The Honorable Carolyn Lerner  
Special Counsel  
U.S. Office of Special Counsel  
1730 M Street NW, Suite 218  
Washington, DC 20036

Re: OSC File No. DI-16-2708

Dear Ms. Lerner:

By letter dated December 6, 2016, you referred for investigation a disclosure regarding an air traffic control procedure at Minneapolis St. Paul International Airport (MSP), which was submitted by an anonymous whistleblower presumed to be employed by the Federal Aviation Administration (FAA) at MSP.

The whistleblower alleged that: (1) FAA’s current mandated policy for landing and departing aircraft is not suited for use with MSP’s unique runway configuration and increases the likelihood of aircraft collisions; and (2) FAA management had been made aware of these safety concerns but has taken no action to adjust the policy for MSP’s configuration. The complainant maintained that the current arrival-descent window (ADW) procedure for Converging Runway Operations (CRO) at MSP is unsafe.

I delegated investigation of these allegations to FAA’s Office of Audit and Evaluation (AAE). Enclosed is FAA’s Report of Investigation (ROI). Our independent investigation found no safety risk or danger to public safety and no violation of an FAA Order or policy associated with either allegation. On the contrary, ADW procedures at MSP and elsewhere are a significant enhancement to safety and were developed and implemented by the FAA in response to a safety recommendation by the National Transportation Safety Board (NTSB).

The very purpose of the ADW procedure is to prevent potential conflicts between arriving and departing traffic while an arrival is within the ADW. The ADW procedure defines the appropriate geometry between aircraft leaving the departure end of the runway should the arrival aircraft execute a missed approach.

MSP is not unique in using ADW procedures for CRO operations as the whistleblower alleges. CRO mitigations, associated tools, and technology were developed as the result of a 2011 Air Traffic Organization (ATO) investigation of missed approach go-arounds, and a July 2013 NTSB recommendation that the FAA establish separation standards between any arriving aircraft, which may initiate a missed approach, and any combination of arriving or departing
The Honorable Carolyn Lerner

aircraft operating on non-intersecting converging runways where arrival or departure paths could possibly converge.

Twelve major airports have implemented ADW procedures for CRO operations, including Memphis and Las Vegas, both with runway configurations similar to MSP. Since ADW procedures for CRO operations have been implemented at MSP, no conflicts have occurred when the proper procedures were utilized. By all objective evidence, ADW procedures have resulted in a significant safety enhancement. The NTSB has accepted FAA's actions and closed the safety recommendation.

I appreciate the opportunity to review this important matter.

Sincerely,

Anthony R. Foxx

Enclosures
Federal Aviation Administration
Report of Investigation
To the Secretary of Transportation

In response to:

U.S. Office of Special Counsel (OSC)
File DI-16-2708

Director, Office of Audit and Evaluation (AAE-1)
Federal Aviation Administration
Washington, D.C.

January 9, 2017
Executive Summary

Secretary of Transportation Anthony Foxx directed the Federal Aviation Administration (FAA), Office of Audit and Evaluation (AAE) to investigate a U.S. Office of Special Counsel (OSC) whistleblower disclosure (OSC File No. DI-16-2708) referred on December 6, 2016. AAE is an independent FAA organization with the statutory authority to conduct impartial investigations of aviation safety-related whistleblower disclosures. This disclosure, regarding an air traffic control procedure at Minneapolis St. Paul International Airport (MSP), was submitted by an anonymous whistleblower presumed to be employed by the FAA at MSP.

The complainant alleged that: (1) FAA’s current mandated policy for landing and departing aircraft is not suited for use with MSP’s unique runway configuration and increases the likelihood of aircraft collisions; and (2) FAA management had been made aware of these safety concerns but has taken no action to adjust the policy for MSP’s configuration. The complainant suggested that the current arrival-descent window (ADW) procedure for Converging Runway Operations (CRO) at MSP is unsafe.

Our independent investigation found no safety risk, no danger to public safety, and no violation of an FAA Order or policy associated with either allegation. On the contrary, ADW procedures at MSP and elsewhere are a significant enhancement to safety and were developed and implemented by the FAA in response to a safety recommendation by the National Transportation Safety Board (NTSB).

The OSC referral states that “generally airports have separate, dedicated departure and arrival runways,” but that is an erroneous assertion. Virtually all major airports must frequently utilize simultaneous takeoffs and landings on each runway to accommodate traffic demand and environmental conditions. When traffic and weather conditions allow, dedicated arrival and departure runways are sometimes utilized during lighter traffic periods. However, the exclusive use of dedicated arrival and departure runway operations would dramatically reduce U.S. airport capacity with no tangible safety benefit, negative environmental consequences, as well as potentially negative safety consequences.

The very purpose of the ADW procedure is to prevent potential conflicts between arriving and departing traffic while an arrival is within the ADW. The ADW procedure defines the appropriate geometry between aircraft leaving the departure end of the runway should the arrival aircraft execute a missed approach.

MSP is not unique in using ADW procedures for CRO operations as the whistleblower alleges. CRO mitigations, associated tools, and technology were developed as the result of a 2011 Air Traffic Organization (ATO) investigation of missed approach go-arounds, and a July 2013 NTSB recommendation that the FAA establish separation standards between any arriving aircraft, which may initiate a missed approach, and any combination of arriving or departing aircraft operating on non-intersecting converging runways where arrival or departure paths could
possibly converge. Twelve major airports have implemented ADW procedures for CRO operations, including Memphis and Las Vegas, both with runway configurations similar to MSP. Since ADW procedures for CRO operations have been implemented at MSP, no conflicts have occurred when the proper procedures were utilized. By all objective evidence, ADW procedures have resulted in a significant safety enhancement. The NTSB has accepted FAA’s actions and closed the safety recommendation. Since ADW was implemented, the NTSB has not launched a single investigation on a “close call” for converging courses at airports that utilize ADW procedures.

**Background:**

During an audit of missed approaches (“go arounds”) conducted in 2011, the ATO uncovered a latent hazard at facilities where takeoff and landing operations were conducted independently on non-intersecting runways with converging flight paths. Specifically, situations in which the flight path of a go-around converged with that of a departure were found to compromise safety margins.

The ATO’s findings were subsequently validated through the July 1, 2013, NTSB Safety Recommendation A-13-024 (See Attachment A). In this Safety Recommendation, the NTSB recommended that the FAA establish separation standards between an arriving aircraft that executes a go-around, and any combination of arriving or departing aircraft operating on non-intersecting converging runways where arrival or departure paths may intersect.

An FAA/Industry Collaborative Workgroup met between August 2013 and March 2014 to analyze the events and develop mitigations. Of the 40 events analyzed by this group, 39 events occurred within 1 nautical mile (NM) of the runway departure end. Based upon this analysis, a CRO intersection point greater than or equal to 1 NM from the runway ends was considered sufficient to provide an acceptable level of safety and mitigate the risk of midair collision.

After the NTSB issued safety recommendation A-13-024, the ATO requested assistance from Flight Standards Service (AFS-450) in developing additional ADWs for 19 major airports with CRO configurations where the intersection point referenced above, was within 1 NM. Due to high workload requirements within AFS-450 and the need to quickly deploy the ADWs, this work was reassigned to the Massachusetts Institute of Technology Research Engineering (MITRE) Corporation. ADWs were developed for 19 major airports and approximately 40 smaller airports during 2013 and 2014. Today, 12 major airports have an ADW to mitigate the identified hazard while in a CRO configuration.

An ADW is a pre-defined region along the approach path that must be clear of arriving aircraft before air traffic controllers can release a departure from a non-intersecting converging runway. This window ensures that arriving and departing aircraft remain at a safe distance from one another if the arriving aircraft must discontinue its landing. The ADW is designed to reduce the risk of collision, while air traffic control actions are taking place to ensure separation.

Development of the ADW was built using a simulation tool to assess airborne collision risk for runways with intersecting or converging operations and generated ADWs to address those risks.
The model ran fast-time simulations, millions of times for each intersecting or converging scenario to evaluate the risk with flights of different speeds, trajectories, and other factors to reach a Target Level of Safety of $1 \times 10^{-9}$. After site-specific validation ADWs were added to the controllers' displays so they could quickly and easily determine when, during an arrival's approach, it is safe to release a departure.

The MSP Runway 30L ADW is along the Runway 35 final approach course from a point 0.4 NM south of the threshold of Runway 35, to a point 1.8 NM from the Runway 35 threshold. The ADW provides a gap at the intersection point of the extended centerlines of Runway 35 and Runway 30L to provide a margin of safety between an arrival on Runway 35 that executes an unplanned balked landing (go-around) and a departure from Runway 30L.

The Runway 30R ADW is along the Runway 35 final approach course from a point 0.2 NM south of the threshold of Runway 35 to a point 1.7 NM from the Runway 35 threshold. The ADW provides a gap at the intersection point of the extended centerlines of Runway 35 and Runway 30R to provide a margin of safety between an arrival aircraft to Runway 35 that executes a go-around and a departure from Runway 30R.

A September 2015 review of MSP’s ADW by FAA’s AFS-400 (Flight Technologies and Procedures Division) confirmed that both the ADW developed for Runway 30L and Runway 30R met the MITRE Target Level of Safety for the probability of collision at the flight path intersection point of less than $1 \times 10^{-9}$ (See Attachment B).

### Detailed Findings

**Allegation 1:** FAA’s current mandated policy for landing and departing aircraft is not suited for use with MSP’s unique runway configuration and increases the likelihood of aircraft collisions.

**Findings:** The allegation that current mandated policy for landing and departing aircraft is not suited for use with MSP Airport’s unique runway configuration and increases the likelihood of aircraft collisions was not substantiated.

The ADW and non-intersecting converging runway operations were designed specifically for MSP airport’s runway configuration. Data and simulations from the MITRE Corporation, subject matter experts that participated on the cross-functional work group including representatives of the National Air Traffic Controllers Association (NATCA), and a Safety Risk Management (SRM) panel were used to develop the MSP ADW.

The whistleblower acknowledges the success of ADW CRO at Charlotte International Airport in Charlotte, and John F. Kennedy International Airport in New York and attributes their success to dedicated arrival and departure runways. However, McCarran International Airport (LAS) in
Las Vegas and Memphis International Airport (MEM) both use a configuration in which an ADW is applied to runways used for both departures and arrivals similar to MSP.

NTSB Safety Recommendation A-13-024 specifically referred to LAS when citing the need to establish separation standards in such converging runway operations. The Safety Recommendation referenced multiple operational safety events at LAS airport in a converging runway operation involving an arrival aircraft executing a go-around. Since the implementation of the ADW and CRO procedures at LAS Airport, the facility has not experienced any significant operational events involving an aircraft executing a go-around and a departure. MSP has also not experienced any significant operational events involving CRO procedures while in compliance with the ADW.

The whistleblower offers hypothetical situations involving risk created with an aircraft holding in position on the runway while awaiting clearance for departure; a procedure called Line Up and Wait (LUAW). The FAA and MSP ATCT have several mitigations involving procedures and equipment to abate the risk associated with LUAW. FAA procedures state the intent of LUAW is to position an aircraft for an imminent departure. Additionally, MSP SOP requires staffing two separate Local Control positions to appropriately monitor Runways 30L and 30R in configurations utilizing an ADW. MSP ATCT is also equipped with Airport Surface Detection Equipment-Model X (ASDE-X), which provides the controller with aural and visual alerts in the event a runway is occupied with an aircraft inbound to land on the occupied runway.

The CRO procedures associated with Runways 30L, 30R, and 35 offer three standard options to ensure ADW compliance (See Attachment C). The facility does not prohibit the controllers from taking immediate action to resolve unusual situations, or using their professional judgment when one of the three standard resolutions does not resolve the conflict. The memorandum from Operations Manager, Justin Wulf, dated March 8, 2016, was to clarify that issuance of “go around” instructions to the Runway 35 arrival may not be the sole option to resolve a potential conflict. Additional verbal briefings, and simulation training was provided to MSP controllers enabling them to recognize adverse situations and determine the correct course of action. MSP has not experienced one significant operational occurrence involving CRO when the ADW procedures have been complied with.

**Allegation 2: FAA management has been notified on several occasions of unsafe conditions caused by the ADW and CRO, but has taken no steps to update its policy for MSP.**

**Findings:** The investigation did not substantiate this allegation. MSP facility management convened multiple SRM panels to address the ADW and non-intersecting CRO procedures for MSP. MSP NATCA representatives were invited to contribute to an SRM panel in January and February 2016, to address risk associated with ADW and CRO procedures.

MSP NATCA representatives initially took part in the January panel before declining to participate further after one day of the February meeting. Minneapolis Terminal Radar Approach Control (M98) NATCA representatives and Minneapolis Air Route Traffic Control Center (ZMP) NATCA representatives continued to participate on the SRM panel and came to
consensus that no areas of “High Risk” were associated with the application of MSP ADW and CRO procedures.

The initial CRO procedures were developed to coincide with the commission of Runway 35 in October, 2005. Those procedures were amended in 2009 to include the development of the ADW on the final approach course for RWY35 during the re-construction of RWY30R. The ADW was primarily used in decision making for the LC controller to optimize departures on Runway 30L, but has been retained since its inception. The facility implemented a mandate that the South LC position be staffed with the primary responsibility of Runway 35 operations only.

Minimum weather conditions required for CRO operations to be conducted at MSP have also been added to the local CRO procedures. Those conditions include: visibility of four statute miles or greater, ceilings of 1,700 feet or greater, winds in accordance with the “tailwind chart”, and no tailwind if the runways contain a contaminant. Facility management has also added that the MSP radar is operational in FUSION mode, ASDE-X must be operational, and the LC controllers must have an operational Tower Display Workstation.

During CRO operations the local CRO procedures have been amended to require the MSP Operational Supervisor (OS)/Controller-In-Charge (CIC) and the M98 OS/CIC to conduct hourly recorded coordination reference weather conditions, arrival needs versus departure needs, and any pertinent information that will affect the next hour of operation. The current facility Notice incorporating these requirements went into effect June 28, 2016.

MSP facility management adjusted the dimensions of the starting and ending points of the ADWs for Runways 30R and 30L to accommodate updated simulation modeling in 2015. Ceiling minimums, spacing requirements provided by M98, maximum wind component values, and required operational equipment were all again reviewed by the SRM panel in October, 2016, for potential procedural updates in 2017; MSP NATCA leadership declined to provide comment on those proposed updates.

Based upon the lack of data demonstrating a safety concern, as well as the extensive efforts at the local and national level to review and adjust the procedure based upon concerns, this allegation is not substantiated.

**Corrective Action:**

None Needed.
Investigation Methodology

With subject matter expertise from ATO’s Safety and Technical Training (AJI) organization, the Investigative Team included a Senior Investigator from AAE, an AJI-13 lead investigator and the Compliance Services Group Manager. The team reviewed relevant radar and audio replays for MSP. The team reviewed relevant documentation including the MSP Standard Operating Procedures (SOP); MSP Notice N7110.442 Converging Runway Operations; MSP Notice N7110.454 Non-Intersecting Converging Runway Operations; MSP Safety Risk Management (SRM) Documents; Las Vegas (LAS) ATCT SOP; Memphis (MEM) ATCT SOP; Federal Aviation Administration (FAA) Order 7110.65, Air Traffic Control.
List of Attachments

A. NTSB Safety Recommendation A-13-024 (11 pages)
B. AFS-400 Analysis of MSP ADW Memorandum (3 pages)
C. MSP N7110.454 (4 pages)
National Transportation Safety Board
Washington, DC 20594

Safety Recommendation

Date: July 1, 2013
In reply refer to: A-13-024

The Honorable Michael P. Huerta
Administrator
Federal Aviation Administration
Washington, DC 20591

We are providing the following information to urge the Federal Aviation Administration (FAA) to take action on the safety recommendation issued in this letter. This recommendation addresses existing FAA separation standards and operating procedures. The recommendation is derived from the National Transportation Safety Board’s (NTSB) investigation and/or review of numerous recent airport events and is consistent with the evidence we found and the analysis we performed. As a result of this investigation, the NTSB has issued one safety recommendation, which is addressed to the FAA. Information supporting this recommendation is discussed below.

The NTSB has recently investigated or reviewed numerous events in which air carrier aircraft that were executing a go-around\(^1\) came within hazardous proximity of other landing or departing aircraft. These events have occurred at airports where air traffic control (ATC) procedures permit independent takeoff and landing operations on nonintersecting runways with intersecting arrival or departure paths (see figure 1) and have resulted in flight crews having to execute evasive maneuvers at low altitude to avoid collisions. The NTSB is concerned that existing FAA separation standards and operating procedures are inadequate to prevent such events and need to be revised to ensure safe separation between aircraft.

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\(^1\) The FAA’s *Airplane Flying Handbook*, FAA-H-8083-3A, chapter 8, “Approaches and Landings,” states the following: “Whenever landing conditions are not satisfactory, a go-around is warranted. There are many factors that can contribute to unsatisfactory landing conditions. Situations such as air traffic control [ATC] requirements, unexpected appearance of hazards on the runway, overtaking another airplane, wind shear, wake turbulence, mechanical failure and/or an unstabilized approach are all examples of reasons to discontinue a landing approach and make another approach under more favorable conditions....The go-around is not strictly an emergency procedure. It is a normal maneuver that may at times be used in an emergency situation....Although the need to discontinue a landing may arise at any point in the landing process, the most critical go-around will be one started when very close to the ground. Therefore, the earlier a condition that warrants a go-around is recognized, the safer the go-around/rejected landing will be.” A go-around may be directed by ATC or initiated by the pilot. The flight crew does not need permission from ATC to execute the maneuver.
Figure 1. An example of runway configurations where simultaneous independent runway operations occur.

Recent Events

_Dotcom Flight 2374 and Spirit Airlines Flight 511, Las Vegas, Nevada_

On July 30, 2012, about 1944 coordinated universal time (UTC), two airplanes came within hazardous proximity of one another at Las Vegas-McCarran International Airport (LAS), Las Vegas, Nevada, when Spirit Airlines flight 511, an Airbus Industries A319, was executing a go-around from runway 19L and Dotcom flight 2374, a Cessna Citation 510, was landing on runway 7R (see figure 2). Runways 19 L/R and 7L intersect and may not be operated independently of one another. Runway 7R is located approximately 1,000 feet south of runway 7L and does not intersect any other landing surface, permitting controllers to conduct arrival and departure operations independently of all other runways; however, the flightpath of runway 19L intersects the flightpath of runway 7R. The airplanes were being controlled by separate LAS ATC tower controllers operating on different frequencies. The pilot of Spirit Airlines flight 511 announced that the airplane was “on the go,” and the air traffic controller immediately responded with “traffic ahead and to your right landing 7R is a Citation out of 2600 off your right.” The transmission was not acknowledged, and the controller

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2 LAS is one example of an airport that has runway layout and procedures that facilitate independent converging runway operations.
instructed Spirit Airlines flight 511 to “expedite your climb.” The pilot of Spirit Airlines flight 511 never reported Dotcom flight 2374 in sight.

When the controller responsible for Dotcom flight 2374 recognized that Spirit Airlines flight 511 was executing a go-around, he notified the Dotcom flight 2374 pilot of the position of Spirit Airlines flight 511 but did not provide any control instructions to ensure that the airplanes avoided one another. According to recorded radar data, the pilot of Dotcom flight 2374 turned the airplane off of the final approach course to the left to pass behind Spirit Airlines flight 511, then turned back to the runway and landed on runway 7R. Spirit Airlines flight 511 passed in front of and slightly above Dotcom flight 2374 on short final. The reported closest proximity was 0.21 nautical miles (nm) laterally and 100 feet vertically. There were no injuries reported to passengers or flight crew and no damage reported to either airplane.

**Figure 2.** Spirit Airlines flight 511 (red dots) executed a go-around while attempting to land on runway 19L. Dotcom flight 2374 (blue dots) was simultaneously landing on runway 7R.

*American Airlines Flight 534 and Pinnacle Airlines Flight 3843, Jamaica, New York*

On July 30, 2012, about 2004 UTC, two airplanes came within hazardous proximity of one another at John F. Kennedy International Airport (JFK), Jamaica, New York, when American Airlines flight 534, a Boeing 737, was executing a go-around while attempting to land
on runway 22L and Pinnacle Airlines flight 3843, a Bombardier CRJ 200 regional jet (RJ), was departing from runway 13R (see figure 3). Runway 13R does not intersect runway 22L; however, the flightpath of runway 13R intersects runway 22L. The airplanes were being controlled by separate JFK ATC tower controllers operating on different frequencies. When the pilot of American Airlines flight 534 notified ATC of the go-around, the controller instructed the pilot to “climb and maintain 2000 feet, traffic off to your left is an RJ turning southbound, turn left immediately heading 130.” The pilot responded and began the maneuver. The controller asked the pilot of American Airlines flight 534 if Pinnacle Airlines flight 3843 was in sight, and the pilot responded “We’re turning as tightly as we can.” When the controller asked the pilot of American Airlines flight 534 about the assigned altitude of 2,000 feet, the pilot responded “Negative, we are trying not to hit this aircraft off our right.” The controller responsible for Pinnacle Airlines flight 3843 had transferred communications to New York Departure Control and was no longer able to provide the pilot with control instructions or traffic advisories. American Airlines flight 534 returned for landing, and Pinnacle Airlines flight 3843 continued to its destination. There were no injuries reported to passengers or flight crew and no damage reported to either airplane.

Because of previous conflicts similar to the situation involving American Airlines flight 534 and Pinnacle Airlines flight 3843, JFK had been the subject of an FAA review of the runway configuration by the FAA Flight Standards Office, AFS-450, in 2009 that resulted in the establishment of an arrival/departure window (ADW) on the runway 22L final approach course. The ADW is an imaginary box including the area between 1 and 3 nm from the runway threshold. The intent of the ADW was to prevent conflicts between runway 13R departures and runway 22L arrivals by requiring the departure aircraft from runway 13R to be rolling for takeoff before the runway 22L arrival aircraft entered the ADW. Pinnacle Airlines flight 3843 was cleared for takeoff when American Airlines flight 534 was about 3.7 nm away from the runway 22L threshold. However, Pinnacle Airlines flight 3843 did not begin the takeoff roll until American Airlines flight 534 was inside the ADW. Consequently, the separation intended to be ensured through use of the ADW procedures was not ensured. Under the circumstances, the tower controller should have canceled the takeoff clearance for Pinnacle Airlines flight 3843 but did not do so. The two airplanes came within 0.3 m laterally and 300 feet vertically following the evasive maneuvers by American Airlines flight 534.
Figure 3. American Airlines flight 534 (blue dots) executed a go-around while attempting to land on runway 22L. Pinnacle Airlines flight 3843 (red dots) was simultaneously cleared for takeoff from runway 13R.

Expressjet Flight 4529 and Air Wisconsin Flight 4039, Charlotte, North Carolina

On July 14, 2012, about 1544 UTC, two airplanes came within hazardous proximity of one another at Charlotte International Airport (CLT), Charlotte, North Carolina, when Expressjet flight 4529, an Embraer 145 RJ, was executing a go-around while attempting to land on runway 23 and Air Wisconsin flight 4039, a Canadair RJ, was simultaneously departing from runway 18C (see figure 4). Runway 18C does not intersect runway 23; however, the flightpath of runway 23 intersects runway 18C. The airplanes were being controlled by separate CLT ATC tower controllers operating on different frequencies. When the pilot of Expressjet flight 4529 indicated that he was going around, the air traffic controller instructed the pilot to “Fly heading 270, climb and maintain 4000, traffic departing runway 18C beneath you.” The pilot of Expressjet flight 4529 did not confirm the transmission and never reported the conflicting departure in sight. The controller handling Air Wisconsin flight 4039 provided the pilot with a traffic advisory about Expressjet flight 4529 but issued no control instructions to resolve the conflict. The two airplanes passed within 0.16 nm laterally and 400 feet vertically of each other as Expressjet flight 4529 approached runway 18C. Expressjet flight 4529 returned for landing,
and Air Wisconsin flight 4039 continued to its destination. There were no injuries reported to passengers or flight crew and no damage reported to either airplane.

![Diagram](image_url)

**Figure 4.** Expressjet flight 4529 (blue dots) executed a go-around while attempting to land on runway 23. Air Wisconsin flight 4039 (red dots) was simultaneously cleared for takeoff from runway 18C.

***Jet Blue Flight 483 and a Bombardier Learjet 60, Las Vegas, Nevada***

On April 26, 2012, about 1825 UTC, two airplanes came within hazardous proximity of one another at LAS when Jet Blue flight 483, an Airbus Industries A320, executed a go-around while attempting to land on runway 25L and XARAV, a Mexican-registered Bombardier Learjet 60, was departing from runway 19L (see figure 5). Runway 19L does not intersect runway 25L; however, the flightpath of runway 19L intersects the flightpath of runway 25L. Both pilots were communicating with separate LAS ATC controllers operating on different frequencies. During the go-around, Jet Blue flight 483 turned left to avoid XARAV. The pilot of XARAV saw Jet Blue flight 483 approaching from his left and initiated a rapid climb in an attempt to establish and maintain vertical separation. Review of recorded radar data for XARAV showed that the airplane’s climb rate was as high as 6,000 feet per minute immediately after

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3 More information about this event, NTSB case number OPS12IA535, can be found online at http://www.ntsb.gov/aviationquery/index.aspx.
departure. In radio transmissions from the pilot, the airplane’s stick shaker\(^4\) can be heard in the background, warning the pilot of an imminent aerodynamic stall. The only separation instruction that ATC issued to XARAV was for the pilot to “go low,” but by the time the instruction was issued, the airplane was climbing at a high rate and the pilot was unable to comply. The two airplanes’ closest proximity was 0.30 nm laterally and 100 feet vertically. There were no injuries reported to passengers or flight crew and no damage reported to either airplane.

\(\text{Figure 5. Jet Blue flight 483 (blue dots) executed a go-around from runway 25L. XARAV (red dots) was simultaneously departing from runway 19L.}\)

*United Airlines Flight 1547 and American Airlines Flight 1913, Las Vegas, Nevada*

On January 27, 2006, about 0044 UTC, a near mid-air collision occurred at LAS when United Airlines flight 1547, an Airbus Industries A320, was attempting to land on runway 19R

\(^4\) The stick shaker vigorously rattles the flight crew’s control yokes, providing a tactile indication that an aerodynamic stall may be imminent.
but was instructed to go around by ATC to prevent a conflict with a Beechcraft BE200 crossing the runway. During the go-around, United Airlines flight 1547 nearly collided with American Airlines flight 1913, a Boeing 757 that was departing from runway 25R (see figure 6). Runway 19L did not intersect runway 25R; however, the flightpath of runway 19L intersected the flightpath of runway 25R. Both airplanes were in communication with separate LAS ATC tower controllers operating on different frequencies. When the controller handling United Airlines flight 1547 became aware of the conflict, he issued a safety alert to the pilot about the conflicting departure and instructed the pilot to “...turn at your discretion.” During a postincident interview, the controller stated that he did not issue a specific direction to turn because wake turbulence separation rules did not permit him to have the Airbus A320 turn left immediately behind the departing Boeing 757, and a right turn might have been too slow as well as rendering the United Airlines flight 1547 flight crew unable to see the conflicting departure. The controller stated that he “...wanted the pilot-in-command to decide what to do.” United Airlines flight 1547 made an evasive turn to the right to avoid a potential collision, reportedly banking as much as 40 degrees to avoid crossing American Airlines flight 1913’s flightpath. American Airlines flight 1913 made a slight left turn and was instructed by the controller to “stay low.” United Airlines flight 1547 returned for landing, and American Airlines flight 1913 continued to its destination. There were no injuries reported to passengers or flight crew and no damage reported to either airplane. In postincident statements, the United Airlines flight 1547 flight crewmembers stated that the tower controllers did not seem to have clear procedures for separating aircraft in the event of a go-around and may not have had the same perception of an impending collision that they did.

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5 More information about this event, NTSB case number OPS06IA004A/B, can be found online at http://www.ntsb.gov/aviationquery/index.aspx.
United Airlines Flight 1547 was instructed to go around while attempting to land on runway 19R. American Airlines Flight 1913 (blue dots) was simultaneously cleared for takeoff from runway 25R.

**Figure 6.** United Airlines flight 1547 (red dots) executed a go-around while attempting to land on runway 19R. American Airlines flight 1913 (blue dots) was simultaneously cleared for takeoff from runway 25R.

**Discussion**

FAA Order 7110.65, "Air Traffic Control," contains specific requirements for ensuring separation between two aircraft that are departing from runways that do not physically touch but have intersecting flightpaths. Paragraph 3-9-8, "Intersecting Runway Separation," requires controllers to do the following:

Separate departing aircraft from an aircraft using an intersecting runway, or nonintersecting runways when the flight paths intersect, by ensuring that the departure does not begin takeoff roll until one of the following exists: 1. The preceding aircraft has departed and passed the intersection, has crossed the departure runway, or is turning to avert any conflict. 2. A preceding arriving aircraft is clear of the landing runway, completed the landing roll and will hold short of the intersection, passed the intersection, or has crossed over the departure runway.

Further, the same paragraph requires that the following aircraft have a minimum 2-minute interval before passing through the airborne flightpath of a heavy jet or Boeing 757 operating on another runway. The separation standards established by paragraph 3-9-8 require that potential
conflicts be resolved as part of the tower controller’s initial decision on when to issue takeoff clearances to two departing aircraft. However, the NTSB notes that there is no requirement for controllers to provide the same protections for the potential go-around flightpath of a landing aircraft even though, in the event of a go-around, the arriving aircraft effectively becomes a departure. Conflicts such as those described in this letter would have been clear violations of FAA safety and separation standards had the scenarios involved two aircraft departing the airport rather than one arrival and one departure. There appears to be no safety justification for treating the situations differently.

As shown by the events described in this letter, although a particular set of runways does not intersect on the ground, the assumption cannot be made that potential conflicts will not occur in the vicinity of the airport. When the pilot of a landing aircraft executes a go-around maneuver, as in the examples provided, air traffic controllers may be left with no viable options to ensure that safe separation exists between the go-around aircraft and aircraft operating to or from converging runways. In these events, the ATC tower controllers attempted to use tower visual separation rules to ensure the aircraft did not collide at the point where the flightpaths intersected. The FAA’s Pilot-Controller Glossary contains the following definition of visual separation:

VISUAL SEPARATION - A means employed by ATC to separate aircraft in terminal areas and en route airspace in the NAS [National Airspace System]. There are two ways to effect this separation:

a. The tower controller sees the aircraft involved and issues instructions, as necessary, to ensure that the aircraft avoid each other.

b. A pilot sees the other aircraft involved and upon instructions from the controller provides his/her own separation by maneuvering his/her aircraft as necessary to avoid it. This may involve following another aircraft or keeping it in sight until it is no longer a factor.

Because of the nature of the geometry of the encounters and the unexpected nature of the go-arounds, it was not possible for the ATC tower controllers to issue effective control instructions to ensure that the airplanes avoided each other. Therefore, visual separation procedures could not be successfully applied or asserted as an adequate means of resolving the conflicts. The NTSB is concerned that in these events, ATC was not able to ensure the safe separation of aircraft. Instead, separation was established by resorting to impromptu evasive maneuvers by pilots during critical phases of flight. The NTSB concludes that the lack of specific separation standards, similar to those defined in paragraph 3-9-8 of FAA Order 7110.65, “Air Traffic Control,” applicable to departing aircraft and aircraft conducting a go-around from nonintersecting runways where flightpaths intersect, facilitates hazardous conflicts and introduces unnecessary collision risk.
Therefore, the National Transportation Safety Board makes the following recommendation to the Federal Aviation Administration:

Amend Federal Aviation Administration Order 7110.65, “Air Traffic Control,” to establish separation standards similar to the provisions of paragraph 3-9-8 between an arriving aircraft that goes around and any combination of arriving or departing aircraft operating on runways where flightpaths may intersect. (A-13-024)

Chairman HERSMAN, Vice Chairman HART, and Members SUMWALT, ROSEKIND, and WEENER concurred in this recommendation.

The NTSB is vitally interested in this recommendation because it is designed to prevent accidents and save lives. We would appreciate receiving a response from you within 90 days detailing the actions you have taken or intend to take to implement it. When replying, please refer to the safety recommendation by number. We encourage you to submit your response electronically to correspondence@ntsb.gov.

[Original Signed]

By: Deborah A.P. Hersman,
Chairman
Background
This memorandum is in response to your request to confirm the Target Level of Safety (TLS) of the current Arrival Departure Window (ADW) at Minneapolis International Airport (MSP). This memorandum addresses two ADW operations. The first ADW operation involves departures on runway 30L and arrivals on runway 35 and the second involves departures on runway 30R and arrivals on runway 35.

Both of these current ADWs at MSP were calculated using a TLS of $4 \times 10^{-8}$ with a Test Criterion Violation (TCV) volume defined by a sphere with a radius of 500 ft. This TLS and TCV volume are consistent with the method of collision risk analyses performed by Flight Technologies and Procedures Division (AFS-400) in July of 2009. At that time, the recommended windows were 0.4/1.9 nautical miles (NM) and 0.2/1.9 NM for runways 30L and 30R departures, respectively.

Currently, AFS-400 collision risk analyses use a TLS of $1 \times 10^{-9}$ and a TCV volume defined by a cylinder with a radius of 265 feet and a total height of 160 feet centered on the aircraft’s center of gravity. Based on your request, both ADWs have been reevaluated with this updated TLS and TCV volume.

Discussion
The distributions of TCVs as a function of the arrival aircraft distance from threshold when the departure is released is shown in figures 1 and 2. Probability distribution functions were fitted to the TCV distributions, and the arrival threshold distances were determined so that the probability of a TCV allowed the TLS of $1 \times 10^{-9}$ to be met. As shown in figure 1, the results of the runway 30L departure and runway 35 arrival analysis show that the departure aircraft on runway 30L should not begin its takeoff roll when the arrival aircraft is between 0.40 NM and 1.80 NM from the runway 35 threshold.
Figure 1: Current Results - TCV Distribution for Runway 30L Departures and Runway 35 Arrivals
As shown in figure 2, the analysis for the runway 30R departure and runway 35 arrival case concluded that the departure aircraft on runway 30R should not begin its takeoff roll when the arrival aircraft is between 0.10 NM and 1.70 NM from the runway 35 threshold.

![Figure 2: Current Results - TCV Distribution for Runway 30R Departures and Runway 35 Arrivals](image)

**Conclusion**

Based on this reevaluation of the MSP ADWs using a TLS of $1 \times 10^{-9}$ and a new cylindrical TCV volume, the MSP ADWs derived from the 2009 analysis are still considered valid. The new results for the 30L departure ADW, 0.4/1.8 NM, are contained within the 2009 ADW dimensions, 0.4/1.9 NM, which confirms the 2009 results.

The 30R departure ADW results are not as straightforward to validate, because the TLS is met at an inner boundary of 0.186 NM which is outside of the 2009 boundary of 0.2 NM. This difference of 0.014 NM is too small to invalidate the 2009 ADW window with the required confidence. As such, it is recommended that the window be moved from 0.2/1.9 NM to 0.1/1.7 NM. This further decreases risk near the arrival runway threshold and, at the same time, makes the window more operation-friendly by decreasing the overall window size by 0.1 NM.
SUBJ: Non-Intersecting Converging Runway Operations

1. Purpose of This Notice. This Notice establishes procedures for the mandatory use of the Arrival/Departure Window (ADW) for operations to non-intersecting converging Runway 30L and Runway 35 and non-intersecting converging Runway 30R and Runway 35 at the Minneapolis-St. Paul International Airport.


3. Where Can I Find This Notice? This Notice is available in Minneapolis Facility Binders, in the IDS-4, and on the FAA Facility Directives Repository at https://loa.faa.gov under MSP.


5. Definitions. Runway 30L ADW. The area along the Runway 35 final approach course from .4 NM south of the threshold of Runway 35 to 1.8 NM from the Runway 35 threshold. The ADW provides a gap at the extended centerline of Runway 35 and Runway 30L between an arrival on Runway 35 that executes an unplanned balked landing (go around) and a departure from Runway 30L.

Runway 30R ADW. The area along the Runway 35 final approach course from .2 NM south of the threshold of Runway 35 to 1.7 NM from the Runway 35 threshold. The ADW provides a gap at the extended centerline of Runway 35 and Runway 30R between an arrival on Runway 35 that executes an unplanned balked landing (go around) and a departure from Runway 30R.


16-10. Runways 30L/R and 35 Converging Runway Operations. Simultaneous operations to converging runways are authorized for Runways 30L/30R and Runway 35. These procedures provide guidance in the selection process, coordination, and implementation of converging operations on Runways 30L/30R and 35. Exceptions to these procedures are authorized for emergency and unusual situations only.

NOTE-
The OS/CIC is expected to maintain a high level of awareness during converging runway operations.

(1) The MSP OS/CIC and M98 OS/CIC must determine if traffic needs dictate the application of Converging Runway Procedures.

(2) The CIC and CC position must be split.

(3) There must be at least two Local Control positions open. The MSP OS/CIC may combine Local Control positions during periods of light traffic.

(4) During Converging Runway Operations, the MSP OS/CIC and M98 OS/CIC must have a conversation on a recorded line with their counterpart in the Tower or TRACON hourly. These conversations must include weather, arrival needs versus departure needs, and any pertinent information that will affect the next hour of operation.

(5) MSP radar must be in FUSION mode.

(6) MSP ASDE-X must be operational.

(7) The ceiling must be 1,700’ or higher.

(8) The visibility must be 4 statute miles or greater.

(9) Wind requirements for Runway 35:

   (a) Tailwind: Wind gusts must be included when referencing the wind charts. If the runway has contaminant, there will be NO tailwind. (Appendix Q)

   **NOTE-**
   A tailwind is any wind 100° or greater from runway centerline.

   (b) Crosswind: The crosswind component must be within the parameters of the wind chart. (Appendix Q)

   **NOTE-**
   A crosswind is any wind that is 10° through 90° from runway centerline.

   (c) Wind shear: Comply with para. 16-13 of the MSP-M98 SOP N7110.26.

(10) The Local Controller must have an operational Tower Display Workstation (TDW).

b. **Implementation.** The OS/CIC must ensure that the ATIS message includes the configuration option in use prior to implementing simultaneous operations to converging runways.

   (1) Converging ILS 35, ILS/LOC/RNAV 30L, ILS/LOC/RNAV 30R

   (2) Visual approaches to Runways 35, 30L and 30R

   (3) Converging ILS 35 and Visual approaches to Runway 30L and/or 30R

   (4) Visual approaches to Runway 35 and ILS/LOC/RNAV approaches to Runways 30L/R

   (5) RNAV (RNP) Y/RNAV (GPS) Z Runway 35 and ILS Z/LOC/RNAV Z Runways 30L/R
16-11. Use of the Arrival Departure Window (ADW). The ADW is a tool used by the Local Controller to determine when a departure on Runway 30L or Runway 30R may be cleared for takeoff so as to reduce the likelihood of a confliction at the convergence of the extended centerlines of Runways 30L and 35 or Runways 30R and 35 in the event the Runway 35 arrival has a go-around or balked landing.

a. Compliance. The following options are available to ensure compliance with the ADW:

(1) Runway 35 arrival traffic is instructed to ‘Go Around’.

(2) Runway 30L or 30R departure clearance is cancelled.

(3) Runway 30L or 30R departure aircraft is taxied off of the runway.

b. Responsibility.

(1) The LCN and LCS Controllers must coordinate the use of Dispersal Airspace.

(2) The Local Controller with the departure aircraft is responsible for resolving the possibility of non-compliance of Converging Runway Operations. They must notify LCW with any course of action.

   (a) If a departure from Runway 30L or Runway 30R begins its departure roll prior to the Runway 35 arrival entering the ADW, the departure should pass the point of convergence ahead of the Runway 35 arrival executing a go-around or balked landing with no controller actions.

   (b) If the Runway 30L or Runway 30R departure begins its departure roll as the Runway 35 arrival exits the ADW, the departure should pass the point of convergence behind the Runway 35 arrival executing a go-around or balked landing with no controller actions.

NOTE:
The local controllers at MSP receive extensive biannual classroom and simulator training on the use of the ADW. The intent of this training is to help controllers recognize adverse situations and to determine the correct course of action for issuing control instructions to an aircraft executing a go-around/balked landing on Runway 35 and to maintain or increase separation with aircraft departing Runway 30L and 30R.

16-12. Management of Balked Landings during Simultaneous Operations on Converging Runways 35, 30L, and 30R. This paragraph contains procedures for handling Runway 35 go-arounds or balked landings executed inside of the published missed approach point.

NOTE:
These procedures are included in the Safety Risk Management Document (SRMD) for Simultaneous Operations on Converging Runways at MSP Airport, dated July 2006.

a. If the Runway 30L or Runway 30R departure is a wake turbulence risk, the type aircraft must also be issued to the Runway 35 arrival.

b. Runway 35 aircraft executing a go-around/balked landing inside of the missed approach point, based on known and observed traffic, must be issued an initial climb to at or above 2,500’ and issued a turn as follows:
(1) Take IMMEDIATE action to resolve traffic conflicts if there are departures on or departing Runway 30L/30R (traffic alerts, traffic advisories, and/or control instructions).

NOTE-
When appropriate, issue a climbing right turn and assign a heading to take the aircraft over the center of the airport. When the aircraft is over the center of the airport, assign a northeasterly heading of approximately 040°, and coordinate with the appropriate TRACON operational positions for a heading to return to the airport.

(2) If there are no departures on or immediately airborne from Runway 30L/30R, issue control instructions to direct the go-around/balked landing aircraft into the dispersal airspace and coordinate with the appropriate TRACON operational positions for a heading to return to the airport.

NOTE-
It is imperative the West Local Controller be prepared to comply with this paragraph by having a keen awareness of not only the Runway 35 arrivals, but the entirety of the operations, including where the departing aircraft off Runways 30L/30R are in relation to the Runway 35 arrival should that aircraft execute a go-around/balked landing.

16-15. Transitioning From the Use of Converging Runway Operations

a. When converging runway operations are no longer conducive due to the criteria listed above, a transition period is needed to allow M98 to safely evolve to an alternate runway configuration. M98 may continue arriving on the 30's/35 configuration with the traffic currently within the confines of M98 airspace while actively emphasizing the transition to the alternate configuration.

b. Coordination must be made between the Tower and TRACON TMCs regarding the urgency of the transition period (Example: during low ceiling conditions).

c. During this transition period, the Local Controller(s) must comply with Section 16-11 Use of the Arrival Departure Window (ADW), or stop departing Runway 30L and 30R until no more arrivals on Runway 35.

7. Background. FAA Notice JO 7110.690, Non-Intersecting Converging Runway Operations, dated June 8, 2015, mandates the use of the MSP Arrival/Departure Window (ADW) for aircraft departing Runway 30L and 30R with respect to the position of arrivals on Runway 35. An updated analysis resulted in a change in the dimensions of the 30R ADW.

Elaine A. Buckner
Air Traffic Manager
Minneapolis Air Traffic Control Tower

Diane D. Langer
Air Traffic Manager
Minneapolis Terminal Radar Approach Control