research and development activities, the Safety Board classified Safety Recommendation A-84-37 "Closed—Acceptable Action."

Since the development of an EMAS as a result of Safety Recommendation A-84-37, several airports have proactively installed the systems.[11] In addition, several airports have installed EMASs following overrun accidents. On June 1, 1999, American Airlines flight 1420, a McDonnell Douglas DC-9-82, crashed after it overran the departure end of runway 4R during landing at Little Rock National Airport (LIT), Little Rock, Arkansas. In the fall of 2000, LIT installed an EMAS at the departure end of runway 4R.[12] Further, as previously noted, BUR completed the installation of an EMAS at the departure end of runway 8 in February 2002.

The safety benefit of EMAS was demonstrated on May 8, 1999, when American Eagle flight 4925, a Saab 340B, overran the departure end of runway 4R at John F. Kennedy International Airport (JFK), Jamaica, New York. The airplane traveled approximately 248 feet across an EMAS before it came to a stop.[13] Of the 30 people on board the airplane, 29 were not injured, and 1 sustained a serious injury during the evacuation. A Safety Board performance study estimated that without the EMAS, the airplane would have entered Thurston Basin, a waterway approximately 600 feet beyond the end of the runway.

The Board is also aware of several overrun accidents in which major damage to the aircraft and injuries to passengers might have been prevented or mitigated if an EMAS had been installed at the end of the runway where the accident occurred.[14] A recent example of such an accident occurred on March 21, 2000, in which a Saab 340B twin turboprop airplane, operating as American Eagle flight 3789, sustained substantial damage upon impact with a drainage ditch following a runway overrun during the landing roll on runway 01 at the Killeen Municipal Airport, Killeen, Texas.[15] The airplane came to rest in a ditch 150 feet beyond the departure end

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[10] For more information, see National Transportation Safety Board, *Airport Certification and Operations,* Safety Study NTSB/SS-84/02 (Washington, DC: NTSB, 1984).

[11] Airports that proactively installed EMASs include the following: Minneapolis-St. Paul International Airport, Minneapolis, Minnesota; Baton Rouge Metropolitan Airport, Baton Rouge, Louisiana; Binghamton Regional Airport, Binghamton, New York; and Rochester International Airport, Rochester, New York.

[12] According to LIT, it is also working with Federal and local government agencies to extend the RSA at the departure end of runway 4R to 1,000 feet.

[13] The Port Authority of New York and New Jersey installed the EMAS at the departure end of runway 4R at JFK in 1997.

[14] For examples, see National Transportation Safety Board, *World Airways, Inc., Flight 30H, McDonnell Douglas DC-10-30CF, N113WA, Boston-Logan International Airport, Boston, Massachusetts, January 23, 1982,* Aircraft Accident Report NTSB/AAR-82/15 (Washington, DC: NTSB, 1982); National Transportation Safety Board, *Scandinavian Airlines System Flight 901, McDonnell Douglas DC-10-30, John F. Kennedy Airport, Jamaica, New York, February 28, 1984,* Aircraft Accident Report NTSB/AAR-84/15 (Washington, DC: NTSB, 1984); and National Transportation Safety Board, *USAIR, Inc., Boeing 737-400, LaGuardia Airport, Flushing, New York, September 20, 1989,* Aircraft Accident Report NTSB/AAR-90/03 (Washington, DC: NTSB, 1990).

[15] The description of this accident, FTW00FA101, can be found on the Safety Board's Web site at <http://www.ntsb.gov>.

of runway 01 and aligned with the right edge of the 100-foot wide runway.[16] The 2.5-foot-deep ditch was aligned perpendicular to the runway. If an EMAS had been installed at the departure end of runway 01, it most likely would have stopped the accident airplane before it contacted the ditch, therefore preventing substantial damage to the airplane.

The Safety Board realizes that EMAS is not a substitute for, nor a safety equivalent to, a standard-size RSA. However, because EMAS does provide an additional level of safety for those runways at which it is installed, the Board supports the installation of EMASs at those runways in which the RSA is less than the minimum standards established in AC 150/5300-13. Therefore, the Safety Board believes that the FAA should require all 14 CFR Part 139 certificated airports to install EMASs in each RSA available for air carrier use that could not, with feasible improvements, be made to meet the minimum standards established by AC 150/5300-13, "Airport Design." The systems should be installed proactively, not only as part of other runway improvement projects.

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

> 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, "Airport Design." The upgrades should be made proactively, not only as part of other runway improvement projects. (A-03-11)
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> 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)

Acting Chairman HAMMERSCHMIDT and Members CARMODY and GOGLIA concurred with these recommendations.

Original Signed

By: Ellen G. Engleman
Chairman

[16] In 1992, Killeen Municipal Airport submitted a proposal to the FAA requesting authorization to extend the south end of runway 01 by 300 feet and to extend the north end of the runway by 194 feet to accommodate larger commuter aircraft. The FAA disapproved the proposal on April 17, 1992, in part, because the runway extensions would reduce the length of the RSAs at the ends of the runways. However, in August 1992, the FAA approved the proposal. The runway extension project was completed in August 1993, and the airport was granted FAA Part 139 certification at that time. The Safety Board notes that runway 01 still does not meet the minimum standards set forth in AC 150/5300-13.