Federal Aviation Administration

Memorandum

Date:

To: Matthew E. Hampton, Assistant Inspector General for Aviation Audits

From: H. Clayton Foushee, Director, Office of Audit and Evaluation, AAE-1

Subject: Federal Aviation Administration's (FAA) Response to Office of Inspector General (OIG) Draft Report: FAA's 2015 Runway Safety Call to Action Initiatives

The FAA has made significant progress toward the implementation of a formal process to identify and address the greatest areas of risk to runway safety. A key element of the process is collaboration across FAA's lines of business, as well as other government and industry stakeholders, with an emphasis upon those initiatives providing the greatest benefit.

In 2015, the Agency implemented the Runway Incursion Mitigation (RIM) program, which utilizes risk-based, decision-making (RBDM) methodology to determine which specific locations have a history of runway incursions. Since introduction, the RIM program has implemented mitigations at 20 locations. At these locations, there were 227 geometry-related runway incursions before mitigation, and zero after mitigation.

The FAA offers the following clarifications to the draft report:

- We disagree with the OIG's description of the Runway Safety Council. A more accurate description of the Runway Safety Council is "a joint group of agency, industry and labor officials that develops a focused implementation of integrated data-driven strategies to reduce the number and severity of runway incursions."
- The OIG is incorrect in stating that the Agency cannot determine whether initiatives are effective in reducing runway incursions based upon the increased reporting of runway incursions after the safety forum. Effectiveness must also take into account other contributing factors. Factors such as voluntary safety reporting programs like the Air Traffic Safety Action Program (ATSAP) and Confidential Information Share Program, the Technical Operations Safety Action Program, the Mandatory Occurrence Reports, and the Comprehensive Electronic Data Analysis and Reporting Tool encourage personnel to demonstrate their commitment to sharing issues without fear of reprisal. As noted in the attached Safety Risk Management Document, Runway Incursion Safety Issue, Version 1.1, "the observed increase in reported [runway incursions] RIs in all categories may be reflective of a thriving safety culture rather than a decrease in safety…" Although the panel did acknowledge, "the rise in incidents demands that controls currently serving to mitigate

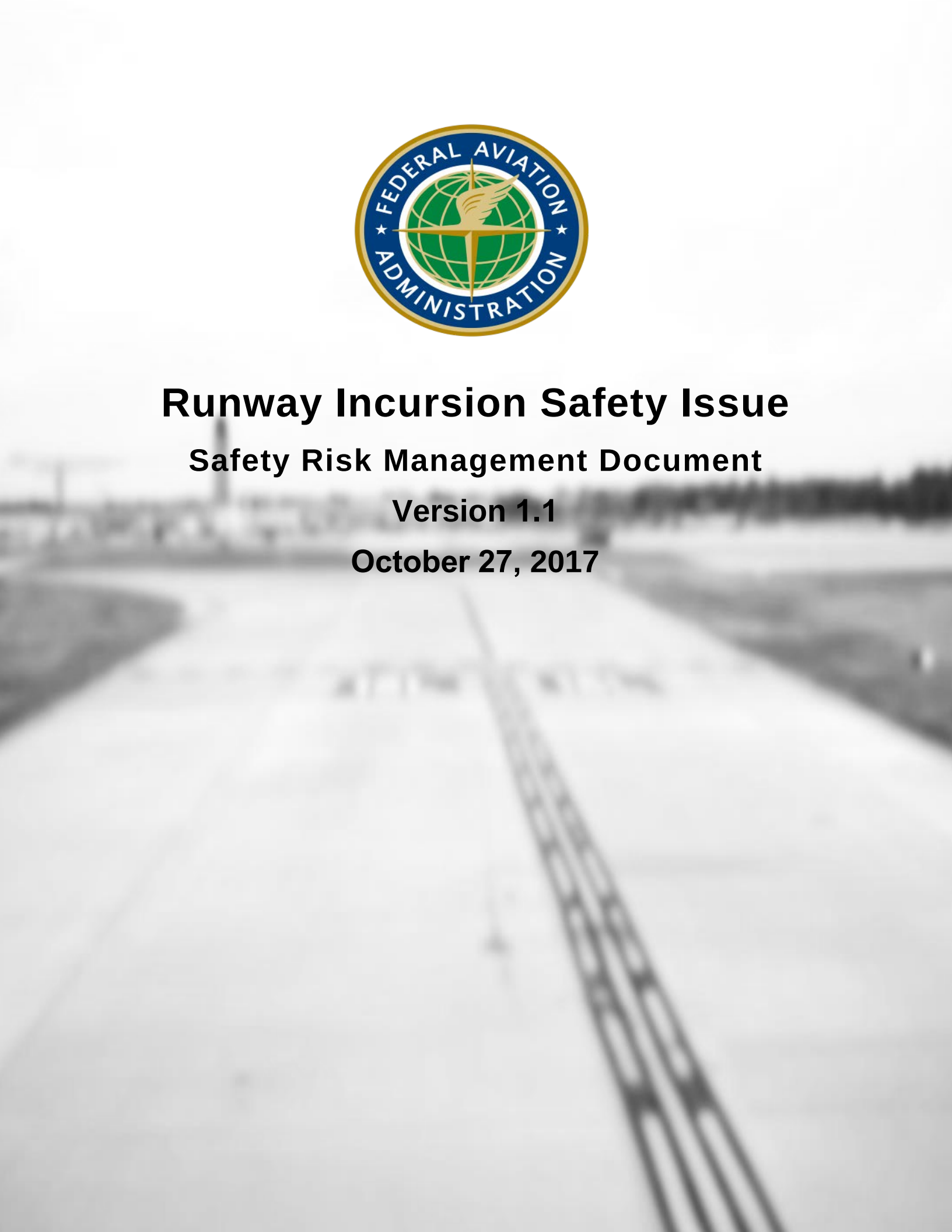
the number and types of [runway incursions] RIs be reviewed, verified, and/or improved if found inadequate." That process is being implemented.

- The draft report cites dedicated funding to complete four initiatives as one of the challenges the Agency faces in fully implementing the initiatives still in progress. That statement is ambiguous, misleading, and does not capture how funding for projects must be obtained. The Office of Management and Budget requires the FAA to administer its Acquisition Management System as a business enterprise. The Agency must evaluate each potential initiative from a life-cycle investment, cost/benefit perspective, and the expected benefits must be equal or greater than the expected cost. The FAA's Joint Resources Council will consider funding the recommended initiatives, but only after finalizing proof-of-concept, life-cycle investment and cost/benefit analyses, along with a solid business plan that aligns with the strategic outlook of the Agency.

The FAA concurs with the draft recommendations. We plan to implement recommendations 1 and 3 by December 31, 2018 and recommendations 2 by April 30, 2019.

We appreciate this opportunity to respond to the OIG draft report. Please contact H. Clayton Foushee at (202) 267-9000 if you have any questions or require additional information about these comments.

Attachment
Runway Incursion Safety Issue Safety Risk Management Document Version 1.1



Runway Incursion Safety Issue

Safety Risk Management Document

Version 1.1

October 27, 2017

SRM Document Change Page

Date	Change Summary	Version Number
6/12/2017	Initial Draft	.01
10/11/2017	Final Draft	1.0
10/27/2017	Added signatories to PD- and VPD-RI safety requirements and revised all safety performance targets per RCAT meeting on 10/17–10/19, 2017.	1.1

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1 EXECUTIVE SUMMARY

1.1 Administrative Information

Title: Runway Incursion Safety Issue Safety Risk Management Document

Initiating Organization: The Air Traffic Organization, AJO-0

Safety Analysis Type: Operations

1.2 Current System

Introduction

Since 2011, the number of reported Runway Incursions (RIs)[1] of all Categories (CATs)[2] has increased annually. Though a total of 12,857 RIs has been reported since Fiscal Year (FY) 2008, that 6,150 of these incidents occurred between FY12 and FY16 is the impetus for the current safety assessment (see Figure 1.1 below). In FY16, approximately 50 percent of RIs were identified as having been caused by Pilot Deviations (PDs), 11 percent by Vehicle/Pedestrian Deviations (VPD), and 39 percent by Operational Incidents (OI) (see Figure 1.2 on the following page).

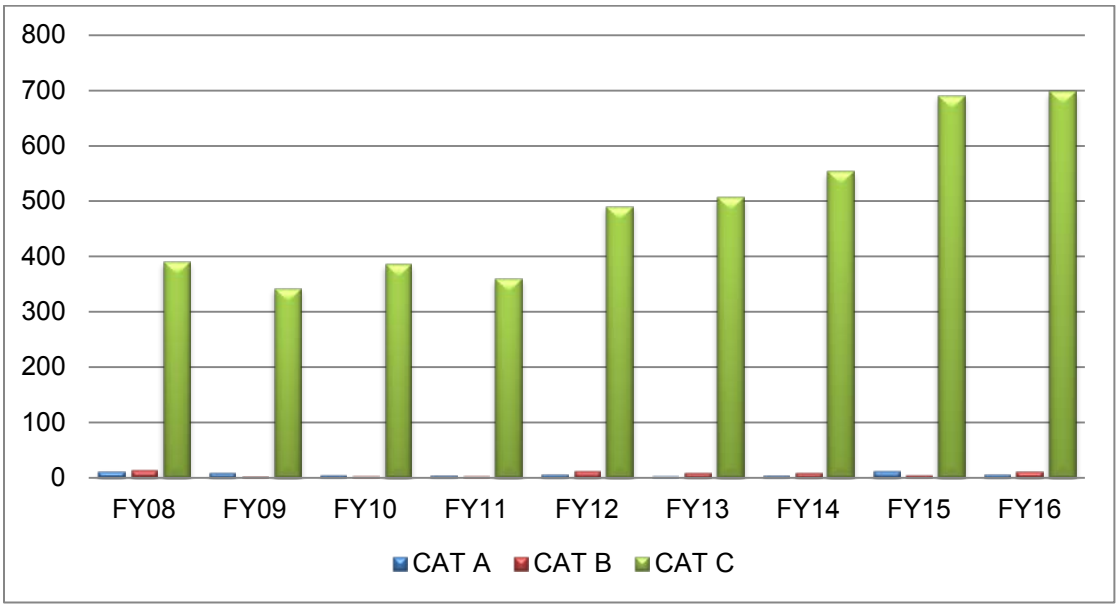


Figure 1.1: FY08–FY16 Reported RIs

[1] An RI is any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for landing and takeoff of aircraft.

[2] The Federal Aviation Administration has aligned its severity categories with that of the International Civil Aviation Organization's, which excludes surface incidents (i.e., an unauthorized or unapproved movement within the designated movement area or an occurrence in that same area associated with the operation of an aircraft that affects or could affect the safety of flight.

This Safety Risk Management (SRM) document does not assume that the annual increase in reported RIs since 2011 indicates that such incidents have been occurring more frequently. In 2008, the Air Traffic Organization (ATO) began improving its Safety Management System (SMS) through voluntary safety reporting programs such as the Air Traffic Safety Action Program (ATSAP); follow-on programs to ATSAP include the Confidential Information Share Program, and the Technical Operations Safety Action Program. These voluntary reporting programs, along with Mandatory Occurrence Reports and the Comprehensive Electronic Data Analysis and Reporting tool, are SMS initiatives intended to maintain a positive safety culture, encouraging personnel to demonstrate their commitment to safety by sharing safety issues without fear of reprisal. Therefore, the panel noted that the observed increase in reported RIs of all categories may be reflective of a thriving safety culture rather than a decrease in safety; nevertheless, the rise in incidents demands that controls currently serving to mitigate the number and types of RIs be reviewed, verified, and/or improved if found inadequate.

Figure 1.2 below provides a graphical overview of the RIs that occurred in FY16 alone. (*Note*: While the percentage of each type of incident differs annually, PD-related RIs consistently account for the greatest portion of RI types [i.e., over OIs and VPDs] year after year.) Moreover, historical data indicate that nearly 75 percent of these events were caused by a General Aviation (GA) pilots.

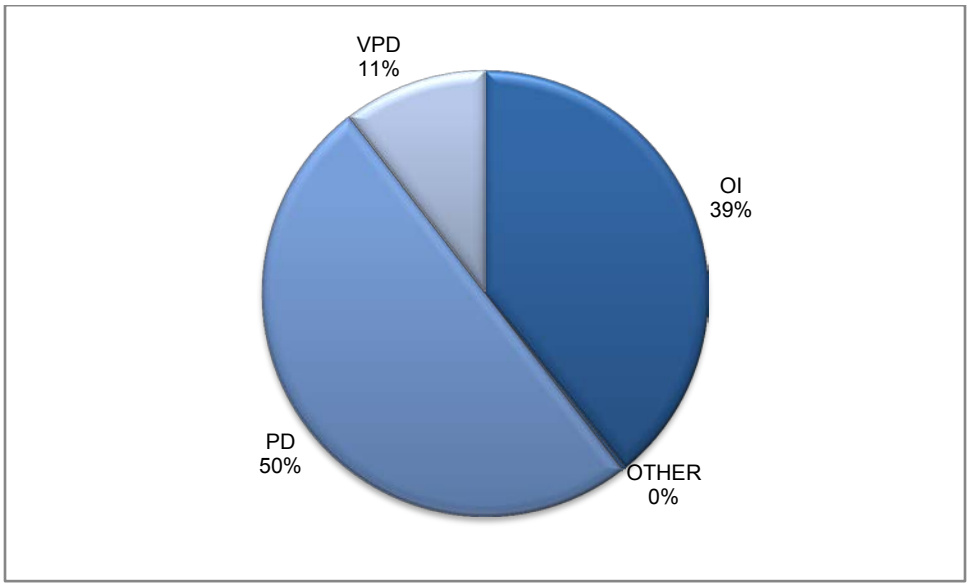


Figure 1.2: FY16 Reported RI Incidents

Furthermore, SMS policy defines risk as the composite of the severity and likelihood of a hazard's potential effect. While the worst credible effect[3] may reflect the highest severity, the likelihood that it will occur may be low. A less severe but more frequent effect of a hazard may retain a higher risk level than the more severe possibility (See

[3] The panel considered the worst credible effect of the causal factors detailed in this document to be CAT A RIs; however, the panel incorporated CATs B and C into their analysis to ensure due diligence is performed and to further remain consistent with the SMS Manual's matrix approach for determining current risk.

the SMS Manual, July 2016, Section 3.5.4.1, *How to Define and Determine Risk*). The RI Safety Issue Team, cognizant of the risk rating method per SMS policy, considered its mission to reduce both the likelihood and the occurrence of the more severe effects of CATs A and B RIs. See Appendix B for the Hazard Severity Classifications for RIs per the SMS Manual.

The panel acknowledged that the SMS policy itself presents a particular difficulty to the safety assessment of RIs, particularly with regard to data challenges (i.e., there is no way of knowing whether the rate of events *reported* reflects the total number of events that occurred) and affecting a positive change in behavior. Subject Matter Experts (SMEs) and panel members from Lines of Business (LOBs) across the Agency, along with three representatives from various pilot organizations (e.g., Aircraft Owners and Pilots Association, the Air Line Pilots Association (ALPA), and the National Business Aviation Association), acknowledged that efforts must first be focused towards reducing the number of RIs that occur each year; this goal included both mitigating the more severe effects of CATs A and B RIs and decreasing the total number of CAT C RIs, which represent the majority of reported events (see Figure 1.3). To observe trends consistent with these objectives was considered by all to be an indication of effective mitigations.

The safety issue occurs for both GA and commercial aircraft. Though more incidents may occur in the GA environment, the risk is systemic. Student pilots may deviate from Air Traffic Control (ATC) instructions or be involved in an RI more frequently, but events occur regardless of the mitigations in place. The analysis of RI data for FY16 was separated into PDs, OIs, and VPDs to better assist the panel with determining whether common causes existed within the individual groups and to subsequently focus the mitigations to treat those common causes.

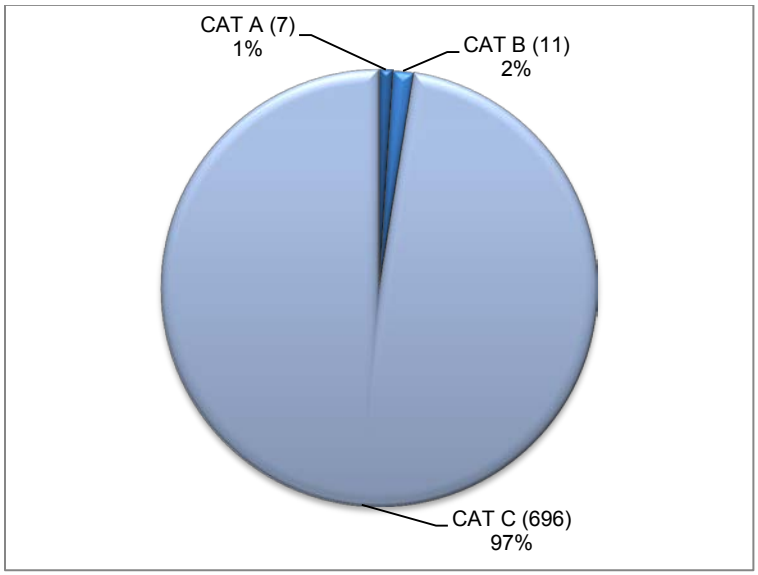


Figure 1.3: FY16 RIs by Category

The panel considered its goal to be identifying a successful approach to achieving a transformed safety culture, whether by building upon previous efforts focused toward mitigating related safety issues or by exploring new strategies for overall risk reduction. Recurrent topics of discussion among panel participants were that of situational awareness from the perspectives of all identified agents: pilots (GA and commercial), ATC, and vehicle operators; effective communication between the cockpit and the Airport Traffic Control Tower (ATCT); and the need for appropriate training, which includes the proper use of surveillance systems and other technological innovations in order to maintain pace with an ever-evolving National Airspace System (NAS).

Need for an SRM Panel

The Federal Aviation Administration (FAA) identified RIs as one of the Agency's high-priority safety issues to be addressed across LOBs in FY17. Due to an increase in CATs A, B, and C RIs, the FAA SMS Committee charged Safety and Technical Training (AJI) with assessing the hazards and identifying targeted safety requirements to mitigate the current safety risk. The Runway Safety Group, AJI-140, and the Safety Engineering Team, AJI-314, collaborated during several pre–SRM panel meetings to identify the appropriate taxonomies for Surface Risk Analysis Process (SRAP) data to inform the impending analysis. All status activities were reported to the FAA SMS Committee and FAA SMS Executive Council at predefined intervals since FY17 commenced.

Prior to the present RI Safety Issue SRM panel, a Runway Safety Call to Action (C2A) convened on June 24, 2015, which was summoned by the FAA Administrator as a continuation of the five-point C2A Safety Summit in 2007. The Summit was a short-term Corrective Action Plan (CAP) intended to address RIs of all categories by exploring technological advancements (see Appendix C for the 2015 C2A Summary Report). In addition to technological improvements, the campaign emphasized training for pilots, airport signage, and communications to meet predefined objectives. CATs A and B RI events reduced in the short term after this original activity, but recent years have shown an increase yet again, necessitating the safety assessment detailed in this document.

In addition, a recent SRM panel initiated by the ATO Top 5 Program assessed the FY17 hazard identified as "runway or Runway Safety Area (RSA) contaminated with aircraft, vehicle, or pedestrian," which resulted in runway flyovers corresponding to the effects of CATs A, B, and C RIs. Safety requirements imposed by this SRM panel included a Back to Basics campaign for pilots and ATC that was similar to the National Air Traffic Controllers Association's (NATCA's) "Turn Off, Tune In Campaign" a Safety Alert for Operators (SAFO) 01 Run, *High Collision Risk During Runway Crossing*, aimed at the pilot community with the goal of increasing situational awareness and ultimately reducing PDs; and a Human Factors Study, *Visual Scanning Techniques*, all of which the RI Safety Issue panel considered to inform their discussions surrounding additional mitigation strategies (i.e., safety requirements).

Moreover, AJI considered the FY16 RI data a vital component in, not only identifying whether additional safety requirements were needed at the time of the forthcoming

safety assessment, but also in determining the necessary stakeholders and SMEs who would leverage their operational expertise at that time.

Scope of SRM Panel

In order to focus the analysis of the RI Safety Issue and to aptly measure the current level of risk observed in the NAS, data analysts restricted the data set to events occurring in FY16 alone; doing so subsequently assisted the panel in focusing proposed mitigations. Reviewing FY16 data of CATs A, B, and C RIs, AJI-140 and AJI-314 analyzed the data and developed a baseline level of risk, determined trends, common contributing factors, and system states. With regard to RI categories, the panel remained consistent with the International Civil Aviation Organization's (ICAO) definitions. Table 1.1 below provides the ICAO definitions for the RI CATs considered by the panel.

Table 1.1: ICAO RI Definitions

Category	ICAO Definition
CAT A	A serious incident in which a collision was narrowly avoided.
CAT B	An incident in which separation decreased and there is a significant potential for collision, which may result in a time critical/evasive response to avoid a collision.
CAT C	An incident characterized by ample time and/or distance to avoid a collision.

SRAP data reviewed showed that RIs of all categories occurred at towered[4] facilities NAS-wide, irrespective of Service Area or facility level; therefore, the facilitation team sought to conduct a risk assessment that reflected this finding. The panel was also convinced that considering an airport's facility level would be beneficial to the panel for the purpose of treating risk (e.g., Hartsfield-Jackson Atlanta International Airport, a Level 12 facility, conducts more complex airport operations and has more technology than Mansfield Municipal Airport). Attentiveness to the range of facilities, particularly the differences in number of operations and available technology, would serve to augment the original efforts resulting from the C2As initiated in 2007 and 2015.

In order to bound the system, a 5M Model was used to capture details necessary to describe the system and verify the pre-developed Hazard Analysis Worksheet (HAW). The 5M Model depicts the interrelationships among the essential elements involved in the safety assessment of RIs and is detailed in Table 1.2 on the following page.

[4] Per FAA Order 7050.1B, *Runway Safety Program*, Appendix A, Runway Incursion Determination and Surface Incident Determinations, Paragraph A-2a., "Only surface events at airports with an operating ATCT are recorded and classified as **runway incursions** and surface incidents. The FAA Air Traffic Organization does not control surface movement where an ATCT is not present or operational." Facilities without towers were excluded from this safety assessment. "Towered" facilities include ATCTs with radar, those combined with Terminal Radar Approach Control facilities (with and without radar), and Federal Contract Towers.

Table 1.2: 5M Model

Mission: The clearly defined and detailed purpose of the NAS change proposal or system/operation being assessed	Identify new and/or improve existing mitigations to reduce the overall number and types of CATs A, B, and C RIs NAS-wide.
(hu)Man: Operators, maintainers, and affected stakeholders	ATC, Pilots, Airport Operators, Vehicle Operators,
Machine: Equipment used in the system	ASDE-X, RWSL, RID Tool Box, Airport Signage and Markings
Management: Procedures and policies that govern the system's behavior	FAA Order JO 7110.65, *Air Traffic Control*; FAA Order JO 7210.3, *Facility Operation and Administration*; Title 14 of the Code of Federal Regulations; Letters of Agreement; Advisory Circulars
Media: The environment in which the system is operated/maintained	All movement areas, runways, and RSAs at towered airports.

1.3 Existing Safety Issue Description

AJI's chief objective in preparation for the RI Safety Issue panel was to ensure a data-driven analysis. Observing that the data of reported RIs revealed common causes, contributing factors, and controls (i.e., "barriers"), the RI Safety Issue Team developed summary categories encapsulating similar events, which were grouped according to their associated causes, subcauses, and controls. The panel's aim was to verify and validate that the correct causes, subcauses, and controls identified by the data analysts were in fact included in the pre-developed HAW; furthermore, the panel discussed whether the controls (i.e., measures that currently exist in the system that work against the hazard's occurrence) are functioning at an adequate level or require additional mitigations.

For consistency with ICAO standards, the panel verified the definition of an RI as:

> Any occurrence at an aerodrome involving the incorrect presence of an **aircraft**, **vehicle**, or **person** on the protected area of a surface designated for landing and takeoff of aircraft.

The panel noted that "incorrect" does not mean "unauthorized." An aircraft may be authorized to be on a particular runway and still be involved in an RI. Observing that the incorrect presence may be that of an aircraft, vehicle, or person, the panel was convinced that further delineation was required between factors manifesting in each type of RI.

1.3.1 Hazard Identification and Causes

The panel subcategorized the hazard into three separate classes according to the key causative agents whose action(s) or inaction(s) manifest in the effects of a CAT A, B, or C RI. The following are the types of RIs considered by the panel:

- **PDs:** Action by pilot that violates any Federal Aviation Regulation [FAR] (e.g., a pilot crosses a runway without a clearance while enroute to an airport gate.)
- **OIs:** Action of an air traffic controller that results in: less than required minimum separation between two or more aircraft, or between an aircraft and obstacles (vehicles, equipment, personnel on runways) or clearing an aircraft to takeoff or land on a closed runway.
- **VPDs:** Pedestrians or vehicles entering any portion of the airport movement areas (runways/RSAs) without authorization from ATC.

The identified hazards are listed below in order of their frequency, with PD-related RIs representing the highest percentage of reported events in FY16. (*Note:* Hazard identification codes are alpha-numeric according to the FY of data reviewed and the types of RIs aforementioned.) The hazards according to their key agents are as follows:

- **16-RI-PD:** Incorrect presence of aircraft in the protected area designated for takeoff or landing of an aircraft.
- **16-RI-OI:** Incorrect presence of vehicle, pedestrian, or aircraft in the protected area designated for takeoff or landing of an aircraft.
- **16-RI-VPD:** Incorrect presence of personnel/vehicle in the protected area designated for takeoff or landing of an aircraft.

1.3.2 System States

As the expression of the various conditions in which hazards can exist, the system states were verified by the panel according to their operational/procedural, conditional, and physical natures. The system states discussed were those that the panel believed most exposed the hazards associated with the contributory factors of PD, OI, and VPD RIs. In order to facilitate ease of discussion later when identifying mitigations targeted to each of the identified agents, the panel agreed to list Part 139 / federally-obligated airports and non–Part 139 airports separately on the HAW. These categories were then subcategorized according to their natures (e.g., technology availability and GA airports versus those that are primarily for training pilots). The system states in which RIs of all types are likely to occur are as follows:

- ***Operational and Procedural:***
    - Aircraft on arrival or departure
- ***Conditional:***
    - Instrument Meteorological Conditions (IMC) and Visual Meteorological Conditions (VMC)
    - Day or night

- ***Physical:***
    - Part 139 Airports (those with ground surveillance with or without Runway Status Lights (RWSL) and those without ground surveillance)
    - Non–Part 139 Airports (GA airports and GA "flight-training" facilities)

1.3.3 Controls

The panel acknowledged policies and procedures currently functioning to mitigate the RIs associated with PDs, OIs, and VPDs; while the majority of the controls listed apply to all types of RIs, panel members also listed various controls that were considered specific to particular scenarios based on SME input, knowledge of current controls, and relevant SRAP data indicating the barriers existing at the time of a particular event. The policy documentation, procedures, and technology that the panel identified as currently mitigating RIs of all types are as follows:

- ***Policy Documentation:***
    - Title 14 of the Code of Federal Regulations (14 CFR)
    - FAA Order JO 7110.65, *Air Traffic Control*
    - FAA Order JO 7210.3, *Facility Operation and Administration*
    - FAA Order JO 7050.1B, *Runway Safety Program*
    - Advisory Circulars (ACs)
    - Notices to Airmen (NOTAMs)
- ***Procedures:***
    - Go around
    - Canceled takeoff clearance
    - ATC instructions to pilot, airport/vehicle operator
- ***Technology:***
    - Safety Logic (e.g., Airport Surface Detection Equipment Model X [ASDE-X], ASDE-3, and Airport Surface Surveillance Capability [ASSC] / Airport Movement Area Safety System [AMASS])
    - Airport lighting, signage, and markings
    - RWSL

Conversely, certain controls were considered more effective to mitigate specific *types* of RIs. For example, the Pilot Handbook of Aeronautical Knowledge, FAA-H-8083-25B 2016, Chapter 14, was cited as a control functioning to reduce PDs. Controls such as FAA Order 6000.15, *General Maintenance Handbook for NAS Facilities*, and the Electronic Management System (eLMS) Course 60004747, *Airfield Driver Education* (TechOps) pertain to VPD-induced RIs. To manage OI-related RIs, controls such as

On-the-Job-Training (OJT) and FAA Order 8000.94, *Procedures for Establishing Airport Low Visibility Operations and Approval of Low-Visibility Operations / Surface Movement Guidance and Control System Operations*, were documented. Please note that this narrative is not a comprehensive list of the controls discussed during the safety assessment. See Section 1.8, *Hazard and Risk Analysis*, for the panel's complete list for each type of RI (contained in their respective HAWs). (*Note*: The panel recognized that PD- and OI-related RIs share many of the same controls by virtue of communication concerning the safety of flight between pilots and controllers.)

The aforementioned system states may affect the types of controls functioning to prevent an RI at the time of a specific event. Furthermore, controls may vary even among a single system state. For example, Pilot Electronic Flight Bags (EFBs), electronic management devices that were purposed to minimize the amount of hardcopy reference material found in a typical flight bag, are used by GA pilots to maintain situational awareness in the cockpit; however, not all GA pilots use EFBs. Mobile applications such as Foreflight and WingX Pro 7 are considered EFBs. Acknowledging this inherent complexity, the panel endeavored to be as comprehensive as possible when listing all known controls.

1.4 Risk Summary

1.4.1 Effects

1.4.1.1 RIs Associated with Pilot Deviations[5]

The panel reviewed a data sample of 361 reported RIs in FY16, which were attributed to an action executed by a pilot that violated a FAR or instructions issued by ATC. Of these events, distinct trends were observed with regard to the most prevalent causes, subcauses (i.e., contributing factors), and controls applied in 259 of these instances. Each of the incidents were assigned a single cause, representing the general error resulting in a CAT A, B, or C RI. The primary causes were deconstructed further to account for the chief contributing factors of each. The four dominant causes of PD-related RIs include:

1. Pilot failed to hold short of the runway, as instructed (139),
2. Pilot failed to hold short of the runway (i.e., aircraft entered the runway environment without ATC clearance) (76),
3. Pilot did not follow ATC clearance (25), and
4. Pilot departed without takeoff clearance (19).

The panel observed that 139 of the incidents were attributed to a pilot failing to hold short of the runway, as instructed; 76 of the incidents were attributed to the pilot failing to hold short of the runway hold short line, which is required by 14 CFR 91.129(i),

[5] Note: One CAT A RI was associated with PDs (i.e., a pilot landing on the wrong runway); however, it did not fall into the common causes analyzed by the panel.

Takeoff, landing, taxi clearance;[6] 25 of the events entailed the pilot not following the clearance issued by ATC; and, in 17 cases, the pilot departed without a takeoff clearance.

In the interest of avoiding confusion while maintaining consistency with the SRAP taxonomies used for data collection, the panel leveraged their operational expertise to revise the language of the first cause to distinguish it from the second. The panel noted that the language listed in the HAWs must remain consistent with the predefined SRAP categories to maintain the integrity of data analysis process; however, the distinction between Causes 1 and 2 pertains to the issuing of ATC instructions.[7] In the first scenario, ATC issued instructions to the pilot to hold short of the runway; in the second scenario ATC did not, and the pilot failed to hold short of the runway hold short line.

Severity and Likelihood of PD-related RIs

Upon reviewing the data, the panel assessed the severity and likelihood of the identified effects, which were tied to each of the four dominant causes of PD-related issues. Current risk was calculated by: 1) separating CATs of RIs attributed to each primary cause and assigning them their own severity according to the SMS Manual, July 2016, Section 3.5.4.2, *Determining Severity*; and 2) calculating the likelihood of each CAT RI by dividing the number of events of each CAT of RI by the sum of known affected operations in FY16 (49,994,851) per the SMS Manual, July 2016, Section 3.5.4.3.3, *Calculating Likelihood with Quantitative Data*. This method produced the following current risk scores for each primary cause.

1. Pilot failed to hold short of runway as instructed

FY16 SRAP data indicated that 3 CAT A RIs and 136 CAT C RIs were attributed to this primary cause. The panel subsequently validated the severity of each CAT of RI. According to the SMS Manual, July 2016, Section 3.5.4.2, a CAT A RI maintains a severity of Hazardous (2), while a CAT C RI maintains a severity of Minor (4).

Dividing the number of events of each CAT RI by the total number of airport operations in FY16 yielded the following likelihood rates:

- **CAT A:** $3 \div 49{,}994{,}851 = 6.0 \times 10^{-8}$ — Extremely Remote (D)
- **CAT C:** $136 \div 49{,}994{,}851 = 2.7 \times 10^{-6}$ — Remote (C)

For CAT A RIs associated with the above primary cause, a severity of Hazardous (2) and likelihood of Extremely Remote (D) result in a risk level of **MEDIUM (2D)**. For CAT C RIs, a severity of Minor (4) and likelihood of Remote (C) result in a current risk of **MEDIUM (4C)**.

[6] No person may, at any airport with an operating control tower, operate an aircraft on a runway or taxiway, or take off or land an aircraft, unless appropriate clearance is received from ATC.

[7] ATC is not always required to instruct pilots to hold short of the runway.

Table 1.4A: Current Risk for 16-RI-PD$_A$

Hazard ID	Hazard Description	Primary Cause	Effect	Current Risk
16-RI-PD$_A$	Incorrect presence of aircraft in the protected area designated for takeoff or landing of an aircraft.	A. Pilot failed to hold short of the runway as instructed.	A_1. CAT A RI	**MEDIUM (2D)**
			A_2. CAT C RI	**MEDIUM (4C)**

2. Pilot failed to hold short of the runway (i.e., aircraft entered the runway environment without ATC clearance).

FY16 SRAP data indicated that 2 CAT B RIs and 74 CAT C RIs were attributed to this primary cause. The panel subsequently validated the severity of each CAT of RI. According to the SMS Manual, July 2016, Section 3.5.4.2, a CAT B RI maintains a severity of Major (3), while a CAT C RI maintains a severity of Minor (4).

Dividing the number of events of each CAT RI by the total number of airport operations in FY16 yielded the following likelihood rates:

- **CAT B:** $2 \div 49{,}994{,}851 = 4.0 \times 10^{-8}$ — Extremely Remote (D)
- **CAT C:** $74 \div 49{,}994{,}851 = 1.5 \times 10^{-6}$ — Remote (C)

For CAT B RIs associated with the above primary cause, a severity of Major (3) and likelihood of Extremely Remote (D) result in a risk level of **MEDIUM (3D)**. For CAT C RIs, a severity of Minor (4) and likelihood of Remote (C) result in a current risk of **MEDIUM (4C)**.

Table 1.4B: Current Risk for 16-RI-PD$_B$

Hazard ID	Hazard Description	Primary Cause	Effect	Current Risk
16-RI-PD$_B$	Incorrect presence of aircraft in the protected area designated for takeoff or landing of an aircraft.	B. Pilot failed to hold short of runway (i.e., aircraft entered runway environment without ATC clearance).	B_1. CAT B RI	**MEDIUM (3D)**
			B_2. CAT C RI	**MEDIUM (4C)**

3. Pilot did not follow ATC clearance

FY16 SRAP data indicated that 25 CAT C RIs were attributed to this primary cause. According to the SMS Manual, July 2016, Section 3.5.4.2, a CAT C RI maintains a severity of Minor (4).

Dividing the number of events of CAT C RIs by the total number of airport operations in FY16 yielded the following risk score:

- **CAT C:** $25 \div 49{,}994{,}851 = 5.0 \times 10^{-7}$ — Remote (C)

For CAT C RIs, a severity of Minor (4) and likelihood of Remote (C) result in a current risk of **MEDIUM (4C)**.

Table 1.4C: Current Risk for 16-RI-PD$_C$

Hazard ID	Hazard Description	Primary Cause	Effect	Current Risk
16-RI-PD$_C$	Incorrect presence of aircraft in the protected area designated for takeoff or landing of an aircraft.	C. Pilot did not follow ATC clearance.	C. CAT C RI	**MEDIUM (4C)**

4. Pilot departed without takeoff clearance

FY16 SRAP data indicated that 2 CAT B RIs and 17 CAT C RIs were attributed to this primary cause. According to the SMS Manual, July 2016, Section 3.5.4.2, a CAT B RI maintains a severity of Major (3) and a CAT C RI maintains a severity of Minor (4).

Dividing the number of events of CAT B and CAT C RIs by the total number of airport operations in FY16 yielded the following likelihood rates:

- **CAT B:** $2 \div 49{,}994{,}851 = 4.0 \times 10^{-8}$ — Extremely Remote (D)
- **CAT C:** $17 \div 49{,}994{,}851 = 3.4 \times 10^{-7}$ — Remote (C)

For CAT C RIs, a severity of Minor (4) and likelihood of Remote (C) result in a current risk of **MEDIUM (4C)**.

Table 1.4D: Current Risk for 16-RI-PD$_D$

Hazard ID	Hazard	Primary Cause	Effect	Current Risk
16-RI-PD$_D$	Incorrect presence of aircraft in the protected area designated for takeoff or landing of an aircraft.	D. Pilot departed without takeoff clearance.	D_1. CAT B RI	**MEDIUM (3D)**
			D_2. CAT C RI	**MEDIUM (4C)**

The current risk scores for each subhazard are plotted on the SMS Risk Matrix in Figure 1.4A on the following page.

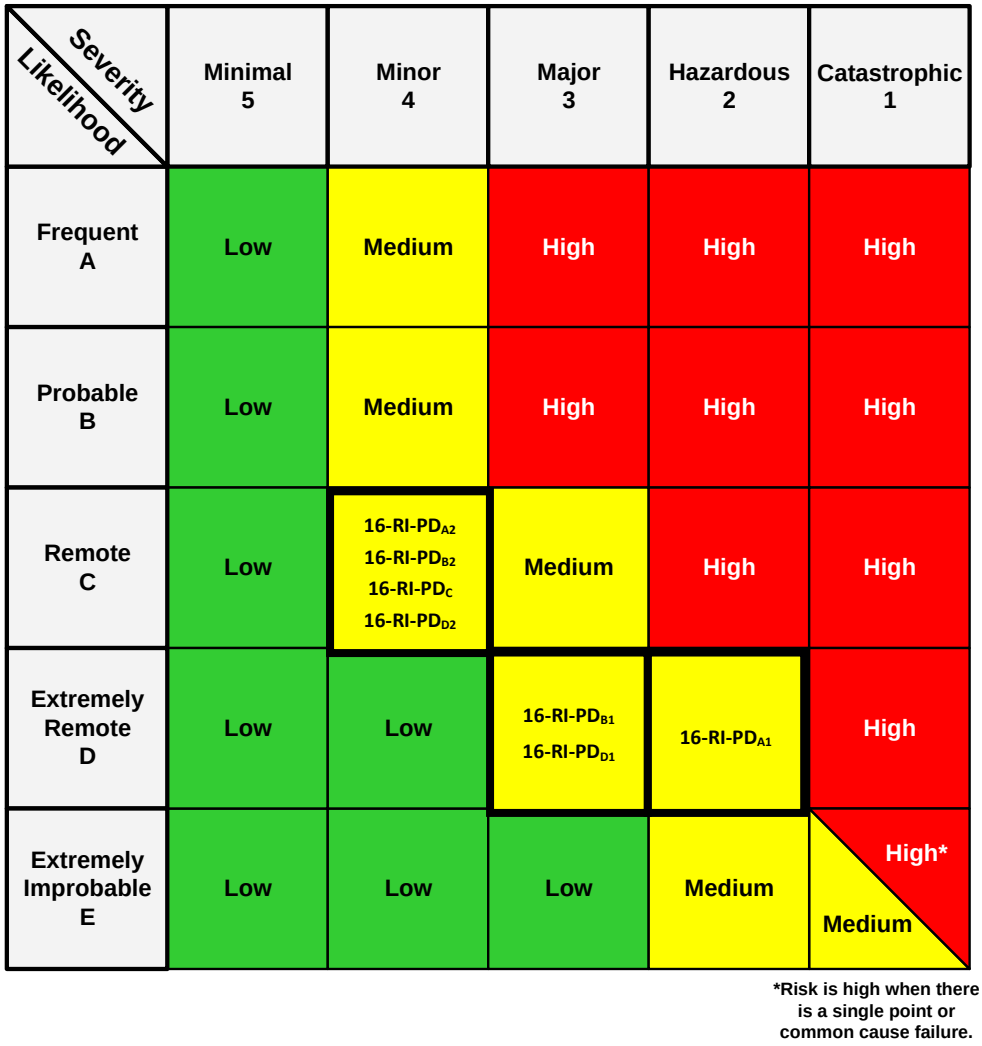


Figure 1.4A: PD-Related RI Risk Matrix

1.4.1.2 RIs Associated with Operational Incidents[8]

The panel reviewed a data sample of 265 reported RIs in FY16, which were attributed to an action executed by ATC that resulted in less than the required minimum separation between two or more aircraft. Of these events, distinct trends were observed with regard to the most prevalent causes, subcauses (i.e., contributing factors), and controls applied in 250 of these instances. Each of the incidents were assigned a single cause, representing the general OI resulting in a CAT A, B, or C RI. The primary causes were deconstructed further to account for the chief contributing factors of each. The four dominant causes of OI-related RIs include:

1. ATC cleared aircraft to land/depart on occupied runway (183),
2. ATC did not monitor aircraft position on approach to intersecting runway (i.e., ATC cleared aircraft to land or depart on an intersecting runway) (52),

[8] Note: One CAT A RI was associated with OIs (i.e., military aircraft conducting night, lights out operational training); however, it did not fall into the common causes analyzed by the panel.

3. ATC cleared aircraft to cross runway with aircraft on departure/landing roll (15).

The panel observed that 183 of the incidents were attributed to a controller clearing aircraft to land or depart on an occupied runway; 52 of the incidents were attributed to controllers failing to monitor aircraft position on approach to an intersecting runway; in 15 cases, a controller cleared an aircraft to cross a runway with another aircraft on departure/landing roll.

Severity and Likelihood of OI-related RIs

Upon reviewing the data, the panel assessed the severity and likelihood of the identified effects, which were tied to each of the four dominant causes of OI-related issues. Current risk was calculated by: 1) separating CATs of RIs attributed to each primary cause and assigning them their own severity according to the SMS Manual, July 2016, Section 3.5.4.2, *Determining Severity*; and 2) calculating the likelihood of each CAT RI by dividing the number of events of each CAT of RI by the sum of known affected operations in FY16 (49,994,851) per the SMS Manual, July 2016, Section 3.5.4.3.3.

1. ATC cleared aircraft to land/depart on occupied runway

FY16 SRAP data indicated that 2 CAT A RI, 5 CAT B RI, and 176 CAT C RIs were attributed to this primary cause. According to the SMS Manual, July 2016, Section 3.5.4.2, a CAT A RI maintains a severity of Hazardous (2), a CAT B RI maintains a severity of Major (3), and a severity of Minor (4) constitutes a CAT C RI.

Dividing the number of events of each CAT RI by the total number of airport operations in FY16 yielded the following likelihood rates:

- **CAT A:** $2 \div 49{,}994{,}851 = 4.0 \times 10^{-8}$ — Extremely Remote (D)
- **CAT B:** $5 \div 49{,}994{,}851 = 1.0 \times 10^{-7}$ — Remote (C)
- **CAT C:** $176 \div 49{,}994{,}851 = 3.5 \times 10^{-6}$ — Remote (C)

For CAT A RIs associated with the above primary cause, a severity of Hazardous (2) and likelihood of Extremely Remote (D) result in a risk level of **MEDIUM (2D)**. For CAT B RIs, a severity of Major (3) and a likelihood of Remote result in a risk level of **MEDIUM (3C)**. For CAT C RIs, a severity of Minor (4) and likelihood of Remote (C) result in a current risk of **MEDIUM (4C)**.

Table 1.4E: Current Risk for 16-RI-OI_A

Hazard ID	Hazard Description	Primary Cause	Effect	Current Risk
16-RI-OI_A	Incorrect presence of aircraft in the protected area	A. ATC cleared aircraft to land/ depart on	A_1. CAT A RI	**MEDIUM (2D)**

Hazard ID	Hazard Description	Primary Cause	Effect	Current Risk
	designated for the takeoff or landing of an aircraft.	occupied runway.	A_2. CAT B RI	**MEDIUM (3C)**
			A_3. CAT C RI	**MEDIUM (4C)**

2. ATC did not monitor aircraft position on approach to intersecting runway (i.e., ATC cleared aircraft to land or depart on an intersecting runway

FY16 SRAP data indicated that 2 CAT B RIs and 50 CAT C RIs were attributed to this primary cause. According to the SMS Manual, July 2016, Section 3.5.4.2, a CAT B RI maintains a severity of Major (3), and a severity of Minor (4) constitutes a CAT C RI.

Dividing the number of events of each CAT RI by the total number of airport operations in FY16 yielded the following likelihood rates:

- **CAT B:** $2 \div 49{,}994{,}851 = 4.0 \times 10^{-8}$ — Extremely Remote (D)
- **CAT C:** $50 \div 49{,}994{,}851 = 1.0 \times 10^{-6}$ — Remote (C)

For CAT B RIs associated with the above primary cause, a severity of Major (3) and likelihood of Extremely Remote (D) result in a risk level of **MEDIUM (3D)**. For CAT C RIs, a severity of Minor (4) and likelihood of Remote (C) result in a current risk of **MEDIUM (4C)**.

Table 1.4F: Current Risk for 16-RI-OI_B

Hazard ID	Hazard Description	Primary Cause	Effect	Current Risk
16-RI-OI_B	Incorrect presence of aircraft in the protected area designated for takeoff or landing of an aircraft.	B. ATC did not monitor aircraft position on approach to intersecting runway (i.e., ATC cleared aircraft to land or depart on an intersecting runway).	B_1. CAT B RI	**MEDIUM (3D)**
			B_2. CAT C RI	**MEDIUM (4C)**

3. ATC Cleared aircraft to cross runway with aircraft on departure/landing roll

FY16 SRAP data indicated that 15 CAT C RIs were attributed to this primary cause. According to the SMS Manual, July 2016, Section 3.5.4.2, a CAT C RI maintains a severity of Minor (4).

Dividing the number of events of CAT C RIs by the total number of airport operations in FY16 yielded the following risk score:

- **CAT C:** $15 \div 49{,}994{,}851 = 3.0 \times 10^{-7}$ — Remote (C)

For CAT C RIs, a severity of Minor (4) and likelihood of Remote (C) result in a current risk of **MEDIUM (4C)**.

Table 1.4G: Current Risk for 16-RI-OI_C

Hazard ID	Hazard Description	Primary Cause	Effect	Current Risk
16-RI-OI_C	Incorrect presence of aircraft in the protected area designated for takeoff or landing of an aircraft.	C. ATC cleared aircraft to cross runway with aircraft on departure/landing roll.	C. CAT C RI	**MEDIUM (4C)**

The current risk scores for each subhazard are plotted on the SMS Risk Matrix in Figure 1.4B.

Likelihood \ Severity	Minimal 5	Minor 4	Major 3	Hazardous 2	Catastrophic 1
Frequent A	Low	Medium	High	High	High
Probable B	Low	Medium	High	High	High
Remote C	Low	16-RI-OI_{A3} 16-RI-OI_{B2} 16-RI-OI_C	16-RI-OI_{A2}	High	High
Extremely Remote D	Low	Low	16-RI-OI_{B1}	16-RI-OI_{A1}	High
Extremely Improbable E	Low	Low	Low	Medium	High* Medium

*Risk is high when there is a single point or common cause failure.

Figure 1.4B: OI-Related RI Risk Matrix

1.4.1.3 RIs Associated with Vehicle/Pedestrian Deviations

The panel reviewed a data sample of 74 reported RIs in FY16, which were attributed to pedestrians or vehicles. Of these events, distinct trends were observed with regard to the most prevalent causes, subcauses (i.e., contributing factors), and controls applied in these instances. Each of the incidents were assigned a single cause, representing the general error resulting in a CAT B or C RI. The primary causes were deconstructed further to account for the chief contributing factors of each. The two dominant causes of VPD-related RIs include:

1. Driver failed to hold short of runway / RSA (37) and
2. Pedestrian or driver entered runway without authorization (37).

The panel observed that 37 of the incidents were attributed to a driver failing to hold short of the runway or RSA, and in 37 cases, a pedestrian or driver entered the runway without authorization from ATC.

Severity and Likelihood of VPDs

Upon reviewing the data, the panel assessed the severity and likelihood of the identified effects, which were tied to each of the dominant causes of VPD-related issues. Current risk was calculated by: 1) separating CATs of RIs attributed to each primary cause and assigning them their own severity according to the SMS Manual, July 2016, Section 3.5.4.2, *Determining Severity*, and 2) calculating the likelihood by dividing the number of occurrences of the effect of each CAT of RI by the sum of known affected operations in FY16 (49,994,851) per the SMS Manual, July 2016, Section 3.5.4.3.3.

1. Driver failed to hold short of runway/RSA

FY16 SRAP data indicated that 1 CAT B RI and 36 CAT C RIs were attributed to this primary cause. According to the SMS Manual, July 2016, Section 3.5.4.2, a CAT B RI maintains a severity of Major (3), and a severity of Minor (4) constitutes a CAT C RI.

Dividing the number of events of each CAT RI by the total number of airport operations in FY16 yielded the following likelihood rates:

- **CAT B:** $1 \div 49{,}994{,}851 = 2.0 \times 10^{-8}$ — Extremely Remote (D)
- **CAT C:** $36 \div 49{,}994{,}851 = 7.2 \times 10^{-7}$ — Remote (C)

For CAT B RIs associated with the above primary cause, a severity of Major (3) and likelihood of Extremely Remote (D) result in a risk level of **MEDIUM (3D)**. For CAT C RIs, a severity of Minor (4) and likelihood of Remote (C) result in a current risk of **MEDIUM (4C)**.

Table 1.4H: Current Risk for 16-RI-VPD$_A$

Hazard ID	Hazard Description	Primary Cause	Effect	Current Risk
16-RI-VPD$_A$	Incorrect presence of vehicle/personnel in the protected area designated for takeoff or landing of an aircraft.	A. Driver failed to hold short of runway/RSA.	A_1. CAT B RI	**MEDIUM (3D)**
			A_2. CAT C RI	**MEDIUM (4C)**

2. Pedestrian/driver entered runway without authorization

FY16 SRAP data indicated that 37 CAT C RIs were attributed to this primary cause. According to the SMS Manual, July 2016, Section 3.5.4.2, a severity of Minor (4) constitutes a CAT C RI.

Dividing the number of CAT C RIs by the total number of airport operations in FY16 yielded the following risk score:

- **CAT C:** $37 \div 49{,}994{,}851 = 7.4 \times 10^{-7}$ — Remote (C)

For CAT C RIs associated with the above primary cause, a severity of Minor (4) and likelihood of Remote (C) results in a risk level of **MEDIUM (4C)**.

Table 1.4I: Current Risk for 16-RI-VPD$_B$

Hazard ID	Hazard Description	Primary Cause	Effect	Current Risk
16-RI-VPD$_B$	Incorrect presence of vehicle/personnel in the protected area designated for takeoff or landing of an aircraft.	B. ATC cleared aircraft to cross runway with aircraft on departure/landing roll.	B. CAT C RI	**MEDIUM (4C)**

The current risk scores for each subhazard are plotted on the SMS Risk Matrix in Figure 1.4C on the following page.

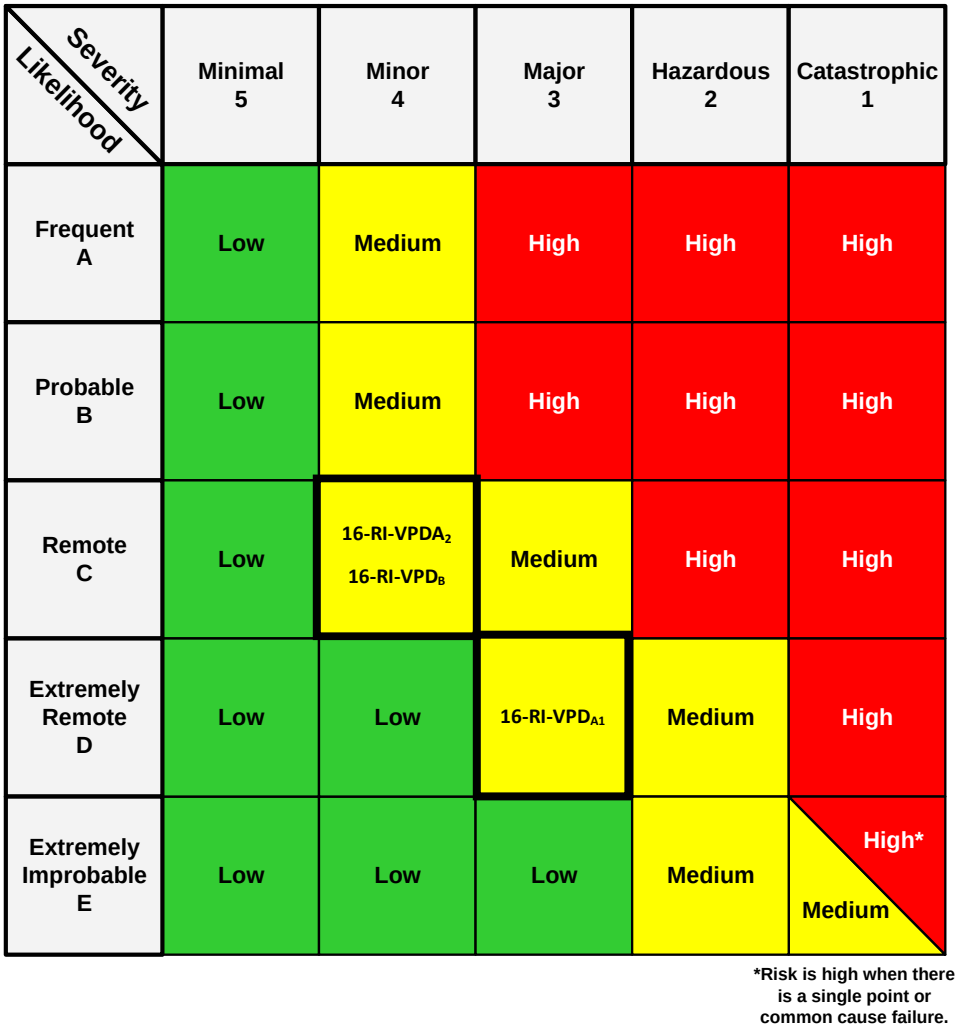


Figure 1.4C: VPD-Related RI Risk Matrix

1.5 Risk Treatment and Monitoring

The panel discussed a variety of mitigations to treat the RI Safety Issue and each of its unique causal scenarios. Some of the safety requirements proposed will have more immediate effects, while others were considered to require additional time to implement in order for a positive safety impact to be observed. The panel's methodology for identifying appropriate mitigations was to review the contributing factors that led to the primary causes for each type of RI. The panel believed that drawing corrective measures back to the factual events exhibited by data patterns would maintain the integrity of the SRM process and produce a more robust analysis.

1.5.1 Overview of Safety Requirements and Responsible Organizations

Since the causes identified vary in their nature and association with RIs, the panel was convinced that the safety requirements identified must correspond to the types of RIs analyzed as well as address the primary causes indicated by the FY16 SRAP data.

SMEs emphasized the necessity of tailoring mitigations to the range of facilities across the NAS. The panel remained resolute in its consideration that any additional mitigations imposed must also serve to strengthen corrective actions already in place, such as ongoing activities generated by the 2015 C2A, FY17 Top 5 Program assessments, and NATCA's 2011 Back to Basics campaign. The intention is not to impose more training; participants acknowledged the breadth of extant training already working to mitigate RIs across the NAS and endeavored to identify innovative ways to approach corrective measures.

Note: Though the panel considered it incumbent upon them to impose safety requirements targeted towards separately mitigating each type of RI (e.g., PD, OI, and VPD), they affirmed that the mitigations implemented to treat one may interface with either one or both of the remaining RI types. Safety performance monitoring will be conducted in accordance with this consideration.

1.5.1.1 Safety Requirements for PD-Related RIs

FY16 SRAP data showed that the top contributing factors of PD-related RIs are as follows:

- Communication issues,
- Confusion,
- Inattention,
- Distraction,
- Expectation bias, and
- A need for targeted training.

One of the most notable items of discussion with regard to risk treatment pertained to the pervasiveness of communication issues[9] between pilots and ATC, particularly hearback/readback issues. Panelists noted that communication may be the overarching factor manifesting in several ways (e.g., confusion). FY16 data showed that 65 percent of the pilots read back the correct instructions but still executed an unauthorized operation—most frequently not holding short of the runway hold short marking.

A representative of ALPA offered insight as to potential reasons behind this statistic, noting that ATC will oftentimes issue lengthy phrases of instructions (e.g., taxi clearances), which lead to confusion. Further complicating the issue are the immediate demands within the cockpit, particularly the need for pilots to make swift judgments while navigating airports with unfamiliar runway geometry or hotspots;[10] additionally, low visibility, distractions in the flight deck, and poor crew resource management prove to be recurrent issues. The panel considered that any one of the aforementioned conditions as well as the interplay of several working simultaneously decrease pilots' situational awareness.

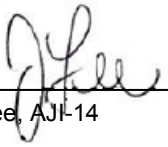
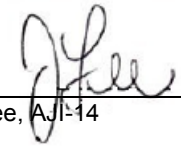
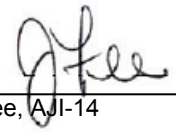
[9] Approximately 1/3 of all RIs are caused by communication incidents between the pilot and ATC.

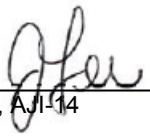
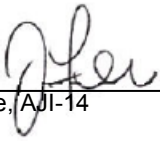
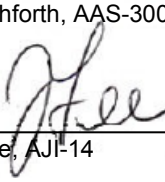
[10] A hotspot is defined as a location on an airport movement area with a history of potential risk of collision or RI; pilots and drivers must be especially vigilant to avoid potential safety incidents.

With this in mind, the panel considered what measures should be taken to augment pilot situational awareness. The panel's proposals ranged from technological advancements based on data reviews of particularly challenging runway geometries, promotional campaigns to educate pilots on the need to hold short of the runway hold short line, measures to improve communication between pilots and ATC, and revisiting/re-emphasizing the 2015 C2A to discover which actions need to be stressed with renewed energy. See Table 1.5A below for the complete list PD-related RI safety requirements and the organizations responsible for their implementation.

Table 1.5A: Safety Requirements for PD-Related RIs

16-RI-PD Safety Requirements	Responsible Organization	Timeframe	Signatures of Responsible Organizations
1. Assemble a team to review data to determine the best locations to install enhanced lighting direct to operator (e.g., embedded or elevated wig-wag lights or runway hold-short markings) based on the prevalence of hotspots. a. Promote/implement/require RSA enhancers/alerts to emphasize a pilot's entry into the RSA. b. Consider opportunities for eliminating the crossing of runways (i.e., end around taxiway).	1. AJI-14; AFS-800; AFS-220 a. ANG-C52 b. AAS-300; ACI-NA;	1. August 2018	1. James Fee, AJI-14 1. Bradley Palmer, AFS-800 1. Calvin Lott, AFS-220 1a. Westley Wright, ANG-C5 1b. Brian Rushforth, AAS-300 1b. Paul Eubanks, ACI-NA
2. Implement a continual promotional campaign or "information push" for pilots to not cross the hold short line or takeoff or land without a clearance (e.g., such as SAFO and FAAST Blast).	2. AFS-800; ALPA; AJI-14	2. August 2018	2. JOSEPH V FAGAN JR Digitally signed by JOSEPH V FAGAN JR Date: 2017.09.14 14:29:58 -04'00' Bradley Palmer, AFS-800 2. Mark Crystal, ALPA

16-RI-PD Safety Requirements	Responsible Organization	Timeframe	Signatures of Responsible Organizations
			2.  James Fee, AJI-14
3. Review corrective actions recommended by 2015 C2A and take appropriate action to accomplish.	3. AJI-14	3. August 2018	3.  James Fee, AJI-14
4. Encourage all operators to use EFBs with ownship position. a. Recommend that the EFB software manufacturers include a tutorial for the pilot to complete prior to unlocking the software functionality. b. Recommend that manufacturers develop their systems to integrated EFB– and situational awareness–enhancing technologies' system performance-based standards. c. Promote situational awareness by the use of integrated technologies (e.g., Pilot-in-the-Loop) in the cockpit.	4. AFS-800 a. AFS-800 b. AJI-14 c. AFS-800 (*Note*: with assistance from AOPA, NBAA, GAMA, ALPA, and EAA)	4. August 2018	4. JOSEPH V FAGAN JR Digitally signed by JOSEPH V FAGAN JR Date: 2017.09.14 14:25:04 -04'00' Bradley Palmer, AFS-800 4a. JOSEPH V FAGAN JR Digitally signed by JOSEPH V FAGAN JR Date: 2017.09.14 14:25:27 -04'00' Bradley Palmer, AFS-800 4b.  James Fee, AJI-14 4c. JOSEPH V FAGAN JR Digitally signed by JOSEPH V FAGAN JR Date: 2017.09.14 14:25:48 -04'00' Bradley Palmer, AFS-800

16-RI-PD Safety Requirements	Responsible Organization	Timeframe	Signatures of Responsible Organizations
5. Schedule a Runway Safety Action Team (RSAT) in conjunction with pilot/controller forums.	5. AJI-14	5. August 2018	5.  James Fee, AJI-14
6. Utilize pilot seminars regarding the four identified causes of PD–related RI issues (e.g., EAA, AOPA, FAAST).	6. AFS-800; AJI-14	6. Ongoing	6. JOSEPH V FAGAN JR Digitally signed by JOSEPH V FAGAN JR Date: 2017.09.14 14:26:07 -04'00' Bradley Palmer, AFS-800 6.  James Fee, AJI-14
7. Enhance performance of the RSAT through communication and the transfer of information between airport management, Air Traffic, and pilots at towered airport facilities (e.g., recurrent meetings with tenants to discuss RI issues).	7. AFS-800; AAS-300; AJI-14	7. Ongoing	7. JOSEPH V FAGAN JR Digitally signed by JOSEPH V FAGAN JR Date: 2017.09.14 14:26:26 -04'00' Bradley Palmer, AFS-800 7.  Brian Rushforth, AAS-300 7.  James Fee, AJI-14

1.5.2 Safety Requirements for OI-Related RIs

FY 16 SRAP data showed that the top three contributing factors of OI-related RIs are as follows:

- Controllers' misjudged or optimistic expectations,
- Anticipated separation rule, and
- Ineffective runway scanning,

Recalling the SRAP data for FY16, 63 percent of OI-related RIs were attributed to ATC clearing aircraft to land or depart on an occupied runway. The data also showed that the majority of contributing factors resulting in this action were associated with controllers misjudging the rate of closure or having optimistic expectations. The panel noted that in most instances this could be remedied by proper use of scanning techniques as well as controller memory aids. Furthermore, the panel recognized that optimistic expectations and anticipated separation rule may be encompassed by noncompliance with FAA Order JO 7110.65, which may require more targeted training regarding runway safety.

One of the chief items of discussion with regard to risk treatment pertained to the necessity of initial training on runway scanning techniques. A NATCA representative noted that there must always be a controller-in-charge or supervisor onsite to ensure proper scanning techniques are employed and that controllers do not overlook traffic; this especially applies where hotspots increase pilots' risk for an RI or potential collision.

With this in mind, the panel considered what measures should be taken to improve controllers' scanning techniques, minimize distraction, and augment Best Practices and Lessons Learned. The panel's proposals ranged from long-term efforts, including further research of technology such as the Small Airport Surveillance Sensor (SASS), which alerts controllers of an occupied runway. Actions for which immediate implementation was considered most feasible were promotional campaigns to emphasize the use of the Memory Aids Tool Box at the facility level, peer groups intended to share Best Practices and Lessons Learned (in order to identify opportunities for further training), and research conducted by the Human Performance Team, which would serve as input into training for effective controller runway scanning. See Table 1.5B below for the complete list OI-related RI safety requirements and the organizations responsible for their implementation.

Table 1.5B: Safety Requirements for OI-Related RIs

16-RI-OI Safety Requirements	Responsible Organization	Timeframe	Signatures of Responsible Officials
1. Utilize the Take a Stand for Safety campaign to raise awareness and address runway safety issues (e.g., RIs, runway	1. AJI-14	1. August 2018	1.  James Fee, AJI-14

16-RI-OI Safety Requirements	Responsible Organization	Timeframe	Signatures of Responsible Officials
flyovers, expectation bias).			
2. Emphasize the use of the Memory Aids Tool Box and improve the resource within a facility (implemented in 2016); create an Air Traffic Procedures Bulletin item emphasizing the need for memory aids, etc.	2. AJT-22; AJV-82	2. August 2018	2. Wendy O'Connor, AJT-22 2. Lawrence Beck, AJV-82
3. Utilize peer groups at facilities to emphasize runway safety Best Practices and develop a database for storing Lessons Learned and opportunities for further training.	3. AJI-14	3. August 2018	3. James Fee, AJI-14
4. AJI-14 and AJI-15 will partner to address controller runway scanning techniques: a. Provide AJI-2 with a Human Factors finding for runway scanning techniques. b. Based on the Human Factors finding, develop training that AJI-2 determines as the most effective way to provide training on runway scanning techniques.	4. AJI a. AJI-15 b. AJI-241	4. August 2018	4a. Jason Demagalski, AJI-15 4b. Darrell Hudson, AJI-241
5. Continue development of a system that indicates the occupied runway status such as the airport-wide surveillance system. (5+ years)	5. ANG-C52	5. Ongoing	5. Westley Wright, ANG-C5

1.5.3 Safety Requirements for VPD-Related RIs

FY 16 SRAP data showed that the top contributing factors of VPD-related RIs are as follows:

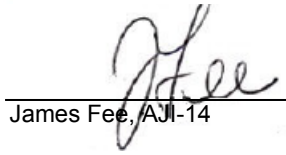
- Vehicle/Driver confusion (lack of situational awareness),
- ATC unaware of the vehicle's location,
- Driver failed to follow taxi instructions,
- ATC did not ensure correct read-back, and
- Incorrect phraseology (ATC speech).

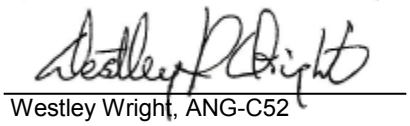
Recalling the SRAP data for FY16, 50 percent of the 74 VPD-related RIs reviewed were attributed to the driver failing to hold short of the runway; 50 percent were attributed to a driver entering the runway without ATC authorization. Much like the contributing factors for both PD- and OI-related events, data showed that the majority of contributing factors resulting in the aforementioned causes were attributed to confusion and lack of situational awareness. Therefore, safety requirements proposed entailed an emphasis on communication between airport management, vehicle operators and pedestrians, ATC, and pilots at towered facilities.

The panel observed that standardized training for vehicle operators is currently functioning to mitigate RIs. This training is available for personnel at Part 139 facilities; participants discussed the need to update educational training videos that are out of date and disseminate them to all facilities, both Part 139 and non-Part 139. Furthermore, a representative of Professional Airway System Specialists voiced the benefit of "ride-alongs" for vehicle drivers, which serve to reinforce classroom-based instruction through On-the-Job, performance-based learning.

The panel considered what measures could be taken to minimize confusion of vehicle operators and improve communication between vehicle operators and ATC. The panel's proposals ranged from long-term efforts such as the enhancement of Runway Safety Action Team activities and researching technology that may be installed in vehicles for operators' situational awareness. Actions for which immediate implementation was considered most feasible were the updates to the driver training videos and performance-based training at both Part 139 and non-Part 139 facilities. See Table 1.5C below for the complete list VPD-related RI safety requirements and the organizations responsible for their implementation.

Table 1.5C: Safety Requirements for VPD-Related RIs

16-RI-VPD Safety Requirements	Responsible Organization	Timeframe	Signatures of Responsible Officials
1. Update the educational/training products that are currently outdated and disseminate to all airports (towered Part 139 and non–Part 139) by August 2018.	1. AAS-300; AJI-14	1. August 2018	1.  Brian Rushforth, AAS-300 1.  James Fee, AJI-14
2. Enhance performance of the RSAT through communication and the transfer of information between airport management, Air Traffic, and pilots, and vehicle operators at towered airport facilities (e.g., recurrent meetings with	2. AFS-800; AAS-300	2. August 2018	2. JOSEPH V FAGAN JR Digitally signed by JOSEPH V FAGAN JR Date: 2017.09.14 14:28:15 -04'00' Bradley Palmer, AFS-800 2.  Brian Rushforth, AAS-300

16-RI-VPD Safety Requirements	Responsible Organization	Timeframe	Signatures of Responsible Officials
recurrent meetings with tenants to discuss RI issues). (1+ years)			
3. For non–Part 139 airports, identify appropriate measures to recommend/re-emphasize the use of enhanced performance-based training requirements (e.g., OJT "ride-alongs") for vehicle operators and technical operations personnel.	3. AAS-300	3. August 2018	3.  Brian Rushforth, AAS-300
4. Research the use of onboard-surveillance technologies for vehicle operators to enhance situational awareness.	4. ANG-C52	4. August 2018	4.  Westley Wright, ANG-C52

1.5.4 Additional Support for Safety Requirement Implementation

The AJI-14 Manager provided a report developed by the EUROCONTROL Safety Improvement Sub-Group (SISG) titled *Operational Safety Study: Sudden High Energy Runway Conflict*, which addressed CATs A and B RIs. Though this report focused on a more limited data set than did the RI Safety Issue SRM panel, the recommendations included in its appendices are consistent with the safety requirements identified by the RI Safety Issue panel. Among the recommendations identified by the EUROCONTROL SISG are the use of memory aids; correct, precise phraseology and visual attentiveness by ATC, pilots, and drivers; and training to support runway safety activities. For the complete list of recommendations, see Appendix D of this document.

1.6 Predicted Residual Risk and Safety Performance Targets

The panel considered predicting residual risk levels for each of the scenarios for which a current risk score was assigned a complex task since the proposed safety requirements are likely to interface among every type of RI. What is more, though the panel remained resolute in its position that any present or future analysis of RIs must be supported with meaningful data, they maintained the integrity of the SRM process by basing their conclusions on SME input and the operational expertise of stakeholders in the field.

Because mitigations were identified for each type of RI according to actions considered by the panel to bear the closest relationship to each of the primary causes, they affirmed the necessity of monitoring each type of RI differently. As a result, the panel developed safety performance targets separately for each PD-, OI-, and VPD-related

RIs. This methodology was believed to assist future endeavors to strengthen requirements, if necessary. The panel's safety performance targets were dependent upon the immediacy of safety requirement implementation; however, long-term activities were developed to provide a foundation upon which to build future risk management strategies. In general, the long-term activities pertain to technological research and enhancements, which the appropriate organizations committed to address with the relevant program management officials.

1.6.1 Predicted Residual Risk and Safety Performance Targets for PD-Related RIs

Considering the safety requirements intended to target PD-induced RIs, the panel expected to observe a five (5) percent overall reduction in the rate of CATs A, B, and C RIs or a reduction in CATs A and B RIs (i.e., those representing the highest severity) for events associated with the four primary causes. The panel did not consider stringent likelihood determinations a factor that could be accurately determined given trends exhibited in available data. Therefore, the predicted residual risk levels are expected to remain in the **MEDIUM** range.

Upon discussing the prevalence of pilots taking off without clearance from ATC, the panel agreed to define an additional safety performance target. Considering the positive influence of other publicity and educational campaigns such as SAFO and FAA Safety Team (FAAST) Blast—the panel believed that a six (6) percent reduction in the rate of RIs (CATs A, B, and C) or a reduction in CATs A and B RIs was also probable with the implementation of the promotional campaign. Table 1.6A briefly summarizes the panel's conclusions as to the predicted residual risk levels for PD-related RIs.

Table 1.6A: Predicted Residual Risk Summary for PD-Related RIs

Hazard ID	Description	Primary Causes	Effect	Current Risk	Predicted Residual Risk
16-RI-PD	Incorrect presence of aircraft in the protected area designated for takeoff or landing of an aircraft.	A. Pilot failed to hold short of runway as instructed	A_1. CAT A RI (3) A_2. CAT C RI (136)	**A_1. MEDIUM (2D)** **A_2. MEDIUM (4C)**	**MEDIUM** (*Note:* While an overall reduction in the rate of RIs is expected, it does not necessarily reduce the risk level from Medium.)
		B. Pilot failed to hold short of runway (i.e., aircraft entered runway environment without ATC clearance)	B_1. CAT B RI (2) B_2. CAT C RI (74)	**B_1. MEDIUM (3D)** **B_2. MEDIUM (4C)**	
		C. Pilot did not follow ATC clearance	CAT C RI (25)	**C. MEDIUM (4C)**	
		D. Pilot departed without takeoff clearance	D_1. CAT B RI (2) D_2. CAT C RI (17)	**D_1. MEDIUM (3D)** **D_2. MEDIUM (4C)**	

1.6.2 Predicted Residual Risk and Safety Performance Targets for OI–Related RIs

Considering the safety requirements intended to target OI-induced RIs, the panel expected to observe a five (5) percent overall reduction in the rate of CATs A, B, and C RIs or a reduction in CATs A and B RIs (i.e., those representing the highest severity) for events associated with the three primary causes by the close of FY20. The panel did not consider stringent likelihood determinations a factor that could be accurately determined given trends exhibited in available data. Therefore, the predicted residual risk levels are expected to remain in the **MEDIUM** range.

The panel discussed the benefit of continued research for technology such as the airport-wide surveillance system, which may take more than five years to implement; despite the long-term endeavor, the panel included this as a requirement but did not base their predicted residual risk levels on the implementation of this activity. However, strengthening prior efforts such as the Take a Stand for Safety Campaign and building upon Human Factors studies to augment controller training and raise awareness were efforts that are likely to be implemented by FY18. Table 1.6B briefly summarizes the panel's conclusions as to the predicted residual risk levels for OI-induced RIs.

Table 1.6B: Predicted Residual Risk Summary for OI-Related RIs

Hazard ID	Description	Primary Causes	Effect	Current Risk	Predicted Residual Risk
16-RI-OI	Incorrect presence of vehicle, pedestrian, or aircraft in the protected area designated for takeoff or landing of an aircraft.	A. ATC cleared aircraft to land/depart on an occupied runway.	A_1. CAT A RI (2) A_2. CAT B RI (5) A_3. CAT C RI (176)	**A_1. MEDIUM (2D)** **A_2. MEDIUM (3C)** **A_3. MEDIUM (4C)**	**MEDIUM** (*Note:* While an overall reduction in the rate of RIs is expected, it does not necessarily reduce the risk level from Medium.)
		B. ATC did not monitor aircraft position on approach to intersecting runway (i.e., ATC cleared aircraft to land/depart with another aircraft on an intersecting runway)	B_1. CAT B RI (2) B_2. CAT C RI (50)	**B_1. MEDIUM (3D)** **B_2. MEDIUM (4C)**	
		C. ATC cleared aircraft to cross runway with another aircraft on departure/landing roll	C. CAT C RI (15)	**C. MEDIUM (4C)**	

1.6.3 Predicted Residual Risk and Safety Performance Targets for VPD-Related RIs

Considering the safety requirements intended to target VPD-induced RIs, the panel expected to observe a five (5) percent overall reduction in the rate of RIs (CAT A, B, and C) by the close of FY20. The panel did not consider stringent likelihood determinations a factor that could be accurately determined given trends exhibited in

available data. Therefore, the predicted residual risk levels are expected to remain in the **MEDIUM** range.

The panel discussed continued research of onboard-surveillance technologies as a possible advantage for vehicle operators to enhance situational awareness; this, however, may require more time to implement. The panel based the safety performance target on the provision of current training to both towered Part 139 and non-Part 139 airports and enhanced communication via recurrent meetings between airport management, Air Traffic, pilots, and vehicle operators, convinced that implementation by FY18 was likely. Table 1.6C briefly summarizes the panel's conclusions as to the predicted residual risk levels for VPD-related RIs.

Table 1.6C: Predicted Residual Risk Summary for VPD-Related RIs

Hazard ID	Description	Primary Causes	Effect	Current Risk	Predicted Residual Risk
16-RI-VPD	Incorrect presence of personnel/vehicle in the protected area designated for takeoff or landing of aircraft.	A. Driver failed to hold short of runway/RSA	A_1. CAT B RI (1) A_2. CAT C RI (36)	**A_1. MEDIUM (3D)** **A_2. MEDIUM (4C)**	**MEDIUM** (*Note:* While an overall reduction in the rate of RIs is expected, it does not necessarily reduce the risk level from Medium.)
		B. Pedestrian/driver entered runway without authorization	B. CAT C RI (37)	**B. MEDIUM (4C)**	

1.7 Monitoring Activities

To measure whether the defined safety performance targets are being achieved, the panel developed monitoring plans for each type of RI. Monitoring will entail compiling CAT A, B, and C RIs associated with each of the mediators (i.e., pilots, ATC, and vehicle operators and pedestrians) assessed during this panel. For consistency with this safety analysis, data will be further subcategorized according to the primary causes and top contributing factors for consistency with the FY16 SRAP data reviewed during this effort. Quarterly monitoring will begin in FY18 upon implementation of (and for two years after) the safety requirements for which it was determined most feasible. The monitoring activities and safety requirements are detailed in Tables 1.7A through 1.7C on the following page.

Table 1.7A: PD-Related RI Monitoring Plan and Safety Performance Targets[11]

Hazard ID: 16-RI-PD (259)	**16-RI-PD$_{A1}$** (3) **16-RI-PD$_{A2}$** (136) **16-RI-PD$_{B1}$** (2) **16-RI-PD$_{B2}$** (74) **16-RI-PD$_{C}$** (25) **16-RI-PD$_{D1}$** (2) **16-RI-PD$_{D2}$** (17)
Monitoring POC	**AJI-313**
Current Risk: **16-RI-PD$_{A1}$:** MEDIUM (2D) **16-RI-PD$_{A2}$:** MEDIUM (4C) **16-RI-PD$_{B1}$:** MEDIUM (3D) **16-RI-PD$_{B2}$:** MEDIUM (4C) **16-RI-PD$_{C}$:** MEDIUM (4C) **16-RI-PD$_{D1}$:** MEDIUM (3D) **16-RI-PD$_{D2}$:** MEDIUM (4C)	**Predicted Residual Risk:** **16-RI-PD$_{A1}$:** MEDIUM **16-RI-PD$_{A2}$:** MEDIUM **16-RI-PD$_{B1}$:** MEDIUM **16-RI-PD$_{B2}$:** MEDIUM **16-RI-PD$_{C}$:** MEDIUM **16-RI-PD$_{D1}$:** MEDIUM **16-RI-PD$_{D2}$:** MEDIUM
Monitoring Activities: One year after implementation of all safety requirements, quarterly monitor CATs A, B, and C RIs attributed to FY16 top identified causes: 1) Pilot failed to hold short of runway, as instructed; 2) Pilot failed to hold short of runway (i.e., entered runway environment without ATC clearance; 3) Pilot did not follow ATC clearance; and 4) Pilot departed without takeoff clearance.	
Safety Performance Target: 1. Five percent overall reduction in the rate of RIs (CATs A, B, and C) associated with PDs or reduction in CATs A and B RIs (i.e., those representing the highest severity) by the close of FY20. 2. Six percent reduction in the rate of RIs (CATs A, B, and C) associated with pilots departing without ATC clearance or a reduction in CATs A and B RIs (i.e., those representing the highest severity) [Safety Requirement Item No. 2].	

Table 1.7 B: OI-Related RI Monitoring Plan and Safety Performance Targets[12]

Hazard ID: 16-RI-OI (250)	**16-RI-OI$_{A1}$** (2) **16-RI-OI$_{A2}$** (5) **16-RI-OI$_{A3}$** (176) **16-RI-OI$_{B1}$** (2) **16-RI-OI$_{B2}$** (50) **16-RI-OI$_{C}$** (15)
Monitoring POC	**AJI-313**
Current Risk: **16-RI-OI$_{A1}$:** MEDIUM (2D) **16-RI-OI$_{A2}$:** MEDIUM (3C) **16-RI-OI$_{A3}$:** MEDIUM (4C) **16-RI-OI$_{B1}$:** MEDIUM (3D)	**Predicted Residual Risk:** **16-RI-OI$_{A1}$:** MEDIUM **16-RI-OI$_{A2}$:** MEDIUM **16-RI-OI$_{A3}$:** MEDIUM **16-RI-OI$_{B1}$:** MEDIUM

[11] Hazard IDs are derived from the FY of data reviewed (i.e., FY**16**) and the acronyms for the *type* of RI (i.e., PD, OI, VPD). Subhazards are the composite of the associate effects (i.e., CATs A, B, and C RIs) and the current risk ratings for each and are indicated by the alpha-numeric subscript (e.g., Hazard 16-RI-PD has six subhazards, each relating to a specific primary cause. Hazard 16-RI-PD$_{A1}$ represents the current risk for CAT A RIs relating to the primary cause "Pilot failed to hold short of runway as instructed.")

[12] Hazard IDs are derived from the FY of data reviewed (i.e., FY**16**) and the acronyms for the *type* of RI (i.e., PD, OI, VPD). Subhazards are the composite of the associate effects (i.e., CATs A, B, and C RIs) and the current risk ratings for each and are indicated by the alpha-numeric subscript (e.g., Hazard 16-RI-OI has six subhazards, each relating to a specific primary cause. Hazard 16-RI-OI$_{A1}$ represents the current risk for CAT A RIs relating to the primary cause "ATC cleared aircraft to land/depart on/from an occupied runway.")

Hazard ID: 16-RI-OI (250)	**16-RI-OI$_{A1}$** (2) **16-RI-OI$_{A2}$** (5) **16-RI-OI$_{A3}$** (176) **16-RI-OI$_{B1}$** (2) **16-RI-OI$_{B2}$** (50) **16-RI-OI$_{C}$** (15)
Monitoring POC	**AJI-313**
16-RI-OI$_{B2}$: MEDIUM (4C) **16-RI-OI$_{C}$:** MEDIUM (4C)	**16-RI-OI$_{B2}$:** MEDIUM **16-RI-OI$_{C}$:** MEDIUM
Monitoring Activities: One year after the implementation of all safety requirements, quarterly monitor CATs A, B, and C RIs attributed to the FY16 top identified causes: 1) ATC cleared aircraft to land/depart on occupied runway; 2) ATC did not monitor aircraft position on approach to intersecting runway (i.e., ATC cleared aircraft to land or depart on an intersecting runway; and 3) ATC cleared aircraft to cross runway with aircraft on departure/landing roll.	
Safety Performance Target: 1. Five percent overall reduction in the rate of RIs (CATs A, B, and C) or a reduction in CATs A and B RIs (i.e., those representing the highest severity) associated with OIs by the close of FY20.	

Table 1.7C: VPD-Related RI Monitoring Plan and Safety Performance Targets[13]

Hazard ID: 16-RI-VPD (74)	**16-RI-VPD$_{A1}$** (1) **16-RI-VPD$_{A2}$** (36) **16-RI-VPD$_{B}$** (37)
Monitoring POC	**AJI-313**
Current Risk: **16-RI-VPD$_{A1}$:** MEDIUM (3D) **16-RI-VPD$_{A2}$:** MEDIUM (4C) **16-RI-VPD$_{B}$:** MEDIUM (4C)	**Predicted Residual Risk:** **16-RI-VPD$_{A1}$:** MEDIUM **16-RI-VPD$_{A2}$:** MEDIUM **16-RI-VPD$_{B}$:** MEDIUM
Monitoring Activities: One year after the implementation of all safety requirements, quarterly monitor CATs A, B, and C RIs attributed to the FY16 top identified causes: 1) Driver failed to hold short of runway/RSA and 2) Pedestrian/driver entered runway without authorization.	
Safety Performance Target: 1. Five percent overall reduction in the rate of RIs (CATs A, B, and C) associated with VPDs by the close of FY20. *(Note*: FY16 VPD-related RIs were all CAT C.)	

[13] Hazard IDs are derived from the FY of data reviewed (i.e., FY**16**) and the acronyms for the *type* of RI (i.e., PD, OI, VPD). Subhazards are the composite of the associate effects (i.e., CATs A, B, and C RIs) and the current risk ratings for each and are indicated by the alpha-numeric subscript (e.g., Hazard 16-RI-OVPD has three subhazards, each relating to a specific primary cause. Hazard 16-RI-VPD$_{A1}$ represents the current risk for CAT B RIs relating to the primary cause "Driver failed to hold short of runway/RSA.")

1.8 Hazard and Risk Analysis

The Safety Management Tracking System Data Entry Worksheet below provides the necessary details to support the Executive Summary.

Table 1.8A: Hazard Analysis Worksheet for Hazard 16-RI-PD

1.	**Hazard ID**
	16-RI-PD
2a.	**Hazard Category and Subcategory** Choose among the following: • **Controller:** Error; Other • **Pilot/Operator:** Error; Other • **Equipment:** Failure; Malfunction; Error; Outage; Other • **Runway/Airport:** Intersection; Convergence; Other • **Route:** Intersection; Convergence; Other • **Obstacle:** Terrain; Structure; Aircraft; Parachutist; Other • **Wake Turbulence**
	Pilot/Operator: Error; Other
2b.	**Hazard Description**
	Incorrect presence of aircraft in the protected area designated for takeoff or landing of an aircraft
3a.	**Cause and Subcause** Choose among the following: • **Controller:** Situational Awareness; Complacency; Compliance; Understanding; Experience; Communication; Distraction; Fatigue; Other • **Technician:** Situational Awareness; Complacency; Compliance; Understanding; Experience; Communication; Distraction; Fatigue; Other • **Pilot:** Situational Awareness; Complacency; Compliance; Understanding; Experience; Communication; Distraction; Fatigue; Other • **Equipment:** Failure; Malfunction; Error; Outage; Other • **Runway/Airport:** Intersection; Convergence; Other • **Route:** Intersection; Convergence; Other • **Obstacle:** Terrain; Structure; Aircraft; Parachutist
	Pilot: Situational Awareness; Complacency; Compliance; Understanding; Experience; Communication; Distraction; Fatigue; Other
3b.	**Cause/Subcause Description**
	1. Pilot failed to hold short of the runway as instructed (139) 2. Pilot failed to hold short of the runway (i.e., aircraft entered runway environment without ATC clearance) (76) 3. Pilot did not follow ATC clearance (25)

	4. Pilot departed without takeoff clearance (17)
4a.	**System State** Indicate a category from the following: • Weather • Traffic • Runway/Airport • Route • Airspace • Equipment • Other
	Runway/Airport
4b.	**System State Description**
	Aircraft on arrival or departure IMC/VMC Day/Night Part 139 Airports: – Ground surveillance with RWSL – Ground surveillance without RWSL – No ground surveillance Non–Part 139 Airports: – GA–flight training – GA
5a.	**Controls Category** Indicate a category among the following: • Equipment • Policy/Procedure • Regulation • Best Practice • Work Aid • Other
	Equipment, Policies/procedures, Regulation, Best Practice
5b.	**Controls Description**
	1. Instruction/Clearance Read-back 2. Go Around 3. Canceled-takeoff clearance 4. Traffic Alert 5. Traffic Advisory 6. Corrective action by pilot 7. Corrective action by controller 8. Pilot awareness 9. Aborted takeoff 10. Hear-back/Read-back

11. 14 CFRs
§91 General and Flight Rules:
a. 91.3, Responsibility and authority of the pilot in command
b. 91.13, Careless or reckless operation
c. 91.103, Preflight action
d. 91.123, Compliance with ATC clearances and instructions
e. 91.125, ATC light signals
f. 91.129 (i), Takeoff, landing, taxi clearance
§139, Certification of Airports
g. 139.309,Safety areas
h. 139.311, Marking, signs, and lighting
i. 139.329, Pedestrians and ground vehicles

12. FAA Order JO 7110.65, *Air Traffic Control*
Chapter 2, General Control, Paragraphs:
a. 2-1-1, ATC SERVICE, and 2-1-2, DUTY PRIORITY
b. 2-4-3, PILOT ACKNOWLEDGEMENT/READ BACK
Chapter 3 Airport Traffic Control – Terminal, Paragraphs:
c. 3-1-3, USE OF ACTIVE RUNWAYS
d. 3-1-4, COORDINATION BETWEEN LOCAL AND GROUND CONTROLLERS
e. 3-1-5, VEHICLES/EQUIPMENT/PERSONNEL NEAR/ON RUNWAYS
f. 3-1-6, TRAFFIC INFORMATION
g. 3-1-7, POSITION DETERMINATION
h. 3-1-12, VISUALLY SCANNING RUNWAYS
Section 6, Airport Surface Detection Procedures
Section 7, Taxi and Ground Movement Procedures, Paragraphs:
i. 3-9-4, LINE UP AND WAIT (LUAW)
j. 3-9-6, SAME RUNWAY SEPARATION
k. 3-9-8, INTERSECTING RUNWAY/INTERSECTING FLIGHT PATH OPERATIONS
l. 3-9-10, TAKEOFF CLEARANCE
m. 3-9-11, CANCELLATION OF TAKEOFF CLEARANCE
n. 3-10-3, SAME RUNWAY SEPARATION
o. 3-10-4, INTERSECTING RUNWAY/INTERSECTING FLIGHT PATH SEPARATION
p. 3-10-5, LANDING CLEARANCE
q. 3-10-6, ANTICIPATING SEPARATION
r. 3-10-7, LANDING CLEARANCE WITHOUT VISUAL OBSERVATION
s. 3-10-9, RUNWAY EXITING
Section 11, Helicopter Operations

13. FAA Order JO 7210.3, *Facility Operation and Administration*
a. 2-1-20, OBSTACLE IDENTIFICATION SURFACES, OBSTACLE FREE ZONES, RUNWAY SAFETY AREAS, AND CLEARWAYS
b. 10-1-7, USE OF ACTIVE RUNWAYS
c. 10-1-8, PROCEDURES FOR OPENING AND CLOSING RUNWAYS
d. 10-3-8, LINE UP AND WAIT (LUAW) OPERATIONS
e. 10-3-9, TAKEOFF CLEARANCE
f. 10-3-10, MULTIPLE RUNWAY CROSSINGS

14. FAA Order 8000.94, *Procedures for Establishing Airport Low Visibility Operations and Approval of Low-Visibility Operations / Surface Movement Guidance and Control System Operations*

15. AIM
Chapter 2, Aeronautical Lighting and Other Airport Visual Aids
a. Section 1, Airport Lighting Aids
b. Section 3, Airport Marking Aids and Signs

	Chapter 4, Air Traffic Control c. Section 1, Services Available to Pilots d. Section 2, Radio Communications Phraseology and Techniques e. Section 3, Airport Operations f. Section 4, ATC Clearances and Aircraft Separation *Chapter 5, Air Traffic Procedures* g. Section 1, Preflight, h. Section 2, Departure Procedures, Paragraphs 5-2-1, Line Up and Wait (LUAW) i. Section 5, Pilot/Controller Roles and Responsibilities, Paragraphs 5-5-1, General, and 5-5-2, Air Traffic Clearance *Chapter 6, Emergency Procedures* j. Section 1, General, Paragraph 6-1-1, Pilot Responsibility and Authority 16. Advisory Circulars a. AC 91-73B, *Parts 91 and 135 Single Pilot, Flight School Procedures During Taxi Operations* b. AC 120-57A, *Surface Movement Guidance Control System* c. AC 120-74, *Parts 91, 121, 125, and 135 Flight crew Procedures During Taxi Operations* d. AC 150/5340-1J, *Standards for Airport Markings* e. AC 150/5340-18F, *Standards for Airport Sign Systems* f. AC 150/5345-50B, *Specification for Portable Runway and Taxiway Lights* 17. Commercial Operator's (OPSSPECS) 18. Controller/Pilot intervention 19. Controller Memory Aids (per FAA Order JO 7210.3) 20. Pilot Electronic Flight Bags (EFBs) with own position (3commercial examples used in GA) 21. RWSL 22. Safety Logic a. ASDE X /ASDE 3 b. ASSC/AMASS 23. Airport lighting, signage, and markings 24. Pilot Handbook of Aeronautical Knowledge, FAA-H-8083-25B 2016, Chapter 14 25. NOTAMs 26. Pilot Initial an Recurrent Training 27. SAFOs a. SAFO 13007, *Using Runways as Taxiways* b. SAFO 11004, *Runway Incursion Prevention Actions* 28. FAA Order JO 7050.1B, *Runway Safety Program*
6.	**Control Justification / Supporting Data**
	1. Pilots respond to control instructions as confirmation to controllers that they understand instructions and will comply. 2. Pilot/controller recognizes potential collision and pilot goes around on own or a controller instructs aircraft to execute go around. 3. Controller recognizes safety issue and cancels a pilot's takeoff clearance. 4. Controller issues appropriate movement instructions to avoid collision. 5. Controller issues appropriate movement instructions to avoid collision.

	6. Pilot intervenes taking action to avoid hazardous situation. 7. Controller intervenes taking action to avoid hazardous situation. 8. Pilot understands present location and traffic movements to help avert hazardous situations. 9. Pilot stops takeoff roll to avoid potential conflict. 10. Confirms to controller that pilot understands instructions and will correctly follow. 11. 14 CFRs *§91 General and Flight Rules:* a. 91.3: Designates the pilot in command of an aircraft and makes the PIC responsible for and final authority for the operation of that aircraft. b. 91.13: Requires pilots to not operate an aircraft in a manner that endangers life or property of another. c. 91.103: Pilots plan actions before beginning ground movement operations. d. 91.123: Requires pilots to obey ATC clearances unless an amended clearance is obtained or an emergency exists. e. 91.125: When employed require pilots and vehicle operators to react and perform certain actions. f. 91.129(i): Pilots at airports with operating control towers take action to follow instructions given by air traffic controllers. *§139:* Airport owners and operators, to achieve FAA airport certification, comply with these regulations standardizing airports across the NAS. g. 139.309: Airport owners and operators provide specified areas near runways used for air carrier operations that are graded and drained for fire and rescue operations—only objects supporting specific flight operations and are on frangible supports at the lowest possible height. h. 139.311: Airport owners and operators must provide and maintain marking systems for air carrier operations on the airport. i. 139.329: Airport owners and operators limit access to movement areas and safety areas to only those pedestrians and ground vehicles necessary for airport operations; establish and implement procedures for the safe and orderly access to and operation in movement areas and safety areas by pedestrians and ground vehicles, including provisions identifying the consequences of noncompliance with the procedures by all persons. 12. FAA Order JO 7110.65 *Chapter 2, General Control, Paragraphs:* a. 2-1-1 and 2-1-2: Controllers prevent aircraft collisions by separating aircraft. b. 2-4-3: Controllers require pilots to acknowledge ATC clearances, instructions, and taxi instructions *Chapter 3 Airport Traffic Control - Terminal* c. 3-1-3: Controllers control operations conducted on an active runway. d. 3-1-4: Local and Ground controllers coordinate and communicate how aircraft conduct surface movements in relation to a runway. e. 3-1-5: Controllers manage activity near an active runway's edge. f. 3-1-6: Based on known traffic controllers issue instructions to separate aircraft. g. 3-1-7: Controllers determine an aircraft's position then issues taxi or takeoff instructions. h. 3-1-12: Controllers scan runways before issuing control instructions. *Section 6*: Controllers use airport surface detection equipment to aid in the movement and separation of air traffic *Section 7*: Controllers issue movement and separation instructions. i. 3-9-4: Controllers issue instructions to place aircraft on runways without a departure clearance based on the traffic situation. j. 3-9-6: Controllers separate traffic using the same runway. k. 3-9-8: Controllers separate aircraft on intersecting runways and flight paths.

l. 3-9-10: Controllers issue takeoff clearances based on the situation
m. 3-9-11: Controllers cancel clearances to maintain separation
n. 3-10-3: Controllers issue instructions to separate aircraft arriving to the same runway.
o. 3-10-4: Controllers issue instructions to separate aircraft arriving to intersecting runways.
p. 3-10-5: Controllers follow procedures for issuing runway landing clearance.
q. 3-10-6: Controllers maintain separation by issuing or withholding clearance instructions.
r. 3-10-7: Controllers follow procedures to clear aircraft to land when the aircraft is not in sight
s. 3-10-9: Controllers maintain safety by issuing runway exiting instructions.

Section 11: Controllers issue instructions to separate helicopters from helicopters and helicopters from other aircraft during ground and tower flight operations.

13. FAA Order JO 7210.3
    a. 2-1-20: Facilities develop and monitor plans for creating protected areas for arriving and departing aircraft
    b. 10-1-7: Facilities develop procedures to for use of runways
    c. 10-1-8: Facilities develop procedures for opening and closing runways.
    d. 10-3-8: Facilities develop procedures to allow Line Up And Wait (LUAW)
    e. 10-3-9: Facilities establish guidelines for how aircraft are cleared for takeoff based on airport configuration.
    f. 10-3-10: Facilities establish guidelines for how aircraft are cleared for takeoff based on airport configuration.
14. FAA Order 8000.94: At Part 139 airports that have operations at 1200 Runway Visual Range and below, controllers, pilots, and vehicle operations must abide by certain prescribed procedures and observe and obey a more controlling set of signs, markings, and lights.
15. AIM: Provides basic flight information and ATC procedures for use in the NAS. The manual provides fundamentals required in order to fly in the US NAS. It is complimented by other operational publications.

    Chapter 2, Aeronautical Lighting and Other Airport Visual Aids
    a. Pilots and Vehicle Operators use airport lights to provide a basic means of situational awareness during night and in low visibility situations conductions operations on airport surfaces.
    b. Pilots and vehicle operator us pavement markings and signs to provide orientation, safety, and situational awareness during ground operations in the movement areas at airports.

    Chapter 4, Air Traffic Control
    c. Pilots operate aircraft using these services.
    d. Controllers and pilots maintain aircraft separation using these procedures and techniques.
    e. Pilots and controllers use these procedures for safe, orderly operations separating aircraft during operations in an airport movement area.
    f. Controllers separate aircraft using these procedures and techniques.

    Chapter 5 Air Traffic Procedures
    g. Pilots use these techniques to plan a safe flight operation on the ground and in the air.
    h. Controllers and pilots use these procedures to maintain safe movement area operations and separate aircraft.
    i. Controllers issue and pilots follow instructions to separate aircraft

    Chapter 6, Emergency Procedures
    j. Pilots are the final authority during the operation of their aircraft and use these techniques to address unusual situations during operations.
16. Advisory Circulars
    a. AC 91-73B provides best practice techniques for single pilot taxi operations and is useful for all pilots.

	b. AC 120-57A describes the standards and provides guidance in the development of SMGCS. c. AC 120-74 provides guidelines for the development and execution of safe aircraft operations during taxiing to avoid causing RIs. d. AC 150/5340-1J is used by airport owners and operators to mark airport pavement for pilot and vehicle operator's movement area orientation. e. AC 150/5340-18F is used by airport owners and operators to create and post airport signs for pilot and vehicle operator movement area orientation. f. AC 150/5340-50B is used by airport owners and operators to create standardized lighting during runway and taxiway construction. 17. Pilots follow these instructions during flight and ground operations; when approved by the carrier's Principal Operations Inspector they have the same level of enforcement as 14 CFRs. 18. Controllers and pilots take actions to maintain aircraft separation. 19. Controllers use memory aids when conducting operations on active runways to maintain situational awareness. 20. Pilots use the EFB with own position to maintain situational awareness. Items below are examples of technologies GA pilots use in the cockpit to maintain movement area SA. a. Garmin Safe Taxi data base for GPS units b. Foreflight Mobile App with Stratus c. WingX Pro7 App 21. When the RWSL system illuminates, pilots do not start takeoff roll or enter a runway. 22. Safety Logic a. Alarms cause controllers to heighten scans of the active runway and cancel clearances for aircraft to land or takeoff. b. Controllers respond to the alarms by checking the active runway and cancelling takeoff or landing clearances for aircraft. 23. Pilots and vehicle operators use the lights, signs, and markings to operate on the airport's movement area. 24. Pilot Handbook of Aeronautical Knowledge, FAA-H-8083-25B 2016, Chapter 14, contains the necessary information for pilots to safely operate in the NAS. 25. NOTAMs include information critical to the safety of flight (e.g., taxiway/runway closures, changes to airport configuration, etc.) 26. Pilot Initial and Recurrent Training include topics such as scanning runways during taxi operations, adherence to ATC taxi route instructions, and awareness of runway hold lines. 27. SAFOs: Contain important safety information and may include recommended actions. SAFOs alert pilots to potentially hazardous situations and may have procedures to mitigate the situation. a. SAFO 13007 provides information for minimizing the risk of RIs when taxiing on intersecting runways b. SAFO 11004: Through continued management emphasis and specific training for pilots, maintenance personnel that taxi aircraft, ground personnel, and tug/tow drivers, air carriers instill permanent and effective understanding of the runway incursion problem and the means to eliminate it. 28. FAA Order JO 7050.1B: This order prescribes the FAA Runway Safety Program and establishes policy to improve runway safety by decreasing the number and severity of runway incursions, excursions, and surface incidents.

7.	**Effect**
	16-RI-PD$_{A1}$: CAT A RI (3) **16-RI-PD$_{A2}$:** CAT C RI (136)
	16-RI-PD$_{B1}$: CAT B RI (2) **16-RI-PD$_{B2:}$** CAT C RI (74)
	16-RI-PD$_{C}$: CAT C RI (25)
	16-RI-PD$_{D1}$: CAT B RI (2) **16-RI-PD$_{D2}$:** CAT C RI (17)
8.	**Severity**
	16-RI-PDA$_{1}$: Hazardous (2) **16-RI-PDA$_{2}$:** Minor (4)
	16-RI-PD$_{B1}$: Major (3) **16-RI-PD$_{B2}$:** Minor (4)
	16-RI-PD$_{C}$: Minor (4)
	16-RI-PD$_{D1}$: Major (3) **16-RI-PD$_{D2}$:** Minor (4)
9.	**Severity Rationale**
	Severity for CATs A, B, and C RIs are based on the SMS Manual, July 2016, Table 3.3: *Hazard Severity Definitions*.
10.	**Likelihood**
	16-RI-PD$_{A1}$: Extremely Remote (D) **16-RI-PD$_{A2}$:** Remote (C)
	16-RI-PD$_{B1}$: Extremely Remote (D) **16-RI-PD$_{B2}$:** Remote (C)
	16-RI-PD$_{C}$: Remote (C)
	16-RI-PD$_{D1}$: Extremely Remote (D) **16-RI-PD$_{D2}$:** Remote (C)

11.	**Likelihood Rationale**
	16-RI-PD$_{A1}$: 3÷49,994,851= 6.0×10^{-8} **16-RI-PD$_{A2}$:** 136÷49,994,851= 2.7×10^{-6}
	16-RI-PD$_{B1}$: 2÷ 9,994,851= 4.0×10^{-8} **16-RI-PD$_{B2}$:** 74÷49,994,851= 1.5×10^{-6}
	16-RI-PD$_{C}$: 25÷49,994,851= 5.0×10^{-7}
	16-RI-PD$_{D1}$: 2÷49,994,851=4.0×10^{-8} **16-RI-PD$_{D2}$:** 17÷49,994,851= 3.4×10^{-7}
12.	**Current Risk Level**
	16-RI-PD$_{A1}$: MEDIUM (2D) **16-RI-PD$_{A2}$:** MEDIUM (4C)
	16-RI-PD$_{B1}$: MEDIUM (3D) **16-RI-PD$_{B2}$:** MEDIUM (4C)
	16-RI-PD$_{C}$: MEDIUM (4C)
	16-RI-PD$_{D1}$: MEDIUM (3D) **16-RI-PD$_{D2}$:** MEDIUM (4C)
13a.	**Safety Requirements Category** Indicate a category among the following options: • System Design • Equipment • Work Aid • Policy/Procedure • Regulatory Requirement • Training • Other
	Training, Equipment, Other
13b.	**Safety Requirements**
	1. Assemble a team to review data to determine the best locations to install enhanced lighting direct to operator (e.g., embedded or elevated wig-wag lights or runway hold-short markings) based on the prevalence of hotspots. a. Promote/implement/require RSA enhancers/alerts to emphasize a pilot's entry into the RSA. b. Consider opportunities for eliminating the crossing of runways (i.e., end around taxiway). 2. Implement a continual promotional campaign or "information push" for pilots to not cross the hold short line or take off or land without a clearance (e.g., such as SAFO and FAAST Blast). Consider encouraging participation from the industry – airport management, ATC collaboration at airport user meetings, aviation insurance companies, ALPA, and other air carrier union groups (e.g., NBAA). 3. Review corrective actions recommended by 2015 Call to Action and take appropriate action to accomplish.

	4. Encourage all operators to use EFBs with ownship position. a. Recommend that the EFB software manufacturers include a tutorial for the pilot to complete prior to unlocking the software functionality. b. Recommend that manufacturers develop their systems to integrated EFB and situational awareness–enhancing technologies system performance-based standards. c. Promote situational awareness by the use of integrated technologies (e.g., Pilot-in-the-Loop) in the cockpit. 5. Schedule a Runway Safety Action Team in conjunction with pilot/controller forums. 6. Utilize pilot seminars regarding the four identified causes of pilot–deviation related RI issues. (e.g., EAA, AOPA, FAAST [address both GA and Air Carrier training, re-emphasize Runway Safety ACs 120-74, 91-73, and SAFOs 13007, Using Runways As Taxiways, and 11004, Runway Incursion Prevention Actions]). 7. Enhance performance of the RSAT through communication and the transfer of information between airport management, Air Traffic, and pilots at towered airport facilities (e.g., recurrent meetings with tenants to discuss RI issues.) (1 + years)
14	**Organization Responsible for Implementing Safety Requirements**
	1. James Fee, AJI-14; Bradley Palmer, AFS-800; Calvin Lott, AFS-220 a. Westley Wright, ANG-C52 b. Brian Rushforth, AAS-300; Paul Eubanks, ACI-NA 2. Bradley Palmer, AFS-800; Mark Crystal, ALPA; James Fee, AJI-14 3. James Fee, AJI-14 4. Bradley Palmer, AFS-800 a. Bradley Palmer, AFS-800 b. James Fee, AJI-14 c. Bradley Palmer, AFS-800 (*Note*: with the assistance of AOPA, NBAA GAMA, ALPA, EAA) 5. James Fee, AJI-14 6. Bradley Palmer, AFS-800; James Fee, AJI-14 7. Bradley Palmer, AFS-800; Brian Rushforth, AAS-300; James Fee, AJI-14
15.	**Predicted Residual Risk**
	MEDIUM
16.	**Safety Performance Targets**
	1. Five percent overall reduction in the rate of RIs (CATs A, B, and C) associated with pilot deviations or reduction in CATs A and B RIs (i.e., those representing the highest severity) by the close of FY20. 2. Six percent reduction in the rate of RIs (CATs A, B, and C) associated with pilots departing without ATC clearance or a reduction in CATs A and B RIs (i.e., those representing the highest severity). [Related to Safety Requirement No. 2]

Table 1.8B: Hazard Analysis Worksheet for Hazard 16-RI-OI

1.	**Hazard ID**
	16-RI-OI
2a.	**Hazard Category and Subcategory** Choose among the following: • **Controller:** Error; Other • **Pilot/Operator:** Error; Other

	• **Equipment:** Failure; Malfunction; Error; Outage; Other • **Runway/Airport:** Intersection; Convergence; Other • **Route:** Intersection; Convergence; Other • **Obstacle:** Terrain; Structure; Aircraft; Parachutist; Other • **Wake Turbulence**
	Controller: Error; Other
2b.	**Hazard Description**
	Incorrect presence of vehicle, pedestrian, or aircraft in the protected area designated for takeoff or landing of an aircraft
3a.	**Cause and Subcause** Choose among the following: • **Controller:** Situational Awareness; Complacency; Compliance; Understanding; Experience; Communication; Distraction; Fatigue; Other • **Technician:** Situational Awareness; Complacency; Compliance; Understanding; Experience; Communication; Distraction; Fatigue; Other • **Pilot:** Situational Awareness; Complacency; Compliance; Understanding; Experience; Communication; Distraction; Fatigue; Other • **Equipment:** Failure; Malfunction; Error; Outage; Other • **Runway/Airport:** Intersection; Convergence; Other • **Route:** Intersection; Convergence; Other • **Obstacle:** Terrain; Structure; Aircraft; Parachutist
	Controller: Situational Awareness; Complacency; Compliance; Understanding; Experience; Communication; Distraction; Fatigue; Other
3b.	**Cause/Subcause Description**
	1. ATC cleared aircraft to land/depart on occupied runway (179) 2. ATC did not monitor aircraft position on approach to intersecting runway (i.e., ATC cleared aircraft to land or depart with another aircraft cleared to land or depart on an intersecting runway (54) 3. ATC cleared aircraft to cross runway with aircraft on departure/landing roll (15)
4a.	**System State** Indicate a category from the following: • Weather • Traffic • Runway/Airport • Route • Airspace • Equipment • Other
	Runway/Airport
4b.	**System State Description**
	Aircraft on arrival or departure IMC/VMC

	Day/Night Part 139 Airports: – Ground surveillance with RWSL – Ground surveillance without RWSL – No ground surveillance Non–Part 139 Airports: – GA–flight training – GA
5a.	**Controls Category** Indicate a category among the following: • Equipment • Policy/Procedure • Regulation • Best Practice • Work Aid • Other
	Equipment, Policies/procedures, Regulation, Best Practice
5b.	**Controls Description**
	1. Go Around 2. Canceled-takeoff clearance 3. Traffic Alert 4. Traffic Advisory 5. Corrective action by pilot 6. Corrective action by controller 7. Pilot awareness 8. Aborted takeoff 9. Hearback/Readback 10. 14 CFRs *§ 91 General and Flight Rules:* a. 91.3, Responsibility and authority of the pilot in command b. 91.13, Careless or reckless operation c. 91.103, Preflight action d. 91.123, Compliance with ATC clearances and instructions e. 91.125, ATC light signals f. 91.129 (i), Takeoff, landing, taxi clearance. g. §139, Certification of airports h. 139.309, Safety areas i. 139.311, Marking, signs, and lighting j. 139.329, Pedestrians and ground vehicles 11. FAA Order JO 7110.65, *Air Traffic Control* *Chapter 2, General Control, Paragraphs:* a. 2-1-1, ATC SERVICE ,and 2-1-2, DUTY PRIORITY b. 2-4-3, PILOT ACKNOWLEDGEMENT/READ BACK *Chapter 3, Airport Traffic Control – Terminal, Paragraphs:* c. 3-1-3, USE OF ACTIVE RUNWAYS d. 3-1-4, COORDINATION BETWEEN LOCAL AND GROUND CONTROLLERS

e. 3-1-5, VEHICLES/EQUIPMENT/PERSONNEL NEAR/ON RUNWAYS
f. 3-1-6, TRAFFIC INFORMATION
g. 3-1-7, POSITION DETERMINATION
h. 3-1-12, VISUALLY SCANNING RUNWAYS

Section 6, Airport Surface Detection Procedures

Section 7, Taxi and Ground Movement Procedures, Paragraphs:
i. 3-9-4, LINE UP AND WAIT (LUAW)
j. 3-9-6, SAME RUNWAY SEPARATION
k. 3-9-8, INTERSECTING RUNWAY/INTERSECTING FLIGHT PATH OPERATIONS
l. 3-9-10,TAKEOFF CLEARANCE
m. 3-9-11, CANCELLATION OF TAKEOFF CLEARANCE
n. 3-10-3, SAME RUNWAY SEPARATION
o. 3-10-4, INTERSECTING RUNWAY/INTERSECTING FLIGHT PATH SEPARATION
p. 3-10-5, LANDING CLEARANCE
q. 3-10-6, ANTICIPATING SEPARATION
r. 3-10-7, LANDING CLEARANCE WITHOUT VISUAL OBSERVATION
s. 3-10-9, RUNWAY EXITING

Section 11 Helicopter Operations
t. Appendix A, *Standard Operating Practice (SOP) for the Transfer of Position Responsibility (Position Relief Briefings)*

12. FAA Order JO 7210.3, *Facility Operation and Administration*
    a. 2-1-20, OBSTACLE IDENTIFICATION SURFACES, OBSTACLE FREE ZONES, RUNWAY SAFETY AREAS, AND CLEARWAYS
    b. 10-1-7, USE OF ACTIVE RUNWAYS
    c. 10-1-8, PROCEDURES FOR OPENING AND CLOSING RUNWAYS
    d. 10-3-8, LINE UP AND WAIT (LUAW) OPERATIONS
    e. 10-3-9, TAKEOFF CLEARANCE
    f. 10-3-10, MULTIPLE RUNWAY CROSSINGS
13. Currency and Proficiency Time (Per FAA Order 7210.3, Paragraph 2-3-3)
14. FAA Order 8000.94, *Procedures for Establishing Airport Low Visibility Operations and Approval of Low-Visibility Operations / Surface Movement Guidance and Control System Operations*
15. AIM

    Chapter 2, Aeronautical Lighting and Other Airport Visual Aids
    a. Section 1, Airport Lighting Aids
    b. Section 3, Airport Marking Aids and Signs

    Chapter 4, Air Traffic Control
    c. Section 1, Services Available to Pilots
    d. Section 2, Radio Communications Phraseology and Techniques
    e. Section 3, Airport Operations
    f. Section 4, ATC Clearances and Aircraft Separation

    Chapter 5, Air Traffic Procedures
    g. Section 1, Preflight
    h. Section 2, Departure Procedures, Paragraphs 5-2-1, Pre-Taxi Clearance Procedures through Paragraph 5-2-4, Line Up and Wait (LUAW)
    i. Section 5 Pilot/Controller Roles and Responsibilities, Paragraphs 5-5-1, General and 5-5-2 Air Traffic Clearance
    j. Chapter 6, Emergency Procedures
    k. Section 1 General, Paragraph 6-1-1, Pilot Responsibility and Authority
16. Advisory Circulars
    a. AC 91-73B, *Parts 91 and 135 Single Pilot, Flight School Procedures During Taxi Operations*

	b. AC 120-57A, *Surface Movement Guidance and Control System* c. AC 120-74, *Parts 91, 121, 125, and 135 Flight crew Procedures During Taxi Operations* d. AC 150/5340-1J,*Standards for Airport Markings* e. AC 150/5340-18F,*Standards for Airport Sign Systems* f. AC 150/5345-50B, *Specification for Portable Runway and Taxiway Lights* 17. Commercial Operator's (OPSSPECS) 18. Controller/Pilot intervention 19. Controller Memory Aids (FAA Order JO 7210.3) 20. Pilot Electronic Flight Bags (EFBs) with own position (3 commercial examples used in GA aircraft) 21. RWSL 22. Safety Logic a. ASDE X /ASDE 3 b. ASSC/AMASS 23. Airport lighting, signage and markings 24. NOTAMs 25. OJT 26. SAFOs 27. FAA Order JO 7050.1B. *Runway Safety Program*
6.	**Control Justification / Supporting Data**
	1. Pilot/controller recognizes a potential collision and goes around on own or a controller instructs aircraft to execute go around. 2. Controller recognizes safety issue and cancels pilot's takeoff clearance. 3. Controller issues appropriate movement instructions to avoid collision. 4. Controller issues appropriate movement instructions to avoid collision. 5. Pilot intervenes taking action to avoid hazardous situation. 6. Controller intervenes taking action to avoid a hazardous situation. 7. Pilot understands present location and traffic movements to help avert hazardous situations. 8. Pilot stops a takeoff roll to avoid potential conflict. 9. Confirms to controller that pilot understands instructions and will correctly follow. 10. 14 CFRs *§91 General and Flight Rules* l. 91.3: Designates the pilot in command of an aircraft and makes the PIC responsible for and final authority for the operation of that aircraft. m. 91.13: Requires pilots to not operate an aircraft in a manner that endangers life or property of another. n. 91.103: Pilots plan actions before beginning ground movement operations. o. 91.123: Requires pilots to obey ATC clearances unless an amended clearance is obtained or an emergency exists. p. 91.125: When employed require pilots and vehicle operators to react and perform certain actions. q. 91.129(i): Pilots at airports with operating control towers take action to follow instructions given by air traffic controllers. *§139: Airport owners and operators, to achieve FAA airport certification, comply with these*

regulations standardizing airports across the NAS.

r. 139.309: Airport owners and operators provide specified areas near runways used for air carrier operations that are graded and drained for fire and rescue operations—only objects supporting specific flight operations and are on frangible supports at the lowest possible height.
s. 139.311: Airport owners and operators must provide and maintain marking systems for air carrier operations on the airport.
t. 139.329: Airport owners and operators limit access to movement areas and safety areas to only those pedestrians and ground vehicles necessary for airport operations; establish and implement procedures for the safe and orderly access to and operation in movement areas and safety areas by pedestrians and ground vehicles, including provisions identifying the consequences of noncompliance with the procedures by all persons.

11. FAA Order JO 7110.65, *Air Traffic Control*

Chapter 2, General Control, Paragraphs:

a. 2-1-1 and 2-1-2: Controllers prevent aircraft collisions by separating aircraft.
b. 2-4-3: Controllers require pilots to acknowledge ATC clearances, instructions, and taxi instructions.

Chapter 3, Airport Traffic Control – Terminal, Paragraphs:

c. 3-1-3: Controllers control operations conducted on an active runway.
d. 3-1-4: Local and Ground controllers coordinate and communicate how aircraft conduct surface movements in relation to a runway.
e. 3-1-5: Controllers manage activity near an active runway's edge.
f. 3-1-6: Traffic Information: Based on known traffic controllers issue instructions to separate aircraft.
g. 3-1-7: Controllers determine an aircraft's position then issues taxi or takeoff instructions.
h. 3-1-12: Controllers scan runways before issuing control instructions.

Section 6: Controllers use airport surface detection equipment to aid in the movement and separation of air traffic.

Section 7: Controllers issue movement and separation instructions.

i. 3-9-4: Controllers issue instructions to place aircraft on runways without a departure clearance based on the traffic situation.
j. 3-9-6: Controllers separate traffic using the same runway.
k. 3-9-8: Controllers separate aircraft on intersecting runways and flight paths.
l. 3-9-10: Controllers issue takeoff clearances based on the situation
m. 3-9-11: Controllers cancel clearances to maintain separation
n. 3-10-3: Controllers issue instructions to separate aircraft arriving to the same runway.
o. 3-10-4: Controllers issue instructions to separate aircraft arriving to intersecting runways.
p. 3-10-5: Controllers follow procedures for issuing runway landing clearance
q. 3-10-6: Controllers maintain separation by issuing or withholding clearance instructions.
r. 3-10-7: Controllers follow procedures to clear aircraft to land when the aircraft is not in sight.
s. 3-10-9: Controllers maintain safety by issuing runway exiting instructions.

Section 11: Controllers issue instructions to separate helicopters from helicopters and helicopters from other aircraft during ground and tower flight operations.

t. Appendix A: Prescribes the method and step-by-step process for conducting a position relief briefing and transferring positions responsibility from one specialist to another.

12. FAA Order JO 7210.3, *Facility Operation and Administration*

a. 2-1-20: Facilities develop and monitor plans for creating protected areas for arriving and departing aircraft
b. 10-1-7: Facilities develop procedures to for use of runways
c. 10-1-8: Facilities develop procedures for opening and closing runways.
d. 10-3-8: Facilities develop procedures to allow Line Up And Wait (LUAW) operations.
e. 10-3-9: Facilities establish guidelines for how aircraft are cleared for takeoff based on airport configuration.

f. 10-3-10: Facilities establish guidelines for how aircraft are cleared for takeoff based on airport configuration.

13. Requirements for operational personnel to maintain familiarization and currency.

14. FAA Order 8000.94: At Part 139 airports that have operations at 1200 Runway Visual Range and below, controllers, pilots, and vehicle operations must abide by certain prescribed procedures and observe and obey a more controlling set of signs, markings, and lights.

15. AIM: Provides basic flight information and ATC procedures for use in the NAS. The manual provides fundamentals required in order to fly in the US NAS. It is complemented by other operational publications.

Chapter 2, Aeronautical Lighting and Other Airport Visual Aids

a. Pilots and Vehicle Operators use airport lights to provide a basic means of situational awareness during night and in low visibility situations conductions operations on airport surfaces.
b. Pilots and vehicle operator us pavement markings and signs to provide orientation, safety, and situational awareness during ground operations in the movement areas at airports.

Chapter 4, Air Traffic Control

c. Pilots operate aircraft using these services.
d. Controllers and pilots maintain aircraft separation using these procedures and techniques.
e. Pilots and controllers use these procedures for safe, orderly operations separating aircraft during operations in an airport movement area.
f. Controllers separate aircraft using these procedures and techniques.

Chapter 5, Air Traffic Procedures

g. Pilots use these techniques to plan a safe flight operation on the ground and in the air.
h. Controllers and pilots use these procedures to maintain safe movement area operations and separate aircraft.
i. Controllers issue and pilots follow instructions to separate aircraft

Chapter 6, Emergency Procedures

j. Pilots are the final authority during the operation of their aircraft and use these techniques to address unusual situations during operations.

16. Advisory Circulars
    a. AC 91-73B provides best practice techniques for single pilot taxi operations and are useful for all pilots.
    b. AC 120-57A describes the standards and provides guidance in the development of Surface Movement and Guidance Control System (SMGCS).
    c. AC 120-74 provides guidelines for the development and execution of safe aircraft operations during taxiing to avoid causing RIs.
    d. AC 150/5340-1J is used by airport owners and operators to mark airport pavement for pilot and vehicle operator's movement area orientation.
    e. AC 150/5340-18F is used by airport owners and operators to create and post airport signs for pilot and vehicle operator's movement area orientation.
    f. AC 150/5340-50B is used by airport owners and operators to create standardized lighting during runway and taxiway construction.

17. Pilots follow these instructions during flight and ground operations; when approved by the carrier's Principal Operations Inspector, they have the same level of enforcement as 14 CFRs.

18. Controllers and pilots take actions to maintain aircraft separation.

19. Controllers use memory aids when conducting operations on active runways to maintain situational awareness.

	20. Pilots use the EFB with own position to maintain situational awareness. Items below are examples of technologies GA pilots use in the cockpit to maintain movement area SA. a. Garmin Safe Taxi data base for GPS units b. Foreflight Mobile App with Stratus c. WingX Pro7 App 21. When the RWSL system illuminates, pilots do not start takeoff roll or enter a runway. 22. Safety Logic a. Controllers scan the active runway and cancel clearances for aircraft to land or takeoff. b. Controllers respond to the alarms by checking the active runway and cancelling takeoff or landing clearances for aircraft. 23. Pilots and vehicle operators use the lights, signs, and markings to operate on the airport's movement area. 24. NOTAMs include information critical to the safety of flight (e.g., taxiway/runway closures, changes to airport configuration, etc.). 25. OJT: Instructors assume control of frequency to ensure separation and safety. 26. SAFOs: Contain important information and may include recommended actions. SAFOs alert pilots to potentially hazardous situations and may have procedures to mitigate the situation. 27. FAA Order JO 7050.1B: This order prescribes the FAA Runway Safety Program and establishes policy to improve runway safety by decreasing the number and severity of runway incursions, excursions, and surface incidents.
7.	**Effect**
	16-RI-OI$_{A1}$: CAT A RI (2) **16-RI-OI$_{A2}$:** CAT B RI (5) **16-RI-OI$_{A3}$**: CAT C RI (176)
	16-RI-OI$_{B1}$: CAT B RI (2) **16-RI-OI$_{B2}$:** CAT C RI (50)
	16-RI-OI$_{C}$: CAT C RI (15)
8.	**Severity**
	16-RI-OI$_{A1}$: Hazardous (2) **16-RI-OI$_{A2}$:** Major (3) **16-RI-OI$_{A3}$:** Minor (4)
	16-RI-OI$_{B1}$: Major (3) **16-RI-OI$_{B2}$:** Minor (4)
	16-RI-OI$_{C}$: Minor (4)
9.	**Severity Rationale**
	Severity for CATs A, B, and C RIs are based on the SMS Manual, July 2016, Table 3.3: *Hazard Severity Definitions*.
10.	**Likelihood**
	16-RI-OI$_{A1}$: Extremely Remote (D) **16-RI-OI$_{A2}$:** Remote (C) **16-RI-OI$_{A3}$:** Remote (C)

	16-RI-OI$_{B1}$: Extremely Remote (D) **16-RI-OI$_{B2}$:** Remote (C)
	16-RI-OI$_{C}$: Remote (C)
11.	**Likelihood Rationale**
	16-RI-OI$_{A1}$: $1 \div 49{,}994{,}851 = 4.0 \times 10^{-8}$ **16-RI-OI$_{A2}$:** $5 \div 49{,}994{,}851 = 1.0 \times 10^{-7}$ **16-RI-OI$_{A3}$:** $176 \div 49{,}994{,}851 = 3.5 \times 10^{-6}$
	16-RI-OI$_{B1}$: $2 \div 49{,}994{,}851 = 4.0 \times 10^{-8}$ **16-RI-OI$_{B2}$:** $50 \div 49{,}994{,}851 = 1.0 \times 10^{-6}$
	16-RI-OI$_{C}$: $15 \div 49{,}994{,}851 = 3.0 \times 10^{-7}$
12.	**Current Risk Level**
	16-RI-OI$_{A1}$: MEDIUM (2D) **16-RI-OI$_{A2}$:** MEDIUM (3C) **16-RI-OI$_{A3}$:** MEDIUM (4C)
	16-RI-OI$_{B1}$: MEDIUM (3D) **16-RI-OI$_{B2}$:** MEDIUM (4C)
	16-RI-OI$_{C}$: MEDIUM (4C)
13a.	**Safety Requirements Category** Indicate a category among the following options: • System Design • Equipment • Work Aid • Policy/Procedure • Regulatory Requirement • Training • Other
	Equipment, Training, Other
13b.	**Safety Requirements**
	1. Utilize the Take a Stand for Safety campaign to raise awareness and address runway safety issues (e.g., RIs, runway flyovers, expectation bias). 2. Emphasize the use of the Memory Aids Tool Box and continuously improve the resource within a facility (implemented in 2016); create an Air Traffic Procedures Bulletin item emphasizing the need for memory aids, etc. 3. Utilize peer groups at facilities to emphasize runway safety Best Practices and develop a database for storing Lessons Learned and opportunities for further training. 4. AJI-14 and AJI-15 will partner to address controller runway scanning techniques: a. Provide AJI-2 with a Human Factors finding for runway scanning techniques. b. Based on the Human Factors finding, develop training that AJI-2 determines as the most effective way to provide training on runway scanning techniques. 5. Continue development of system that indicates the occupied runway status such as the airport-wide surveillance system. (5+ years)

14	**Organization Responsible for Implementing Safety Requirements**
	1. James Fee, AJI-14 2. Wendy O'Connor, AJT-22; Lawrence Beck, AJV-82 3. James Fee, AJI-14 4. AJI a. Jason Demagalski, AJI-15 b. Darrell Hudson, AJI-241 5. Westley Wright, ANG-C52
15.	**Predicted Residual Risk**
	MEDIUM
16.	**Safety Performance Targets**
	1. Five percent overall reduction in the rate of RIs (CATs A, B, and C) or a reduction in CATs A and B RIs (i.e., those representing the highest severity) associated with OIs by the close of FY20.[14]

Table 1.8C: Hazard Analysis Worksheet for Hazard 16-RI-VPD

1.	**Hazard ID**
	16-RI-VPD
2a.	**Hazard Category and Subcategory** Choose among the following: • **Controller:** Error; Other • **Pilot/Operator:** Error; Other • **Equipment:** Failure; Malfunction; Error; Outage; Other • **Runway/Airport:** Intersection; Convergence; Other • **Route:** Intersection; Convergence; Other • **Obstacle:** Terrain; Structure; Aircraft; Parachutist; Other • **Wake Turbulence**
	Pilot/Operator: Error; Other (i.e., Vehicle Driver / Pedestrian)
2b.	**Hazard Description**
	Incorrect presence of personnel/vehicle in the protected area designated for takeoff or landing of an aircraft

[14] The current safety performance target is dependent upon current reporting system.

3a.	**Cause and Subcause** Choose among the following: • **Controller:** Situational Awareness; Complacency; Compliance; Understanding; Experience; Communication; Distraction; Fatigue; Other • **Technician:** Situational Awareness; Complacency; Compliance; Understanding; Experience; Communication; Distraction; Fatigue; Other • **Pilot:** Situational Awareness; Complacency; Compliance; Understanding; Experience; Communication; Distraction; Fatigue; Other • **Equipment:** Failure; Malfunction; Error; Outage; Other • **Runway/Airport:** Intersection; Convergence; Other • **Route:** Intersection; Convergence; Other • **Obstacle:** Terrain; Structure; Aircraft; Parachutist
	Technician: Situational Awareness; Complacency; Compliance; Understanding; Experience; Communication; Distraction; Fatigue; Other
3b.	**Cause/Subcause Description**
	1. Driver failed to hold short of runway/RSA (37) 2. Pedestrian/driver entered runway without authorization (37)
4a.	**System State** Indicate a category from the following: • Weather • Traffic • Runway/Airport • Route • Airspace • Equipment • Other
	Runway/Airport
4b.	**System State Description**
	Aircraft on arrival or departure IMC/VMC Day/Night Part 139 Airports: – Ground surveillance with RWSL – Ground surveillance without RWSL – No ground surveillance Non–Part 139 Airports: – GA–flight training – GA
5a.	**Controls Category** Indicate a category among the following: • Equipment • Policy/Procedure • Regulation • Best Practice • Work Aid

	• Other
	Equipment, Policies/procedures, Regulation, Best Practice
5b.	**Controls Description**
	1. Go Around 2. Vehicle driver training a. eLMS Course 60004747, Airfield Driver Education (TechOps) b. Annual Recurrent Training eLMS Course 49460001, (TechOps) 3. Cancel takeoff clearance 4. LOAs for vehicle operation on the airfield 5. 14 CFRs *§91 General and Flight Rules* a. 91.123, Compliance with ATC clearances and instructions b. 91.125, ATC light signals c. 91.103, Preflight Action d. 91.129 (i), Takeoff, landing, taxi clearance. *§139, Certification of Airports* e. 139.309,Safety areas f. 139.311, Marking, signs, and lighting g. 139.329, Pedestrians and ground vehicles 6. FAA Order JO 7110.65, *Air Traffic Control* *Chapter 2 General Control, Paragraphs:* a. 2-1-1, ATC SERVICE, and 2-1-2, DUTY PRIORITY b. 2-4-3, PILOT ACKNOWLEDGEMENT/READ BACK *Chapter 3 Airport Traffic Control – Terminal, Paragraphs:* c. 3-1-3, USE OF ACTIVE RUNWAYS d. 3-1-4, COORDINATION BETWEEN LOCAL AND GROUND CONTROLLERS e. 3-1-5, VEHICLES/EQUIPMENT/PERSONNEL NEAR/ON RUNWAYS f. 3-1-6, TRAFFIC INFORMATION g. 3-1-7, POSITION DETERMINATION h. 3-1-12, VISUALLY SCANNING RUNWAYS *Section 6, Airport Surface Detection Procedures* *Section 7, Taxi and Ground Movement Procedures, Paragraphs:* i. 3-9-4, LINE UP AND WAIT (LUAW) j. 3-9-6, SAME RUNWAY SEPARATION k. 3-9-8, INTERSECTING RUNWAY/INTERSECTING FLIGHT PATH OPERATIONS l. 3-9-10, TAKEOFF CLEARANCE m. 3-9-11, CANCELLATION OF TAKEOFF CLEARANCE n. 3-10-3, SAME RUNWAY SEPARATION o. 3-10-4, INTERSECTING RUNWAY/INTERSECTING FLIGHT PATH SEPARATION p. 3-10-5, LANDING CLEARANCE q. 3-10-6, ANTICIPATING SEPARATION r. 3-10-7, LANDING CLEARANCE WITHOUT VISUAL OBSERVATION s. 3-10-9, RUNWAY EXITING *Section 11 Helicopter Operations* 7. FAA Order JO 7210.3, *Facility Operation and Administration* a. 2-1-20, OBSTACLE IDENTIFICATION SURFACES, OBSTACLE FREE ZONES, RUNWAY SAFETY AREAS, AND CLEARWAYS b. 10-1-7, USE OF ACTIVE RUNWAYS c. 10-1-8, PROCEDURES FOR OPENING AND CLOSING RUNWAYS

	d. 10-3-8, LINE UP AND WAIT (LUAW) OPERATIONS e. 10-3-9, TAKEOFF CLEARANCE f. 10-3-10, MULTIPLE RUNWAY CROSSINGS 8. Advisory Circulars a. AC 150/5340-1J, Standards for Airport Markings b. AC 150/5340-18F, Standards for Airport Sign Systems c. AC 150/5345-50B, Specification for Portable Runway and Taxiway Lights d. AC 150/5210-20A, Ground Vehicle Operations to Include Taxiing or Towing an Aircraft on Airports 9. Airport Operators and Owner Standard Operating Procedures 10. Controller/Pilot/Vehicle Operator intervention 11. ATC instructions to vehicle (hold short, taxi, etc.) 12. RWSL 13. Safety Logic a. ASDE X /ASDE-3 b. ASSC/AMASS 14. Airport lighting, signage, and markings 15. FAA Order 6000.15, General Maintenance Handbook for NAS Facilities 16. Initial Training 17. Driver Memory Aids (Form 5280-7) assist vehicle operators with maintaining situational awareness while operating within the movement area. 18. FAA Order JO 7050.1B, *Runway Safety Program*
6.	**Control Justification / Supporting Data**
	1. Pilot/controller recognizes potential collision and the pilot goes around on own or controller instructs the aircraft to execute go around. 2. Vehicle drivers operate on airport movement area based on their driver training experience. a. The eLMS Course 60004747 equips vehicle operators with the necessary knowledge to navigate the airfield, communicate with ATC, and operate in special circumstances. b. The eLMS Course 49460001 equips FAA employees requiring unescorted access to any part of the airport operations to have sufficient knowledge of runway safety procedures. 3. Controller recognizes safety issue and cancels pilot's takeoff clearance. 4. Vehicle drivers operate vehicles near active runways based on LOAs between the airport owners/operators and the ATC facility for that airport. 5. 14 CFRs a. 91.123: Vehicle operators obey ATC clearances. b. 91.125: when employed vehicle operators react and obey light signals. c. 91.103: Pilots plan actions before beginning ground movement operations. d. 91.129 (i): Vehicle operators at airports with operating control towers take action to follow instructions given by air traffic controllers. *§139:* Airport owners and operators comply with these regulations to standardize airports across the NAS. e. 139.309: Airport owners and operators provide specified areas near runways used for air carrier operations that are graded and drained for fire and rescue operations—only objects supporting specific flight operations and are on frangible supports at the lowest possible height.

f. 139.311: Airport owners and operators must provide and maintain marking systems for air carrier operations on the airport.
g. 139.329: Airport owners and operators limit access to movement areas and safety areas to only those pedestrians and ground vehicles necessary for airport operations; establish and implement procedures for the safe and orderly access to and operation in movement areas and safety areas by pedestrians and ground vehicles, including provisions identifying the consequences of noncompliance with the procedures by all persons.

6. FAA Order JO 7110.65

Chapter 2 General Control, Paragraphs:

a. 2-1-1 and 2-1-2: Controllers prevent aircraft collisions by separating aircraft.
b. 2-4-3: Pilot Acknowledgement/Read Back: controllers require pilots to acknowledge ATC clearances, instructions, and taxi instructions

Chapter 3 Airport Traffic Control – Terminal, Paragraphs:

c. 3-1-3: controllers control operations conducted on an active runway.
d. 3-1-4: Local and Ground controllers coordinate and communicate how aircraft conduct surface movements in relation to a runway.
e. 3-1-5: Controllers manage activity near an active runway's edge.
f. 3-1-6: Based on known traffic controllers issue instructions to separate aircraft.
g. 3-1-7: Controllers determine an aircraft's position then issue taxi or takeoff instructions.
h. 3-1-12: Controllers scan runways before issuing control instructions.

Section 6: Controllers use airport surface detection equipment to aid in the movement and separation of air traffic.

Section 7: Controllers issue movement and separation instructions.

i. 3-9-4: Controllers issue instructions to place aircraft on runways without a departure clearance based on the traffic situation.
j. 3-9-6: Controllers separate traffic using the same runway.
k. 3-9-8: Controllers separate aircraft on intersecting runways and flight paths.
l. 3-9-10: Controllers issue takeoff clearances based on the situation
m. 3-9-11: Controllers cancel clearances to maintain separation
n. 3-10-3: Controllers issue instructions to separate aircraft arriving to the same runway.
o. 3-10-4: Controllers issue instructions to separate aircraft arriving to intersecting runways.
p. 3-10-5: Controllers follow procedures for issuing runway landing clearances.
q. 3-10-6: Controllers maintain separation by issuing or withholding clearance instructions.
r. 3-10-7: Controllers follow procedures to clear aircraft to land when the aircraft is not in sight
s. 3-10-9: Controllers maintain safety by issuing runway exiting instructions.

Section 11: Controllers issue instructions to separate helicopters from helicopters and helicopters from other aircraft during ground and tower flight operations.

7. FAA Order JO 7210.3
   a. 2-1-20: Facilities develop and monitor plans for creating protected areas for arriving and departing aircraft
   b. 10-1-7: Facilities develop procedures to for use of runways
   c. 10-1-8: Facilities develop procedures for opening and closing runways.
   d. 10-3-8: Facilities develop procedures to allow Line Up and Wait (LUAW) operations.
   e. 10-3-9: Facilities establish guidelines for how aircraft are cleared for takeoff based on airport configuration.
   f. 10-3-10: Facilities develop procedures to authorize multiple runway crossings.

8. Advisory Circulars
   a. AC 150/5340-1J is used by airport owners and operators to mark airport pavement for pilot and vehicle operator's movement area orientation.
   b. AC 150/5340-18F is used by airport owners and operators to create and post airport signs for pilot and vehicle operator's movement area orientation.

	c. AC 150/5340-50B is used by airport owners and operators to create standardized lighting during runway and taxiway construction. d. AC 150/5210-20A is used by airport operators to develop training programs for safe ground vehicle operation, personnel taxiing or towing aircraft, and pedestrian control on movement and safety areas of an airport. 9. Vehicle operators, drivers and personnel take actions to comply with Standard Operating Procedures 10. Controllers, pilots, and vehicle operators take actions to maintain aircraft separation. 11. Vehicle drivers comply with ATC control instructions operating on the movement area. 12. When the RWSL system illuminates, vehicle operators do not start takeoff roll or enter a runway. 13. Safety Logic a. Alarms cause controllers to heighten scan of the active runway and cancel clearances for vehicles to enter or cross an active runway. b. Controllers respond to the alarms by checking the active runway and cancelling takeoff or landing clearances for aircraft. 14. Pilots and vehicle operators use the lights, signs and markings to operate on the airport's movement area. 15. FAA Order 6000.15: Technical Operations personnel (vehicle operators and drivers) take actions to comply with SOPs. 16. Initial Training: Technical Operations personnel complete initial training to learn how to maintain airfield safety. 17. Driver Memory Aids (Form 5280-7): Driver memory aids such as FAA 5280-7, *Airfield Visual Aid Safety Placard*, provide safety procedures to ground personnel for the safe operation of vehicles at airports. 18. FAA Order JO 7050.1B: This order prescribes the FAA Runway Safety Program and establishes policy to improve runway safety by decreasing the number and severity of runway incursions, excursions, and surface incidents.
7.	**Effect**
	16-RI-VPD$_{A1}$: CAT B RI (1) **16-RI-VPD$_{A2}$:** CAT C RI (36)
	16-RI-VPD$_{B}$: CAT C RI (37)
8.	**Severity**
	16-RI-VPD$_{A1}$: Major (3) **16-RI-VPD$_{A2}$:** Minor (4)
	16-RI-VPD$_{B}$: Minor (4)
9.	**Severity Rationale**
	Severity for CATs A, B, and C RIs are based on the SMS Manual, July 2016, Table 3.3: *Hazard Severity Definitions*.
10.	**Likelihood**
	16-RI-VPD$_{A1}$: Extremely Remote (D) **16-RI-VPD$_{A2}$:** Remote (C)

	16-RI-VPD$_B$: Remote (C)
11.	**Likelihood Rationale**
	16-RI-VPD$_{A1}$: 1÷49,994,851=2.0×10^{-8} **16-RI-VPD$_{A2}$:** 36÷49,994,851=7.2×10^{-7}
	16-RI-VPD$_B$: 37÷49,994,851=7.4×10^{-7}
12.	**Current Risk Level**
	16-RI-VPD$_{A1}$: MEDIUM (3D) **16-RI-VPD$_{A2}$:** MEDIUM (4C)
	16-RI-VPD$_B$: MEDIUM (4C)
13a.	**Safety Requirements Category** Indicate a category among the following options: • System Design • Equipment • Work Aid • Policy/Procedure • Regulatory Requirement • Training • Other
	Training, Equipment, Other
13b.	**Safety Requirements**
	1. Update the educational/training products that are currently outdated and disseminate to all airports (towered Part 139 and non–Part 139) by August 2018. 2. Enhance performance of the RSAT through communication and the transfer of information between airport management, Air Traffic, and pilots, and vehicle operators at towered airport facilities (e.g., recurrent meetings with tenants to discuss RI issues). (1+ years) 3. For towered non–Part 139 airports, identify appropriate measures to recommend/re-emphasize the use of enhanced performance-based training requirements (e.g., OJT “ride-alongs”) for vehicle operators and technical operations personnel. 4. Research the use of onboard-surveillance technologies for vehicle operators to enhance situational awareness.
14	**Organization Responsible for Implementing Safety Requirements**
	1. Brian Rushforth, AAS-300; James Fee, AJI-14 2. Bradley Palmer, AFS-800; Brian Rushforth, AAS-300 3. Brian Rushforth, AAS-300 4. Westley Wright, ANG-C52
15f.	**Predicted Residual Risk**
	MEDIUM
16.	**Safety Performance Targets**
	1. Five percent overall reduction in the rate of RIs (CATs A, B, and C) associated with VPDs by the close of FY20. (*Note*: FY16 VPD-related RIs were all CAT C).

1.9 Attachments

- FY16 Runway Incursion Safety Issue Horizontal HAWs
- SMS Manual, July 2016, Hazard Severity Classification Table
- 2015 Runway Safety Call to Action Summary Report
- EUROCONTROL Operational Safety Study
- FY16 RI SRAP Data by Facility Level
- FY16 RI SRAP Causal Factors
- Acronyms

2 SRM Document Signatures

Title: Runway Incursion Safety Issue Safety Risk Management Document

Submitted By: Gregory Pray — 9/22/2017
Gregory Pray, Manager, Headquarters Safety Team, AJI-141 — Date

Approved By: — 9/22/2017
James Fee, Manager, Runway Safety Group, AJI-14 — Date

Risk Accepted By: — 10/10/2017
Juan Fuentes, Director (A), Operations – Headquarters, AJT-2 — Date

Approved By: _____ _____
Huan Nguyen
ATO Chief Safety Engineer, AJI-3 — Date

3 SRM Panel Attendees

The SRM panel convened on May 23, through May 25, 2017 to perform a thorough analysis of the mission statement. Representatives and SMEs from across the agency, as well as stakeholders from several organizations outside the ATO, were invited to leverage their operational experience. Experts in the SRM process were present to maintain its integrity. Table 3.1 lists the panel participants by their organizations.

Table 3.1: SRM Panel Members, SMEs, Observers, and Facilitation Team

Name	Organization	Role	Email	Phone*	SRM
Colon, Jose	AJI-141	Observer	Jose.Colon@faa.gov	(202) 267-6419	☒
Crowe, Ramone	AJW-137	SME	Ramone.Crowe@faa.gov	(734) 621-3299	
Crystal, Mark	ALPA	Panel Member	Mark.Crystal@alpa.gov	(802) 233-6678	☒
Davis, Alcus	AJI-141	Panel Member	Alcus.Davis@faa.gov	(202) 267-6509	☒
Eubanks, Paul	ACI-NA	Panel Member	PEubanks@aci-na.org	(202) 293-4534	
Fee, James	AJI-14	Issue Lead	James.Fee@faa.gov	(202) 267-4572	☒
Foreman, David	AOV-140	Observer	David.W.Foreman@faa.gov	(202) 267-8475	☒
Foresto, Joseph	AFS-820	Panel Member	Joseph.Foresto@faa.gov	(718) 553-3235	☒
Gee, Bridget	NATCA	Panel Member	Runwaysafety@natca.net	(210) 240-4777	☒
Gertsen, Alex	NBAA	Panel Member	AGertsen@nbaa.org	(202) 737-4477	
James, Freddie	AAS-300	Panel Member	Freddie.James@faa.gov	(202) 267-8792	☒
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Williams, Adam	AOPA	Panel Member	Adam.Williams@aopa.org	(202) 609-9702	☒
Facilitation Team					
Olsen, Samantha	AJI-31/SENTEL	Technical Editor	Samantha.CTR.Olsen@faa.gov	(703) 566-4023	☒
Virga, Michael	AJI-314	Facilitator	Michael.Virga@faa.gov	(202) 267-1735	☒
Watkins, Daniel	AJI-314/GGTI	Co-Facilitator	Daniel.CTR.Watkins@faa.gov	(202) 267-9223	☒

Appendix A. FY16 Runway Incursion Safety Issue Horizontal HAWs

Table A1: 16-RI-PD Horizontal Hazard Analysis Worksheet

1.	2.	3.	4.	5.	6.	7.		8.
ID	**Hazard Description**	**Cause**	**System State**	**Controls**	**Control Justification**	**Effect**		**Severity**
16-RI-PD	Incorrect presence of aircraft in the protected area designated for takeoff or landing of an aircraft[15]	1. Pilot failed to hold short of runway as instructed (139) 2. Pilot failed to hold short of runway (i.e., aircraft entered runway environment without ATC clearance) (76) 3. Pilot did not follow ATC clearance (25) 4. Pilot departed without takeoff clearance (17)	Aircraft on arrival or departure IMC/VMC Day/Night Part 139 Airports: – Ground surveillance with RWSL – Ground surveillance without RWSL – No ground surveillance Non–Part 139 Airports: – GA–flight training – GA	1. Instruction/Clearance Read-back 2. Go Around 3. Canceled-takeoff clearance 4. Traffic Alert 5. Traffic Advisory 6. Corrective action by pilot 7. Corrective action by controller 8. Pilot awareness 9. Aborted takeoff 10. Hear-back/Read-back 11. 14 CFRs *§91 General and Flight Rules:* a. 91.3, Responsibility and authority of the pilot in command b. 91.13, Careless or reckless operation c. 91.103, Preflight action d. 91.123, Compliance with ATC clearances and instructions e. 91.125, ATC light signals f. 91.129 (i), Takeoff, landing, taxi clearance *§139, Certification of Airports* g. 139.309, Safety areas h. 139.311, Marking, signs, and lighting	1. Pilots respond to control instructions as confirmation to controllers that they understand instructions and will comply. 2. Pilot/controller recognizes potential collision and pilot goes around on own or a controller instructs aircraft to execute go around. 3. Controller recognizes safety issue and cancels a pilot's takeoff clearance. 4. Controller issues appropriate movement instructions to avoid collision. 5. Controller issues appropriate movement instructions to avoid collision. 6. Pilot intervenes taking action to avoid hazardous situation. 7. Controller intervenes taking action to avoid hazardous situation. 8. Pilot understands present location and traffic movements to help avert hazardous situations. 9. Pilot stops takeoff roll to avoid potential conflict. 10. Confirms to controller that pilot understands instructions and will correctly follow. 11. 14 CFRs *§91 General and Flight Rules:*	1.	**CAT A RI** (3)	Hazardous (2)
							CAT C RI (136)	Minor (4)
						2.	**CAT B RI** (2)	Major (3)
							CAT C RI (74)	Minor (4)
						3.	**CAT C RI** (25)	Minor (4)
						4.	**CAT B RI** (2)	Major (3)
							CAT C RI (17)	Minor (4)

[15] **ICAO Definition:** Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the takeoff and landing of an aircraft. (*Note*: The term "protected area" is defined in FAA Order 7050.1, *Runway Safety Program*.)

1.	2.	3.	4.	5.	6.	7.	8.
ID	Hazard Description	Cause	System State	Controls	Control Justification	Effect	Severity
				i. 139.329, Pedestrians and ground vehicles 12. FAA Order JO 7110.65, *Air Traffic Control* *Chapter 2, General Control, Paragraphs:* a. 2-1-1, ATC SERVICE, and 2-1-2, DUTY PRIORITY b. 2-4-3, PILOT ACKNOWLEDGEMENT/READ BACK *Chapter 3 Airport Traffic Control – Terminal, Paragraphs:* c. 3-1-3, USE OF ACTIVE RUNWAYS d. 3-1-4, COORDINATION BETWEEN LOCAL AND GROUND CONTROLLERS e. 3-1-5, VEHICLES/EQUIPMENT/PERSONNEL NEAR/ON RUNWAYS f. 3-1-6, TRAFFIC INFORMATION g. 3-1-7, POSITION DETERMINATION h. 3-1-12, VISUALLY SCANNING RUNWAYS *Section 6, Airport Surface Detection Procedures* *Section 7, Taxi and Ground Movement Procedures, Paragraphs:* i. 3-9-4, LINE UP AND WAIT (LUAW) j. 3-9-6, SAME RUNWAY SEPARATION k. 3-9-8, INTERSECTING RUNWAY/INTERSECTING FLIGHT PATH OPERATIONS l. 3-9-10, TAKEOFF CLEARANCE m. 3-9-11, CANCELLATION OF TAKEOFF CLEARANCE n. 3-10-3, SAME RUNWAY SEPARATION o. 3-10-4, INTERSECTING RUNWAY/INTERSECTING FLGHT PATH SEPARATION p. 3-10-5, LANDING CLEARANCE q. 3-10-6, ANTICIPATING SEPARATION r. 3-10-7, LANDING CLEARANCE WITHOUT VISUAL OBSERVATION s. 3-10-9, RUNWAY EXITING *Section 11, Helicopter Operations* 13. FAA Order JO 7210.3, Facility Operation and Administration a. 2-1-20, OBSTACLE IDENTIFICATION	a. 91.3: Designates the pilot in command of an aircraft and makes the PIC responsible for and final authority for the operation of that aircraft. b. 91.13: Requires pilots to not operate an aircraft in a manner that endangers life or property of another. c. 91.103: Pilots plan actions before beginning ground movement operations. d. 91.123: Requires pilots to obey ATC clearances unless an amended clearance is obtained or an emergency exists. e. 91.125: When employed require pilots and vehicle operators to react and perform certain actions. f. 91.129(i): Pilots at airports with operating control towers take action to follow instructions given by air traffic controllers. *§139:* Airport owners and operators, to achieve FAA airport certification, comply with these regulations standardizing airports across the NAS. g. 139.309: Airport owners and operators provide specified areas near runways used for air carrier operations that are graded and drained for fire and rescue operations—only objects supporting specific flight operations and are on frangible supports at the lowest possible height. h. 139.311: Airport owners and operators must provide and maintain marking systems for air carrier operations on the airport. i. 139.329: Airport owners and operators limit access to movement areas and safety areas to only those pedestrians and ground vehicles necessary for airport operations; establish and implement procedures for the safe and orderly access to and operation in movement areas and safety areas by pedestrians and ground vehicles, including provisions identifying the consequences of noncompliance with the procedures by all		

1.	2.	3.	4.	5.	6.	7.	8.
ID	Hazard Description	Cause	System State	Controls	Control Justification	Effect	Severity
				SURFACES, OBSTACLE FREE ZONES, RUNWAY SAFETY AREAS, AND CLEARWAYS b. 10-1-7, USE OF ACTIVE RUNWAYS c. 10-1-8, PROCEDURES FOR OPENING AND CLOSING RUNWAYS d. 10-3-8, LINE UP AND WAIT (LUAW) OPERATIONS e. 10-3-9, TAKEOFF CLEARANCE f. 10-3-10, MULTIPLE RUNWAY CROSSINGS 14. FAA Order 8000.94, Procedures for Establishing Airport Low Visibility Operations and Approval of Low-Visibility Operations / Surface Movement Guidance and Control System Operations 15. AIM *Chapter 2, Aeronautical Lighting and Other Airport Visual Aids* a. Section 1, Airport Lighting Aids b. Section 3, Airport Marking Aids and Signs *Chapter 4, Air Traffic Control* c. Section 1, Services Available to Pilots d. Section 2, Radio Communications Phraseology and Techniques e. Section 3, Airport Operations f. Section 4, ATC Clearances and Aircraft Separation *Chapter 5, Air Traffic Procedures* g. Section 1, Preflight, h. Section 2, Departure Procedures, Paragraphs 5-2-1, Line Up and Wait (LUAW) i. Section 5, Pilot/Controller Roles and Responsibilities, Paragraphs 5-5-1, General, and 5-5-2, Air Traffic Clearance *Chapter 6, Emergency Procedures* j. Section 1, General, Paragraph 6-1-1, Pilot Responsibility and Authority 16. Advisory Circulars a. AC 91-73B, *Parts 91 and 135 Single Pilot, Flight School Procedures During Taxi Operations*	persons. 12. FAA Order JO 7110.65 *Chapter 2, General Control, Paragraphs:* a. 2-1-1 and 2-1-2: Controllers prevent aircraft collisions by separating aircraft. b. 2-4-3: Controllers require pilots to acknowledge ATC clearances, instructions, and taxi instructions *Chapter 3 Airport Traffic Control - Terminal* c. 3-1-3: Controllers control operations conducted on an active runway. d. 3-1-4: Local and Ground controllers coordinate and communicate how aircraft conduct surface movements in relation to a runway. e. 3-1-5: Controllers manage activity near an active runway's edge. f. 3-1-6: Based on known traffic controllers issue instructions to separate aircraft. g. 3-1-7: Controllers determine an aircraft's position then issues taxi or takeoff instructions. h. 3-1-12: Controllers scan runways before issuing control instructions. *Section 6*: Controllers use airport surface detection equipment to aid in the movement and separation of air traffic *Section 7*: Controllers issue movement and separation instructions. i. 3-9-4: Controllers issue instructions to place aircraft on runways without a departure clearance based on the traffic situation. j. 3-9-6: Controllers separate traffic using the same runway. k. 3-9-8: Controllers separate aircraft on intersecting runways and flight paths. l. 3-9-10: Controllers issue takeoff clearances based on the situation m. 3-9-11: Controllers cancel clearances to maintain separation n. 3-10-3: Controllers issue instructions to		

1.	2.	3.	4.	5.	6.	7.	8.
ID	Hazard Description	Cause	System State	Controls	Control Justification	Effect	Severity
				b. AC 120-57A, *Surface Movement Guidance Control System* c. AC 120-74, *Parts 91, 121, 125, and 135 Flightcrew Procedures During Taxi Operations* d. AC 150/5340-1J, *Standards for Airport Markings* e. AC 150/5340-18F, *Standards for Airport Sign Systems* f. AC 150/5345-50B, *Specification for Portable Runway and Taxiway Lights* 17. Commercial Operator's (OPSSPECS) 18. Controller/Pilot intervention 19. Controller Memory Aids (FAA Order JO 7210.3) 20. Pilot Electronic Flight Bags (EFBs) with own position (3commercial examples used in GA) 21. RWSL 22. Safety Logic a. ASDE X /ASDE 3 b. ASSC/AMASS 23. Airport lighting, signage, and markings 24. Pilot Handbook of Aeronautical Knowledge, FAA-H-8083-25B 2016, Chapter 14 25. NOTAMs 26. Pilot Initial an Recurrent Training 27. SAFOs a. SAFO 13007, *Using Runways as Taxiways* b. SAFO 11004, *Runway Incursion Prevention Actions* 28. FAA Order 7050.1B, Runway Safety Program	separate aircraft arriving to the same runway. o. 3-10-4: Controllers issue instructions to separate aircraft arriving to intersecting runways. p. 3-10-5: Controllers follow procedures for issuing runway landing clearance. q. 3-10-6: Controllers maintain separation by issuing or withholding clearance instructions. r. 3-10-7: Controllers follow procedures to clear aircraft to land when the aircraft is not in sight s. 3-10-9: Controllers maintain safety by issuing runway exiting instructions. *Section 11*: Controllers issue instructions to separate helicopters from helicopters and helicopters from other aircraft during ground and tower flight operations. 13. FAA Order JO 7210.3 a. 2-1-20: Facilities develop and monitor plans for creating protected areas for arriving and departing aircraft b. 10-1-7: Facilities develop procedures to for use of runways c. 10-1-8: Facilities develop procedures for opening and closing runways. d. 10-3-8: Facilities develop procedures to allow Line Up And Wait (LUAW) e. 10-3-9: Facilities establish guidelines for how aircraft are cleared for takeoff based on airport configuration. f. 10-3-10: Facilities establish guidelines for how aircraft are cleared for takeoff based on airport configuration. 14. FAA Order 8000.94: At Part 139 airports that have operations at 1200 Runway Visual Range and below, controllers, pilots, and vehicle operations must abide by certain prescribed procedures and observe and obey a more controlling set of signs, markings, and		

1.	2.	3.	4.	5.	6.	7.	8.
ID	Hazard Description	Cause	System State	Controls	Control Justification	Effect	Severity
					lights. 15. AIM: Provides basic flight information and ATC procedures for use in the NAS. The manual provides fundamentals required in order to fly in the US NAS. It is complimented by other operational publications. *Chapter 2, Aeronautical Lighting and Other Airport Visual Aids* a. Pilots and Vehicle Operators use airport lights to provide a basic means of situational awareness during night and in low visibility situations conductions operations on airport surfaces. b. Pilots and vehicle operator us pavement markings and signs to provide orientation, safety, and situational awareness during ground operations in the movement areas at airports. *Chapter 4, Air Traffic Control* c. Pilots operate aircraft using these services. d. Controllers and pilots maintain aircraft separation using these procedures and techniques. e. Pilots and controllers use these procedures for safe, orderly operations separating aircraft during operations in an airport movement area. f. Controllers separate aircraft using these procedures and techniques. *Chapter 5 Air Traffic Procedures* g. Pilots use these techniques to plan a safe flight operation on the ground and in the air. h. Controllers and pilots use these procedures to maintain safe movement area operations and separate aircraft. i. Controllers issue and pilots follow instructions to separate aircraft *Chapter 6, Emergency Procedures* j. Pilots are the final authority during the		

1. ID	2. Hazard Description	3. Cause	4. System State	5. Controls	6. Control Justification	7. Effect	8. Severity
					operation of their aircraft and use these techniques to address unusual situations during operations. 16. Advisory Circulars a. AC 91-73B provides best practice techniques for single pilot taxi operations and is useful for all pilots. b. AC 120-57A describes the standards and provides guidance in the development of SMGCS. c. AC 120-74 provides guidelines for the development and execution of safe aircraft operations during taxiing to avoid causing RIs. d. AC 150/5340-1J is used by airport owners and operators to mark airport pavement for pilot and vehicle operator's movement area orientation. e. AC 150/5340-18F is used by airport owners and operators to create and post airport signs for pilot and vehicle operator movement area orientation. f. AC 150/5340-50B is used by airport owners and operators to create standardized lighting during runway and taxiway construction. 17. Pilots follow these instructions during flight and ground operations; when approved by the carrier's Principal Operations Inspector they have the same level of enforcement as 14 CFRs. 18. Controllers and pilots take actions to maintain aircraft separation. 19. Controllers use memory aids when conducting operations on active runways to maintain situational awareness. 20. Pilots use the EFB with own position to maintain situational awareness. Items below are examples of technologies GA pilots use in		

1.	2.	3.	4.	5.	6.	7.	8.
ID	Hazard Description	Cause	System State	Controls	Control Justification	Effect	Severity
					the cockpit to maintain movement area SA. a. Garmin Safe Taxi data base for GPS units b. Foreflight Mobile App with Stratus c. WingX Pro7 App 21. When the RWSL system illuminates, pilots do not start takeoff roll or enter a runway. 22. Safety Logic a. Alarms cause controllers to heighten scans of the active runway and cancel clearances for aircraft to land or takeoff. b. Controllers respond to the alarms by checking the active runway and cancelling takeoff or landing clearances for aircraft. 23. Pilots and vehicle operators use the lights, signs, and markings to operate on the airport's movement area. 24. Pilot Handbook of Aeronautical Knowledge, FAA-H-8083-25B 2016, Chapter 14, contains the necessary information for pilots to safely operate in the NAS. 25. NOTAMs include information critical to the safety of flight (e.g., taxiway/runway closures, changes to airport configuration, etc.) 26. Pilot Initial and Recurrent Training include topics such as scanning runways during taxi operations, adherence to ATC taxi route instructions, and awareness of runway hold lines. 27. SAFOs: Contain important safety information and may include recommended actions. SAFOs alert pilots to potentially hazardous situations and may have procedures to mitigate the situation. a. SAFO 13007 provides information for minimizing the risk of RIs when taxiing on intersecting runways b. SAFO 11004: Through continued management emphasis and specific training for pilots, maintenance personnel		

1.	2.	3.	4.	5.	6.	7.	8.
ID	Hazard Description	Cause	System State	Controls	Control Justification	Effect	Severity
					that taxi aircraft, ground personnel, and tug/tow drivers, air carriers instill permanent and effective understanding of the runway incursion problem and the means to eliminate it. 28. FAA Order JO 7050.1B: This order prescribes the FAA Runway Safety Program and establishes policy to improve runway safety by decreasing the number and severity of runway incursions, excursions, and surface incidents.		

9.	10.		11.	12.	13.	14.	15.	16.
Severity Rationale	**Likelihood**		**Likelihood Rationale**	**Initial Risk**	**Safety Requirements**	**Organization Responsible for Implementing Safety Requirements**	**Predicted Residual Risk**	**Safety Performance Targets**
Severity for CATs A, B, and C RIs are based on the SMS Manual, July 2016, Table 3.3: *Hazard Severity Definitions*.	1.	Extremely Remote (D)	3 ÷ 49,994,851= 6.0×10^{-8}	**MEDIUM (2D)**	1. Assemble a team to review data to determine the best locations to install enhanced lighting direct to operator (e.g., embedded or elevated wig-wag lights or runway hold-short markings) based on the prevalence of hotspots. a. Promote/implement/require RSA enhancers/alerts to emphasize a pilot's entry into the RSA. b. Consider opportunities for eliminating the crossing of runways (i.e., end around taxiway). 2. Implement a continual promotional campaign or "information push" for pilots to not cross the hold short line or take off or land without a clearance (e.g., such as SAFO and FAAST Blast). Consider encouraging participation from the industry – airport management, ATC collaboration at airport user meetings, aviation insurance companies, ALPA, and other air carrier union groups (e.g., NBAA). 3. Review corrective actions recommended by 2015 Call to Action and take appropriate action to accomplish.	1. AJI-14; AFS-800; AFS-220 a. ANG-C52 b. AAS-300; ACI-NA 2. AFS-800; ALPA; AJI-14 3. AJI-14 4. AFS-800 a. AFS-800 b. AJI-14 c. AFS-800 AFS-800 (Note: with the assistance of AOPA, NBAA GAMA, ALPA, and EAA)	**MEDIUM**	1. Five percent overall reduction in the rate of RIs (CATs A, B, and C) associated with pilot deviations or reduction in CATs A and B RIs (i.e., those representing the highest severity) by the close of FY20.
		Remote (C)	136 ÷ 49,994,851= 2.7×10^{-6}	**MEDIUM (4C)**				
	2.	Extremely Remote (D)	2 ÷ 49,994,851= 4.0×10^{-8}	**MEDIUM (3D)**				
		Remote (C)	74 ÷ 49,994,851= 1.5×10^{-6}	**MEDIUM (4C)**				
	3.	Remote (C)	25 ÷ 49,994,851= 5.0×10^{-7}	**MEDIUM (4C)**				
	4.	Extremely Remote (D)	2÷49,994.851=4.0×10^{-8}	**MEDIUM (3D)**				2. Six percent reduction in the rate of RIs (CATs A, B, and C) associated with pilots departing without ATC clearance or a reduction in CATs A
		Remote (C)	17 ÷ 49,994,851= 3.4×10^{-7}	**MEDIUM (4C)**				

					4. Encourage all operators to use EFBs with own position. a. Recommend that the EFB software manufacturers include a tutorial for the pilot to complete prior to unlocking the software functionality. b. Recommend that manufacturers develop their systems to integrated EFB and situational awareness–enhancing technologies system performance-based standards. c. Promote situational awareness by the use of integrated technologies (e.g., Pilot-in-the-Loop) in the cockpit. 5. Schedule a Runway Safety Action Team in conjunction with pilot/controller forums. 6. Utilize pilot seminars regarding the four identified causes of pilot–deviation related RI issues. (e.g., EAA, AOPA, FAAST [address both GA and Air Carrier training, re-emphasize Runway Safety ACs 120-74, 91-73, and SAFOs 13007, Using Runways As Taxiways, and 11004, Runway Incursion Prevention Actions]). 7. Enhance performance of the RSAT through communication and the transfer of information between airport management, Air Traffic, and pilots at towered airport facilities (e.g., recurrent meetings with tenants to discuss RI issues.) (1 + years)	5. AJI-14 6. AFS-800; AJI-14 7. AFS-800; AAS-300; AJI-14		and B RIs (i.e., those representing the highest severity.

Table A2: 16-RI-OI Horizontal Hazard Analysis Worksheet

1.	2.	3.	4.	5.	6.	7.	8.
ID	**Hazard Description**	**Cause**	**System State**	**Controls**	**Control Justification**	**Effect**	**Severity**
16-RI- OI	Incorrect presence of vehicle, pedestrian, or aircraft in the protected area designated for takeoff or landing of an aircraft[16]	1. ATC cleared aircraft to land/depart on occupied runway (183)[17]	Aircraft on arrival or departure IMC/VMC Day/Night Part 139 Airports: – Ground surveillance with RWSL – Ground surveillance without RWSL – No ground surveillance Non–Part 139 Airports: – GA–flight training – GA	1. Go Around 2. Canceled-takeoff clearance 3. Traffic Alert 4. Traffic Advisory 5. Corrective action by pilot 6. Corrective action by controller 7. Pilot awareness 8. Aborted takeoff 9. Hearback/Readback 10. 14 CFRs *§ 91 General and Flight Rules:* a. 91.3, Responsibility and authority of the pilot in command b. 91.13, Careless or reckless operation c. 91.103, Preflight action d. 91.123, Compliance with ATC clearances and instructions e. 91.125, ATC light signals f. 91.129 (i), Takeoff, landing, taxi clearance. *§139, Certification of airports* g. 139.309, Safety areas h. 139.311, Marking, signs, and lighting i. 139.329, Pedestrians and ground vehicles 11. FAA Order JO 7110.65, Air Traffic Control *Chapter 2, General Control, Paragraphs:* a. 2-1-1, ATC SERVICE ,and 2-1-2, DUTY PRIORITY	1. Pilot/controller recognizes a potential collision and goes around on own or a controller instructs aircraft to execute go around. 2. Controller recognizes safety issue and cancels pilot's takeoff clearance. 3. Controller issues appropriate movement instructions to avoid collision. 4. Controller issues appropriate movement instructions to avoid collision. 5. Pilot intervenes taking action to avoid hazardous situation. 6. Controller intervenes taking action to avoid a hazardous situation. 7. Pilot understands present location and traffic movements to help avert hazardous situations. 8. Pilot stops a takeoff roll to avoid potential conflict. 9. Confirms to controller that pilot understands instructions and will correctly follow. 10. 14 CFRs *§91 General and Flight Rules:*	1. **CAT A RI** (2)	Hazardous (2)
						CAT B RI (5)	Major (3)
						CAT C RI (176)	Minor (4)
		2. ATC did not monitor aircraft position on				2. **CAT B RI** (2)	Major (3)

[16] **ICAO Definition:** Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the takeoff and landing of an aircraft. (*Note*: The term "protected area" is defined in FAA Order 7050.1, *Runway Safety Program*.)

[17] **For facility levels 10 and above**: 3 facilities were equipped with Airport Movement Area Safety System (AMASS), 93 with Automatic Surface Detection Equipment Model X (ASDE-X), and 1 had no AMASS (for a rate of 8.954137 [97÷10,832,981]. For facility levels 9 and below, 10 were equipped with AMASS, 18 with ASDE-X, and 42 had no AMASS (for a rate of 10.86902 [69÷6,348,321].

1.	2.	3.	4.	5.	6.	7.	8.
ID	Hazard Description	Cause	System State	Controls	Control Justification	Effect	Severity
		approach to intersecting runway (i.e., ATC cleared aircraft to land or depart with another aircraft cleared to land or depart on an intersecting runway) (52) 3. ATC cleared aircraft to cross runway with aircraft on departure/landing roll (15)		b. 2-4-3, PILOT ACKNOWLEDGEMENT/READ BACK *Chapter 3, Airport Traffic Control – Terminal, Paragraphs:* c. 3-1-3, USE OF ACTIVE RUNWAYS d. 3-1-4, COORDINATION BETWEEN LOCAL AND GROUND CONTROLLERS e. 3-1-5, VEHICLES/EQUIPMENT/PERSONNEL NEAR/ON RUNWAYS f. 3-1-6, TRAFFIC INFORMATION g. 3-1-7, POSITION DETERMINATION h. 3-1-12, VISUALLY SCANNING RUNWAYS *Section 6, Airport Surface Detection Procedures* *Section 7, Taxi and Ground Movement Procedures, Paragraphs:* i. 3-9-4, LINE UP AND WAIT (LUAW) j. 3-9-6, SAME RUNWAY SEPARATION k. 3-9-8, INTERSECTING RUNWAY/INTERSECTING FLIGHT PATH OPERATIONS l. 3-9-10,TAKEOFF CLEARANCE m. 3-9-11, CANCELLATION OF TAKEOFF CLEARANCE n. 3-10-3, SAME RUNWAY SEPARATION o. 3-10-4, INTERSECTING RUNWAY/INTERSECTING FLIGHT PATH SEPARATION p. 3-10-5, LANDING CLEARANCE q. 3-10-6, ANTICIPATING SEPARATION r. 3-10-7, LANDING CLEARANCE WITHOUT VISUAL OBSERVATION s. 3-10-9, RUNWAY EXITING *Section 11 Helicopter Operations* t. Appendix A, *Standard Operating Practice for the Transfer of Responsibility (Position Relief Briefings)*	k.91.3: Designates the pilot in command of an aircraft and makes the PIC responsible for and final authority for the operation of that aircraft. l. 91.13: Requires pilots to not operate an aircraft in a manner that endangers life or property of another. m. 91.103: Pilots plan actions before beginning ground movement operations. n. 91.123: Requires pilots to obey ATC clearances unless an amended clearance is obtained or an emergency exists. o. 91.125: When employed require pilots and vehicle operators to react and perform certain actions. p. 91.129(i): Pilots at airports with operating control towers take action to follow instructions given by air traffic controllers. *§139:* Airport owners and operators, to achieve FAA airport certification, comply with these regulations standardizing airports across the NAS. q. 139.309: Airport owners and operators provide specified areas near runways used for air carrier operations that are graded and drained for fire and rescue operations—only objects supporting specific	**CAT C RI** (50) 3. **CAT C RI** (15)	Minor (4) Minor (4)

1.	2.	3.	4.	5.	6.	7.	8.
ID	Hazard Description	Cause	System State	Controls	Control Justification	Effect	Severity
				12. FAA Order JO 7210.3, Facility Operation and Administration a. 2-1-20, OBSTACLE IDENTIFICATION SURFACES, OBSTACLE FREE ZONES, RUNWAY SAFETY AREAS, AND CLEARWAYS b. 10-1-7, USE OF ACTIVE RUNWAYS c. 10-1-8, PROCEDURES FOR OPENING AND CLOSING RUNWAYS d. 10-3-8, LINE UP AND WAIT (LUAW) OPERATIONS e. 10-3-9, TAKEOFF CLEARANCE f. 10-3-10, MULTIPLE RUNWAY CROSSINGS 13. Currency and Proficiency Time (Per FAA Order 7210.3, Paragraph 2-3-3) 14. FAA Order 8000.94, Procedures for Establishing Airport Low Visibility Operations and Approval of Low-Visibility Operations / Surface Movement Guidance and Control System Operations 15. AIM *Chapter 2, Aeronautical Lighting and Other Airport Visual Aids* a. Section 1, Airport Lighting Aids b. Section 3, Airport Marking Aids and Signs *Chapter 4, Air Traffic Control* c. Section 1, Services Available to Pilots d. Section 2, Radio Communications Phraseology and Techniques e. Section 3, Airport Operations f. Section 4, ATC Clearances and Aircraft Separation *Chapter 5, Air Traffic Procedures* g. Section 1, Preflight h. Section 2, Departure Procedures, Paragraphs 5-2-1, Pre-Taxi Clearance Procedures through Paragraph 5-2-4, Line Up and Wait (LUAW) i. Section 5 Pilot/Controller Roles and Responsibilities, Paragraphs 5-5-1, General and 5-5-2 Air Traffic Clearance *Chapter 6, Emergency Procedures*	flight operations and are on frangible supports at the lowest possible height r. 139.311: Airport owners and operators must provide and maintain marking systems for air carrier operations on the airport. s. 139.329: Airport owners and operators limit access to movement areas and safety areas to only those pedestrians and ground vehicles necessary for airport operations; establish and implement procedures for the safe and orderly access to and operation in movement areas and safety areas by pedestrians and ground vehicles, including provisions identifying the consequences of noncompliance with the procedures by all persons. 11. FAA ORDER JO 7110.65 *Chapter 2, General Control, Paragraphs:* a. 2-1-1 and 2-1-2: Controllers prevent aircraft collisions by separating aircraft. b. 2-4-3: Controllers require pilots to acknowledge ATC clearances, instructions, and taxi instructions. *Chapter 3, Airport Traffic Control – Terminal, Paragraphs:* c. 3-1-3: Controllers control operations conducted on an active runway. d. 3-1-4: Local and Ground controllers coordinate and		

1.	2.	3.	4.	5.	6.	7.	8.
ID	Hazard Description	Cause	System State	Controls	Control Justification	Effect	Severity
				j. Section 1 General, Paragraph 6-1-1, Pilot Responsibility and Authority 16. Advisory Circulars a. AC 91-73B, *Parts 91 and 135 Single Pilot, Flight School Procedures During Taxi Operations* b. AC 120-57A, *Surface Movement Guidance and Control System* c. AC 120-74, *Parts 91, 121, 125, and 135 Flightcrew Procedures During Taxi Operations* d. AC 150/5340-1J,*Standards for Airport Markings* e. AC 150/5340-18F,*Standards for Airport Sign Systems* f. AC 150/5345-50B, *Specification for Portable Runway and Taxiway Lights* 17. Commercial Operator's OPSSPECS 18. Controller/Pilot intervention 19. Controller Memory Aids (FAA Order JO 7210.3) 20. Pilot Electronic Flight Bags (EFBs) with own position (3 commercial examples used in GA aircraft) 21. RWSL 22. Safety Logic a. ASDE X /ASDE 3 b. ASSC/AMASS 23. Airport lighting, signage and markings 24. NOTAMs 25. OJT 26. SAFOs 27. FAA Order JO 7050.1B, *Runway Safety Program*	communicate how aircraft conduct surface movements in relation to a runway. e. 3-1-5: Controllers manage activity near an active runway's edge. f. 3-1-6: Traffic Information: Based on known traffic controllers issue instructions to separate aircraft. g. 3-1-7: Controllers determine an aircraft's position then issues taxi or takeoff instructions. h. 3-1-12: Controllers scan runways before issuing control instructions. *Section 6:* Controllers use airport surface detection equipment to aid in the movement and separation of air traffic. *Section 7:* Controllers issue movement and separation instructions. i. 3-9-4: Controllers issue instructions to place aircraft on runways without a departure clearance based on the traffic situation. j. 3-9-6: Controllers separate traffic using the same runway. k. 3-9-8: Controllers separate aircraft on intersecting runways and flight paths. l. 3-9-10: Controllers issue takeoff clearances based on the situation m. 3-9-11: Controllers cancel clearances to maintain separation n. 3-10-3: Controllers issue instructions to separate		

1.	2.	3.	4.	5.	6.	7.	8.
ID	Hazard Description	Cause	System State	Controls	Control Justification	Effect	Severity
					aircraft arriving to the same runway. o. 3-10-4: Controllers issue instructions to separate aircraft arriving to intersecting runways. p. 3-10-5: Controllers follow procedures for issuing runway landing clearance q. 3-10-6: Controllers maintain separation by issuing or withholding clearance instructions. r. 3-10-7: Controllers follow procedures to clear aircraft to land when the aircraft is not in sight. s. 3-10-9: Controllers maintain safety by issuing runway exiting instructions. *Section 11:* Controllers issue instructions to separate helicopters from helicopters and helicopters from other aircraft during ground and tower flight operations. t. Appendix A: Prescribes the method and step-by-step process for conducting a position relief briefing and transferring positions responsibility from one specialist to another. 12. FAA Order JO 7210.3 a. 2-1-20: Facilities develop and monitor plans for creating protected areas for arriving and departing aircraft b. 10-1-7: Facilities develop procedures to for use of runways		

1.	2.	3.	4.	5.	6.	7.	8.
ID	Hazard Description	Cause	System State	Controls	Control Justification	Effect	Severity
					c. 10-1-8: Facilities develop procedures for opening and closing runways. d. 10-3-8: Facilities develop procedures to allow Line Up and Wait (LUAW) operations. e. 10-3-9: Facilities establish guidelines for how aircraft are cleared for takeoff based on airport configuration. f. 10-3-10: Facilities establish guidelines for how aircraft are cleared for takeoff based on airport configuration. 13. Requirements for operational personnel to maintain familiarization and currency. 14. FAA Order 8000.94, SMGCS operations: At Part 139 airports that have operations at 1200 Runway Visual Range and below, controllers, pilots, and vehicle operations must abide by certain prescribed procedures and observe and obey a more controlling set of signs, markings, and lights. 15. AIM: Provides basic flight information and ATC procedures for use in the NAS. The manual provides fundamentals required in order to fly in the US NAS. It is complemented by other operational publications. *Chapter 2, Aeronautical Lighting and Other Airport Visual Aids* a. Pilots and Vehicle Operators use airport lights to provide a basic means		

1.	2.	3.	4.	5.	6.	7.	8.
ID	Hazard Description	Cause	System State	Controls	Control Justification	Effect	Severity
					of situational awareness during night and in low visibility situations conductions operations on airport surfaces. b. Pilots and vehicle operator us pavement markings and signs to provide orientation, safety, and situational awareness during ground operations in the movement areas at airports. *Chapter 4, Air Traffic Control* c. Pilots operate aircraft using these services. d. Controllers and pilots maintain aircraft separation using these procedures and techniques. e. Pilots and controllers use these procedures for safe, orderly operations separating aircraft during operations in an airport movement area. f. Controllers separate aircraft using these procedures and techniques. *Chapter 5, Air Traffic Procedures* g. Pilots use these techniques to plan a safe flight operation on the ground and in the air. h. Controllers and pilots use these procedures to maintain safe movement area operations and separate aircraft. i. Controllers issue and pilots follow instructions to separate aircraft		

1.	2.	3.	4.	5.	6.	7.	8.
ID	Hazard Description	Cause	System State	Controls	Control Justification	Effect	Severity
					Chapter 6, Emergency Procedures j. Pilots are the final authority during the operation of their aircraft and use these techniques to address unusual situations during operations. 16. Advisory Circulars: a. AC 91-73B provides best practice techniques for single pilot taxi operations and are useful for all pilots. b. AC 120-57A describes the standards and provides guidance in the development of Surface Movement and Guidance Control System (SMGCS). c. AC 120-74 provides guidelines for the development and execution of safe aircraft operations during taxiing to avoid causing RIs. d. AC 150/5340-1J is used by airport owners and operators to mark airport pavement for pilot and vehicle operator's movement area orientation. e. AC 150/5340-18F is used by airport owners and operators to create and post airport signs for pilot and vehicle operator's movement area orientation. f. AC 150/5340-50B is used by airport owners and		

1.	2.	3.	4.	5.	6.	7.	8.
ID	Hazard Description	Cause	System State	Controls	Control Justification	Effect	Severity
					operators to create standardized lighting during runway and taxiway construction. 17. Pilots follow these instructions during flight and ground operations; when approved by the carrier's Principal Operations Inspector, they have the same level of enforcement as 14 CFRs. 18. Controllers and pilots take actions to maintain aircraft separation. 19. Controllers use memory aids when conducting operations on active runways to maintain situational awareness. 20. Pilots use the EFB with own position to maintain situational awareness. Items below are examples of technologies GA pilots use in the cockpit to maintain movement area SA. a. Garmin Safe Taxi data base for GPS units b. Foreflight Mobile App with Stratus c. WingX Pro7 App 21. When the RWSL system illuminates, pilots do not start takeoff roll or enter a runway. 22. Safety Logic a. Controllers scan the active runway and cancel clearances for aircraft to land or takeoff. b. Controllers respond to the alarms by checking the		

1.	2.	3.	4.	5.	6.	7.	8.
ID	Hazard Description	Cause	System State	Controls	Control Justification	Effect	Severity
					active runway and cancelling takeoff or landing clearances for aircraft. 23. Pilots and vehicle operators use the lights, signs, and markings to operate on the airport's movement area. 24. NOTAMs include information critical to the safety of flight (e.g., taxiway/runway closures, changes to airport configuration, etc.) 25. OJT: Instructors assume control of frequency to ensure separation and safety. 26. SAFOs contain important information and may include recommended actions. SAFOs alert pilots to potentially hazardous situations and may have procedures to mitigate the situation. 27. FAA Order JO 7050.1B: This order prescribes the FAA Runway Safety Program and establishes policy to improve runway safety by decreasing the number and severity of runway incursions, excursions, and surface incidents.		

9.	10.		11.	12.	13.	14.	15.	16.
Severity Rationale	**Likelihood**		**Likelihood Rationale**	**Initial Risk**	**Safety Requirements**	**Organization Responsible for Implementing Safety Requirements**	**Predicted Residual Risk**	**Safety Performance Targets**
Severity for CATs A, B, and C RIs are based on the SMS Manual, July 2016, Table 3.3: *Hazard Severity Definitions*.	1.	Extremely Remote (D)	2÷49,994,851= 4.0×10^{-8}	**MEDIUM (2D)**	1. Utilize the Take a Stand for Safety campaign to raise awareness and address runway safety issues (e.g., RIs, runway flyovers, expectation bias). 2. Emphasize the use of the Memory Aids Tool Box and continuously improve the resource within a facility (implemented in 2016); create an Air Traffic Procedures Bulletin item emphasizing the need for memory aids, etc. 3. Utilize peer groups at facilities to emphasize runway safety Best Practices and develop a database for storing Lessons Learned and opportunities for further training. 4. AJI-14 and AJI-15 will partner to address controller runway scanning techniques: a. Provide AJI-2 with a Human Factors finding for runway scanning techniques. b. Based on the Human Factors Finding, develop training that AJI-2 determines as the most effective way to provide training on runway scanning techniques. 5. Continue development of system that indicates the occupied runway status such as the airport-wide surveillance system. (5+ years)	1. AJI-14 2. AJT-22; AJV-82; AJI-14 3. AJI-14 4. AJI a. AJI-15 b. AJI-2 5. ANG-C52	**MEDIUM**	1. Five percent overall reduction in the rate of RIs (CATs A, B, and C) or a reduction in CATs A and B RIs (i.e., those representing the highest severity) associated with OIs by the close of FY20.[18]
		Remote (D)	5÷49,994,851= $1..0\times10^{-7}$	**MEDIUM (3C)**				
		Remote (C)	176÷49,994,851= 3.5×10^{-6}	**MEDIUM (4C)**				
	2.	Extremely Remote (D)	2÷49,994,851= 8.0×10^{-8}	**MEDIUM (3D)**				
		Remote (C)	50÷49,994,851= 1.0×10^{-6}	**MEDIUM (4C)**				
	3.	Remote (C)	15÷49,994,851= 3.0×10^{-7}	**MEDIUM (4C)**				

[18] The current safety performance target is dependent upon current reporting system.

Table A3: 16-RI-VPD Horizontal Hazard Analysis Worksheet

1. ID	2. Hazard Description	3. Cause	4. System State	5. Controls	6. Control Justification	7. Effect	8. Severity
16-RI-VPD	Incorrect presence of personnel/vehicle in the protected area designated for takeoff or landing of an aircraft[19]	1. Driver failed to hold short of runway/RSA (37) 2.Pedestrian/driver entered runway without authorization (37)	Aircraft on arrival or departure IMC/VMC Day/Night Part 139 Airports: – Ground surveillance with RWSL – Ground surveillance without RWSL – No ground surveillance Non–Part 139 Airports: – GA–flight training – GA	1. Go Around 2. Vehicle driver training a. eLMS Course 60004747, Airfield Driver Education (TechOps) b. Annual Recurrent Training eLMS Course 49460001, (TechOps) 3. Cancel takeoff clearance 4. LOAs for vehicle operation on the airfield 5. 14 CFRs *§91 General and Flight Rules:* a. 91.123, Compliance with ATC clearances and instructions b. 91.125, ATC light signals c. 91.129 (i), Takeoff, landing, taxi clearance. d. §139, Certification of Airports e. 139.309,Safety areas f. 139.311, Marking, signs, and lighting g. 139.329, Pedestrians and ground vehicles 6. FAA Order JO 7110.65, *Air Traffic Control* *Chapter 2 General Control, Paragraphs:* a. 2-1-1, ATC SERVICE, and 2-1-2, DUTY PRIORITY b. 2-4-3, PILOT ACKNOWLEDGEMENT/READ BACK *Chapter 3 Airport Traffic Control – Terminal, Paragraphs:* c. 3-1-3, USE OF ACTIVE RUNWAYS	1. Pilot/controller recognizes potential collision and the pilot goes around on own or controller instructs the aircraft to execute go around. 2. Vehicle drivers operate on airport movement area based on their driver training experience. a. The eLMS Course 60004747 equips vehicle operators with the necessary knowledge to navigate the airfield, communicate with ATC, and operate in special circumstances. b. The eLMS Course 49460001 equips FAA employees requiring unescorted access to any part of the airport operations to have sufficient knowledge of runway safety procedures. 3. Controller recognizes safety issue and cancels pilot's takeoff clearance. 4. Vehicle drivers operate vehicles near active runways based on LOAs between the airport owners/operators and the ATC facility for that airport. 5. 14 CFRs a. 91.123: Vehicle operators obey ATC clearances. b. 91.125: when employed vehicle operators react and obey light signals. c. 91.103: Pilots plan actions before beginning ground movement operations.	1. **CAT B RI** (1) **CAT C RI** (36) 2. **CAT C RI** (37)	Major (3) Minor (4) Minor (4)

[19]**ICAO Definition:** Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the takeoff and landing of an aircraft. (*Note*: The term "protected area" is defined in FAA Order 7050.1, *Runway Safety Program*.)

1. ID	2. Hazard Description	3. Cause	4. System State	5. Controls	6. Control Justification	7. Effect	8. Severity
				d. 3-1-4, COORDINATION BETWEEN LOCAL AND GROUND CONTROLLERS e. 3-1-5, VEHICLES/EQUIPMENT/PERSONNEL NEAR/ON RUNWAYS f. 3-1-6, TRAFFIC INFORMATION g. 3-1-7, POSITION DETERMINATION h. 3-1-12, VISUALLY SCANNING RUNWAYS *Section 6, Airport Surface Detection Procedures* *Section 7, Taxi and Ground Movement Procedures, Paragraphs:* i. 3-9-4, LINE UP AND WAIT (LUAW) j. 3-9-6, SAME RUNWAY SEPARATION k. 3-9-8, INTERSECTING RUNWAY/INTERSECTING FLIGHT PATH OPERATIONS l. 3-9-10, TAKEOFF CLEARANCE m. 3-9-11, CANCELLATION OF TAKEOFF CLEARANCE n. 3-10-3, SAME RUNWAY SEPARATION o. 3-10-4, INTERSECTING RUNWAY/INTERSECTING FLIGHT PATH SEPARATION p. 3-10-5, LANDING CLEARANCE q. 3-10-6, ANTICIPATING SEPARATION r. 3-10-7, LANDING CLEARANCE WITHOUT VISUAL OBSERVATION s. 3-10-9, RUNWAY EXITING *Section 11 Helicopter Operations* 7. FAA Order JO 7210.3, *Facility Operation and Administration* t. 2-1-20, OBSTACLE IDENTIFICATION SURFACES, OBSTACLE FREE ZONES, RUNWAY SAFETY AREAS, AND CLEARWAYS u. 10-1-7, USE OF ACTIVE RUNWAYS v. 10-1-8, PROCEDURES FOR OPENING AND CLOSING RUNWAYS w. 10-3-8, LINE UP AND WAIT (LUAW) OPERATIONS	d. 91.129 (i): Vehicle operators at airports with operating control towers take action to follow instructions given by air traffic controllers. *§139:* Airport owners and operators comply with these regulations to standardize airports across the NAS. e. 139.309: Airport owners and operators provide specified areas near runways used for air carrier operations that are graded and drained for fire and rescue operations—only objects supporting specific flight operations and are on frangible supports at the lowest possible height. f. 139.311: Airport owners and operators must provide and maintain marking systems for air carrier operations on the airport. g. 139.329: Airport owners and operators limit access to movement areas and safety areas to only those pedestrians and ground vehicles necessary for airport operations; establish and implement procedures for the safe and orderly access to and operation in movement areas and safety areas by pedestrians and ground vehicles, including provisions identifying the consequences of noncompliance with the procedures by all persons. 6. FAA Order JO 7110.65 Chapter 2 General Control, Paragraphs: a. 2-1-1 and 2-1-2: Controllers prevent aircraft collisions by separating aircraft. b. 2-4-3: Pilot Acknowledgement/Read Back: controllers require pilots to acknowledge ATC clearances, instructions, and taxi instructions *Chapter 3 Airport Traffic Control – Terminal, Paragraphs:* c. 3-1-3: controllers control operations conducted on an active runway.		

1. ID	2. Hazard Description	3. Cause	4. System State	5. Controls	6. Control Justification	7. Effect	8. Severity
				x. 10-3-9, TAKEOFF CLEARANCE y. 10-3-10, MULTIPLE RUNWAY CROSSINGS 8. Advisory Circulars a. AC 150/5340-1J, Standards for Airport Markings b. AC 150/5340-18F, Standards for Airport Sign Systems c. AC 150/5345-50B, Specification for Portable Runway and Taxiway Lights d. AC 150/5210-20A, Ground Vehicle Operations to Include Taxiing or Towing an Aircraft on Airports 9. Airport Operators and Owner Standard Operating Procedures 10. Controller/Pilot/Vehicle Operator intervention 11. ATC instructions to vehicle (hold short, taxi, etc.) 12. RWSL 13. Safety Logic a. ASDE X /ASDE-3 b. ASSC/AMASS 14. Airport lighting, signage, and markings 15. FAA Order 6000.15, *General Maintenance Handbook for NAS Facilities* 16. Initial Training 17. Driver Memory Aids (Form 5280-7)	d. 3-1-4: Local and Ground controllers coordinate and communicate how aircraft conduct surface movements in relation to a runway. e. 3-1-5: Controllers manage activity near an active runway's edge. f. 3-1-6: Based on known traffic controllers issue instructions to separate aircraft. g. 3-1-7: Controllers determine an aircraft's position then issue taxi or takeoff instructions. h. 3-1-12: Controllers scan runways before issuing control instructions. *Section 6:* Controllers use airport surface detection equipment to aid in the movement and separation of air traffic. *Section 7:* Controllers issue movement and separation instructions. i. 3-9-4: Controllers issue instructions to place aircraft on runways without a departure clearance based on the traffic situation. j. 3-9-6: Controllers separate traffic using the same runway. k. 3-9-8: Controllers separate aircraft on intersecting runways and flight paths. l. 3-9-10: Controllers issue takeoff clearances based on the situation m. 3-9-11: Controllers cancel clearances to maintain separation n. 3-10-3: Controllers issue instructions to separate aircraft arriving to the same runway. o. 3-10-4: Controllers issue instructions to separate aircraft arriving to intersecting runways. p. 3-10-5: Controllers follow procedures for issuing runway landing clearances. q. 3-10-6: Controllers maintain separation by issuing or withholding clearance instructions. r. 3-10-7: Controllers follow procedures to clear aircraft to land when the aircraft is not		

1. ID	2. Hazard Description	3. Cause	4. System State	5. Controls	6. Control Justification	7. Effect	8. Severity
					in sight s. 3-10-9: Controllers maintain safety by issuing runway exiting instructions. *Section 11:* Controllers issue instructions to separate helicopters from helicopters and helicopters from other aircraft during ground and tower flight operations. 7. FAA Order JO 7210.3 a. 2-1-20: Facilities develop and monitor plans for creating protected areas for arriving and departing aircraft b. 10-1-7: Facilities develop procedures to for use of runways c. 10-1-8: Facilities develop procedures for opening and closing runways. d. 10-3-8: Facilities develop procedures to allow Line Up And Wait (LUAW) operations. e. 10-3-9: Facilities establish guidelines for how aircraft are cleared for takeoff based on airport configuration. f. 10-3-10: Facilities develop procedures to authorize multiple runway crossings.. 8. Advisory Circulars a. AC 150/5340-1J is used by airport owners and operators to mark airport pavement for pilot and vehicle operator's movement area orientation. b. AC 150/5340-18F is used by airport owners and operators to create and post airport signs for pilot and vehicle operator's movement area orientation. c. AC 150/5340-50B is used by airport owners and operators to create standardized lighting during runway and taxiway construction. d. AC 150/5210-20A is used by airport operators to develop training programs for safe ground vehicle operation, personnel taxiing or towing aircraft, and pedestrian control on movement and safety areas of		

1. ID	2. Hazard Description	3. Cause	4. System State	5. Controls	6. Control Justification	7. Effect	8. Severity
					an airport. 9. Vehicle operators, drivers and personnel take actions to comply with Standard Operating Procedures 10. Controllers, pilots, and vehicle operators take actions to maintain aircraft separation. 11. Vehicle drivers comply with ATC control instructions operating on the movement area. 12. When the RWSL system illuminates, vehicle operators do not start takeoff roll or enter a runway. 13. Safety Logic a. Alarms cause controllers to heighten scan of the active runway and cancel clearances for vehicles to enter or cross an active runway. b. Controllers respond to the alarms by checking the active runway and cancelling takeoff or landing clearances for aircraft. 14. Pilots and vehicle operators use the lights, signs and markings to operate on the airport's movement area. 15. FAA Order 6000.15: Technical Operations personnel (vehicle operators and drivers) take actions to comply with SOPs. 16. Initial Training: Driver memory aids such as FAA 5280-7, *Airfield Visual Aid Safety Placard*, provide safety procedures to ground personnel for the safe operation of vehicles at airports. 17. Driver Memory Aids (Form 5280-7): This order prescribes the FAA Runway Safety Program and establishes policy to improve runway safety by decreasing the number and severity of runway incursions, excursions, and		

1. ID	2. Hazard Description	3. Cause	4. System State	5. Controls	6. Control Justification	7. Effect	8. Severity
					surface incidents.		

9.	10.		11.	12.	13.	14.	15.	16.
Severity Rationale	**Likelihood**		**Likelihood Rationale**	**Initial Risk**	**Safety Requirements**	**Organization Responsible for Implementing Safety Requirements**	**Predicted Residual Risk**	**Safety Performance Targets**
Severity for CATs A, B, and C RIs are based on the SMS Manual, July 2016, Table 3.3: *Hazard Severity Definitions*.	1.	Extremely Remote (D)	$1 \div 49{,}994{,}851 = 2.0 \times 10^{-8}$	**MEDIUM (3D)**	1. Update the educational/training products that are currently outdated and disseminate to all airports (towered Part 139 and non–Part 139) by August 2018. 2. Enhance performance of the RSAT through communication and the transfer of information between airport management, Air Traffic, and pilots, and vehicle operators at towered airport facilities (e.g., recurrent meetings with tenants to discuss RI issues). (1+ years) 3. For towered non–Part 139 airports, identify appropriate measures to recommend/re-emphasize the use of enhanced performance-based training requirements (e.g., OJT "ride-alongs") for vehicle operators and technical operations personnel. 4. Research the use of onboard-surveillance technologies for vehicle operators to enhance situational awareness.	1. AAS-300; AJI-14 2. AFS-800; AAS-300 3. AAS-300 4. ANG-C52	**MEDIUM**	1. Five percent overall reduction in the rate of RIs (CATs A, B, and C) associated with VPDs by the close of FY20. *Note*: FY16 VPD-related RIs were all CAT C.
		Remote (C)	$36 \div 49{,}994{,}851 = 7.2 \times 10^{-7}$	**MEDIUM (4C)**				
	2.	Remote (C)	$37 \div 49{,}994{,}851 = 7.4 \times 10^{-7}$	**MEDIUM (4C)**				

Appendix B. SMS Hazard Severity Classification Table

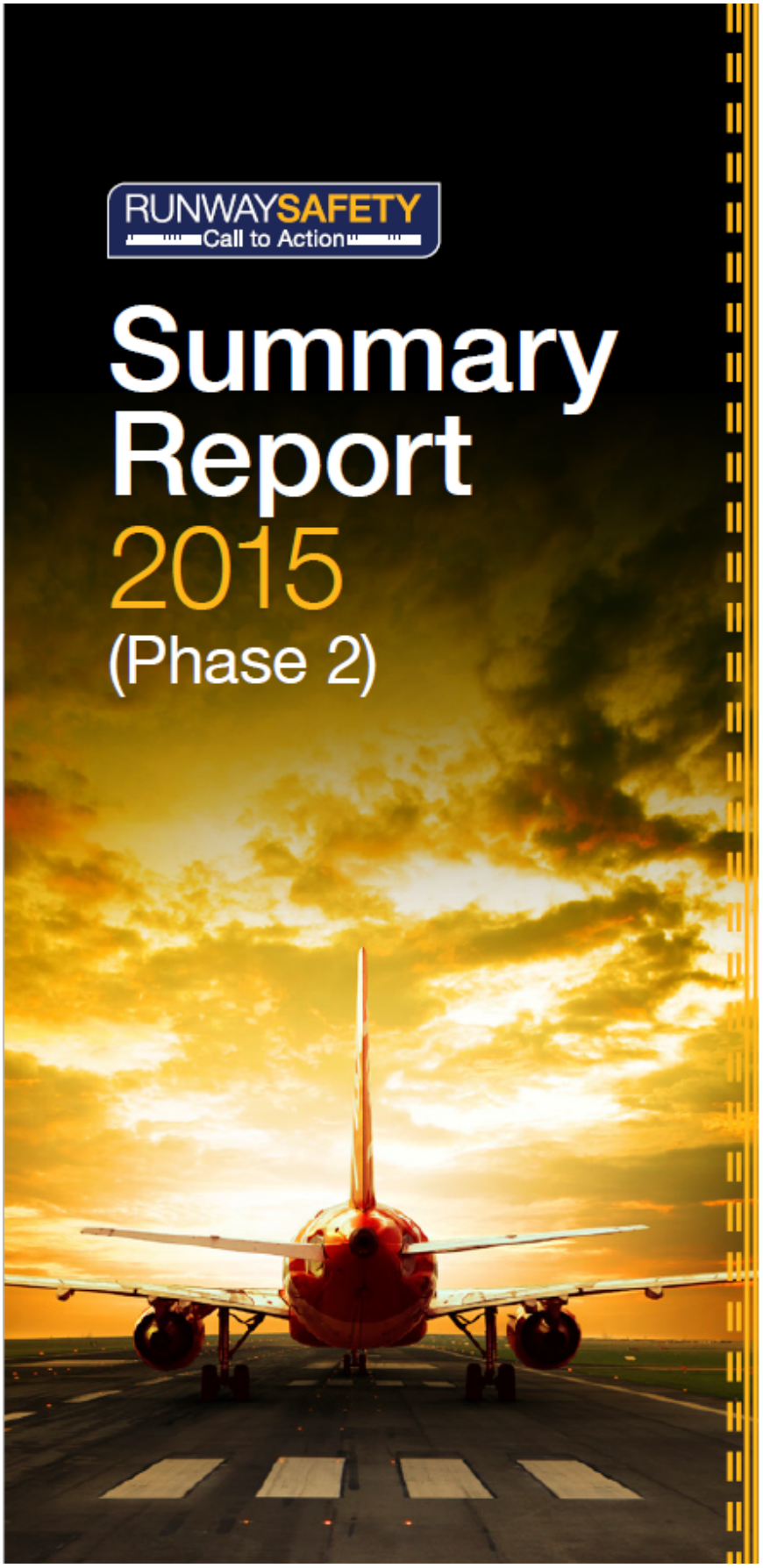
The Safety Management System Manual, July 2016, Section 3.5.4.2, *Determining Severity*

Table 3.3: Hazard Severity Definitions

	Hazard Severity Classification *Note: Severities related to ground-based effects apply to movement areas only.*				
	Minimal **5**	**Minor** **4**	**Major** **3**	**Hazardous** **2**	**Catastrophic** **1**
	CONDITIONS RESULTING IN ANY ONE OF THE FOLLOWING:				
ATC Services	A minimal reduction in ATC services CAT D Runway Incursion[1] Proximity Event, Operational Deviation, or measure of compliance greater than or equal to 66 percent[2]	Low Risk Analysis Event severity,[3] two or fewer indicators fail CAT C Runway Incursion	Medium Risk Analysis Event severity, three indicators fail CAT B Runway Incursion	High Risk Analysis Event severity, four indicators fail CAT A Runway Incursion	Ground collision[4] Mid-air collision Controlled flight into terrain or obstacles
Unmanned Aircraft Systems	Discomfort to those on the ground Loss of separation leading to a Measure of Compliance greater than or equal to 66 percent	Low Risk Analysis Event severity, two or fewer indicators fail Non-serious injury to three or fewer people on the ground	Medium Risk Analysis Event severity, three indicators fail Non-serious injury to more than three people on the ground A reduced ability of the crew to cope with adverse operating conditions to the extent that there would be a significant reduction in safety margins Manned aircraft making an evasive maneuver, but proximity from Unmanned Aircraft remains greater than 500 feet	High Risk Analysis Event severity, four indicators fail Incapacitation to Unmanned Aircraft System crew Proximity of less than 500 feet to a manned aircraft Serious injury to persons other than the Unmanned Aircraft System crew	A collision with a manned aircraft Fatality or fatal injury to persons other than the Unmanned Aircraft System crew

	Hazard Severity Classification *Note: Severities related to ground-based effects apply to movement areas only.*				
	Minimal **5**	**Minor** **4**	**Major** **3**	**Hazardous** **2**	**Catastrophic** **1**
	CONDITIONS RESULTING IN ANY ONE OF THE FOLLOWING:				
Flying Public	Minimal injury or discomfort to persons on board	Physical discomfort to passenger(s) (e.g., extreme braking action, clear air turbulence causing unexpected movement of aircraft resulting in injuries to one or two passengers out of their seats) Minor injury to less than or equal to 10 percent of persons on board[5]	Physical distress to passengers (e.g., abrupt evasive action, severe turbulence causing unexpected aircraft movements) Minor injury to greater than 10 percent of persons on board	Serious injury to persons on board[6]	Fatal injuries to persons on board[7]
NAS Equipment (with Table 3.4)	Flight crew inconvenience Slight increase in ATC workload	Increase in flight crew workload Significant increase in ATC workload Slight reduction in safety margin	Large increase in ATC workload Significant reduction in safety margin	Large reduction in safety margin	Collision between aircraft and obstacles or terrain

Appendix C. 2015 Runway Safety Call to Action Summary Report



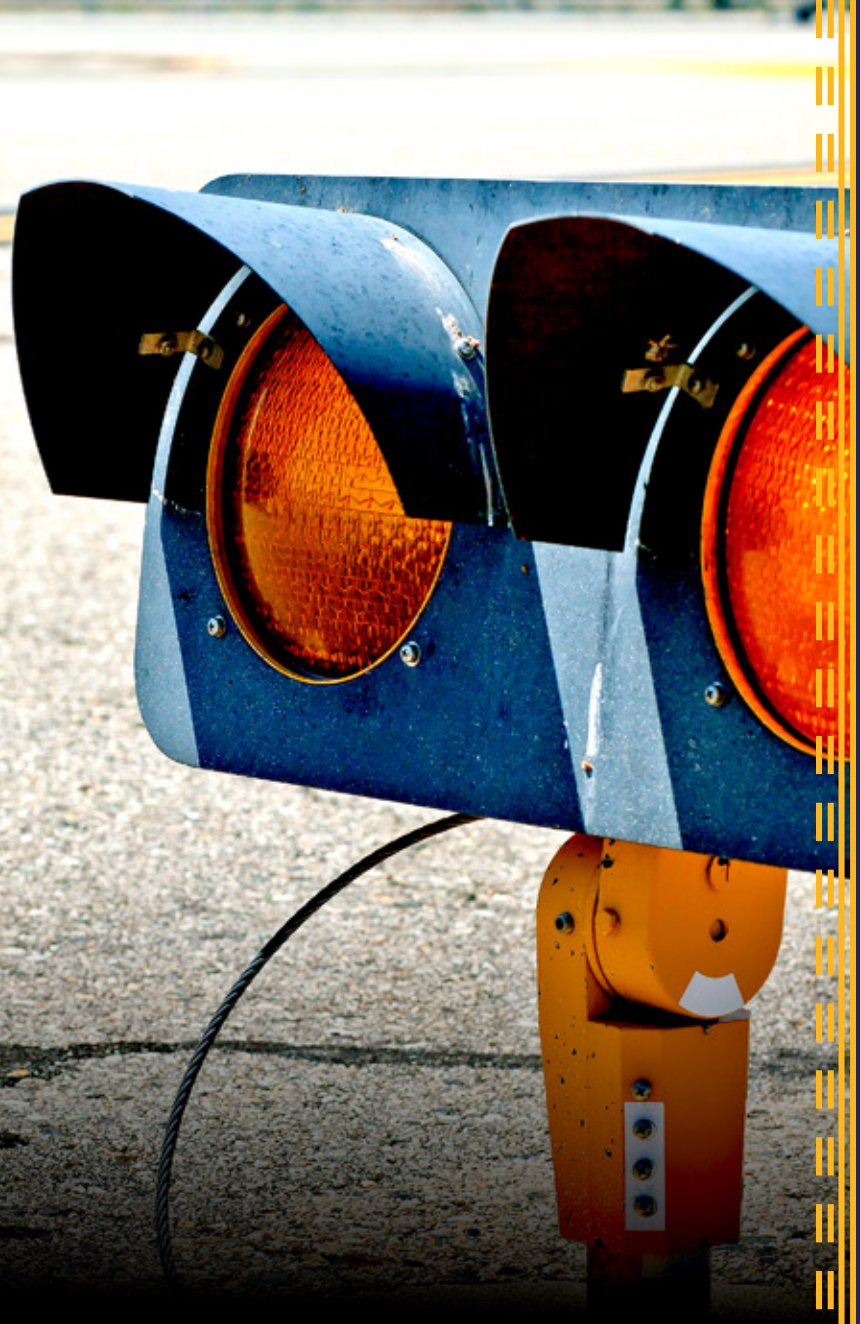
Federal Aviation Administration

Call to Action Summary Report 2015
(Phase 2)

The mitigations and timelines contained in this report will be presented to all Call to Action participants from industry, labor, and government. Each responsible Line of Business (LOB) or Industry Organization has identified a point-of-contact (POC) to develop a corresponding Action and Implementation Plan to include a timeline to completion. This Phase 2 report is presented for approval by the respective LOBs. Approved plans will be published, and the recommendations will be tracked by the Runway Safety Group within Safety and Technical Training (AJI-14).

11/30/15

James Fee — **Date**
Runway Safety Program Group Manager (A)
ATO Safety and Technical Training



RUNWAYSAFETY
Call to Action

SUMMARY REPORT PHASE 2

OVERVIEW

The Runway Safety Call to Action (C2A) convened on June 24, 2015, with 108 representatives from industry, labor, and government. The "Call" was summoned by the Federal Aviation Administration (FAA) Administrator, Michael Huerta, and was a follow-up to the 2007 Call to Action Safety Summit. Here, the Summit established a five-point, short-term Call to Action Plan that was completed, while the mid- and long-term Call to Action Plans involving technology improvements are either complete or are now in their final stages of deployment.

The campaign, which steadily achieved its goal of reducing every type of runway incursion, focused on pilot training, technology, airport signage, and communications to meet its outlined objectives.

Since this time, Category A and B runway incursions, events that represent the highest risk of a collision, have dropped by 44 percent since the last C2A. Seven years have passed since the last runway collision at a major airport and nine years since the last fatal runway collision. Despite this long-standing trend, A and B events have recently begun to increase.

In the months following the 2015 C2A meeting, points-of-contact were identified and assigned a corrective action recommendation by their line of business. The points of contact developed a corresponding implementation plan for each of the corrective actions. In some cases, corrective actions were combined where there was significant overlap of purpose.

RUNWAYSAFETY
Call to Action

SUMMARY REPORT PHASE 2

STRATEGY

The 2015 C2A attendees were organized into three breakout sessions and charged to devise short-, mid, and long-term corrective action recommendations.

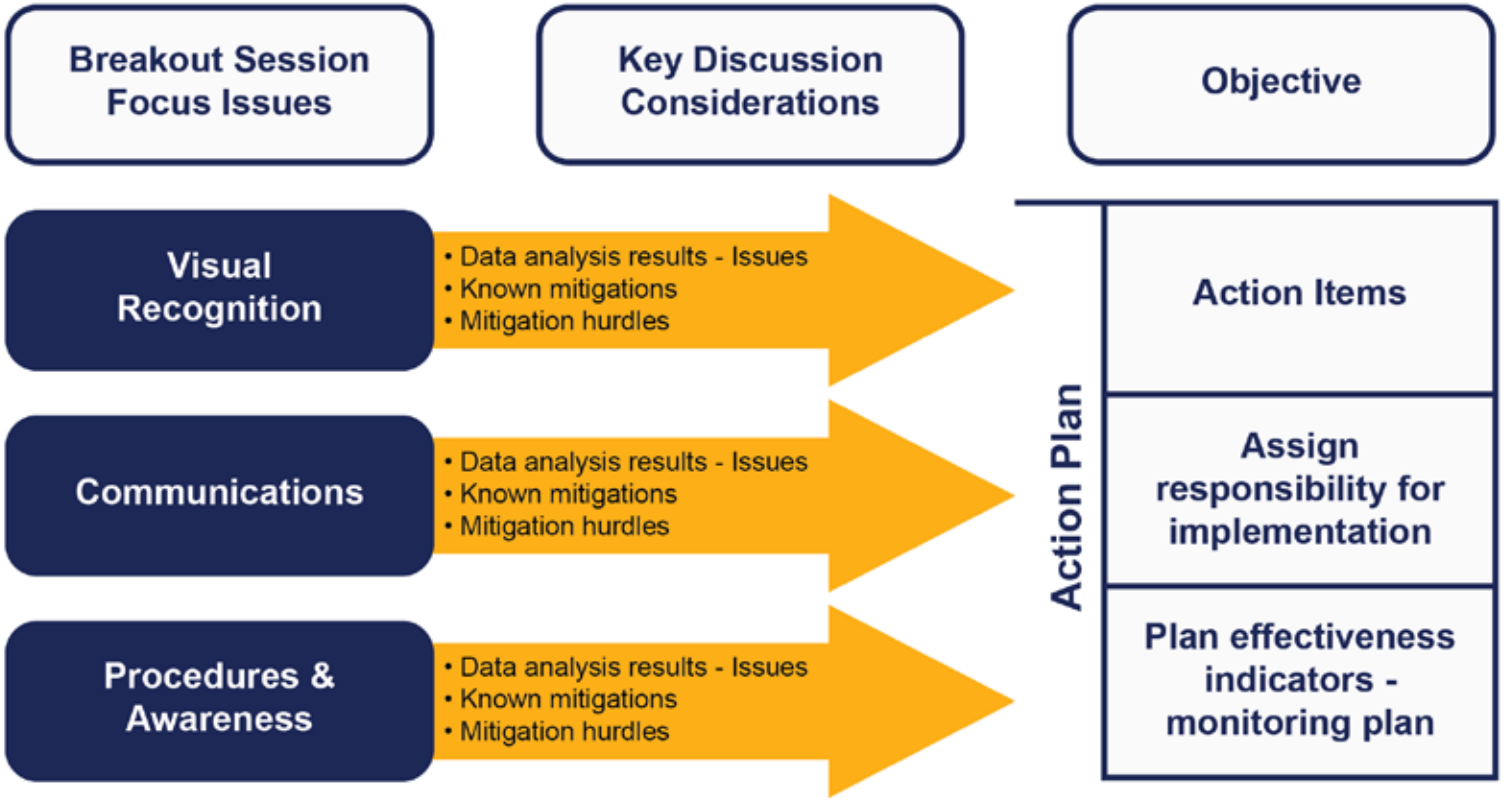
Each team (Visual, Communication, and Procedures & Awareness) followed the same basic premise: to review all relevant runway safety data available and reach a group consensus on the best corrective actions.

The MITRE Corporation analyzed 1,782 records from the FAA Runway Safety Database. In addition to characteristics identified in Mandatory Occurrence Reports (MORs), investigator remarks from Flight Standards Service and Airports often provide insights into the cause of an incident or the sequence of events that led to the incursion. Further, all participants were asked to review the issues identified in the data analysis and be prepared to discuss and develop:

- Known mitigations, best practices, and new innovations
- Recommended corrective actions
- Mitigations and any hurdles to implementation
- Responsible points-of-contact (POCs)
- A monitoring plan that can quantify the effectiveness of each action

Implementation plans have been developed and actions will be taken to initiate actions to reduce the number and severity of surface events.

Figure 1. Call to Action Workflow



RUNWAYSAFETY
Call to Action

SUMMARY REPORT PHASE 2

THE PATH TO ACTION

TEAM LEADER: MICHAEL O'DONNELL
DIRECTOR OF AIRPORTS SAFETY AND STANDARDS
Visual

TEAM LEADER: JOHN BARBAGALLO
DEPUTY DIRECTOR FLIGHT STANDARDS
Communication

TEAM LEADER: JONATHAN GRAY
DIRECTOR FOR SAFETY (A)
Procedures & Awareness

Visual

Michael O'Donnell | Director of Airports Safety and Standards

The Visual Markings breakout team focused on one problem that continues to exist within the general aviation (GA) community: pilots who ignore or miss runway signage and markings. Data analysis indicated that pilots with 1,500 hours of flight time or more are primarily involved in these runway incursions. Most of these incidents involved inadequate or missing signage, recent airfield modifications or construction, and confusing geometry.

In nearly every incident, pilots reported having received training in lighting and signage. Non-home-base airport events account for many of the identified incursions. And in nearly 90 percent of incidents, the crew was not using a moving map with own-ship position at the time of the incident. In 25 percent of cases, pilots reported they did not review the airfield diagram prior to taxi.

The group's recommendations centered on education, technology, and human factors research. Participants in the session suggested the FAA and the Aircraft Owners and Pilots Association (AOPA) work together to educate AOPA's members about situational awareness and share information and lessons learned with the GA community in the same way that the FAA and commercial airlines share information through the InfoShare program. Biennial pilot training on runway markings and signage should continue to be emphasized, as well as remedial training to strengthen plot skills.

Visual Recommendations

IMPLEMENTATION PLANS, MITIGATIONS, AND INTENDED OUTCOMES	DELIVERY DATE AND POINT/S OF CONTACT
1. CONDUCT STUDIES, FATIGUE – CONTROLLERS/PILOTS **MITIGATION** Conduct Human Factors studies (also refer to previous studies and research) to include location of signs, line of sight, familiarity with airport environment, and possible distractions. Using data from previous and newly conducted research, the ATO Runway Safety Group, and ATSAP/ASAP, determine the extent to which human factors and fatigue represent hazards that were contributory or causal to runway safety events, and recommend corrective actions as appropriate to reduce, control and/or mitigate associated elevated safety risk. Conduct an assessment for factors associated with fatigue and Human Factors and its relationship to runway incursions. Recommend corrective actions, as necessary. **INTENDED OUTCOMES** Corrective action recommendations developed and forwarded to appropriate parties (ATO, Airports, Industry) intended to reduce, control and/or mitigate elevated safety risk associated with human factors and fatigue hazards identified as contributory or causal in runway safety events.	**DELIVERY DATE** 9/28/2018 **POINT OF CONTACT** **Jason Demagalski** ATO AJI-155 Human Performance Program, Manager

Visual Recommendations

IMPLEMENTATION PLANS, MITIGATIONS, AND INTENDED OUTCOMES	DELIVERY DATE AND POINT/S OF CONTACT
2. PERIODIC/BI-ANNUAL MANDATED GA PILOT TRAINING ON SIGNS AND MARKINGS/AND SURFACE SITUATIONAL AWARENESS. Establish remedial training for pilots who had a runway safety event. **MITIGATION** Explore amending the 14 Code of Federal Regulations (CFR) Section 61.56 Flight Review to include a training matrix to address Runway Safety elements as 14 CFR Section 61.57, and 61.58 include a training matrix relative to Instrument Proficiency, and Pilot-In-Command Proficiency respectfully. Proceed to develop an awareness campaign directed at CFIs to advise CFIs to use AC-61-98, Currency Requirements and Guidance for the Flight Review and Instrument Proficiency Check, review current edition of "Conducting an Effective Flight Review" for a runway safety element and include link in Appendix 10 to the Runway Safety, and review FAA order 8900.1 to include CFI look back program, previously included in the National Work Program Order 1800.56H, Appendix A Certificated Flight Instructors, in the assessment of occurrences reported to Flight Standards to review if the CFI of the individual involved in the occurrence utilized the recommended documents to conduct an effective 14 CFR required check. Remedial training for Runway Incursions implemented October 2015. **INTENDED OUTCOMES** 1. Explore the feasibility of amending 14 CFR Section 61.56 Flight Review to include a training matrix to address runway safety elements. 2. Develop an awareness campaign directed at CFIs to use appropriate guidance and practices in conducting an effective flight review. 3. Remedial training for Runway Incursions implemented October 2015. **COMPLETE**	**DELIVERY DATE** 9/30/2017 **POINTS OF CONTACT** **Joe Foresto** Flight Standards, AFS Operations Safety Inspector **Freddie James** Airports Division, Airport Certification Safety Inspector **Ronald Rifenberg** Flight Standards, AFS Operations Safety Inspector

Visual Recommendations

IMPLEMENTATION PLANS, MITIGATIONS, AND INTENDED OUTCOMES	DELIVERY DATE AND POINT/S OF CONTACT
3. TAXI CONFORMANCE MONITORING Convey audible taxi instructions/alerts electronically using available technology such as GPS in cockpit. **INTENDED OUTCOMES** Conduct research to refine concept and develop tools for tower-based and cockpit-based taxi conformance monitoring using near-term and farther-term technologies. 1. Conduct a shortfall analysis to identify Runway Incursions that may be prevented by various taxi conformance monitoring concepts at controlled airports. **DELIVERY DATE** 9/30/2017 2. Research state-of-the-art in taxi conformance monitoring technology used around the world. Estimate the expected impact of near-term and far-term taxi conformance monitoring capabilities on Runway Incursions at controlled airports across Commercial and General Aviation operations. **DELIVERY DATE** 9/30/2017 3. Research and refine existing near and far-term capabilities needed to digitize taxi route instructions. Examples include speech recognition, “point and click” route entry, D-taxi, etc. **DELIVERY DATE** 9/30/2019 4. Develop airport surface database requirements to support taxi conformance monitoring, determine if data meeting the requirements exists, and if the data does not exist, identify ways in which it could be generated or compiled. **DELIVERY DATE** 9/30/2019 5. Research and develop algorithms and human interfaces for taxi conformance monitoring and alerting of controllers and/or pilots when deviations occur. **DELIVERY DATE** 9/30/2019 6. Develop and demonstrate a prototype cockpit-based taxi conformance monitoring system to reduce Runway Incursions at controlled airports. **DELIVERY DATE** 9/30/2019 7. Develop and demonstrate a prototype tower-based taxi conformance monitoring system to reduce Runway Incursions at controlled airports. **DELIVERY DATE** 9/30/2019	**DELIVERY DATE** Refer to the numbered intended outcomes for delivery dates. **POINT OF CONTACT** **Andras Kovacs** Technology Development and Prototyping, Surveillance Branch (ANG-C52), Manager

Visual Recommendations

IMPLEMENTATION PLANS, MITIGATIONS, AND INTENDED OUTCOMES	DELIVERY DATE AND POINT/S OF CONTACT
4. OUTREACH AND EDUCATION Using surface event data available to the FAA's Runway Safety Group collaboratively develop and share focused outreach material through various government and industry channels. Historically, 60% of runway incursions involve a pilot deviation; therefore, the outreach material will primarily focus on the pilot community. **INTENDED OUTCOMES** 1. Use a joint government and industry body to analyze surface event data as to gain insight into potential focus topics to generate outreach material. **DELIVERY DATE** 3/30/2016 2. Collaboratively develop timely outreach material using the focus topics from Mitigation 1. An emphasis should be made to incorporate the Aircraft Owners and Pilots Association (AOPA) online Runway Safety Course into the material. **DELIVERY DATE** 5/30/2016 3. Incorporate the material from Mitigation 2 into the AOPA communication/outreach plan by promoting and distributing material via their member base. Such methods may include: AOPA ePilot newsletter and Flight Training Edition, AOPA Pilot Magazine, direct e-mail marketing, Facebook or YouTube, AOPA's Air Safety Institute's (ASI) Flight Instructor Refresher Course, and ASI's Safety To Go. **DELIVERY DATE** 6/30/2017 4. Incorporate the material from Mitigation 2 into various National Association of State Aviation Officials (NASAO) partnership activities such as state aviation conferences and/or pilot forums. **DELIVERY DATE** 6/30/2017 5. Incorporate the material from Mitigation 2 into the FAA Safety Team (FAAST) outreach and education plan by promoting and distributing material via various business plan initiatives. The initiatives are targeted towards the general aviation pilot community, Certified Flight Instructors, Designated Pilot Examiners, and Training Center Evaluators. Such methods may include: FAAST BLASTs, FAA Safety Briefing Magazine, FAASafety.gov website, targeted actions at airports needing heightened awareness, and direct email to advocacy groups / airports / flight schools. **DELIVERY DATE** 6/30/2017 6. Sustainment – At a minimum of once per year, the Runway Safety Council (RSC) will analyze surface event data to provide specific focus topics for outreach. The RSC, along with the representative government and industry organizations, will determine the available means to develop the specific material. The delivery means should, at a minimum, follow the means dictated within Mitigations 2 through 5 above. **DELIVERY DATE** Continuous	**DELIVERY DATE** Refer to the numbered intended outcomes for delivery dates. **POINTS OF CONTACT** **Chad Brewer** ATO AJI-141 Runway Safety, Safety Analyst **Paul Deres** AOPA, Director of Education

Visual Recommendations

IMPLEMENTATION PLANS, MITIGATIONS, AND INTENDED OUTCOMES	DELIVERY DATE AND POINT/S OF CONTACT
5. FURTHER RESEARCH/DATA ANALYSIS AND POST EVENT COMMUNICATIONS BETWEEN FAA AND INDUSTRY Provide a recurring forum to collaboratively share lessons learned information for the general aviation community. **INTENDED OUTCOMES** Brief the Safety Analysis Team (SAT) of the General Aviation Joint Steering Committee (GA JSC) each quarter on runway safety lessons learned from events or from any research or data analysis supplied by the Runway Safety Office. The SAT is composed of representatives from the various industry associations and government, including: AOPA, EAA, GAMA, specific manufacturers, the instructor community, type clubs, NTSB, NASA and the various lines of business within the FAA. This team meets at a minimum every quarter (depending on workload). This would be the most direct path to get the lessons learned out to industry and the organizations within the FAA who communicate directly with pilots, operators, instructors, type clubs and manufacturers.	**DELIVERY DATE** This action will be continuous under the Runway Safety Council. **POINT OF CONTACT** **Corey Stephens** AVS Aviation Safety Organization, Operations Research Analyst
6. INCREASE EXPANSION AND UTILIZATION Determine where expansion would be most beneficial. Explore existing/alternative technology. • Deploy a “right site, right size” approach for candidate airports and selected technologies to decrease Runway Incursions. **INTENDED OUTCOMES** 1. Engage stakeholders and visual panel workgroup in FY15 “right site, right size” technology evaluation conducted by the Runway Incursion Reduction Program (RIRP). **DELIVERY DATE** 9/30/2017 2. Survey candidate airports for “right site, right size” approach and develop initial cost estimate for candidate technology. **DELIVERY DATE** 9/30/2017 3. Conduct additional data driven analysis on Runway Incursion trends, locations, and contributing factors. **DELIVERY DATE** 9/30/2018 4. Continue evaluation of runway safety technologies as they are identified. **DELIVERY DATE** 9/30/2018 5. Deploy selected technology at candidate airport to mitigate Runway Incursions. **DELIVERY DATE** 9/30/2018	**DELIVERY DATE** Refer to the numbered intended outcomes for delivery dates. **POINT OF CONTACT** **Andras Kovacs** Technology Development and Prototyping, Surveillance Branch (ANG-C52), Manage

Visual Recommendations

IMPLEMENTATION PLANS, MITIGATIONS, AND INTENDED OUTCOMES	DELIVERY DATE AND POINT/S OF CONTACT
7. CONTINUE RESEARCH AND EXPLORE TECHNOLOGY Safely incorporate LED technology into the National Airspace System. **INTENDED OUTCOMES** 1. Conduct Flight tests to ensure safe deployment of currently installed LEDs in NAS. 2. Continue with flight test plan to test future LED deployment of airport lighting systems (i.e. MALSR, HIRLs) when funding is available.	**DELIVERY DATE** 9/30/2016 **POINT OF CONTACT** **Coby Johnson** AFS-410 Operations Branch, Manager
8. EXPAND NOTAM Expand airfield construction graphic NOTAMS. **INTENDED OUTCOMES** 1. Define ownership and technological potential for automation. **DELIVERY DATE** 12/31/2015 2. Develop technological platform for automation of diagrams. **DELIVERY DATE** 9/30/2016 3. Implement Core Airport automation. **DELIVERY DATE** 12/31/2016 4. Expand to construction graphics to focus airports. **DELIVERY DATE** 3/31/2017 5. Implement construction graphics for all towered airports. **DELIVERY DATE** 9/30/2017	**DELIVERY DATE** Refer to the numbered intended outcomes for delivery dates. **POINT OF CONTACT** **David Siewert** JFKT & Construction Council Advisory Chairperson

Communication

John Barbagallo | Deputy Director Flight Standards

The Communication group focused its attention on three issues:

- The familiarity of pilots and vehicle drivers with their given airports
- The relationships between pilots and controllers
- Deficiencies in airport communications

MITRE research showed that communications issues were predominant in 149 records, and the factors associated with communications-related incidents were not isolated to any one causal area. Pilots continue to mistake the intended recipient of some communications and to commit read-back errors. These incidents are not limited to inexperienced pilots; a large percentage of the records can be attributed to pilots with more than 1,500 hours. Further, the events are not prevalent in specific airports or airport types. In nearly every case where the pilot provided a response, the pilot did not ask for clarification. In 28 percent of cases, pilots reported a congested radio frequency. And in 10 percent of cases, pilots admitted that they did not "clearly understand the taxi instruction."

More than 500 events from the MITRE study were associated with Airport Surface Detection Equipment – Model X, or ASDE-X, installations. For those incidents, there were fewer cases where communications was cited as a contributing factor, suggesting that ASDE-X may have played a role in reducing communications errors, which, in turn, reduces the overall rate of incursions.

To increase airport familiarity, the communications breakout group proposed that the FAA and the aviation industry develop ways for pilots and vehicle drivers to alert air traffic control if they are new to an airport or still learning its surface layout. Also recommended was the formation of a working group to identify best practices in communications. The working group would then develop training, and finally, review current orders, the Aeronautical Information Manual (AIM), and other relevant materials to suggest appropriate changes and updates.

Communication Recommendations

IMPLEMENTATION PLANS, MITIGATIONS, AND INTENDED OUTCOMES	DELIVERY DATE AND POINT/S OF CONTACT
1. DEVELOP GUIDANCE AND AWARENESS FOR THE PILOT OR VEHICLE DRIVER WHEN UNFAMILIAR WITH AIRPORT, AND INCORPORATE RESULTING GUIDANCE INTO AIM, TRAINING COURSES, ETC. (AIRPORTS AFS-800 AND AFS-200) **INTENDED OUTCOMES** Per Airports Division, the alert technology for vehicle driver's mitigation is being deployed, and addressed by the Procedures group. ADS-B squitter is the system that the ASDE-X system works on to provide an alert to vehicle of aircraft traffic and position on the airport. Also, per AC 5210-20A published September 2015, a vehicle driver unfamiliar with an airport is required to be trained by the Airport before driving in the movement area, and the AC states that any driver not trained if they are to drive on the airport must be accompanied by a trained driver. Alert system for Pilots. Coordinate with AFS-200 to re-emphasize the content of AC 120-74, Parts 91, 121, 125, and 135 Flight crew Procedures During Taxi Operations, and AC 91-74, Parts 91 and 135 Single Pilot, Flight School Procedures During Taxi Operations. Incorporate any resultant updates into appropriate FAA guidance, and training materials. Projected to take place beyond 2018.	**DELIVERY DATE** 9/30/2018 **POINTS OF CONTACT** **Joe Foresto** Flight Standards, AFS Operations Safety Inspector **Freddie James** Airports Division, Airport Certification Safety Inspector **Ronald Rifenberg** Flight Standards, AFS Operations Safety Inspector
2. ENHANCE OPERATOR AND CONTROLLER RELATIONSHIPS Efforts will begin to schedule "familiarization" between operators/controllers at Core 30 airports and regional and towered airports. The efforts to reach all part 139 airports will be on-going and time-consuming but we will engage these airports on two fronts; 1: Industry action to reach out to core 30 airports and 2: Air Traffic managers will institute similar activities by way of their Local RSAT meetings. The Runway Safety Council (RSC) will include communication issues as part of their quarterly meeting agenda to monitor the efforts on the regional/national level. **INTENDED OUTCOMES** 1. Schedule "familiarization" meetings between operators/controllers at Core 30 airports. 2. Expand operator/controller familiarization meetings to regional and local towered airport. 3. Create a national working group to meet annually and act as public/private advocate for the effort.	**DELIVERY DATE** 11/01/2016 **POINTS OF CONTACT** **Steve Jangelis** ALPA International, Airport and Ground Environment Chairman **Chris Stephenson** NATCA Headquarters, National Representative

Communication Recommendations

IMPLEMENTATION PLANS, MITIGATIONS, AND INTENDED OUTCOMES	DELIVERY DATE AND POINT/S OF CONTACT
3. ESTABLISH A WORKING GROUP AND DEVELOP TRAINING/CHANGES IN AIRPORT COMMUNICATIONS Conduct an internal working group of cross organizational (ATO, AVS, ARP) as well as any external stakeholder (Airport Authorities/Owners, Pilots, Fixed Base Operators, etc.) at least annually, and poll of best practices as they relate to Airport Surface/Movement Areas. Best practices will be formalized in cooperation with the Runway Safety Council (RSC) with the assistance of the Runway Safety Group. Develop training and familiarization as necessary to ensure Pilot/Vehicle/Air Traffic Control participants are fully informed about communication related issues in Runway Safety. Once a best practice is ready to be accepted as a formalized process or training item, existing measures will be used to implement and regulate the same. The Runway Safety Group can act as facilitator for those changes. **INTENDED OUTCOMES** 1. Establish a Runway Safety Communications Working Group to review “best practices” and make recommendations for formalizing where appropriate. **DELIVERY DATE** 11/01/2016 2. Develop training and familiarization as necessary. **DELIVERY DATE** 11/01/2016 3. Amend orders, AIM, CFR, etc., as necessary to formalize changes. **DELIVERY DATE** 11/01/2016	**DELIVERY DATE** Refer to the numbered intended outcomes for delivery dates. **POINTS OF CONTACT** **Maurice Hoffman** Air Traffic Procedures, Deputy Director **Chris Stephenson** NATCA Headquarters, National Representative

Procedures & Awareness

Jonathan Gray | Director for Safety (A)

In the Procedures & Awareness breakout session, participants considered safety risks caused by pilot distraction, memory failure, expectation bias, multitasking, and inattention during clearance delivery.

More than 260 events reviewed by MITRE indicated that procedures and awareness factors played a role. A review of investigation narratives confirms that, in a significant number of cases, pilots get lost on the airport surface or are taking wrong turns due to distractions or inattentiveness. Here again, a large number of cases are associated with experienced pilots, including Part 121 operations.

Within the subset of incidents involving aircraft taxiing out for departure, the effects of inattention to procedure and distraction appear to be even greater, as indicated by the larger percentage of narratives categorized for awareness or flagged for pilot distraction. This could be the result of the limited time available to complete tasks during short taxi routes. In cases where information is provided during the ground movement phase, incident rates are three times as likely to occur during taxi out. In 40 percent of cases, pilots reported a distraction in the cockpit at the time of incident.

Experienced pilots again are equally susceptible: 55 percent of incidents involved pilots with more than 1,500 hours. Pilots reported they did not review the airfield diagram prior to taxi 25 percent of the time. Another 25 percent of the time, pilots reported feeling rushed. Additionally, lack of sleep played a role, with hours since awakening showing to be less than five in 30 percent of the cases that were analyzed. Additionally, the group suggested that an expansion in the use of technology for speech recognition should also be considered.

Procedures and Awareness Recommendations

IMPLEMENTATION PLANS, MITIGATIONS, AND INTENDED OUTCOMES	DELIVERY DATE AND POINT/S OF CONTACT
1. IMPLEMENT CROPD VOICE RECOGNITION VERSION (SPEECH ONLY WITHOUT CONTEXT) • Reduce takeoffs and landings on closed runways. • Implement one CROPD per service area. • Track each instance of CROPD alerts. **INTENDED OUTCOMES** Prepare Operational Test Plan and Master schedule to finish the Operational Test Demonstration site 1 and execute Operational Test Demonstration at site 2 & 3.	**DELIVERY DATE** 9/30/2017 (Date dependent on obtaining additional funding.) **POINT OF CONTACT** **Valerie Outlaw** Air Traffic Systems Directorate, Senior Systems Engineer
2. CONTINUE TO DEVELOP THE CROPD TECHNOLOGY BY IMPLEMENTING ADDITIONAL REQUIREMENTS **INTENDED OUTCOMES** Implement CROPD voice recognition version and continue to develop the CROPD technology by implementing additional requirements.	**DELIVERY DATE** 9/30/2018 (Date dependent on obtaining additional funding.) **POINT OF CONTACT** **Valerie Outlaw** Air Traffic Systems Directorate, Senior Systems Engineer
3. EVALUATE NAS-WIDE IMPLEMENTATION OF ADVANCED ELECTRONIC FLIGHT STRIPS (AEFS) • Terminal Flight Data Manager (TFDM) Program Office has identified the proposed locations to receive AEFS as a component of TFDM. • AEFS was installed in Cleveland Air Traffic Control Tower in September 2015. **INTENDED OUTCOMES** AJT-2 will review runway incursion data for CLE quarterly for FY2016 and FY2017. The review will focus on the cause, frequency and severity of runway incursions and whether AEFS impacted those events. **DELIVERY DATE** 9/30/2017	**DELIVERY DATE** 9/30/2017 **POINT OF CONTACT** **Ron Singletary** ATO, Technical Advisory Group, Manager

Procedures and Awareness Recommendations

IMPLEMENTATION PLANS, MITIGATIONS, AND INTENDED OUTCOMES	DELIVERY DATE AND POINT/S OF CONTACT
4. AURAL AWARENESS FOR GA AND GROUND VEHICLE OPERATORS (AIRPORTS DIVISION AND AFS-800) **INTENDED OUTCOMES** 1. Airports deploying a vehicle alerting system. Reference the Communication item 1. 2. GA ground/taxi alerting technology. Most of the GPS systems utilized by General Aviation have "Safe Taxi" installed in their system. Re-emphasis to GA the importance of situational awareness when taxiing for takeoff or taxiing to parking and the situational asset these systems bring to a pilot. Also, increase awareness of GA pilots to state to ATC that they are "unfamiliar" with the airport and to request "progressive" taxi instructions.	**DELIVERY DATE** 9/30/2016 **POINTS OF CONTACT** **Joe Foresto** Flight Standards, AFS Operations Safety Inspector **Freddie James** Airports Division, Airport Certification Safety Inspector **Ronald Rifenberg** Flight Standards, AFS Operations Safety Inspector
5. PROCEDURES TO ADDRESS AIRPORT GEOMETRY ISSUES Improve construction planning and geometry • Develop procedures to avoid direct access/entrances to runways (violates existing airport design criteria), RIM and other RSAT recommendations. • ACAC – Identify other procedural gaps, geometry problems and general issues, i.e. construction monitoring and coordination with local ATC. • Improving runway construction NOTAMS and the corresponding data to address current process shortfalls. **INTENDED OUTCOMES** 1. The Office of Airport Engineers AAS-100 implemented the design standards in AC 150/5300-13A to prevent direct access to a runway from an apron or ramp area. This guidance can be utilized to ensure airport designers and builders use the same concept to reduce the number of direct access/entrances to runways. **COMPLETE** 2. Current NOTAM guidance details the procedures available to retrieve construction NOTAMs which present the available airports in a digital map presentation. The presentation shows the location of the outage on an airfield diagram. This product is available, however, not all airports are in the database. The goal is to have all airports imported into the system. NOTE: NOTAM item is included in Visual 8, Expand NOTAMs.	**DELIVERY DATE** 9/30/2017 **POINTS OF CONTACT** **Freddie James** Airports Division, Airport Certification Safety Inspector **Ragaey Mansour** ATO, Supervisor, Aviation Technical System

Procedures and Awareness Recommendations

IMPLEMENTATION PLANS, MITIGATIONS, AND INTENDED OUTCOMES	DELIVERY DATE AND POINT/S OF CONTACT
6. FREQUENCY PROCEDURES Review common protocols for dual frequency concerning military aircraft. **INTENDED OUTCOMES** Validate there is a hazard that needs to be corrected. If there is a hazard discovered then AJV-8 make the necessary changes to FAA Orders through current processes.	**DELIVERY DATE** 7/31/2016 **POINT OF CONTACT** **Lawrence Beck** AJV-82, Terminal Procedures, Manager
7. ATC MEMORY AIDS Establish a requirement to review memory aid efficacy on an annual basis. • A Work Group was formed to address Surface Memory Aids from the Top 5 from 2015. One of the outcomes was to visit memory aids annually to see if they are been effective. Six tower operations have been made mandatory for the use of memory aids. The effective date of the change is May 26, 2016. **INTENDED OUTCOMES** A work group was formed to address Surface Memory Aids from the Top 5 from 2015. One of the outcomes was to visit memory aids annually to see if they have been effective. Six tower operations have been made mandatory for the use of memory aids. The effective date of the change is May 26, 2016.	**DELIVERY DATE** 7/2/2018 **POINTS OF CONTACT** **Ross Knoll** AJI-151 Safety Services **Ric Loewen** NATCA, National Runway Safety Representative
8. PILOT MEMORY AIDS. EVALUATE MEMORY AIDS FOR PILOTS. MANDATE AT LEAST ONE OR TWO PILOTS TO BE "HEADS UP" DURING TAXI TRAIN/PRACTICE FOR "RECOVERY UNUSUAL SITUATIONS." **INTENDED OUTCOMES** Re-emphasize AC-120-74 and AC-91-74, which contains specific information regarding pilots maintaining situational awareness.	**DELIVERY DATE** 9/30/2016 **POINTS OF CONTACT** **Joe Foresto** Flight Standards, AFS Operations Safety Inspector **Ronald Rifenberg** Flight Standards, AFS Operations Safety Inspector

Procedures and Awareness Recommendations

IMPLEMENTATION PLANS, MITIGATIONS, AND INTENDED OUTCOMES	DELIVERY DATE AND POINT/S OF CONTACT
9. WORKGROUP TO EVALUATE TAXI INSTRUCTIONS This item will include: • Evaluate current taxi instructions. • The lack of progressive taxi instructions. • The use of the phrase "Via" instead of "Turn Left/Right." • Long and complex taxi instructions. • Heightened awareness around hot spots. • Evaluate when/where "Hold Short" instructions should be issued in the taxi instructions. **INTENDED OUTCOMES** Determine if changes to the current procedures are necessary. AJV-8 will process those changes though current processes if it is determined that changes are needed.	**DELIVERY DATE** 9/30/2016 **POINT OF CONTACT** **Lawrence Beck** AJV-82, Terminal Procedures, Manager
10. HOLD SHORT TAXI INSTRUCTIONS Evaluate use of NextGen Technologies e.g. Data Communications (DATACOM), Electronic Flight Strips. 1. Evaluate the use of Data Comm to issue taxi instruction including hold short instructions. The concept of operations for Data Comm includes the D-Taxi function. D-Taxi instructions will be typed by the controller and transmitted to the pilots. The pilots will acknowledge the instructions using a keyboard entry. The implementation of D-Taxi is included in the NAS Segment Implementation Plan (NISP). 2. Taxi Conformance Monitoring for Controllers. D-Taxi instructions are interfaced with ground surveillance technology. Controllers are alerted if an aircraft does not follow their assigned route when taxing. Taxi Conformance Monitoring is included in the NAS Segment Implementation Plan. 3. The use of NextGen technology to issue taxi clearances instructions including hold short is expected between 2023 – 2027.	**DELIVERY DATE** 2023 – 2027 **POINT OF CONTACT** **Ron Singletary** AJT-22, Technical Advisory Group, Manager

Procedures and Awareness Recommendations

IMPLEMENTATION PLANS, MITIGATIONS, AND INTENDED OUTCOMES	DELIVERY DATE AND POINT/S OF CONTACT
11. TOWER/MAINTENANCE COMMUNICATION Evaluate current standards and improve where needed. • On September 1, 2015 the release of AC 150/5210-20A, Ground Vehicle Operations to include Taxiing or Towing an Aircraft on Airport, reminds drivers of the requirement for communication between Tower and vehicle drivers, which are mandatory in the movement areas. It also provides guidance on developing procedures to effectively operate in the Runway Safety Area during emergency conditions. **INTENDED OUTCOMES** 1. Require Towered facilities at non-Part 139 airports receiving FAA funding to enter into a Letter of Agreement with their airport operator. Safety Risk Management Document (SRMD) complete and Advisory Circular update is in the process for vehicle operation in the RSA.	**DELIVERY DATE** 9/30/2016 **POINTS OF CONTACT** **Freddie James** Airports Division, Airport Certification Safety Inspector **Ragaey Mansour** ATO, Supervisor, Aviation Technical System

RUNWAYSAFETY
Call to Action

SUMMARY REPORT PHASE 2

NEXT STEPS

With more than 53.8 million arrivals and departures annually, the National Airspace System (NAS) is the busiest air traffic environment in the world. The day-long focus on runway safety in June 2015 is part of a continuum of steps to demonstrate the FAA's commitment to its objective of reducing conditions that give rise to surface events.

The recommendations gathered from the June 2015 meeting were provided to all Call to Action participants from industry, labor, and government. Lines of business (LOB) assigned points of contact who analyzed the recommendations and developed implementation plans to include mitigations and a timeline. The Runway Safety Group will track the progress of the plans through completion in the Runway Safety Tracking System. The Runway Safety Group will coordinate quarterly updates with all POCs.

As recommendations from the Runway Safety Call to Action Plan are implemented, the goals of formulating a collaborative action plan and roadmap to develop runway safety solutions will be achieved. With the advent and maturation of NextGen, the NAS continues to become more complex. New technologies mean that the risk of new hazards is inevitable. We must continue to actively prepare for these challenges. Only with continuous improvement and faithful monitoring activities can we expect to provide the global leadership for which the FAA is known.

Acronyms

A

AAAE	American Association of Airport Executives
ACAC	Airport Construction Advisory Council
ACI	Airports Council International
ADS-B	Automatic Dependent Surveillance Broadcast
AEFS	Advanced Electronic Flight Strips
AFS	Flight Standards Service
AFS-800	General Aviation and Commercial Division
AIM	Aeronautical Information Manual
AJI	Safety and Technical Training
AJM	Office of Program Management
AJT	Air Traffic Services
AJW	Technical Operations
AJV	Mission Support Services
ALPA	Air Line Pilots Association
ANG	NextGen
AOA	Airport Operations Area
AOPA	Aircraft Owners and Pilots Association
ASDE-X	Airport Surface Detection Equipment – Model X
ARP	Office of Airports
ATC	Air Traffic Control
ATO	Air Traffic Organization
AVP	Office of Accident Investigation and Prevention
AVS	Aviation Safety

C

CFR	Code of Federal Regulations
CROPD	Closed Runway Operation Prevention Device
C2A	Runway Safety Call to Action

D

DOD	Department of Defense

F

FAA	Federal Aviation Administration
FAM	Familiarization
FAAST	FAA Safety Team
FBO	Fixed Base Operators

G

GA	General Aviation
GAJSC	General Aviation Joint Steering Committee
GPS	Global Positioning System

L

LED	Light-Emitting Diode
LOB	Line of Business

M

MOR	Mandatory Occurrence Report

N

NAS	National Airspace System
NATCA	National Air Traffic Controllers Association
NextGen	Next Generation Air Transportation System
NOTAM	Notices to Airmen

P

PASS	Professional Aviation Safety Specialists
PFS	Partnership for Safety
PMO	Program Management Organization
POC	Point-of-Contact

R

RIM	Runway Incursion Mitigation
RIWS	Runway Incursion Warning System
RSA	Runway Safety Area
RSAT	Runway Safety Action Teams

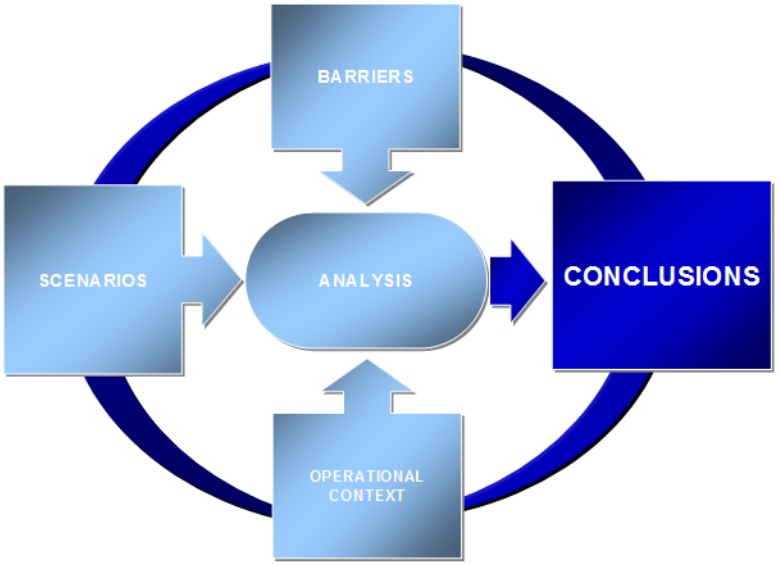
S

SRMD	Safety Risk Management Document
SOP	Standard Operating Procedures

RUNWAY SAFETY
Call to Action

Federal Aviation Administration
Air Traffic Organization
Safety and Technical Training
800 Independence Avenue SW
Washington, DC 20591

Chapter 13 Conclusions and Recommendations



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Conclusion 1	This study concurs with and supports the FAA National Runway Safety Plan conclusion that an incorporation of multiple layers of technology is currently the most effective response to Sudden High Energy Runway Conflicts.
Conclusion 2	This study identified twelve barriers available that could potentially prevent runway incursions that, if not halted, could escalate into Sudden High Energy Runway Conflict events. It was established that no barrier by itself has the potential to prevent more than 35% of identified potential scenarios. It is concluded that a combination/s of the following barriers have the highest potential to prevent Sudden High Energy Runway Conflicts: ❑ ATC Conformance Monitoring and Conflicting Clearances Alerts. ❑ The correct use of ATC memory aids. ❑ The use of stop bars 24H together with procedures never to cross an illuminated bar. ❑ Autonomous Runway Incursion Warning Systems (such as Runway Status Lights). ❑ Flight deck Airport Moving Maps.
Conclusion 3	The study identified seven barriers that might mitigate the collision risk. Once a Sudden High Energy Runway Conflict event had been initiated, almost all of them relied upon belated visual detection from aircrew/drivers for collision avoidance. There is currently no functionality available that will provide timely alerts involving movement on two intersecting runways. It is concluded therefore that there is currently a lack of an effective system barrier that can make a significant impact in reducing the risk of collision.
Conclusion 4	Visual detection by ATC of SHERC events is limited by meteorological conditions and is unlikely to be effective once the event has been initiated. It is concluded therefore that ATC training should emphasise the importance of Prevention of SHERC events, focussing on the correct use of memory aids, visual vigilance and precise ATC clearances.
Conclusion 5	The use of stop bars 24H together with procedures to never cross a lit stop bar or to give a clearance across a lit stop bar could have prevented almost half of the actual serious runway incursions studied. It is concluded therefore that there are significant safety gains available from this established safety barrier with appropriate procedures.

Recommendation 1	**European ANSPs and Airport Authorities review the identified potential barriers and the conclusions in case they undertake operational safety analysis and improvement activities for Sudden High Energy Runway Conflict events.**
Recommendation 2	**European ANSPs and the EUROCONTROL Safety Improvement Sub-Group (SISG) monitor occurrences involving Sudden High Energy Runway Conflict to determine changes in frequency and severity.**
Recommendation 3	**All European industry stakeholders support the development of procedures, tools and functionality that have the potential to prevent or mitigate the high collision risk that is present in Sudden High Energy Runway Conflicts.**
Recommendation 4	**All European industry stakeholders promote and support the deployment and use of H24runway stop bars with procedures to never cross an illuminated stop bar or to give a clearance across an illuminated stop bar, subject to contingency procedures.**
Recommendation 5	**All European industry stakeholders to note that the consistent use of memory aids, correct and precise phraseology and visual vigilance by both ATC and Pilots/Drivers can combine to create a strong preventative barrier. Training and competence programmes should reinforce these essential activities.**

Appendix E. Fiscal Year 2016 Runway Incursion SRAP Data by Facility Level

Facility	Facility Level	Airport Operations	Number of Runway Incursions	Facility Type	Facility Type Description
LAX	12	685889	21	Tower	Tower With Radar
DFW	12	676890	19	Tower	Tower With Radar
ORD	12	872332	15	Tower	Tower With Radar
MIA	12	416920	13	CTT	Combined Tower/TRACON
ATL	12	899040	12	Tower	Tower With Radar
CLT	12	545894	12	CTT	Combined Tower/TRACON
IAH	12	479778	12	Tower	Tower With Radar
PHL	12	402013	8	CTT	Combined Tower/TRACON
DEN	12	566035	6	Tower	Tower With Radar
HCF	11	307537	31	CCF	Combined Control Facility
MSP	11	410593	24	Tower	Tower With Radar
LAS	11	532979	15	Tower	Tower With Radar
LGA	11	374720	9	Tower	Tower With Radar
DTW	11	392383	4	Tower	Tower With Radar
SFO	10	447252	15	Tower	Tower With Radar
DCA	10	299899	14	Tower	Tower With Radar
BOS	10	394817	8	Tower	Tower With Radar
IAD	10	291475	5	Tower	Tower With Radar
SLC	10	318285	5	Tower	Tower With Radar
TPA	10	189302	4	CTT	Combined Tower/TRACON
EWR	10	427796	3	Tower	Tower With Radar
PHX	10	442322	3	Tower	Tower With Radar
JFK	10	458830	2	Tower	Tower With Radar
MSY	9	133506	8	CTT	Combined Tower/TRACON
SAT	9	165352	7	CTT	Combined Tower/TRACON
BWI	9	247576	5	Tower	Tower With Radar
DAB	9	307391	5	CTT	Combined Tower/TRACON
CVG	9	136532	4	CTT	Combined Tower/TRACON
SEA	9	407637	4	Tower	Tower With Radar
BNA	9	190432	2	CTT	Combined Tower/TRACON
CLE	9	118790	2	CTT	Combined Tower/TRACON
GFK	9	321136	2	Tower	Tower With Radar
PBI	9	144379	2	CTT	Combined Tower/TRACON
ICT	9	114430	1	CTT	Combined Tower/TRACON

Facility	Facility Level	Airport Operations	Number of Runway Incursions	Facility Type	Facility Type Description
MCI	9	121394	1	CTT	Combined Tower/TRACON
MCO	9	323148	1	Tower	Tower With Radar
MEM	9	224541	1	Tower	Tower With Radar
PIT	9	141077	1	CTT	Combined Tower/TRACON
HOU	8	202871	15	Tower	Tower With Radar
DVT	8	365920	11	Tower	Tower With Radar
MDW	8	252326	11	Tower	Tower With Radar
ANC	8	278990	10	Tower	Tower With Radar
APA	8	332493	9	Tower	Tower With Radar
VNY	8	208973	7	Tower	Tower With Radar
SNA	8	300928	6	Tower	Tower With Radar
DAL	8	223997	5	Tower	Tower With Radar
IND	8	161766	4	CTT	Combined Tower/TRACON
ABQ	8	131878	3	CTT	Combined Tower/TRACON
COS	8	128297	3	CTT	Combined Tower/TRACON
LGB	8	294969	3	Tower	Tower With Radar
MKE	8	113902	3	CTT	Combined Tower/TRACON
SDF	8	153331	3	CTT	Combined Tower/TRACON
STL	8	188748	3	Tower	Tower With Radar
FAT	8	97999	2	CTT	Combined Tower/TRACON
FLL	8	287264	2	Tower	Tower With Radar
BHM	8	94007	1	CTT	Combined Tower/TRACON
CHS	8	107250	1	CTT	Combined Tower/TRACON
LIT	8	105557	1	CTT	Combined Tower/TRACON
MOB	8	67799	1	CTT	Combined Tower/TRACON
ORF	8	74089	1	CTT	Combined Tower/TRACON
PDX	8	226031	1	Tower	Tower With Radar
SAV	8	93283	1	CTT	Combined Tower/TRACON
CNO	7	177165	11	Tower	Tower With Radar
FFZ	7	270072	7	Tower	Tower With Radar
DWH	7	98263	6	Tower	Tower With Radar
HIO	7	196061	6	Tower	Tower With Radar
MYF	7	191478	6	Tower	Tower With Radar
BED	7	125134	5	Tower	Tower With Radar
PDK	7	156071	5	Tower	Tower With Radar
BUR	7	131077	4	Tower	Tower With Radar

Facility	Facility Level	Airport Operations	Number of Runway Incursions	Facility Type	Facility Type Description
PRC	7	256052	4	Tower	Tower With Radar
TMB	7	279264	4	Tower	Tower With Radar
TUS	7	139555	4	Tower	Tower With Radar
BFI	7	165624	3	Tower	Tower With Radar
FAI	7	125602	3	CTT	Combined Tower/TRACON
SEE	7	216009	3	Tower	Tower With Radar
ABE	7	81072	2	CTT	Combined Tower/TRACON
BFL	7	52350	2	CTT	Combined Tower/TRACON
BOI	7	132591	2	CTT	Combined Tower/TRACON
ELP	7	91602	2	CTT	Combined Tower/TRACON
FRG	7	210413	2	Tower	Tower With Radar
HPN	7	164756	2	Tower	Tower With Radar
PUB	7	165983	2	Tower	Tower With Radar
ROC	7	78129	2	CTT	Combined Tower/TRACON
SFB	7	285311	2	Tower	Tower With Radar
BTR	7	71065	1	CTT	Combined Tower/TRACON
CAK	7	68488	1	CTT	Combined Tower/TRACON
GRR	7	79665	1	CTT	Combined Tower/TRACON
MSN	7	80631	1	CTT	Combined Tower/TRACON
OAK	7	224591	1	Tower	Tower With Radar
RVS	7	174780	1	Tower	Tower With Radar
SBN	7	40766	1	CTT	Combined Tower/TRACON
SJC	7	156461	1	Tower	Tower With Radar
FXE	6	158394	7	Tower	Tower With Radar
RHV	6	142892	7	Tower	Tower With Radar
HWD	6	111966	6	Tower	Tower With Radar
LVK	6	122472	6	Tower	Tower With Radar
ADS	6	100860	5	Tower	Tower With Radar
SMO	6	89519	5	Tower	Tower With Radar
PAO	6	156428	4	Tower	Tower With Radar
MRI	6	125536	3	Tower	Tower With Radar
PNS	6	107090	3	Tower	Tower With Radar
CAE	6	50847	2	CTT	Combined Tower/TRACON
CID	6	48139	2	CTT	Combined Tower/TRACON
CRQ	6	149029	2	Tower	Tower With Radar
FPR	6	152438	2	Tower	Tower With Radar

Facility	Facility Level	Airport Operations	Number of Runway Incursions	Facility Type	Facility Type Description
ISP	6	122002	2	Tower	Tower With Radar
LFT	6	50393	2	CTT	Combined Tower/TRACON
OMA	6	95051	2	Tower	Tower With Radar
PIE	6	108555	2	Tower	Tower With Radar
SRQ	6	105347	2	Tower	Tower With Radar
VGT	6	150293	2	Tower	Tower With Radar
VRB	6	207923	2	Tower	Tower With Radar
AZO	6	39889	1	CTT	Combined Tower/TRACON
BIL	6	79133	1	CTT	Combined Tower/TRACON
CMA	6	135961	1	Tower	Tower With Radar
CRW	6	44262	1	CTT	Combined Tower/TRACON
FAR	6	73581	1	CTT	Combined Tower/TRACON
FSD	6	70054	1	CTT	Combined Tower/TRACON
GGG	6	54593	1	CTT	Combined Tower/TRACON
GRB	6	49396	1	CTT	Combined Tower/TRACON
ILM	6	49524	1	CTT	Combined Tower/TRACON
LAN	6	33674	1	CTT	Combined Tower/TRACON
OGG	6	136510	1	Tower	Tower With Radar
PAE	6	106966	1	Tower	Tower With Radar
PWM	6	51330	1	CTT	Combined Tower/TRACON
RIC	6	95663	1	Tower	Tower With Radar
SDL	6	155493	1	Tower	Tower With Radar
TOA	6	118594	1	Tower	Tower With Radar
TRI	6	46519	1	CTT	Combined Tower/TRACON
POC	5	87534	5	Tower	Tower With Radar
ARR	5	59423	3	Tower	Tower With Radar
HUF	5	52215	3	CTT	Combined Tower/TRACON
MLI	5	33640	3	CTT	Combined Tower/TRACON
NEW	5	53569	3	Tower	Tower With Radar
CDW	5	74504	2	Tower	Tower With Radar
FCM	5	84095	2	Tower	Tower With Radar
MKC	5	71235	2	Tower	Tower With Radar
MLU	5	32840	2	CTT	Combined Tower/TRACON
PTK	5	127732	2	Tower	Tower With Radar
SUS	5	103609	2	Tower	Tower With Radar
AFW	5	108380	1	Tower	Tower With Radar

Facility	Facility Level	Airport Operations	Number of Runway Incursions	Facility Type	Facility Type Description
AGC	5	54203	1	Tower	Tower With Radar
ALO	5	19930	1	CTT	Combined Tower/TRACON
ARB	5	56948	1	Tower	Tower With Radar
BGM	5	16065	1	CTT	Combined Tower/TRACON
CCR	5	114359	1	Tower	Tower With Radar
CPR	5	31908	1	CTT	Combined Tower/TRACON
DAY	5	51465	1	Tower	Tower With Radar
DLH	5	58982	1	CTT	Combined Tower/TRACON
DPA	5	95507	1	Tower	Tower With Radar
EMT	5	86133	1	Tower	Tower With Radar
GTF	5	36343	1	CTT	Combined Tower/TRACON
HLN	5	37768	1	CNRT	Combined Non-Radar Approach/Tower
JNU	5	92930	1	Tower	Tower With Radar
LNK	5	62129	1	Tower	Tower With Radar
MKG	5	25661	1	CTT	Combined Tower/TRACON
PSP	5	54847	1	Tower	Tower With Radar
PWK	5	77293	1	Tower	Tower With Radar
TVC	5	82208	1	Tower	Tower With Radar
MIC	4	36989	1	Tower	Tower With Radar
APF	0	93123	5	Tower	Federal Contract
DTO	0	141696	4	Tower	Federal Contract
BET	0	90617	3	Tower	Federal Contract
OCF	0	62231	3	Tower	Federal Contract
BKV	0	51768	2	Tower	Federal Contract
DXR	0	53468	2	Tower	Federal Contract
ESN	0	71001	2	Tower	Federal Contract
EVB	0	133342	2	Tower	Federal Contract
GMU	0	47799	2	Tower	Federal Contract
IWA	0	235790	2	Tower	Federal Contract
SAC	0	94911	2	Tower	Federal Contract
SQL	0	107752	2	Tower	Federal Contract
TKI	0	118594	2	Tower	Federal Contract
ABY	0	19592	1	Tower	Federal Contract
AEG	0	64629	1	Tower	Federal Contract
ANE	0	82695	1	Tower	Federal Contract
BAK	0	42701	1	Tower	Federal Contract

Facility	Facility Level	Airport Operations	Number of Runway Incursions	Facility Type	Facility Type Description
BLI	0	86338	1	Tower	Federal Contract
BMI	0	27027	1	Tower	Federal Contract
BZN	0	78392	1	Tower	Federal Contract
CXY	0	21405	1	Tower	Federal Contract
DHN	0	72734	1	Tower	Federal Contract
FMN	0	31845	1	Tower	Federal Contract
FOE	0	21356	1	Tower	Federal Contract
FYV	0	22297	1	Tower	Federal Contract
GLH	0	20695	1	Tower	Federal Contract
GTU	0	92742	1	Tower	Federal Contract
GUM	0	76253	1	Tower	Federal Contract
GYR	0	114360	1	Tower	Federal Contract
HFD	0	50395	1	Tower	Federal Contract
HYI	0	43893	1	Tower	Federal Contract
JVL	0	31420	1	Tower	Federal Contract
LSE	0	20267	1	Tower	Federal Contract
LWS	0	30518	1	Tower	Federal Contract
MQY	0	66968	1	Tower	Federal Contract
MSO	0	36802	1	Tower	Federal Contract
OGD	0	63522	1	Tower	Federal Contract
OMN	0	119152	1	Tower	Federal Contract
OPF	0	135136	1	Tower	Federal Contract
OUN	0	51742	1	Tower	Federal Contract
PMP	0	149804	1	Tower	Federal Contract
RAL	0	105538	1	Tower	Federal Contract
SFF	0	50779	1	Tower	Federal Contract
SWO	0	68791	1	Tower	Federal Contract
TOP	0	29350	1	Tower	Federal Contract
TTN	0	86002	1	Tower	Federal Contract
TYR	0	41816	1	Tower	Federal Contract
UAO	0	44292	1	Tower	Federal Contract
VCT	0	54808	1	Tower	Federal Contract
FDK		63073	1	Tower	FAA Contract

Appendix F. Fiscal Year 2016 Runway Incursion SRAP Causal Factors

Factor Code	Factor Name	Total RAE
1.4.5.2	ATC overlooked traffic due to ineffective runway scan	90
1.5.3.1.4	Misjudge rate of closure	66
1.5.3.2.2	Misjudge - optimistic expectations ("Betting on the Come")	49
1.4.9.1.7.12	Pilot failed to hold short of runway as instructed	43
2.4.17	CRM issues	34
1.4.9.1.7.11	Pilot failed to hold short of runway	29
3.2.8.26	Memory Aid	29
1.4.9.5.1.46	ATC did not comply with 7110.65 requirement	21
1.4.9.1.7.28	ATC used runway for arrival/departure with previous aircraft not clear of hold short lines	18
1.4.9.1.7.8	Pilot/driver entered runway without authorization	18
1.4.9.5.2.5	ATC forgot about aircraft who was cleared to land/for takeoff	16
1.4.9.1.2.16	ATC did not catch incorrect readback by correct aircraft/vehicle	13
1.4.9.1.7.1	ATC cleared aircraft to land/depart on an occupied runway	11
1.4.9.1.7.10	Pilot failed to follow taxi instructions	11
1.5.3.2.1	Expectation Bias (controller)	11
1.4.9.1.7.15	Driver failed to hold short of runway	10
1.4.9.1.2.17	Incorrect pilot readback by correct aircraft	9
1.4.9.1.7.7	Pilot started takeoff roll without clearance	9
1.4.9.1.8.3	OJTI did not intervene in situation	8
1.5.1.1	Duty related distractions	8
1.4.9.1.7.13	Pilot departed without departure clearance	7
1.4.9.1.7.6	Pilot stopped prior to completely clearing the runway	7
1.2.3.2	Mis-perceive auditory information	6
1.4.9.1.14.14	Pilot landed/executed low approach/touch and go without clearance	6
1.4.9.5.2.6	ATC forgot about aircraft/vehicle on runway	6
1.4.9.8.2.3	Student pilot	6
1.1.3.5	ATC thought appropriate separation standard was applied	5
1.4.9.1.2.25	Pilot responded to clearance meant for another aircraft	5
1.4.9.5.1.9	ATC did not comply with SOP requirements	5
1.4.9.5.2.7	ATC forgot about previous coordination	5
3.2.8.26.2	Memory Aids was available but not used	5
1.2.1	Situational Awareness	4
1.2.1.18	OJTI unaware of developing event	4
1.4.9.1.13.33	Intersecting runways	4
1.4.9.1.14.11	Pilot did not follow ATC clearance	4
3.10.1	Aircraft equipment issues	4
1.1.2.1	Currency/Proficiency Issue	3
1.1.3.10	Pilot unfamiliar with airport layout/environment	3
1.1.3.3	ATC unaware of separation standard	3
1.2.1.14	ATC was unaware of aircraft/vehicle/pedestrian position	3
1.4.7.2.2	PRB - Incomplete	3
1.4.9.1.2.20	ATC did not ensure correct readback of hold short instructions	3
1.4.9.1.2.28	OJTI did not catch read back error	3
1.4.9.1.7.14	Pilot/driver failed to hold short of runway	3
1.4.9.1.7.5	ATC misspoke taxi clearance	3
1.4.9.1.8.4	OJTI intervened, but actions were inadequate to maintain separation	3

Factor Code	Factor Name	Total RAE
1.4.9.3.22	OJTI allowed situation to deteriorate too far to recover	3
1.4.9.3.24	ATC was late to issue go-around	3
1.4.9.5.1.26	Pilot failed to comply with ATC instructions	3
1.4.9.5.1.4	ATC did not monitor aircraft position on approach to intersecting runway	3
1.4.9.7.2.2.3	Go Around	3
1.5.1.11	Pilot Factors (Distraction)	3
1.5.1.16	Weather	3
1.5.3.3	Confusion	3
2.2.13	Combined position/sectors	3
2.5.3	Training in Progress	3
1.1.2.4	Student pilot	2
1.1.3.12	Pilot/driver unfamiliar with airport layout/environment	2
1.1.4.2	Currency/Proficiency or Experience Level	2
1.4.7.2.3	PRB - In progress during event	2
1.4.7.5	Coordination between Ground and Local Factors	2
1.4.7.5.5	Vehicle, Equipment or Personnel on active runway	2
1.4.7.6.17	Lack of coordination between controllers	2
1.4.8.9	Pilot switched frequency prior to ATC instruction	2
1.4.9.1.10.2	PRB - Ineffective or no required overlap	2
1.4.9.1.12.2	ATC used incorrect call sign	2
1.4.9.1.13.34	LAHSO	2
1.4.9.1.13.42	ATC execution of plan to avoid loss of separation incorrect/inadequate	2
1.4.9.1.2	Incorrect / Inadequate Action-Readback	2
1.4.9.1.2.12	ATC did not ensure correct readback	2
1.4.9.1.2.18	Incomplete readback by correct aircraft	2
1.4.9.1.2.26	ATC failed to detect same readback by multiple aircraft	2
1.4.9.3.21	OJTI intervened but too late to salvage the situation	2
1.4.9.5.2.22	ATC forgot previously issued clearance	2
1.4.9.5.2.3	ATC forgot about previously coordinated traffic	2
1.5.3.1.6	Misjudge control actions - prioritization of duties	2
1.5.3.2.4	Expectation bias (pilot)	2
1.5.3.4.2	Phraseology misinterpreted	2
1.6.1.5	Work related fatigue	2
2.1.1	Supervisory Influences	2
2.2.23	ATC working combined positions/sectors affecting safety/efficiency	2
2.3.1.3.19	Anticipated Separation Rule (Tower Only)	2
2.3.3.10	Phraseology not adequate	2
3.2.8.17	Safety Alert Equipment	2
4.1.2.2.5.5	Helicopter route	2
4.5.18	Language Barrier	2
1.1.1.3	ATC had only recently been fully certified, resulting in lack of experience on the situation	1
1.1.4.3	Proficiency / time on position issues	1
1.2.1.1	ATC was unaware of location of aircraft/vehicle	1
1.2.3.1.1.2.1	Pilot mis-identified landing runway	1
1.4.1.14	ATC did not plan for or apply required separation	1
1.4.1.9	ATC Loss of Separation Planning Inadequate	1
1.4.7.2.4	PRB - Relieving controller not paying attention/missed item	1
1.4.7.5.1	Coordination between Ground and Local	1
1.4.7.5.3	Runway closure	1
1.4.9.1	Incorrect/Inadequate Action	1

Factor Code	Factor Name	Total RAE
1.4.9.1.1	Incorrect / Inadequate Action-Phraseology / Speech	1
1.4.9.1.10.1	Transmit / record incorrect information	1
1.4.9.1.12.1	ATC misspoke the aircraft call sign	1
1.4.9.1.14	Incorrect / Inadequate Action NEC (Pilot)	1
1.4.9.1.1.5	Ambiguous transmission	1
1.4.9.1.1.7	Non-standard/sloppy phraseology (Due to Boredom Complacency)	1
1.4.9.1.2.14	Pilot failed to acknowledge/readback	1
1.4.9.1.6.5	Pilot flew approach to wrong runway	1
1.4.9.1.7	Incorrect / Inadequate Action-Surface	1
1.4.9.1.7.21	Pilot landed on the wrong runway (not closed)	1
1.4.9.1.7.24	Pilot departed on the wrong runway (not closed)	1
1.4.9.1.7.30	ATC cleared aircraft to cross runway with aircraft on departure roll	1
1.4.9.1.8.2	OJTI technique	1
1.4.9.3.14	Timely runway exit	1
1.4.9.5.1.59	ATC did not ensure that aircraft was on proper frequency	1
1.4.9.5.1.6	ATC did not record clearance on Flight Progress Strip	1
1.4.9.5.2.14	ATC forgot SOP/LOA/waiver requirement	1
1.4.9.5.2.2	Forgot Previous Action	1
1.4.9.8.1.1	ATC misapplied or did not apply provisions of JO 7110.65	1
1.5.1.12	Distraction by other aircraft	1
1.5.1.20	Pilot distracted by aircraft system malfunction	1
1.5.1.22	Duty related distraction	1
1.5.1.3	Distraction by coordination	1
1.5.3.2.5	Expectation bias (pilot)	1
1.5.3.2.8	Pilot/Driver heard what was expected, not what was said	1
1.5.3.5.7	ATC actions were too late to maintain separation	1
1.5.5.1	Complacency/Boredom	1
1.6.4.19	Impaired situational awareness	1
1.7.9	OJTI Issues	1
2	Organizational Factors	1
2.1.3	Adequacy of supervisory decisions and support	1
2.2.10	OSIC/CIC did not ensure appropriate staffing for position/sector workload	1
2.2.11	Similar sounding call signs	1
2.3.3.17	Documentation-SOP	1
2.3.3.9	Adequacy of management decisions and support	1
2.4.3	ATC actions non-compliant in interest of safety	1
2.5.14	Training gap	1
3.10.20.14	Aircraft radio failure	1
3.2.4.2	RADAR/Surveillance Equipment	1
3.2.8.26.5	Memory Aids Not Elsewhere Classified	1
4.1.1.1.23	Use of a runway as a taxiway	1
4.1.1.1.26	Non-Standard or Non Typical marking and/or signage placements and layouts	1
4.1.1.1.29.4	Improper Presence Location: RSA Non-Movement Area	1
4.1.1.5.8	Airport construction	1
4.1.1.7.15	Caused confusion	1
4.2.3.7	Snow	1
4.3.8.1	Military activity	1
4.4.18	Emergency situation	1
4.4.7	Minimum fuel	1

Appendix G. Acronyms

AC	Advisory Circular
AJI	Safety and Technical Training
ALPA	Air Line Pilots Association
AMASS	Airport Movement Area Safety System
AOPA	Aircraft Owners and Pilots Association
ASSC	Airport Surface Surveillance Capability
ATC	Air Traffic Control
ATO	Air Traffic Organization
ATCT	Airport Traffic Control Tower
ATSAP	Air Traffic Safety Action Program
CAP	Corrective Action Plan
CAT	Category
CFR	Code of Federal Regulations
C2A	Call to Action
EAA	Experimental Aircraft Association
EFB	Electronic Flight Bag
eLMS	Electronic Management System
FAA	Federal Aviation Administration
FAAST	FAA Safety Team
FAR	Federal Aviation Regulation
FY	Fiscal Year
GA	General Aviation
GAMA	General Aviation Manufacturers Association
HAW	Hazard Analysis Worksheet
ICAO	International Civil Aviation Organization
IMC	Instrument Meteorological Conditions
LOA	Letter of Agreement
LOB	Lines of Business
LUAW	Line Up and Wait
NAS	National Airspace System
NATCA	National Air Traffic Controllers Association
NBAA	National Business Aviation Association
NOTAM	Notices to Airmen
OI	Operational Incident
OJT	On-the-Job-Training

OPSSPECS	Operations Specifications
PD	Pilot Deviation
POC	Point of Contact
RI	Runway Incursion
RSA	Runway Safety Area
RSAT	Runway Safety Action Team
RWSL	Runway Status Lights
SAFO	Safety Alert for Operators
SASS	Small Airport Surveillance Sensor
SI	Safety Issue
SISG	Safety Improvement Sub-Group
SME	Subject Matter Expert
SMS	Safety Management System
SRAP	Surface Risk Analysis Process
SRM	Safety Risk Management
TechOps	Technical Operations
VMC	Visual Meteorological Conditions
VPD	Vehicle/Pedestrian Deviation