U.S. Department
of Transportation
Federal Aviation
Administration

SAFO

Safety Alert for Operators

SAFO 19001
DATE: 3/11/19

Flight Standards Service
Washington, DC

http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/safo

A SAFO contains important safety information and may include recommended action. SAFO content should be especially valuable to air carriers in meeting their statutory duty to provide service with the highest possible degree of safety in the public interest. Besides the specific action recommended in a SAFO, an alternative action may be as effective in addressing the safety issue named in the SAFO.

Subject: Landing Performance Assessments at Time of Arrival

Purpose: This SAFO replaces cancelled SAFO 06012 and provides recommendations for airplane operators at airports reporting runway conditions following the procedures in AC 150/5200-30 (Airport Field Condition Assessments and Winter Operations Safety). This information is provided to assist operators in developing methods to ensure sufficient landing distance exists to safely make a full stop landing.

Background: After a Boeing 737-700 runway overrun accident at Chicago Midway Airport in December 2005, the FAA convened the Takeoff and Landing Performance Assessment (TALPA) Aviation Rulemaking Committee (ARC). The Federal Aviation Administration (FAA) adopted certain recommendations of the ARC (which became known as "TALPA"), and implemented them into the National Airspace System on October 1, 2016. This SAFO provides information and guidelines to airplane operators on utilizing the safety benefits TALPA provides.

Applicability: This SAFO is applicable to all Title 14 of the Code of Federal Regulations (14 CFR) part 121, part 125, part 135, and part 91 airplane operators. This guidance is independent of the preflight landing distance-planning requirements of §§ 121.195, 135.385, and 91.1037.

Terminology: The following terms are specific to this guidance and may differ with definitions contained in other published references.

a. Landing Distance at Time of Arrival. These distances are advisory performance data (i.e., not required by regulation) intended to provide a more accurate assessment of actual landing distance at time of arrival, considering factors that cannot be accurately predicted at time of preflight, such as runway contaminants, winds, speed additives, and touchdown points. These distances may be based upon the use of reverse thrust, ground spoilers, autobrakes, etc.

b. Pilot Braking Action Report. A Pilot Report (PIREP) reflecting the brake contribution to the airplane's deceleration. A PIREP Braking Action Report reflects the pilots' impression of the available wheel braking. The report may also be based on directional control feedback. The parameters are as follows;

- Good – Braking deceleration is normal for the wheel braking effort applied, and directional control is normal.

- Good to Medium – Braking deceleration OR directional control is between Good and Medium; i.e. Braking deceleration is between "normal and noticeably reduced for the wheel braking effort applied" AND "directional control is between normal and noticeably reduced".

- Medium – Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.

- Medium to Poor – Braking deceleration OR directional control is between Medium and Poor; i.e., Braking deceleration is between "noticeably reduced and significantly reduced for the wheel braking effort applied" AND "directional control is between noticeably reduced and significantly reduced".

- Poor – Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.

- Nil – Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain.

c. Reliable Braking Action Report. Items to be considered to determine if the braking action report is reliable:

- Similar weight and class of airplane. An example would be the Boeing 737 and Airbus 320, where the weight and gear track are similar.
- Time since braking action report was given. For example, stable conditions with cold temperature and no active precipitation will likely be reliable for a longer time than reports provided during an active precipitation event with temperatures near 0-degrees Celsius.

d. Airplane Ground Deceleration Devices. Any devices used to aid in the onset or rate of airplane deceleration on the ground during the landing roll out. These would include, but are not limited to: brakes (either manual braking or autobrakes), spoilers, and thrust reversers.

e. At Time of Arrival. For the purpose of this guidance, Time of Arrival is a point in time close enough to the airport to allow the crew to obtain the most current meteorological and runway surface conditions considering pilot workload and traffic surveillance, but no later than the commencement of the approach procedures or visual approach pattern.

f. Landing Distance Available. The length of the runway declared available and suitable for landing an aircraft.

g. Runway Surface Conditions. The state of the runway surface: dry, wet, or contaminated.

- A dry runway is one that is clear of contaminants and visible moisture within the required length and the width being used.

- A wet runway is one that is neither dry nor contaminated.
- A contaminated runway is one where the runway surface conditions report includes the type and depth (if applicable) of the substance on the runway surface (e.g., water, dry snow, wet snow, slush, ice, frost, sanded, or chemical treatment).

The FAA acknowledges that there are situations where the flightcrew needs to know the absolute performance capability of the airplane. These situations include abnormal configurations of the airplane or during emergencies such as engine failure or flight control malfunctions. In such circumstances, the pilot must consider whether it is safer to remain in the air or to land immediately and should know the actual landing performance capability (without an added safety margin) when making these evaluations. This guidance is not intended to curtail such evaluations from being made for these situations (e.g., a pilot in command's (PIC) authority to exercise § 91.3(b).

h. Unfactored Certificated Airplane Flight Manual (AFM) Landing Distance. The landing distance required by § 25.125 without any factors applied. This landing distance is based on dry runway wheel braking and does not need to include runway slope or air temperature accountability, or approach speed additives. It may be based on aggressive flight test techniques when determining the air distance, and does not take credit for reverse thrust or account for the effect of autobrakes. The Unfactored Certified AFM Landing Distance may be used with the factors from Table 1 below to determine a factored time of arrival landing distance.

Discussion: The TALPA ARC was formed in 2008 to address issues associated with landing operations at the time of arrival and with takeoff on non-dry, non-wet runways. The committee consisted of airport operators, aircraft operators, aircraft manufacturers as well as their FAA and other regulatory agency counterparts.

a. The TALPA ARC discovered significant gaps in information needed to determine if a safe landing can be made. The ARC produced consistent terminology and runway assessment criteria, and recommended usage of non-dry, non-wet performance data for takeoff and time of arrival landing calculations. The TALPA ARC did not recommend any changes in the *preflight* landing distance requirements.

b. The following ACs and Orders were revised or created in support of the TALPA ARC implementation:

1. AC 150/5200-30D, Airport Field Conditions Assessments and Winter operations Safety
2. AC 150/5200-28F, Notices to Airmen (NOTAMs) for Airport Operators
3. AC 25-31, Takeoff Performance Data for Operations on Contaminated Runways
4. AC 25-32, Landing Performance Data for Time-of-Arrival Landing Performance Assessments
5. AC 91-79a, Mitigating the Risks of a Runway Overrun Upon landing
6. FAA Order 7930.2R Notices to Airmen (NOTAMs)
7. FAA Order 8900.1 Volume 4 Chapter 3 Section 1 Safety Assurance System: Airplane Performance Computation Rules, paragraph 4-494 Takeoff From a Runway which is Wet or Contaminated, and paragraph 4-503 Landing Distances at the Time of Arrival.
8. SAFO 15009 Turbojet Braking Performance on Wet Runways

These references may be consulted for definitions, Runway Condition Assessment Matrix (RCAM), Runway Condition Code (RwyCC) assignments etc.

c. 14 CFR part 139 certificated and/or federally obligated airports use the procedures in AC 150/5200-30D to report runway surface conditions when they are not dry. These conditions may be reported using the RCAM in AC 150/5200-30D, when airport operators receive pilot braking action reports, or when surface conditions are other than dry. Friction measuring equipment values are no longer used to determine and report surface conditions because joint industry and multi-national government tests have not established a reliable correlation between runway friction values and the relationship to airplane braking performance.

d. The basis for time of arrival landing distance as defined by the TALPA ARC reflects the recommended method of operationally landing and stopping an airplane in service. As such, it accounts for and quantifies many of the factors that may not be explicitly accounted for in the certificated (AFM) landing distance. Subparagraphs c. and d. Landing Distance Assessment at Time of Arrival (below) list the runway condition and aircraft performance factors that should be used for the time of arrival landing distance calculation.

e. Sections 121.195, 135.385 and 91.1037 wet or slippery landing data may not provide adequate runway length for landing on a wet or contaminated surface. Operators, through performance analysis, should identify those airports and aircraft that may be affected. In those cases, operators should take appropriate action to ensure the flightcrew will have sufficient runway for the conditions expected at the estimated time of arrival.

Landing Distance Assessment at Time of Arrival. There is no specific regulation requiring operators to assess landing distance requirements at time of arrival, however the FAA encourages operators to adopt such procedures to ensure that a safe landing can be made. Additionally, the FAA highly encourages operators to use their FAA-approved landing performance data and any associated manufacturer-provided supplemental/advisory data in concert with the AC 91-79-generated RCAM Braking Action Codes to conduct an adequate landing distance assessment at the time of arrival. This is particularly important when the landing runway is contaminated or not the same runway analyzed for preflight calculations. The following are best practices for conducting a landing distance assessment at time of arrival.

a. Timeliness. An assessment is initially performed when landing weather and field conditions are obtained, usually around Top of Descent (TOD). It is important to note the time of the latest Field Condition report and any associated reliable braking action reports. A number of overruns have occurred when pilots were provided with a runway condition that was no longer reliable given changes in meteorological conditions. Pilots are strongly advised to review the weather conditions and compare that to the time of the latest braking action report. The assessment should include consideration of how much deterioration in field conditions can be tolerated, the minimum RwyCC(s), and Field Condition (FICON) or Braking Action Reports needed to safely land, should those factors deteriorate from the ones used in the TOD landing distance

b. Source of Data. When possible, the Operational Landing Distance data used is advisory data based on the recommendations of AC 25-32. This data may be provided by the manufacturer. If it is not provided by the manufacturer, data developed by a performance data provider may be used.

1. If advisory data for a landing distance assessment at time-of-arrival is not available from the manufacturer, performance provider data may be used. If performance-provider data is not available, the landing distance factors (LDF) from Table 1, Landing Distance Factors, may be used. To find the Landing Distance Required (LDR), multiply the certificated (i.e., AFM dry, *unfactored*) Landing Distance by the applicable LDF in Table 1 for the runway conditions existing at the time of arrival. If the AFM landing distances are presented as *factored* landing distances, then those data must be adjusted to remove the applicable preflight factors applied to that data. The LDFs given in Table 1 include a 15 percent safety margin, an air distance representative of normal operational practices, a reasonable accounting for temperature, the effect of increased approach speed, reduced wheel braking, reverse thrust usage (or not), the additional effect of reduced wheel braking capability on altitude and wind distance adjustment.

2. Currently, the Small Airplane Directorate does not plan to provide aircraft manufacturers with advisory information similar to AC 25-32. In the absence of guidance to manufacturers of part 23 aircraft, Operational Landing Distance data may be based on the recommendations of AC 25-32. This data may be provided by the manufacturer or developed by a performance data provider if manufacturer data is not available. In the absence of guidance to part 23 aircraft manufacturers, the manufacturer or data provider may consider the recommendations in AC 25-32 when creating data for a time-of-arrival assessment. Manufacturer-provided guidance on the use of existing data with the runway condition codes (RwyCC) must be used when available.

Table 1. Landing Distance Factors

The following are multipliers to the unfactored certificated (AFM) landing distances

	Runway Condition Code						
Braking Action	6 (Dry)	5 Grooved /PFC Good	5 Smooth Good	4 Good to Medium	3 Medium	2 Medium to Poor	1 Poor
Turbojet, No Reverse	1.67	2.3	2.6	2.8	3.2	4.0	5.1
Turbojet, With Reverse	1.67	1.92	2.2	2.3	2.5	2.9	3.4
Turboprop Note 1	1.67	1.92	2.0	2.2	2.4	2.7	2.9
Reciprocating	1.67	2.3	2.6	2.8	3.2	4.0	5.1

Note 1: These LDFs apply only to turboprops where the AFM provides for a landing distance credit for the use of ground idle power lever position. Turboprops without this credit should use the Turbojet, No Reverse LDFs.

c. Runway Condition Considerations. When available for the portion of the runway that will be used for landing, the following are considered:

1) Runway condition code (RwyCC).
2) Expected runway conditions (contaminate type and depth).
3) Pilot braking action report.

d. Aircraft Performance Considerations. The following considerations may impact operational landing distance calculations:

1) Runway slope,
2) Airport elevation,
3) Wind,
4) Temperature,
5) Airplane weight and configuration,
6) Approach speed at threshold,
7) Adjustment to landing distance (such as autoland), and
8) Planned use of airplane ground deceleration devices.

e. Safety Margin. The operational landing distance (OLD) used for a time of arrival landing assessment includes a safety margin of at least 15 percent when based on manual wheel braking.

f. Autobrake Usage. While autobrakes are part of the aircraft's landing configuration, the landing distance assessment is not intended to force higher than necessary autobrake selection. For operations when the runway is dry or wet if the manual braking distance provides a 15 percent safety margin, then the braking technique may include a combination of autobrakes and manual braking even **IF** the selected autobrake landing data does not provide a 15 percent safety margin.

g. Touchdown Point. The touchdown point used in the performance data assessment reflects the assumed air distance. Operational landing data usually includes an allowance for 1,500 feet or 7 seconds of air distance from the threshold to touchdown. An air distance as short as 1,000 feet may be used **IF** an operator's landing assessment procedures include enhancements to minimize the risk of overruns or undershoots, including:

1) Training in touchdown control and short field landing techniques.
2) Identification of required touchdown point and training to assure go-around procedures are initiated if unable to achieve a suitable touchdown point.
3) Approach guidance and runway markings on the specific runway are consistent with a shorter air distance.
4) Operational data (without the need for interpolation) are provided to the crew for the specific runway, conditions, and aircraft landing configuration.
5) The flight techniques assumed in the creation of the performance data used for a shorter air distances are based on flight techniques to be used in the shorter air distance operation.

For example, the assumed speed bleed off used in the performance data needs to be consistent with the trained flight techniques for flaring the aircraft.

NOTE: If no other information is available, the autoland or other similar low visibility guidance system may be assumed to be consistent with the 7 second air distance.

h. Assessment Based on Preflight Criteria. When the runway is dry, or when the runway is wet and grooved or PFC, the assessment for turbojet airplanes with thrust reversers and turboprop airplanes with a landing distance credit for the use of ground idle may be as simple as confirming that the runway meets the criteria used for preflight.

i. Documentation and Training. Published material and training material include the assumptions and limitations on the use of data provided to do a landing distance assessment at the time of arrival.

1) The operator's flightcrew and dispatcher (part 121 Operations) training programs should include elements that provide knowledge in all aspects and assumptions used in landing distance performance determinations. This training should emphasize the airplane ground deceleration devices, settings, and piloting methods (e.g., air distance) used in determining landing distances for each make, model, and series of airplane. Elements such as braking action reports, airplane configuration, optimal stopping performance techniques, stopping margin, the effects of excess speed, delays in activating deceleration devices, and other pilot performance techniques should be addressed. All dispatchers and flightcrew members should be trained on these elements prior to operating on contaminated runway surfaces. This training should be accomplished in a manner consistent with the operator's methods for conveying similar knowledge to flight operations personnel. It may be conducted via operations/training bulletins or extended learning systems, if applicable to the operator's current methods of training.

2) Procedures for obtaining optimal stopping performance on contaminated runways should be included in flight training programs. All flight crewmembers should be made aware of these procedures for the make/model/series of airplane they operate. This training should be accomplished in a manner consistent with the operator's methods for conveying similar information to flight operations personnel. It may be conducted via operations/training bulletins or extended learning systems, if applicable to the operator's current methods of training. In addition, if not already included, these procedures should be incorporated into each airplane or simulator training curriculum for initial qualification on the make/model/series airplane, or differences training as appropriate. All flight crewmembers should have hands-on training and validate proficiency in these procedures during their next flight training event unless previously demonstrated with their current employer in that make/model/series of airplane.

Recommended Action: Directors of safety and directors of operations (part 121); directors of operations (part 135, and 125), program managers, (part 91K), and pilots (part 91) should take appropriate action within their operation to address the safety concerns with landing performance on wet or contaminated runways discussed in this SAFO. Operators should develop procedures for flightcrews to assess landing

performance based on conditions existing at time of arrival, distinct from conditions forecast prior to departure. Those conditions may include weather, Runway Condition Code (RwyCC) (if provided), FICON report (if provided), the airplane's weight, braking systems to be used, and any other conditions the operator deems necessary to conduct a safe landing, such as Pilot Reports of Braking action. Once the actual landing distance is determined at the time of arrival, an additional safety margin of at least 15 percent should be added to actual landing distance. Except under emergency conditions flight crews should not attempt to land on runways that do not meet the assessment criteria and safety margins as specified in this SAFO.

Contact: Questions or comments regarding this SAFO should be directed to the Air Transportation Division at 202-267-8166.