



**PARTY SUBMISSION OF  
SOUTHWEST AIRLINES PILOTS' ASSOCIATION  
TO THE NATIONAL TRANSPORTATION SAFETY BOARD**

**SOUTHWEST FLIGHT 278  
KBUR - Burbank, California  
06 December 2018**

**NTSB DCA19IA036**

In accordance with Title 49, CFR § 831.14, Southwest Airlines Pilots Association (SWAPA) submits its proposed findings of fact, proposed probable cause, and proposed safety recommendations designed to prevent future incidents or accidents. SWAPA's submission does not attempt to address all of the issues that arose during the course of the investigation. It focuses on what SWAPA believes are the significant findings to be drawn from the evidence made available to SWAPA. We reserve the right to provide an addendum when the complete factual record is made available for evaluation.

## I. EXECUTIVE SUMMARY

On December 6, 2018, at approximately 0905 Pacific Standard Time, 1705Z, Southwest Airlines Flight 278, a Boeing 737-700W, registration N752SW, overran runway 08 on landing at Burbank, CA (KBUR) and came to rest in the engineered materials arresting system (EMAS) at the end of the runway. All crew and passengers deplaned via air stairs. No injuries were reported. The regularly scheduled domestic passenger flight was operated by Southwest Airlines under the provisions of 14 CFR Part 121. An instrument flight rules (IFR) flight plan was filed for the flight, which departed Metropolitan Oakland International Airport (KOAK), Oakland, California, at approximately 0810 PST.

Although winds of 120/8 and visibility of 6NM were forecast for their arrival, Instrument Meteorological Conditions (IMC) prevailed at the time of the incident. Air Traffic Control (ATC) advised the flight of moderate to extreme precipitation around the airport, with only light chop reported by preceding aircraft. Despite prevailing westerly winds at the time of arrival, the ILS Z RWY 08 approach was in use due to reduced ceilings and visibility and the lack of a suitable approach to RWY 26. The runway and approach limitations at KBUR necessitated a tailwind approach and landing on a wet runway. The wind values relied on by the crew and PWB programming to determine landing performance, and the winds initially forecast and reported by ATC, were within aircraft and landing performance limitations. The final wind readout broadcast to the crew less than one minute before touchdown was 270 at 11 knots, which both pilots thought was within the 10 knot tailwind limitation.<sup>1</sup>

The approach was stabilized.<sup>2</sup> The aircraft crossed the threshold at a radio altitude of 54'.<sup>3</sup> As we will show below, Flight 278's Threshold Crossing Height (TCH) was in compliance with published values. Target airspeed (V-target) was 131 KIAS. The aircraft crossed the threshold at 137 knots, which met stabilized approach criteria tolerance of V-target to V-target plus 10. The aircraft touched down at 126 KIAS (132 kt. after correcting for static port pressure errors), a true airspeed of 133.5 knots, and a groundspeed of 151 knots corresponding to a 17.5 knot tailwind.<sup>4</sup>

As directed by the performance calculations from the Performance Weight and Balance system (PWB), autobrakes were set to MAX. The captain immediately used maximum reverse thrust after touchdown and began blending in manual brakes to obtain maximum braking performance. The

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<sup>1</sup> See Cockpit Voice Recorder Group Chairman Factual Report, p. 48, and Operational Factors/Human Performance Factual Report, Attachment 1, Crew Interview Summaries, pp. 5 and 11.

<sup>2</sup> See Aircraft Performance Study, p. 62.

<sup>3</sup> *Id.* p. 8, The radar altimeter measures the distance from the ground to the bottom of the main landing gear.

<sup>4</sup> *Id.*

captain attempted to turn off the runway at the D1 intersection but felt the nose wheel skid. He then straightened the nose wheel to avoid entering EMAS at an angle and the aircraft came to a stop.

#### Proposed Probable Cause:

SWAPA submits that the probable cause of the incident was an unreported direct tailwind of 13 to 18 knots and approach guidance that required a higher than standard threshold crossing height, resulting in the aircraft touching down beyond the intended touchdown point.

#### Proposed Contributing Causes:

1. The first 490' of Runway 08 is white concrete and distinctly lighter in appearance than the remaining asphalt runway. The white concrete, white threshold markings, and reduced visibility due to extreme precipitation combined to preclude recognition of the runway threshold and planned touchdown zone.
2. At the time of the incident, there was no definitive guidance for pilots to conclusively determine the Latest Touchdown Point (LTP) on RW 08 at KBUR under conditions similar to those existing at the time of this incident.

Post-incident interviews indicate the pilots believed the aircraft touched down between 1300' to 1500' from the runway threshold.<sup>5</sup> The aircraft actually touched down 2504' beyond the runway threshold. The unreported tailwind and higher than normal threshold crossing height guidance led to a delayed touchdown and a landing outside the touchdown zone. The issues discussed in this report focus on why these two experienced pilots, who had flown into KBUR many times before, did not recognize they were outside the touchdown zone, and what can be done to prevent a recurrence of a similar hazard in the future.

As discussed in greater detail below, numerous factors contributed to the delayed touchdown and the crew's inability to stop the aircraft on the runway. This Submission highlights key issues impacting the flight that we believe the NTSB should consider for its final report on the incident. As a result of this investigation, SWAPA has developed safety recommendations that we believe should be studied and implemented.

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<sup>5</sup> See Operational Factors/Human Performance Factual Report, Attachment 1, Crew Interview Summaries, pp. 5, 10.

## **PREVIOUS RUNWAY OVERRUNS: NTSB RECOMMENDATIONS - CLOSED UNACCEPTABLE ACTION**

As a result of the NTSB investigation into the American Airlines Flight 331 B737 accident at the Norman Manley International Airport, Kingston, Jamaica (MKJP) on December 22, 2009, the NTSB issued several recommendations to prevent runway overruns on landing. (See Attachments 1 and 2). There are a number of factors in the American accident that are similar to this incident: tailwind approach, tailwind landing, wet runway, heavy rain, long landing, and departure off the end of the runway. The crew in the American accident, similar to the crew in this incident, testified they thought they were in the landing zone on touchdown. American Flight 331 touchdown was approximately 4100 feet past the runway threshold.<sup>6</sup>

Recommendations A-11-092 and A-11-094 (Closed Unacceptable Action,) in pertinent parts to this incident, address pilot training for maximum tailwind landings, the importance of landing in the touchdown zone, and the preparation for executing a go-around. We think these recommendations to the FAA should be revisited, along with an additional recommendation for the FAA to develop training and technology to ensure pilots will recognize when, landing at much higher than normal groundspeeds due to tailwinds, they have passed the touchdown zone and should perform a go-around.

## **HAZARDS ASSOCIATED WITH RUNWAY OVERRUNS**

We refer to FAA Advisory Circular 91-79A, titled Mitigating Risks of a Runway Overrun Upon Landing (AC No. 91-79A). According to the AC, a study of FAA and NTSB data indicates that the following hazards increase the risk of a runway overrun:

- Unstabilized Approach;
- High Airport elevation or high-density altitude, resulting in increased groundspeed;
- Effect of excess speed over the runway threshold;
- Airplane weight;
- Landing beyond the touchdown point;
- Downhill runway slope;
- Excessive height over the runway threshold;
- Delayed use of deceleration devices;
- Landing with a tailwind; and
- A wet or contaminated runway.

In this incident, the approach was stabilized and the airspeed was within stabilized approach criteria tolerances. However, multiple risks for a runway overrun as identified in AC 91-79A were present:

- Tailwind landing;

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<sup>6</sup> See Jamaican Civil Aviation Authority Accident Report at <http://www.jcaa.gov.jm/wp-content/uploads/2020/08/2009-Dec-22-AA331-FINAL-REPORT.pdf>

- Wet or contaminated runway;
- Downhill runway slope;
- Tailwinds greater than those reported to the crew;
- Excess groundspeed over the threshold due to tailwind; and
- Higher than the nominal 50 foot threshold crossing height due to VGSI guidance.

These hazards cumulatively resulted in a landing beyond the desired touchdown point. As in other landing overruns, this crew was unaware they were about to touch down beyond the touchdown zone. Had the pilots been aware the tailwind was significantly in excess of aircraft limitations, or had they been aware they were about to land outside the touchdown zone, they undoubtedly would have executed a go around. This is not the first incident or accident in which highly experienced crews were unaware they were landing outside the touchdown zone. Clearly the information available to the pilots on aircraft position relative to touchdown zone under conditions of extreme precipitation is inadequate, and further investigation and development of assistive technology is warranted.

## **AIR TRAFFIC CONTROL**

The facts identified during this investigation reveal that the crew was not provided critical weather information at several key points during the flight. Without this information, the crew was unable to accurately assess the actual tailwinds and make appropriate performance calculations and decisions, which contributed to the delayed touchdown and landing beyond the touchdown zone.

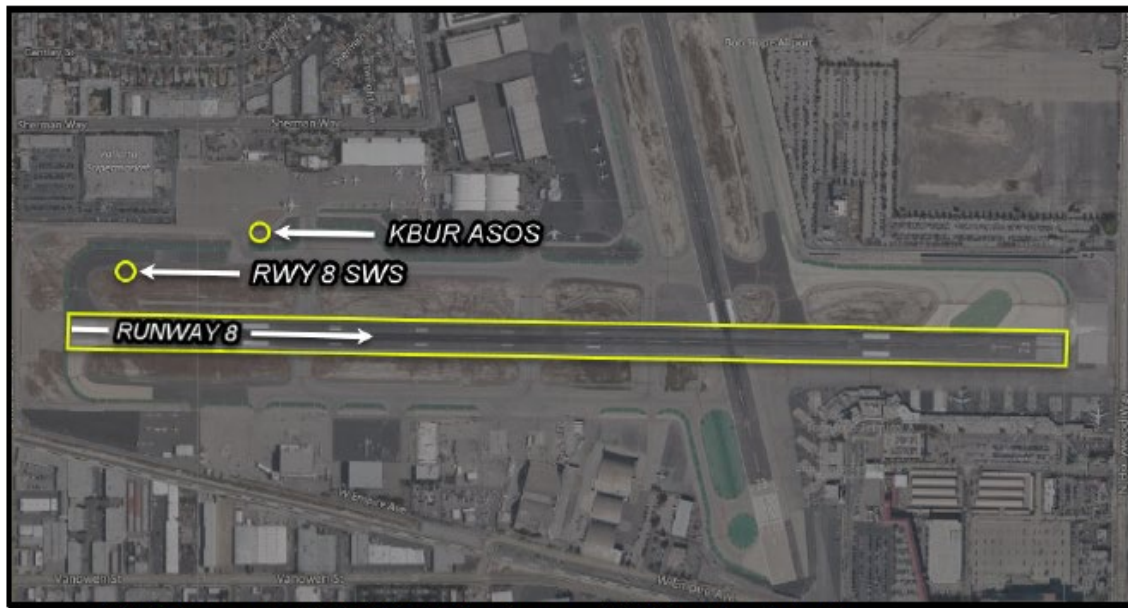
The crew checked in with SoCal Approach at 0851, received the KBUR altimeter setting and were advised to expect the ILS Z approach to runway 08. The crew stated they had ATIS information H, but the controller did not provide the crew with the then-current ATIS information J. The controller advised the flight that a King Air had experienced a 15-knot loss of airspeed and that a Challenger had gone around due to winds.

Next, the flight was handed off to the KBUR tower controller. The tower controller informed the crew of moderate to heavy precipitation from their current position all the way to the airport, with winds of 260/9. The controller also reported a braking action report of “good”, received from a 737 that had landed ten minutes earlier.

The controller subsequently advised the crew of heavy precipitation directly over KBUR and provided two more wind updates: 270/10 at 9:00 and 270/11 at 9:01, the latter less than one minute before the aircraft touched down. The controller did not specify the winds were for runway 08.

The wind readouts provided to the crew by the controller were from the Surface Weather System (SWS), and differed considerably from those recorded by the Automated Surface Observation System (ASOS), which includes the average 2-minute winds and is updated every 5 seconds. As depicted below, there is an 800’ difference in locations of the ASOS and the runway 08 SWS, with

the SWS located near the beginning of the runway and the ASOS located closer to the actual touchdown zone.<sup>7</sup>



KBUR Runway 8 with KBUR ASOS and runway 8 SWS locations depicted

There was a significant difference in wind values between these two independent wind measuring systems. The average 2-minute winds recorded by ASOS were 269/16 at 9:00 and 273/15 at 9:01. At the time of SWA 278's landing, the average 2-minute winds were 279/14 at 9:02 and 282/14 at 9:03, equating to approximately a 14-knot tailwind component.

Importantly, the wind information provided to the crew did not correctly reflect the actual winds. In a tailwind landing situation such as this with winds at or above limits, the crew lacked essential information to determine whether to continue the landing or execute a go around. The crew discussed the winds they were given (270/11), and, at a time-critical moment close to the ground, determined they were within the 10-knot tailwind landing limitation and continued with the landing. While it is true that the tailwind component based on these winds was actually 10.8 knots, had the crew been informed of the actual winds of 279/14, a different analysis and decision would have likely occurred.

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<sup>7</sup> See Specialist's Report, Air Traffic Control, March 23, 2021, pp. 7-8.

## AIRCRAFT PERFORMANCE STUDY: Omitted Issues

SWAPA submits that the Aircraft Performance Study (“Study”) omits certain critical facts, leading to a distortion of the Study’s conclusions.

On pages 59-62 of the Study, the following observations and conclusions are noted:

[F]light 278 crossed the threshold about 20 ft. higher in radio altitude than during the previous landings<sup>8</sup>, and took more than twice as long to touch down after crossing the threshold....Flight 278’s higher altitude over the threshold necessitated more time to descend to the runway; and the additional time, at a high groundspeed, resulted in much more distance over the runway before touchdown....

The airplane crossed the threshold at a higher radio altitude than in two previous flaps 40 landings recorded on the FDR...The higher altitude and ground speed of flight 278 over the threshold compared to the previous flaps 40 landings, without any adjustment in thrust to compensate, resulted in its delayed touchdown and a long touchdown point 2,504 ft. from the threshold.

The Study fails to consider the following notes on the ILS Z Rwy 8 approach charts, which are important in the analysis of this approach:<sup>9</sup>

- “Remain on or above VGSI Glideslope until threshold”<sup>10</sup>
- “VGSI and ILS glidepath not coincident (VGSI angle 3°/TCH 72°)”
- “LOC unusable within 0.5 NM to threshold” (This limitation is further restricted by a NOTAM indicating the “LOC unusable within 0.9 NM to the threshold”)
- “Autopilot coupled approach not authorized below 1027”

As discussed in greater detail below, these important notes require compliance by operators. The Study does not account for these considerations when it compares the incident approach to two previous approaches, nor does it provide the weather and winds for those approaches. The Study also does not factor in the differences in typical line operations in VMC versus IMC when landing on shorter runways. It is common practice and acceptable airmanship in narrow body aircraft to cross the landing threshold below vertical guidance in VMC when landing on short runways and the landing is assured. Here, the crew could not avail themselves of that option due to reduced visibility and unannounced tailwinds.

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<sup>8</sup> Previous landing #1 was performed on runway 02L at John Wayne Airport in Santa Ana, California (KSNA), and previous landing #2 was also on KBUR runway 08.

<sup>9</sup> We note that the approach chart attached to the Performance Study and the approach chart used in the Operational Factors/Human Performance Factual Report are from two different sources.

<sup>10</sup> This note appears on both approach charts but appears to be applicable only to night approaches on the chart used by the OP/HP Group.

**The Study's inference that the aircraft may have been too high is incorrect and misleading.**

The Study provides an analysis of multiple issues impacting the landing performance of the flight. However, with respect to the glidepath, the Study does not address certain specifics of the ILS Z 08 BUR that distinguish this approach from other approaches. **Essentially, there are five different glidepaths to runway 08 at BUR to consider, all of which impact the touchdown point:**

1. The 3.00° glidepath of the ILS Z 08 approach to a 60' TCH;
2. the 3.00° glidepath of the VGSI to a 72' TCH (as required to be flown by the note on the approach chart);
3. the 3.00° glidepath of the hypothetical ILS to a 50' TCH utilized in the Study;
4. the unknown glidepath used by the previous flights into KBUR, but with a possible descent below the glidepath once landing was assured in VMC; and
5. the glidepath of Flight 278, with a tailwind on the approach, a **13-18 knot tailwind** at the threshold, and a groundspeed crossing the threshold of 156 knots (179 MPH)

In its analysis of the approach, the Study states “[t]he Instrument Landing System (ILS) glide slope Course Deviation Indicator (CDI) parameter recorded on the FDR indicated that N752SW started to drift above the glide slope at 9:02:10, about 3,986 ft. (0.66 nm) from the threshold, with the glide slope CDI deviation increasing steadily past this point.” In fact, the aircraft did not “drift above the glide slope”. As noted in the Crew Interview Summaries, the captain stated “[h]e flew the PAPIs<sup>11</sup> to touchdown.”<sup>12</sup> Following the PAPIs (in compliance with procedures for transitioning to a visual landing) predictably results in flying the aircraft above the ILS glide slope and subsequent glide slope CDI deviation because the TCH for a visual approach using the VGSI *is higher than* the threshold crossing height on the ILS. The approach chart relied on by the Study directs the pilot to “[r]emain on or above VGSI glidepath until threshold.” Given the low ceiling and degraded visibility, the crew of Flight 278 would have had to rely on the VGSI glidepath, which would have resulted in a higher threshold crossing altitude. As noted in the Aeronautical Information Manual, “[a] higher than optimum TCH, with the same glide path angle, may cause the aircraft to touch down further from the threshold if the trajectory of the approach is maintained until the flare.”<sup>13</sup>

The Study statement that the aircraft “crossed the threshold about 20 feet higher in radio altitude than during the previous landings” creates an inference that the aircraft was improperly above glidepath at threshold crossing. This is incorrect. The aircraft crossed the threshold at a radar altimeter altitude of 54'. This altitude should be distinguished from the “Pilot Eye Height” at threshold crossing. Pilot Eye Height is the main gear height plus the distance from the main gear to the pilot's eye, or approximately 10-14' above main gear height, depending on flap setting and other factors. The BUR published Visual Glide Slope Indicator (VGSI) threshold crossing height (TCH) of 72' and the ILS glideslope TCH of 60' are Pilot Eye Height altitudes, not radar altimeter altitudes. Here, the radar altimeter altitude of 54' plus an additional 14' for Pilot Eye Height put

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<sup>11</sup> PAPIs are part of the VGSI system.

<sup>12</sup> See OF/HP Factual Report, Attachment 1 – Crew Interview Summaries, p. 5.

<sup>13</sup> FAA Aeronautical Information Manual, 1-1-9(d)(7)

the aircraft at approximately 68', or almost exactly at the VGSI TCH of 72'. During his interview, the Captain testified that when approaching minimums, he saw the runway edge lights and the PAPI through the HUD and further testified that when hand flying the approach "the PAPIs were two and two and so he stayed with that."<sup>14</sup>

The Study uses the two previous landings (one at KSNA and one at KBUR) to contrast with the incident flight. However, the Study does not provide the weather for these two prior landings. As previously discussed, in VMC it is possible or even probable that a crew may descend slightly below the glidepath when landing is assured. This would result in a lower radio altitude when crossing the threshold, such as that commented on in the Study for the two prior landings. Thus, caution is advised when reviewing the Study's comparison of the threshold crossing height of the two prior approaches to this approach.

Although the Study is correct in stating that the incident aircraft was higher than the previous two flaps 40 landings evaluated<sup>15</sup>, the flight was not higher than the TCH altitude published in the approach chart. The conclusion reached in the Study should be the inverse: the two previous flaps 40 landings crossed the threshold below the published TCH in contravention of the approach procedures, not that Flight 278 was too high.

The Performance Study does not properly credit the crew in flying this approach in these conditions and instead compares the flight path to two previous Flaps 40 approaches that happened to be included on the FDR, without investigating the differences in each flight. The Study effectively compares apples to oranges to the detriment of the SWA 278 pilots in its failure to analyze the weather and winds for the two prior approaches. The Study also does not address why the navigation aids to this runway are inconsistent, unreliable, and non-coincident. A further example of the unreliable navigation aids at KBUR is the following NOTAM:

!FDC 8/7703 BUR IAP BOB HOPE, Burbank, CA.  
ILS Z OR LOC Z RWY 8, AMDT 39...  
CIRCLING CAT A MDA 1280/HAA 502. DISREGARD NOTE: AUTOPILOT COUPLED  
APPROACH NA BELOW 1027. NOTE: CIRCLING TO RWY 33 NA AT NIGHT FOR  
CAT D.  
1809111909-1904231909EST<sup>16</sup>

Apparently, some of the various approach charts in service at the time of the incident (depending on the source and revision date) included this "Autopilot Coupled Approach NA Below 1027" note.

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<sup>14</sup> See OF/HP Factual Report, Attachment 1 – Crew Interview Summaries, p. 7.

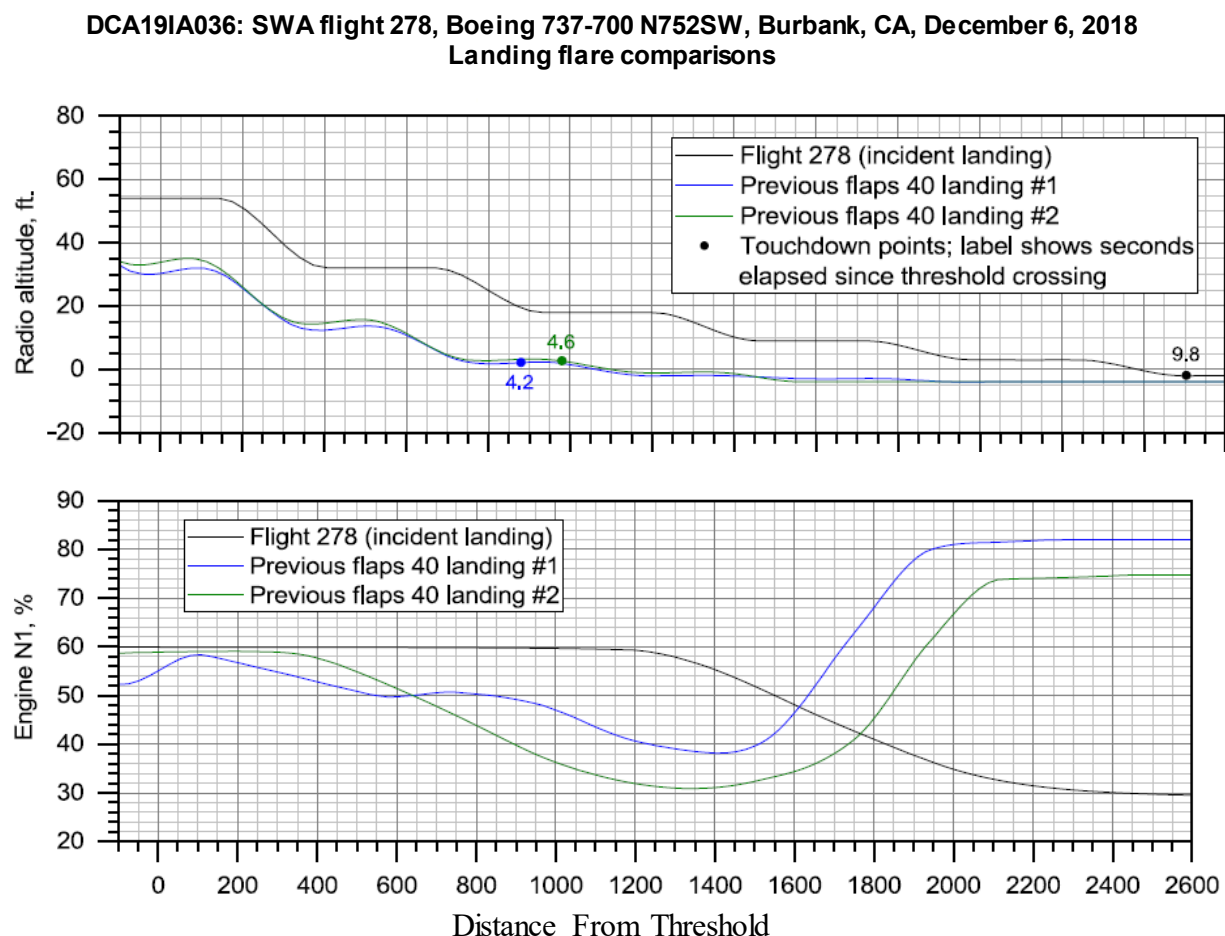
<sup>15</sup> See Aircraft Performance Study, p. 62.

<sup>16</sup> See OF/HP Group Factual Report, Attachment 6, KBUR Destination Information.

## Additional Performance Study Disparities

The Study also implies that the pilots were late in reducing power: “In addition, Figure 19 shows that 1,200 feet from the threshold, the engine N1 is only beginning to reduce from 60%. During the previous landings, the engine N1 is reduced below 60% well before the 400 ft. mark.”

The following two graphs are taken from the Performance Study Figure 19 (page 93). To simplify our point, we have reduced the four graphs to two for ease of comparison of “Radio Altimeter,” “N1” and “Distance From Threshold.”



In its analysis of N1 reduction, the Study does not account for the fact that there is no flight deck instrument that alerts the pilots to the distance traveled beyond the threshold, exact threshold crossing height, or time since threshold passage. Pilots do not fly the aircraft based on those parameters; they fly the aircraft based on the parameters they have access to – height above ground, indicated airspeed, sink rate, and thrust. Power is reduced in the flare based on these parameters, not distance or time in seconds from the threshold. A closer review of Figure 19 shows that all crews reduced power at approximately 20 feet. It was the excessive tailwind, unknown/unreported to the crew that caused the late touchdown, not pilot technique or airmanship.

## **“LOC Unusable Within 0.9 NM of the Threshold” NOTAM and Failure to NOTAM Corresponding DH and LOC Only MDA**

With respect to the lateral path of the aircraft, the Study states “[f]ollowing the autopilot and autothrottle disconnect, the airplane started to drift to the right of the centerline.” Again, the Study does not address the relevant note on the approach chart: localizer course guidance is unreliable inside of 0.5 NM and the NOTAMs issued and in effect at the time of the flight further downgrade the localizer reliability to 0.9NM. Later publications of the same approach chart increase the decision altitude from 280’ to 348’, likely as a result of the unreliability of the localizer guidance. With heavy rain, gusty winds, visibility at or near minimums for the approach, and unreliable localizer course guidance, lateral course corrections in the last 0.5 NM of the approach were both required and normal, not a lack of airmanship, as the decontextualized use of “drift” by the Study implies.

The NOTAM stating the “LOC is unusable inside of 0.9 NM” without a corresponding NOTAM revising the DH and visibility requirements for the approach lead the crew to rely on navigation aids potentially not in compliance with FAA standards and pilot expectations. The fact that the localizer unreliability was increased by NOTAM with no simultaneous increase to DH or MDA at least warrants further investigation and discussion.

## **Performance Study “Conclusion” Inconsistent With Scope of Study**

The Study concludes “once the airplane overflowed the nominal 1,500 ft. touchdown point, the PWB landing distance calculations became “invalid” and “a go-around [was] the better option”. While SWA procedures direct a go around when landing beyond the touchdown zone, this statement also lacks context. It assumes the crew was aware they had overflowed the nominal touchdown zone and infers they ignored SWA procedures. In fact, the crew was unaware they had overflowed the touchdown zone, as stated in their interview testimony. The Captain believed they touched down between 1300’ and 1500’ down the runway and the FO believed they touched down about 1500’ down the runway.<sup>17</sup>

This statement from the Study is inconsistent with the objective and scope of the Study, and instead lends itself to distortion and misunderstanding of the root causes of this incident. It is intuitively obvious that a go-around is a “better option” than a landing overrun. What is not obvious, and presumably why there is an investigation, is why two experienced, extremely well-qualified pilots, both of whom had landed at KBUR between 80-100 times prior to the incident flight<sup>18</sup>, did not realize they were outside the landing zone and what can be done to prevent a recurrence in the future.

SWAPA objects to the inclusion of this statement and respectfully requests that “go-around was the better option” statement be stricken from the Aircraft Performance Study Conclusion. Like any incident, there are a number of factors that contributed to cause this incident. The tendency to

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<sup>17</sup> See Operational Factors/Human Performance Factual Report, Attachment 1, Crew Interview Summaries, pp. 5, 10.

<sup>18</sup> *Id.* pp. 3, 12.

oversimplify causation must be avoided, in keeping with the overarching goal of safety and preventing future similar incidents.

## **SWA SYSTEMS AND PROCEDURES - Performance Weight and Balance System (PWB)**

### **Approach Speeds**

The criteria for a “stabilized approach” set forth in SWA’s operating manuals permit a crew to fly an approach with a speed of V-target up to V-target plus 10 knots or minus 5 knots. However, the PWB utilizes V-target, not V-target plus 10 knots when calculating required landing distance. In gusty wind conditions such as those present in this incident, airspeed has a tendency to fluctuate. Here, the crew was confronted with a report of an airspeed loss of 15 knots by a prior landing aircraft, as well as a report of a go-around due to winds by another aircraft. It is not uncommon for a crew to add a few knots to V-target as a precaution under these circumstances, and the crew discussed being “a little bit hot” for the approach.<sup>19</sup>

The PWB computed a V-reference speed of 126 knots. The indicated airspeed at the time of the aircraft’s touchdown was exactly 126 knots, so the crew was precisely on V-reference airspeed on touchdown. However, the aircraft’s groundspeed at this point was determined to be 151 knots after correcting for static port pressure errors and corresponding to a 17.5-knot tailwind, or 25 knots higher than V-reference.

### **Stopping Margins**

The PWB calculated a stopping margin of 245’ based on a 5-knot tailwind. Both pilots stated they were aware of and concerned about this unusually low stopping margin in post-incident interviews.<sup>20</sup> There is no clear guidance in SWA manuals related to reduced stopping margins. An unexpected tailwind, an airspeed bounce, a gust of wind – any number of variables likely to be encountered in rapidly changing weather conditions – can easily eliminate any stopping margin in such a performance critical situation.

Southwest should perform a review of its Risk and Resource Management (RRM) strategies and Standard Operating Procedures. Definitive guidance should be developed that provides crews quick, real-time landing performance when conditions change.

SWA did issue a procedural directive in December, 2020 in the form of a Flight Operations Bulletin on intended touch down point and latest touch down point (LTP) that provides some guidance in these runway critical situations. However, a problem arises in that pilots may have very little real-time information available to them to accurately determine their actual touch down point, as clearly demonstrated in this incident where both pilots thought they had touched down 1300’ to 1500’ down the runway. In practice, the landing pilot is likely looking down the runway toward the far end for the flare and is therefore unlikely to be able to note the touchdown point. The HUD does not provide runway remaining guidance until the aircraft has already touched

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<sup>19</sup> See Cockpit Voice Recorder Factual Report, p. 44

<sup>20</sup> See Operational Factors/Human Performance Factual Report, Attachment 1, Crew Interview Summaries, pp. 4, 12.

down, which may be too late. In this incident, reduced visibility due to heavy precipitation hampered crew awareness of the touchdown point. Some airports may have an obvious LTP, such as a taxiway, but that option is not available at all runway critical airports, which forces the pilots to estimate the LTP. As discussed in the Performance Study, Boeing has developed additional flight deck enhancements to provide the crew with greater awareness that could help prevent future runway excursions. These enhancements should be further studied and their implementation should be evaluated.

## **AIRCRAFT ISSUES**

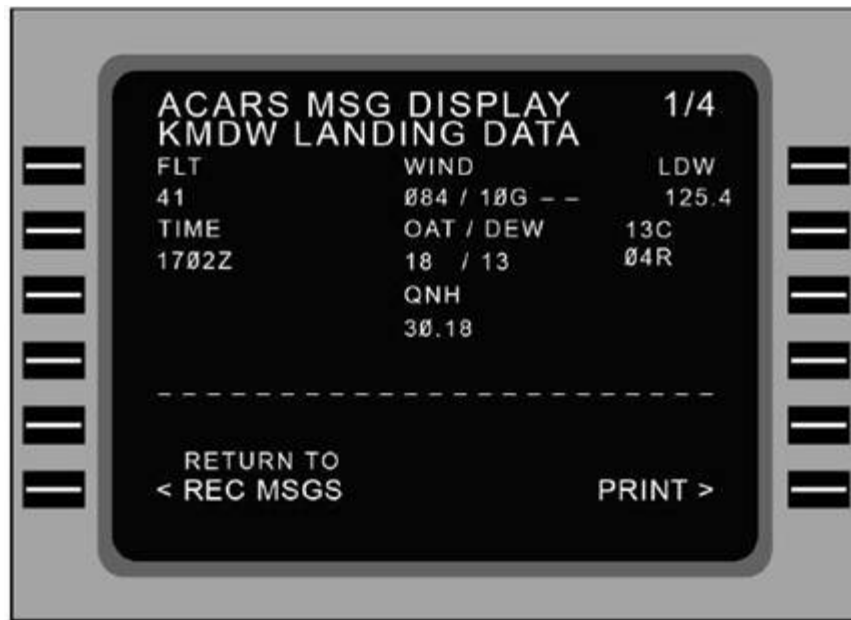
### **ACARS Auto Update Function Not Available**

The aircraft flown by the crew was equipped with an Aircraft Communications Addressing and Reporting System (ACARS). The crew obtained landing performance data and the Automatic Terminal Information Service (ATIS) information for KBUR via the ACARS prior to top of descent in accordance with SWA procedures. However, there were significant changes to the weather conditions at KBUR between the time the crew requested the ATIS and the time of the actual approach and landing.

SWA aircraft do not have an “auto update” function option for ATIS information. The auto update function automatically sends updated weather information to the aircraft whenever there is a change to the ATIS, whether it is the latest hourly weather report or a special issuance for changing weather conditions. Without this feature, the crew does not receive updated ATIS information unless they manually request it. Here, the crew was faced with deteriorating weather conditions, including heavy precipitation and tailwinds. During periods of heavy workload such as these, the auto update function for ATIS information would decrease task saturation for the crew.

### **No ACARS Printer Available**

This aircraft also did not have an ACARS printer, although some SWA aircraft are equipped with printers. As can be seen in the figure below, the ACARS installed on the aircraft have a prompt at 6R to print the information on the screen but there is no printer installed on most aircraft.



PWB System Landing Data page 1. Source: SWA

An ACARS printer can also reduce workload, as the crew does not have to copy down the information for later review. A printed weather report also reduces the possibility for errors in transcription.

As stated by Captain Jeff Rees, FAA MAX APM, Southwest Airlines CMO:

... I would characterize it as a disadvantage to not having ACARS printers because what other carriers do is they print that information out and they can hand that piece of paper back and forth if they're discussing the weather or the runway and so forth.

Whereas, with Southwest, I mean, the pilots are sharing that FMC monochrome screen and they might have to page through a couple of the screens so that clearly it's just a little -- you know, it's more cumbersome. You know, it's going to require more heads down than OPC and it's a little bit more -- I'm talking the OPC versus AeroData just in the process. (emphasis added)

And then in the actual presentation of the information not having the ACARS printer available it just makes it a little bit more difficult to get access to see and process that information and discuss it.

You know, in a busy air traffic environment at low altitude those are just additional challenges that they have to manage.

...[I]t is clearly easier to manage information on a printed piece of paper that you can make annotations on and hand back and forth than it is to look at a green

monochrome screen and two people have to look at that and you've got parallax and those things.<sup>21</sup>

## **AIRPORT INFORMATION- Where the Rubber Meets the Runway**



### **KBUR Runway 08**

### **KMDW Runway 22L**

Both runways may appear as though they have displaced thresholds, but only one does.

The two runways pictured above are of the incident runway at BUR and Runway 22L at Midway Airport (KMDW).<sup>22</sup> It is close to self-evident from the rubber deposit patterns on both runways that pilots tend to land on the numbers at MDW (the numbers are obscured by rubber deposits) but tend to land longer at BUR, well past the runway 08 numbers marking. This is also confirmed

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<sup>21</sup> See NTSB Interview transcript Jeff Rees, pp. 69-71.

<sup>22</sup> Images are dated 10/30/2018.

anecdotally from our discussions with Southwest Airlines pilots and those familiar with the data generated by various safety programs.

The runways have the following characteristics:

- Both runways are approximately the same length: BUR 08 is 5802 feet long and the runway available beyond the displaced threshold for 22L at MDW is 5812 feet;
- The TCH for the ILS Runway 08 at BUR is 60 feet and the TCH for the VGSI is 72 feet;
- The TCH for the RNAV (GPS) Runway 22L at MDW is 50 feet and the TCH for the VGSI is 43 feet;
- The entire length of the runway at MDW, including the area prior to the displaced threshold, is uniform in color (white concrete);
- The first 490 feet at BUR is white concrete and a distinctly different color from the remaining runway, black asphalt.

The following statement is from the FO Interview Summary:

“When they broke out of the clouds, they were slightly right of course by less than half a dot. The captain corrected from slightly high on glide path to slightly low on glide path. They crossed the threshold between the 50- and 30-foot calls (closer to the 30 ft. call).”<sup>23</sup>

The 50 and 30 foot automatic calls refer to the aircraft’s radar altimeter readings. Looking at the charts above comparing aircraft radar altitude versus distance from the threshold shows that the 50 foot call may have occurred at approximately 200 feet beyond the runway threshold and the 30 foot call may have occurred at approximately 750 feet beyond the threshold. This approximation of threshold crossing by the First Officer is closer to the position on the runway where the color changes from white to black than to the actual runway threshold.

The combination of two different runway materials, literally black and white, so close the threshold of Runway 08 could be mistaken by pilots for a displaced threshold, especially in conditions of reduced visibility and high ground speeds. These factors, in combination with the higher than normal TCHs of the ILS and the VGSI at BUR and distinctly different from the similar runway at MDW, deserve more study to determine if they contribute to the tendency to land long at BUR.

## CONCLUSION

SWAPA has provided findings of the multiple causal and contributing factors for this incident. Under demanding environmental conditions, the crew of Flight 278 flew a stable, legal, and normal approach and crossed the threshold at the appropriate altitude. Critical tailwind information which significantly impacted their groundspeed was unavailable, and they did not perceive they were landing outside the touchdown zone. We anticipate that the NTSB will consider all of these issues in its determination of the probable and contributing causes of this incident and in its recommendations to the FAA to improve safety and avoid future runway overruns.

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<sup>23</sup> See, OF/HP Factual Report, Attachment 1, Crew Interview Summaries, FO page 2

## RECOMMENDATIONS OF SWAPA

- The wind measurement systems utilized by controllers should be evaluated, with a consideration toward providing additional information to landing or departing aircraft when winds are at or above predetermined values.
- Information should be provided to pilots on the reliability and accuracy of winds generated by the aircraft's navigation system as compared to ATC reported winds. Guidance should be provided for recommended crew actions when aircraft computed wind exceeds aircraft limitations but reported wind does not.
- Simulator training should be provided using an ILS tailwind approach to short wet runways, with an unreported tailwind in excess of aircraft limitations.
- When tailwinds are forecast for arrival, performance calculation for the maximum allowable tailwind should be readily available to the crew.
- Latest Touchdown Point guidance should be published for all runways with available runway lengths of less than 7000 feet.
- ACARS printers should be installed on all SWA aircraft and the auto update function for ATIS reporting should be added.
- Flight deck enhancements of Runway Awareness and Advisory System (RAAS) and Runway Situational Awareness Tools (RSAT) should be evaluated and considered for possible implementation to increase situational awareness.

# **ATTACHMENT 1**

## Safety Recommendation A-11-092

TO THE FEDERAL AVIATION ADMINISTRATION: Require principal operations inspectors to review flight crew training programs and manuals to ensure training in tailwind landings is (1) provided during initial and recurrent simulator training; (2) to the extent possible, conducted at the maximum tailwind component certified for the aircraft on which pilots are being trained; and (3) conducted with an emphasis on the importance of landing within the touchdown zone, being prepared to execute a go-around, with either pilot calling for it if at any point landing within the touchdown zone becomes unfeasible, and the related benefits of using maximum flap extension in tailwind conditions.

### Recommendation Details

 [Original recommendation transmittal letter](#)

|                     |                                                                                                                |
|---------------------|----------------------------------------------------------------------------------------------------------------|
| Overall status      |  Closed - Unacceptable Action |
| Mode                |  Aviation                     |
| On Most Wanted List | No                                                                                                             |
| Priority level      | Non-urgent                                                                                                     |
| Times reiterated    | 0                                                                                                              |
| Is hazmat           | No                                                                                                             |
| Is NPRM             | No                                                                                                             |
| SR coding           |                                                                                                                |
| Date issued         | 12/07/2011                                                                                                     |
| Overall date closed | 08/07/2018                                                                                                     |

### Event Details - DCA10RA017

On December 22, 2009, about 2222 eastern standard time, American Airlines flight 331, a Boeing 737-800, N977AN, ran off the departure end of runway 12 after landing at Norman Manley International Airport (KIN) Kingston, Jamaica. The aircraft landed approximately 4,000 feet down the 8,911-foot-long, wet runway with a 14-knot tailwind component and was unable to stop on the remaining runway length. After running off the runway end, it went through a fence, across a road, and came to a stop on the sand dunes and rocks above the waterline of the Caribbean Sea adjacent to the road. No fatalities or postcrash fire occurred. Eighty-five of the 154 occupants (148 passengers, 4 flight attendants, and 2 pilots) received injuries ranging from minor to serious. The airplane was substantially damaged. Instrument meteorological conditions and heavy rains prevailed at the time of the accident flight, which originated at Miami, Florida, on

an instrument flight rules flight plan.

During flight 331's approach to KIN, air traffic control (ATC) advised the flight crew that it may be necessary to circle to land on runway 30 and indicated a wind from 320° at 10 knots. The flight crewmembers acknowledged the wind information and informed ATC of their intent to do a straight-in approach to runway 12. The KIN tower then indicated a wind direction of 320° at 14 knots and asked if the flight crew still wanted to land on runway 12. The flight crew confirmed runway 12, and the tower then advised that the runway was wet. The flight crew configured the airplane to land with a flap setting of 30° rather than the full flap setting of 40°. Both flight crewmembers later reported that they felt the airplane float prior to touchdown. Neither pilot called for a go-around at any point during the approach and landing.

Location            Kingston, Jamaica  
Accident date    12/22/2009  
Accident #        DCA10RA017  
Report #

## Addressee Details

 FAA - Closed - Unacceptable Action - 08/07/2018 ^

Name                FAA  
Acronym            FAA  
Category            Federal Government  
Addressee status   Closed - Unacceptable Action

From                NTSB  
To                    FAA  
Date                08/07/2018  
Type                Official Correspondence  
Response          As a result of our investigation of the American Airlines flight 331 accident, we issued and Reiterated several recommendations related to preventing runway overruns when landing, including issues related to no-fault go-around policies, and the effective use of formalized landing distance assessments prior to landing. We issued Safety Recommendations A-11-92 through -94 because we concluded that training pilots for tailwind landings would better prepare them to mitigate the risk of runway overruns when landing in tailwind conditions. These recommendations were also based on our conclusion that, because the dynamics of a tailwind approach and landing—particularly on wet or contaminated runways—expose flight crews to additional risks and

challenges, pilots should be provided current and comprehensive guidance regarding the risks and made aware of the reduced margins of safety during tailwind landing operations.

On June 6, 2013, you sAdresseeld that you had drafted a notice that would be published after you revised advisory circular (AC) 91-79, "Runway Overrun Prevention," as we recommended in Safety Recommendation A 11 93. The notice would direct all POIs to evaluate their assigned operators' pilot training programs to determine if the provisions of AC 91-79, as revised, had been appropriately incorporated. On September 6, 2013, we replied that the notice should cover the contents of both Safety Recommendations A-11-92 and -94 and, pending issuance of such a notice, Safety Recommendations A-11-92 and -94 were classified "Open—Acceptable Response."

On September 14, 2014, you published AC 91-79A, which revised AC 91-79 to highlight strategies pilots may use to identify, understand, and mitigate risks associated with runway overruns during the landing phase of flight, including issues related to tailwind landings. As a result, on April 6, 2015, Safety Recommendation A-11-93 was classified "Closed—Acceptable Action." At that time, we also sAdresseeld that action to satisfy Safety Recommendations A 11 92 and 94 depended on you issuing the notice for POIs to ensure that tailwind landing information in the AC was incorporated into the training programs and manuals of the POI's assigned carrier.

We note that, after further consideration, you determined that the notice could also address the recommendations of your takeoff and landing performance assessment aviation rulemaking committee (TALPA ARC) concerning operations on contaminated runways. Your determination was based on preventing runway overruns and your belief that the TALPA ARC recommendations complement the intent of Safety Recommendations A-11-92 and -94 by improving runway condition assessments, which can effectively anticipate airplane braking performance. On August 1, 2016, you published Notice 8900.375, "Procedures for Reducing the Risk of Runway Overrun (TALPA)," which provides guidance to POIs on program policies and procedures for operator and certificate-holder procedures to reduce the risk of runway overrun. Your letter also discussed FAA Order 8900.1, volume 3, chapter 10, section 1, paragraph 3 277, "Missed Approach/Go-Around Policy, Procedures and Training," which provides guidance to your POIs for determining the adequacy of a carrier's procedures related to go-around and missed-approach decisions.

We agree with you on the importance of preventing runway overruns. The notice, TALPA ARC recommendations, sections of Order 8900.1, and related safety alerts for operators discussed in your letter all address preventing runway overruns; however, none of them addresses tailwind landings, an important issue that we have identified in our runway overrun accident investigations. Although these other issues have been the Subject of other recommendations that we have issued, we issued Safety Recommendations A-11-92 and -94 because being prepared to safely land in a tailwind is also important in preventing runway overruns. Our review of Notice 8900.375 did not find any mention of tailwind landings, nor any discussion related to Safety Recommendations A-11-92 and -94. We do not agree that you have effectively addressed these safety recommendations, but, because you sAdresseeld that you regard your

actions as complete and plan no further action, Safety Recommendations A-11-92 and -94 are classified CLOSED--UNACCEPTABLE ACTION.

From FAA  
To NTSB  
Date 06/11/2018  
Type Official Correspondence  
Response -From Daniel K. Elwell, Acting Administrator: In our letter to the Board dated June 6, 2013, the Federal Aviation Administration (FAA) noted that we drafted a Notice to be published after the revision to Advisory Circular (AC) 91-79. The Notice was intended to direct all principal operations

inspectors to evaluate their assigned operators' pilot training programs to determine if the provisions of the AC were appropriately incorporated. However, after further consideration. We determined that this Notice could also act as a vehicle to address recommendations issued by the Takeoff and Landing Performance Assessment (TALPA) Aviation Rulemaking Committee (ARC). We understand the criticality of runway overrun prevention. and the TALPA recommendations complement the intent of the Board's recommendations addressed in this letter by creating an improved way of assessing runway conditions, which provides an aircraft operator effective means to anticipate airplane braking performance.

On August 1, 2016, we published Notice 8900.375, Procedures for Reducing the Risk of Runway Overrun (TALPA). which provides guidance

to the FAA 's aviation safety inspectors (ASJs) on program policies and procedures for operator and certificate holder procedures to reduce the risk of runway overrun. This Notice incorporates AC 91-79A, Mitigating the Risks of a Runway Overrun Upon Landing, which primarily focuses on operations not covered by Safety Alert for Operators (SAFO) 06012. Landing Performance Assessments at Time of Arrival (Turbojets). This AC highlights strategies pilots may use to identify, understand, and mitigate risks associated with runway overrun during the landing phase of flight. It also provides detailed information that operators may use to develop company standard operating procedures to mitigate those risks.

This Notice is available at the following website:

[http://www.faa.gov/documentLibrary/media/Notice/N\\_8900\\_375.pdf](http://www.faa.gov/documentLibrary/media/Notice/N_8900_375.pdf).

Notice 8900.375 primarily applies to:

- The FAA 's Flight Standards District Offices;
- Certificate-holding district Office principal operations inspectors responsible for determining the acceptability and approval (as applicable) of procedures submitted to them for operations under Title 14, Code of Federal Regulations (14 CFR) Parts 121 , 125 (including part 125 Letter of Deviation Authority holders), 135, and 91 subpart K;
- Training Center program managers and other ASJs responsible for approval and surveillance of training programs for 14 CFR part 142 training centers; and
- The FAA's Flight Standards Service.

Additionally, on August 11, 2015, we published SAFO 15009, Turbojet Braking Performance on Wet Runways. which warns airplane operators and pilots that the advisory data for wet runway landings may not provide a safe stopping margin under all conditions. This SAFO is available at the following website:

[https://www.faa.gov/othervisit/aviation\\_industry/airline\\_operators/airlinesafety/safo/all\\_safos/media/2015/SAFO\\_15009.pdf](https://www.faa.gov/othervisit/aviation_industry/airline_operators/airlinesafety/safo/all_safos/media/2015/SAFO_15009.pdf).

Beginning October 1, 2016, we required all federally obligated airports to use TALPA procedures to assess runway conditions and report those conditions in newly formatted Field Condition Notices to Airmen in accordance with the TALPA ARC recommendations. This allowed pilots and flight planners to use the information, along with manufacturers' aircraft specific data, to determine the runway length needed to safely stop an aircraft after a rejected takeoff or a landing. This implementation required development of policies, procedures, and coordination across several lines of business, including the FAA's Flight Standards Service. Air

Traffic Control, Aircraft Certification Service. and Office of Airports.

The FAA recognizes the significant importance of runway overrun prevention, and we determined that these actions, in combination with existing guidance, address the safety issues described in the Subject recommendations. Specifically, FAA Order 8900.1, Volume 3, Chapter 10, Section 1, Paragraph 3-277. Missed Approach/Go-Around Policy, Procedures and Training, provides guidance for determining a go-around or missed approach decision. This Order also provides guidance to inspectors of parts 91 K. 121, 125, 135, and 121 / 135 operators responsible for approving/accepting manuals and procedures. Additionally, SAFO 10005, Go-Around Callout and Immediate Response, published March 1, 2010, recommends that all operators provide written policy to flightcrews emphasizing that either pilot may make a go-around callout, and that the response to a go-around callout is an immediate missed approach. This SAFO is available at the following website: [https://www.faa.gov/other\\_visit/aviationindustry/airline\\_operators/airline\\_safety/safo/all\\_safos/media/2010/SAFO10005.pdf](https://www.faa.gov/other_visit/aviationindustry/airline_operators/airline_safety/safo/all_safos/media/2010/SAFO10005.pdf).

I believe that the FAA has effectively addressed these safety recommendations and consider our actions complete.

|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| From     | NTSB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| To       | FAA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Date     | 04/06/2015                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Type     | Official Correspondence                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Response | <p>In your last letter about these recommendations, you told us that you had drafted a notice directing POIs to review their assigned operators' training programs and manuals to ensure that they incorporate guidelines concerning the risks associated with tailwind landings, including tailwind landings on wet or contaminated runways as related to runway overrun prevention. We replied that such action would address Safety Recommendation A-11-94; however, we suggested that you also direct POIs to ensure during the review that operators had incorporated the specifics of Safety Recommendation A-11-92 into their flight crew training programs and manuals. We are curious about whether you still intend to issue a notice and, if so, whether the notice will address both safety recommendations. Pending our receipt and review of this additional information and completion of the recommended actions, Safety Recommendations A 11-92 and -94 remain classified OPEN—ACCEPTABLE RESPONSE.</p> |

From FAA  
To NTSB  
Date 02/05/2015  
Type Official Correspondence  
Response -From Michael P. Huerta, Administrator: The Federal Aviation Administration (FAA) issued Advisory Circular (AC) 91-79A, Mitigating the Risks of Runway Overrun Upon Landing, on September 17, 2014. This AC highlights strategies pilots may use to identify, understand, and mitigate risks associated with runway overruns during the landing phase of flight. It also provides detailed information that operators may use to develop company standard operating procedures to mitigate those risks. The AC was updated to include the following information related to this recommendation: • Paragraph 6(i), pages 7-8, highlights the effects of landing with a tailwind. Particular emphasis is given to the increased landing distances associated with such conditions, and the threat this creates for a runway overrun. This paragraph also provides specific examples that illustrate how dramatically a tailwind can increase landing distances, and the significant differences that may exist between aircraft types in terms of landing distances under tailwind conditions. The AC emphasizes the need for pilots to research the performance characteristics for the specific aircraft they operate. • Paragraph 60), pages 8-9, discusses landings on wet or contaminated runway surfaces. In addition to addressing the performance and planning considerations associated with such operations, the paragraph includes a table highlighting how many potential circumstances may combine to increase landing distances, which increases the likelihood of a runway overrun. One of the compounding factors in the table is a tailwind (element 5). Specifically, the table recommends increasing the anticipated landing distance by 21 percent for each 10 knots of tailwind. The AC is available on the FAA's Regulatory and Guidance Library Web site ([rgl.faa.gov](http://rgl.faa.gov)). I believe that the FAA has effectively addressed this recommendation and consider our actions complete.

From NTSB  
To FAA  
Date 09/06/2013  
Type Official Correspondence  
Response We note that the FAA has drafted a notice directing POIs to review their assigned operators' training programs and manuals to ensure that they

incorporate guidelines concerning the risks associated with tailwind landings, including tailwind landings on wet or contaminated runways as related to runway overrun prevention, as recommended in Safety Recommendations A-11-93 and -94. We believe that the FAA could also direct POIs to ensure, during this same review, that the contents of Safety Recommendation A-11-92 have been incorporated into their operators' flight crew training programs and manuals. Pending our receipt and review of (1) the revised AC and (2) issuance of a notice directing POIs to ensure that the items specified in these recommendations have been incorporated into airline training programs and manuals, Safety Recommendations A-11-92 through -94 remain classified OPEN—ACCEPTABLE RESPONSE.

From FAA  
To NTSB  
Date 06/06/2013  
Type Official Correspondence  
Response -From Michael P. Huerta, Administrator: The Federal Aviation Administration (FAA) has drafted a Notice and the revision to Advisory Circular (AC) 91-79. The revised AC primarily focuses on operations not covered by Safety Alert for Operators (SAFO) 06012, Landing Performance Assessments at Time of Arrival (Turbojets). It also expands its coverage to all airplanes, not just turbine-powered airplanes. The Notice, which will be published after the advisory circular, will direct all principal operations inspectors to evaluate their assigned operators' pilot training programs to determine if the provisions of AC 91-79, as revised, have been appropriately incorporated. The AC and Notice are in internal review and we expect to issue them later this Year. I will keep the Board informed of the FAA's progress on this safety recommendation and provide an update by October 31, 2013.

From NTSB  
To FAA  
Date 04/30/2012  
Type Official Correspondence  
Response The FAA is developing a notice directing POIs and Part 142 training center program managers to review the training programs of their respective operators and training organizations. The review will ensure that the training programs include both the items specified in the recommendations and the contents of the revisions to AC 91-79. Pending

issuance of the notice, Safety Recommendations A-11-92 and -94 are classified OPEN—ACCEPTABLE RESPONSE.

From FAA  
To NTSB  
Date 02/17/2012  
Type Official Correspondence  
Response -From Michael P. Huerta, Acting Administrator: The Federal Aviation Administration (FAA) plans to develop a Notice advising principal operations inspectors (POIs) and Title 14, Code of Federal Regulations (14 CFR) part 142 training center program managers to review their respective operators' and training organizations' training programs. this review would focus on the programs' curricula to ensure the operators have included, to the extent possible, tailwind landings, the increased landing distance associated with tailwind landings, appropriate landing configurations, and the importance of touching down within the touchdown zone of the landing runway. Emphasis would be placed on the execution of a go-around should the aircraft not touch down in the touchdown zone; it would also be emphasized that either the pilot or the co-pilot could execute or call for a go-around.

In the interim, the FAA has contacted American Airlines, Delta Airlines, Southwest Airlines, United Airlines, JetBlue Airlines, and US Airways. These air carriers have assured us that tailwind landing training, at the maximum tailwind component permitted by their respective operations' specifications, has been incorporated into their current training curricula.

# **ATTACHMENT 2**

## Safety Recommendation A-11-094

TO THE FEDERAL AVIATION ADMINISTRATION: Once Advisory Circular 91-79, "Runway Overrun Prevention," has been revised, require principal operations inspectors to review airline training programs and manuals to ensure they incorporate the revised guidelines concerning tailwind landings.

### Recommendation Details

 [Original recommendation transmittal letter](#)

|                     |                                                                                                                |
|---------------------|----------------------------------------------------------------------------------------------------------------|
| Overall status      |  Closed - Unacceptable Action |
| Mode                |  Aviation                     |
| On Most Wanted List | No                                                                                                             |
| Priority level      | Non-urgent                                                                                                     |
| Times reiterated    | 0                                                                                                              |
| Is hazmat           | No                                                                                                             |
| Is NPRM             | No                                                                                                             |
| SR coding           |                                                                                                                |
| Date issued         | 12/07/2011                                                                                                     |
| Overall date closed | 08/07/2018                                                                                                     |

### Event Details - DCA10RA017

On December 22, 2009, about 2222 eastern standard time, American Airlines flight 331, a Boeing 737-800, N977AN, ran off the departure end of runway 12 after landing at Norman Manley International Airport (KIN) Kingston, Jamaica. The aircraft landed approximately 4,000 feet down the 8,911-foot-long, wet runway with a 14-knot tailwind component and was unable to stop on the remaining runway length. After running off the runway end, it went through a fence, across a road, and came to a stop on the sand dunes and rocks above the waterline of the Caribbean Sea adjacent to the road. No fatalities or postcrash fire occurred. Eighty-five of the 154 occupants (148 passengers, 4 flight attendants, and 2 pilots) received injuries ranging from minor to serious. The airplane was substantially damaged. Instrument meteorological conditions and heavy rains prevailed at the time of the accident flight, which originated at Miami, Florida, on an instrument flight rules flight plan.

During flight 331's approach to KIN, air traffic control (ATC) advised the flight crew that it may be necessary to circle to land on runway 30 and indicated a wind from 320° at 10 knots. The flight crewmembers acknowledged the wind information and informed ATC

of their intent to do a straight-in approach to runway 12. The KIN tower then indicated a wind direction of 320° at 14 knots and asked if the flight crew still wanted to land on runway 12. The flight crew confirmed runway 12, and the tower then advised that the runway was wet. The flight crew configured the airplane to land with a flap setting of 30° rather than the full flap setting of 40°. Both flight crewmembers later reported that they felt the airplane float<sup>5</sup> prior to touchdown. Neither pilot called for a go-around at any point during the approach and landing.

Location            Kingston, Jamaica  
Accident date    12/22/2009  
Accident #        DCA10RA017  
Report #

## Addressee Details

 FAA - Closed - Unacceptable Action - 08/07/2018 ^

Name                FAA  
Acronym            FAA  
Category            Federal Government  
Addressee status   Closed - Unacceptable Action

From                NTSB  
To                    FAA  
Date                08/07/2018  
Type                Official Correspondence  
Response    As a result of our investigation of the American Airlines flight 331 accident, we issued and Reiterated several recommendations related to preventing runway overruns when landing, including issues related to no-fault go-around policies, and the effective use of formalized landing distance assessments prior to landing. We issued Safety Recommendations A-11-92 through -94 because we concluded that training pilots for tailwind landings would better prepare them to mitigate the risk of runway overruns when landing in tailwind conditions. These recommendations were also based on our conclusion that, because the dynamics of a tailwind approach and landing—particularly on wet or contaminated runways—expose flight crews to additional risks and challenges, pilots should be provided current and comprehensive guidance regarding the risks and made aware of the reduced margins of safety during tailwind landing operations.

On June 6, 2013, you sAdresseeld that you had drafted a notice that would be published after you revised advisory circular (AC) 91-79, "Runway Overrun Prevention," as we recommended in Safety Recommendation A 11 93. The notice would direct all POIs to evaluate their assigned operators' pilot training programs to determine if the provisions of AC 91-79, as revised, had been appropriately incorporated. On September 6, 2013, we replied that the notice should cover the contents of both Safety Recommendations A-11-92 and -94 and, pending issuance of such a notice, Safety Recommendations A-11-92 and -94 were classified "Open—Acceptable Response."

On September 14, 2014, you published AC 91-79A, which revised AC 91-79 to highlight strategies pilots may use to identify, understand, and mitigate risks associated with runway overruns during the landing phase of flight, including issues related to tailwind landings. As a result, on April 6, 2015, Safety Recommendation A-11-93 was classified "Closed—Acceptable Action." At that time, we also sAdresseeld that action to satisfy Safety Recommendations A 11 92 and 94 depended on you issuing the notice for POIs to ensure that tailwind landing information in the AC was incorporated into the training programs and manuals of the POI's assigned carrier.

We note that, after further consideration, you determined that the notice could also address the recommendations of your takeoff and landing performance assessment aviation rulemaking committee (TALPA ARC) concerning operations on contaminated runways. Your determination was based on preventing runway overruns and your belief that the TALPA ARC recommendations complement the intent of Safety Recommendations A-11-92 and -94 by improving runway condition assessments, which can effectively anticipate airplane braking performance. On August 1, 2016, you published Notice 8900.375, "Procedures for Reducing the Risk of Runway Overrun (TALPA)," which provides guidance to POIs on program policies and procedures for operator and certificate-holder procedures to reduce the risk of runway overrun. Your letter also discussed FAA Order 8900.1, volume 3, chapter 10, section 1, paragraph 3 277, "Missed Approach/Go-Around Policy, Procedures and Training," which provides guidance to your POIs for determining the adequacy of a carrier's procedures related to go-around and missed-approach decisions.

We agree with you on the importance of preventing runway overruns. The notice, TALPA ARC recommendations, sections of Order 8900.1, and related safety alerts for operators discussed in your letter all address

preventing runway overruns; however, none of them addresses tailwind landings, an important issue that we have identified in our runway overrun accident investigations. Although these other issues have been the Subject of other recommendations that we have issued, we issued Safety Recommendations A-11-92 and -94 because being prepared to safely land in a tailwind is also important in preventing runway overruns. Our review of Notice 8900.375 did not find any mention of tailwind landings, nor any discussion related to Safety Recommendations A-11-92 and -94. We do not agree that you have effectively addressed these safety recommendations, but, because you sAdresseeld that you regard your

actions as complete and plan no further action, Safety Recommendations A-11-92 and -94 are classified CLOSED--UNACCEPTABLE ACTION.

From FAA  
To NTSB  
Date 06/11/2018  
Type Official Correspondence  
Response -From Daniel K. Elwell, Acting Administrator: In our letter to the Board dated June 6, 2013, the Federal Aviation Administration (FAA) noted that we drafted a Notice to be published after the revision to Advisory Circular (AC) 91-79. The Notice was intended to direct all principal operations

inspectors to evaluate their assigned operators' pilot training programs to determine if the provisions of the AC were appropriately incorporated. However, after further consideration. We determined that this Notice could also act as a vehicle to address recommendations issued by the Takeoff and Landing Performance Assessment (TALPA) Aviation Rulemaking Committee (ARC). We understand the criticality of runway overrun prevention. and the TALPA recommendations complement the intent of the Board's recommendations addressed in this letter by creating an improved way of assessing runway conditions, which provides an aircraft operator effective means to anticipate airplane braking performance.

On August 1, 2016, we published Notice 8900.375, Procedures for Reducing the Risk of Runway Overrun (TALPA). which provides guidance to the FAA's aviation safety inspectors (ASJs) on program policies and procedures for operator and certificate holder procedures to reduce the risk of runway overrun. This Notice incorporates AC 91-79A, Mitigating the Risks of a Runway Overrun Upon Landing, which primarily focuses on

operations not covered by Safety Alert for Operators (SAFO) 06012. Landing Performance Assessments at Time of Arrival (Turbojets). This AC highlights strategies pilots may use to identify, understand, and mitigate risks associated with runway overrun during the landing phase of flight. It also provides detailed information that operators may use to develop company standard operating procedures to mitigate those risks.

This Notice is available at the following website:

[http://www.faa.gov/documentLibrary/media/Notice/N\\_8900\\_375.pdf](http://www.faa.gov/documentLibrary/media/Notice/N_8900_375.pdf).

Notice 8900.375 primarily applies to:

- The FAA 's Flight Standards District Offices;
- Certificate-holding district Office principal operations inspectors responsible for determining the acceptability and approval (as applicable) of procedures submitted to them for operations under Title 14, Code of Federal Regulations (14 CFR) Parts 121 , 125 (including part 125 Letter of Deviation Authority holders), 135, and 91 subpart K;
- Training Center program managers and other ASJs responsible for approval and surveillance of training programs for 14 CFR part 142 training centers; and
- The FAA's Flight Standards Service.

Additionally, on August 11, 2015, we published SAFO 15009, Turbojet Braking Performance on Wet Runways. which warns airplane operators and pilots that the advisory data for wet runway landings may not provide a safe stopping margin under all conditions. This SAFO is available at the following website:

[https://www.faa.gov/othervisit/aviation\\_industry/airline\\_operators/airlinesafety/safo/all\\_safos/media/2015/SAFO\\_15009.pdf](https://www.faa.gov/othervisit/aviation_industry/airline_operators/airlinesafety/safo/all_safos/media/2015/SAFO_15009.pdf).

Beginning October 1, 2016, we required all federally obligated airports to use TALPA procedures to assess runway conditions and report those conditions in newly formatted Field Condition Notices to Airmen in accordance with the TALPA ARC recommendations. This allowed pilots and flight planners to use the information, along with manufacturers' aircraft specific data, to determine the runway length needed to safely stop an aircraft after a rejected takeoff or a landing. This implementation required development of policies, procedures, and coordination across several lines of business, including the FAA's Flight Standards Service. Air Traffic Control, Aircraft Certification Service. and Office of Airports.

The FAA recognizes the significant importance of runway overrun prevention, and we determined that these actions, in combination with

existing guidance, address the safety issues described in the Subject recommendations. Specifically, FAA Order 8900.1, Volume 3, Chapter 10, Section 1, Paragraph 3-277. Missed Approach/Go-Around Policy, Procedures and Training, provides guidance for determining a go-around or missed approach decision. This Order also provides guidance to inspectors of parts 91 K. 121, 125, 135, and 121 / 135 operators responsible for approving/accepting manuals and procedures. Additionally, SAFO 10005, Go-Around Callout and Immediate Response, published March 1, 2010, recommends that all operators provide written policy to flightcrews emphasizing that either pilot may make a go-around callout, and that the response to a go-around callout is an immediate missed approach. This SAFO is available at the following website: [https://www.faa.gov/other\\_visit/aviationindustry/airline\\_operators/airline\\_safety/safo/all\\_safos/media/2010/SAFO10005.pdf](https://www.faa.gov/other_visit/aviationindustry/airline_operators/airline_safety/safo/all_safos/media/2010/SAFO10005.pdf).

I believe that the FAA has effectively addressed these safety recommendations and consider our actions complete.

From NTSB  
To FAA  
Date 04/06/2015  
Type Official Correspondence  
Response In your last letter about these recommendations, you told us that you had drafted a notice directing POIs to review their assigned operators' training programs and manuals to ensure that they incorporate guidelines concerning the risks associated with tailwind landings, including tailwind landings on wet or contaminated runways as related to runway overrun prevention. We replied that such action would address Safety Recommendation A-11-94; however, we suggested that you also direct POIs to ensure during the review that operators had incorporated the specifics of Safety Recommendation A-11-92 into their flight crew training programs and manuals. We are curious about whether you still intend to issue a notice and, if so, whether the notice will address both safety recommendations. Pending our receipt and review of this additional information and completion of the recommended actions, Safety Recommendations A-11-92 and -94 remain classified OPEN—ACCEPTABLE RESPONSE.

From FAA  
To NTSB

Date 02/05/2015

Type Official Correspondence

Response -From Michael P. Huerta, Administrator: The Federal Aviation Administration (FAA) issued Advisory Circular (AC) 91-79A, Mitigating the Risks of Runway Overrun Upon Landing, on September 17, 2014. This AC highlights strategies pilots may use to identify, understand, and mitigate risks associated with runway overruns during the landing phase of flight. It also provides detailed information that operators may use to develop company standard operating procedures to mitigate those risks. The AC was updated to include the following information related to this recommendation: • Paragraph 6(i), pages 7-8, highlights the effects of landing with a tailwind. Particular emphasis is given to the increased landing distances associated with such conditions, and the threat this creates for a runway overrun. This paragraph also provides specific examples that illustrate how dramatically a tailwind can increase landing distances, and the significant differences that may exist between aircraft types in terms of landing distances under tailwind conditions. The AC emphasizes the need for pilots to research the performance characteristics for the specific aircraft they operate. • Paragraph 6(j), pages 8-9, discusses landings on wet or contaminated runway surfaces. In addition to addressing the performance and planning considerations associated with such operations, the paragraph includes a table highlighting how many potential circumstances may combine to increase landing distances, which increases the likelihood of a runway overrun. One of the compounding factors in the table is a tailwind (element 5). Specifically, the table recommends increasing the anticipated landing distance by 21 percent for each 10 knots of tailwind. The AC is available on the FAA's Regulatory and Guidance Library Web site ([rgl.faa.gov](http://rgl.faa.gov)). I believe that the FAA has effectively addressed this recommendation and consider our actions complete.

From NTSB

To FAA

Date 09/06/2013

Type Official Correspondence

Response We note that the FAA has drafted a notice directing POIs to review their assigned operators' training programs and manuals to ensure that they incorporate guidelines concerning the risks associated with tailwind landings, including tailwind landings on wet or contaminated runways as related to runway overrun prevention, as recommended in Safety Recommendations A-11-93 and -94. We believe that the FAA could also

direct POIs to ensure, during this same review, that the contents of Safety Recommendation A-11-92 have been incorporated into their operators' flight crew training programs and manuals. Pending our receipt and review of (1) the revised AC and (2) issuance of a notice directing POIs to ensure that the items specified in these recommendations have been incorporated into airline training programs and manuals, Safety Recommendations A-11-92 through -94 remain classified OPEN—ACCEPTABLE RESPONSE.

From FAA  
To NTSB  
Date 06/06/2013  
Type Official Correspondence  
Response -From Michael P. Huerta, Administrator: The Federal Aviation Administration (FAA) has drafted a Notice and the revision to Advisory Circular (AC) 91-79. The revised AC primarily focuses on operations not covered by Safety Alert for Operators (SAFO) 06012, Landing Performance Assessments at Time of Arrival (Turbojets). It also expands its coverage to all airplanes, not just turbine-powered airplanes. The Notice, which will be published after the advisory circular, will direct all principal operations inspectors to evaluate their assigned operators' pilot training programs to determine if the provisions of AC 91-79, as revised, have been appropriately incorporated. The AC and Notice are in internal review and we expect to issue them later this Year.

I will keep the Board informed of the FAA's progress on this safety recommendation and provide an update by October 31, 2013.

From NTSB  
To FAA  
Date 04/30/2012  
Type Official Correspondence  
Response The FAA is developing a notice directing POIs and Part 142 training center program managers to review the training programs of their respective operators and training organizations. The review will ensure that the training programs include both the items specified in the recommendations and the contents of the revisions to AC 91-79. Pending issuance of the notice, Safety Recommendations A-11-92 and -94 are classified OPEN—ACCEPTABLE RESPONSE.

From FAA  
To NTSB  
Date 02/17/2012  
Type Official Correspondence  
Response -From Michael P. Huerta, Acting Administrator: The FAA plans to develop a Notice directing all POIs to evaluate their assigned operators' pilot training programs to determine if the provisions of AC 91-79, as revised, have been appropriately incorporated.

In the interim, the FAA has contacted American Airlines, Delta Airlines, Southwest Airlines, United Airlines, JetBlue Airlines, and US Airways. These air carriers have assured us that tailwind landing training, at the maximum tailwind component permitted by their respective operations' specifications, has been incorporated into their current training curricula.