



U.S. Department  
of Transportation  
Federal Aviation  
Administration

## Air Traffic Organization 2012 Safety Report



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# A NOTE FROM THE CHIEF OPERATING OFFICER



It has been said that while it takes only a millisecond to send a message to the entire world, it often takes years for a message to change one person's mind. It's certainly true in large organizations like the Federal Aviation Administration's Air Traffic Organization (ATO). And why would we change anything? 99.997 percent of all ATO operations occur completely according to procedure. We run the safest and most efficient system in the world, and we have the most highly skilled controllers and technicians.

But culture change is essential for us to reach the next level of safety. Collaboration is now the rule, not the exception. Being proactive is simply the way we do business. We've gone from counting errors to identifying and mitigating safety risk. Because of this, we're looking at the system from many angles, and identifying potential issues that might have otherwise gone undetected.

This past year was one of major transformation for Air Traffic Control (ATC) safety in the FAA: from implementing complex systems that will fundamentally transform Air Traffic Management to revamping the way we measure risk. We have effectively made the largest and most significant improvements in the last 30 years to the way risk and safety performance are managed in the United States. What enabled our success? There were many factors, but key among them is the implementation of our proactive Safety Management System (SMS), designed to identify and address risks before safety can be compromised. This strategy has four components and informs the structure of our safety programs.



**First, we are listening to our dedicated frontline employees**, those most aware of safety issues that might otherwise go unnoticed. That is why we developed Voluntary Safety Reporting Programs (VSRPs), such as the Air Traffic and Technical Operations Safety Action Programs, that rely on the expertise of field employees. Simply put, frontline employees are the greatest resource for eliminating risk in the National Airspace System (NAS).

**Second, we have deployed automated tools that collect safety-critical data.** In addition to reporting from our frontline employees, advances in technology over the last three years have resulted in 10 times more collected data than traditional reporting systems. We also improved centralized hazard tracking and data storage programs that enable us to better identify systemic problems and conduct more comprehensive safety performance analysis.

**Third, we have improved the analytical capabilities necessary to critically assess NAS safety performance.** As part of our strategy to proactively identify risk, we have embraced efforts to identify underlying causal factors of safety risk in the NAS. The Risk Analysis Process, supported by data from VSRPs, enables the FAA to identify the Top 5 Safety Hazards that contribute to risk in the NAS and to outline and implement specific measures to mitigate those hazards. In Fiscal Year 2012, we implemented 90 percent of the mitigations identified for the Top 5, exceeding the Department of Transportation's target of 80 percent.

**Finally, we have embraced correction as a means to mitigate risk.** Correction is the ultimate measure of our progress. Today, we have the ability to reach new levels of safety because we have improved our means of predicting and preventing risk. It is fundamentally important to work collaboratively with the correct stakeholders, both locally and nationally, to identify solutions and invest in the path forward. The Top 5 Safety Hazards and our Runway Safety program are shining examples of collaborative approaches among government, industry, and union partners to address risk.

Because of our proactive safety efforts – with data collection, analytical tools and corrective actions – the FAA was recently honored to receive this year's prestigious IHS Jane's ATC Global Award. It shows how far we've come toward reaching the next level of safety, and it keeps us in a position of international leadership in aviation and air traffic safety.

Together, our proactive safety programs are helping us to identify and mitigate risk in order to continue to operate the safest and most efficient airspace system in the world. This report, the first of its kind, both highlights the current state of ATC safety in the NAS and points to where we need to go in order to meet the challenges that will confront us tomorrow.

J. David Grizzle  
Chief Operating Officer  
Air Traffic Organization, Federal Aviation Administration

## 1: EXECUTIVE SUMMARY

# The number one priority of the Federal Aviation Administration (FAA) is safety.

Because of the agency's commitment to this priority, the United States boasts one of the safest airspace systems in the world. Some 99.997 percent of all air traffic operations occur without incident and in full compliance with Air Traffic Control (ATC) procedures. The foundation for this success is the Air Traffic Organization (ATO) Safety Management System (SMS), a holistic approach to safety—including safety policy, safety risk management processes, safety assurance programs, and a proactive safety culture—that enables the FAA to identify and mitigate risks before they jeopardize the safety of our National Airspace System (NAS) and to focus its efforts on continuously improving safety performance.

Drawing on information gathered by numerous data collection and analysis tools, reporting programs, audits, and assessments, this Air Traffic Organization Safety Report describes our air traffic safety performance for Fiscal Year (FY) 2012. It also highlights some of the significant changes that the FAA has made in its approach to risk identification, analysis and mitigation.

Even as its air traffic safety indicators confirm that it is meeting and exceeding stringent performance targets, the FAA is investigating and employing new safety metrics that provide better insight into the actual safety performance of the NAS and the root causes and contributing factors of the most serious hazards. These metrics have been made possible by a significant increase in the amount of safety data that the agency collects, as well as continual enhancement of the ATO's Risk Analysis Process (RAP) for airborne incidents, including the development of a second RAP for surface incidents. Robust RAPs, leveraging the FAA's vastly expanded field of data resources, provide a more comprehensive analysis capability critical to proactively identifying and managing safety risks in the NAS.

In FY 2012, the FAA collected 10 times more safety data than was previously possible. Achievements contributing to this increase include:

- Sophisticated digital data recording and collection tools, such as the Traffic Analysis and Review Program (TARP) and the Comprehensive Electronic Data Analysis and Recording (CEDAR) tool, were fully deployed.
- Safety orders expanding the requirements for mandatory reporting of safety occurrences were published.
- A critical transformation in air traffic safety culture was achieved through active collaboration with our Unions and the implementation of Voluntary Safety Reporting Programs (VSRPs) such as the Air Traffic Safety Action Program (ATSAP), which is now the largest aviation VSRP in the world; the Technical Operations Safety Action Program (T-SAP); and the Confidential Information Safety Program (CISP), a first-of-its-kind program designed to exchange safety data with airlines.

Another new initiative, the list of the Top 5 Safety Hazards, underscores the FAA's commitment to improving safety across the NAS. A panel composed of FAA safety and operational experts and labor union representatives relies on RAP data to identify the Top 5 most serious hazards in the NAS, supplementing its analysis efforts with data taken from ATSAP. Teams with appropriate expertise then develop comprehensive corrective action plans to address the identified hazards. In FY 2012, the FAA implemented 90 percent of the mitigations identified for the Top 5, exceeding its target of 80 percent and illuminating the power of teamwork.

A critical element in improving air traffic safety performance is to document lessons learned from the FAA's advanced data collection capabilities and analysis programs and incorporate them into structured training for the frontline operational workforce. Air Traffic Recurrent Training, which incorporates information from ATSAP and RAP, is a mandatory training program designed to increase controller proficiency, enhance awareness of human factors affecting aviation, and promote behaviors essential to the identification and mitigation of risks.

The Airport Construction Advisory Council (ACAC), a volunteer group of air traffic managers and industry stakeholders, works to identify potential dangers associated with airport construction and provide solutions, which, in FY 2012, included facility outreach programs, procedural changes, and guidance published for the ATC, pilot, airport, and operator communities. The council's success is another powerful example of what can be achieved—in this case, a significant reduction in the risks associated with airport construction—when those invested in aviation safety, both within and outside of the agency, work together to address common concerns.

Recognizing that air traffic safety improvements must extend beyond United States airspace, the FAA provides leadership and support to the international aviation community. In FY 2012, FAA-led international efforts included the development of an international common taxonomy, initiatives on fatigue management and runway safety, as well as definitions for aviation incident reporting. These initiatives promise to enhance the global aviation community's ability to address safety issues.

To move to the next level of safety, the FAA's safety performance metrics and analysis capabilities must continue to evolve and provide predictive indicators of potentially adverse situations, and the agency must continue to work aggressively to correct problems and mitigate risk. Specifically, the FAA must:

- Provide confidence in the system by ensuring that current safety standards are met;
- Continuously improve the safety of air traffic services;
- Understand the effectiveness of risk mitigation activities;
- Be able to predict how anticipated increases in traffic volume and density will affect the safety risk of air traffic services; and
- Be able to predict how specific changes in air traffic operational concepts, technologies, and procedures affect the safety of air traffic services.

There will always be room for improvement, but in FY 2012, the FAA has made significant strides toward honoring the above commitments and remaining the safest air transportation system in the world.



## 2: KEY SAFETY INDICATORS

The ATO's proactive Safety Management System is focused on identifying the factors that contribute to elevated risk, as well as prioritizing resources and programs that reduce risk and improve safety performance.

To achieve this, the FAA has developed new safety metrics supported by occurrence reporting requirements, VSRPs, sophisticated data recording technologies, and more comprehensive Risk Assessment Programs that, together, provide a more thorough and accurate understanding of risk in the NAS, which is the foundation for improving safety performance.

Historically, the FAA's air traffic safety metrics focused on compliance with procedurally required safety margins. Categories of operational incidents (A, B, C, and D) were based on a single dimension: the proximity of involved aircraft. However, the FAA has learned that while proximity is a valid indicator of risk, it is not sufficient in and of itself. That is, it does not provide insight into the causal factors that contribute to a loss of standard separation or elevated risk.

As part of its new approach to safety risk analysis, the FAA continues to collect information on every potential loss of standard separation in the NAS through Mandatory Occurrence Reports (MORs), which are reports manually entered at the facility level, and Electronic Occurrence Reports (EORs), which are automated alerts generated by TARP and the Operational Incident Detection Program. The CEDAR tool takes data from MORs and EORs and makes them accessible to Quality Assurance personnel, who validate the reports and classify the events.

The FAA's data collection capability also has been substantially enhanced by new programs that have resulted in a fundamental shift from a punitive culture to a positive safety culture in which employees are encouraged to participate in the identification of safety issues and improvements. VSRPs such as ATSAP and T-SAP encourage employees to report potential safety hazards, and programs like the CISP allow airlines and the FAA to share safety-related data. Collected

data are then analyzed by processes such as the RAP, which focuses on risk rather than determining who is at fault, that enable the FAA and the airlines to identify and address safety risks more effectively and consistently.

The FAA's new safety metrics, enabled by sophisticated data collection, reporting, and analysis capabilities, support its organizational culture transformation. Once an agency that relied upon legacy safety metrics centered on event-counting, the FAA is now a learning organization, with proactive safety management practices focused on discovering and understanding the risk of potential hazards. These new metrics and processes have enabled the FAA to collect 10 times more data than ever before and to prioritize the correction of identified safety risks more effectively, consistently, and efficiently.

These new collection and reporting methods will continue to produce additional data throughout 2013. The FAA's goal is to establish a completely new baseline of incident data based on a full year of improved data collection in 2014.

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The ATO anticipates a significant increase in both the quantity and quality of data from these new processes (see Table 1) that, for the first time in the history of the FAA, provide a true picture of risk based on objective data.

### Establishing a New Baseline

FROM	TO
Local Reporting	→ National Voluntary Reporting
Minimal Local Electronic Monitoring	→ Automated Electronic Detection
Operational Incident Counts	→ Standardized Risk Analysis
Distance-Based Categorization	→ Application of Risk Matrix
Single Event Mitigation	→ Addressing Systemic Issues (Top 5)
Categorization Buckets (A, B, C)	→ Identification of High Risk Events
Event Reporting	→ Investigation and ID of Causal Factors
A+B Metric	→ Metric on ratio of High Risk Events
Local Mitigation Monitoring	→ National High-Priority Goal on Addressing Risk Mitigation

Table 1

### Risk Analysis Process

The RAP, implemented in 2009, is designed to proactively identify issues before they cause incidents. It has been a key factor in improving the FAA's ability to determine contributory causes of hazards and to prioritize mitigation strategies. The process also enables the agency to:

- Increase the amount of data analyzed;
- Align its approach with that of its international partners;
- Integrate pilot and controller performance data on all air traffic incidents;
- Evaluate loss-of-separation incidents caused by other factors, such as pilot actions;
- More effectively identify hazards that contribute to NAS-wide risk; and
- Avoid under-reporting and misclassification of incidents.

Once an airborne loss of standard separation has been validated by Quality Assurance personnel, it is examined. If less than two-thirds of the required separation was maintained, it is categorized as a Risk Analysis Event (RAE). RAEs are then investigated and analyzed using a standardized process known as the RAP. The RAP is conducted by a panel of experts, including pilots and controllers, who examine events using criteria such as:

- Proximity
- Closure Rate
- Repeatability
- Severity
- Controller/Pilot Actions

**Risk Analysis Event** — A validated loss of airborne separation where more than one-third (34%) of the required radar separation has been lost.

## 2: KEY SAFETY INDICATORS

Figure 1, the Risk Analysis Matrix, is used to assess the level of risk as it pertains to severity and likelihood during the RAP.

### Risk Analysis Matrix

REPEATABILITY \ SEVERITY	Minimal 1	Minor 2	Major 3	Hazardous 4	Catastrophic 5
Frequent 5	0	0	1	1	0
Probable 4	1	7	10	3	4
Remote 3	4	78	108	19	2
Extremely Remote 2	100	427	430	67	1
Extremely Improbable 1	4	0	4	0	0
HIGH RISK		41			
MEDIUM RISK		182			
LOW RISK		1048			
Total RAE		1271			

• PROXIMITY  
 • CLOSURE RATE  
 • REPEATABILITY  
 • SEVERITY

Figure 1

This process replaces the former method of risk categorization, which was based solely on distances (A, B, C, D). Now, with the Risk Analysis Process, we make a risk-based evaluation that allows the FAA to proactively focus on the causal factors associated with high-risk events. Because this new process takes advantage of new reporting requirements and automated event detection and reporting, we have significantly increased transparency. This includes an improved view of how many reports are processed, how many losses of separation actually occur, how many require further investigation and analysis and how many are determined to be high-risk events, as illustrated in Figure 2. The data indicate a high level of success, with

### Proactive Reporting

October 2011 – September 2012	
Total Volume Air Traffic Operations	132,517,880
Processed Mandatory/Electronic Occurrences	121,499*
Validated Losses of Separation	4,394
Non Risk Analysis Events	3,123
Risk Analysis Events	1,271
High-Risk Events	41
Percent Air Traffic Operations With No Loss of Separation	99.99667

\* Occurrences from February - September 2012 due to implementation of TARP

Figure 2

99.997 percent of all air traffic operations occurring normally and in full compliance with FAA safety standards.

Formerly, fewer than 100 causal and contributory factors related to air traffic safety incidents were identified. Today, more than 500 of these factors have been incorporated into the RAP. This multitude of options enables analysts to explore the causes of safety incidents at a much finer level of detail and to more precisely determine the level of risk presented by each RAE.

As the quantity and quality of data grows, new metric baselines are developed from which we will gauge our success going forward. We expect that we will be able to measure against these more accurate baselines by the end of FY 2014 — when a full year of information has been collected and analyzed using this new process.

### System Risk Event Rate

As part of its strategy to move beyond traditional reporting of one-dimensional safety metrics, the FAA introduced in 2011 a new metric: the SRER. The SRER represents a move away from legacy safety indicators consisting of merely counting losses of separation and a move toward a metric that illuminates, with far greater precision, the frequency and rate of high-risk events across the NAS. This is possible because the SRER is supported by RAP, a rigorous process that determines causal factors for and considers pilot and controller performance on every loss of separation event, and assesses the potential repeatability and severity of each event.

The SRER is a 12-month rolling rate that compares the number of high-risk RAEs with the total number of validated losses of standard separation that have occurred. As expected, the vast increase in reported safety data in 2012 has resulted in an increase in the overall number of events and RAEs reported. However, it is notable that even with a significantly greater number of recorded events and a higher number of reported RAEs, the total number of high-risk events has remained low. Figure 3 depicts the FAA's SRER performance in FY 2012.

Figure 4 compares the numbers of RAEs classified as high-risk events to the total number of RAEs and the total number of events considered losses of standard separation.

### FY 2012 SRER Performance

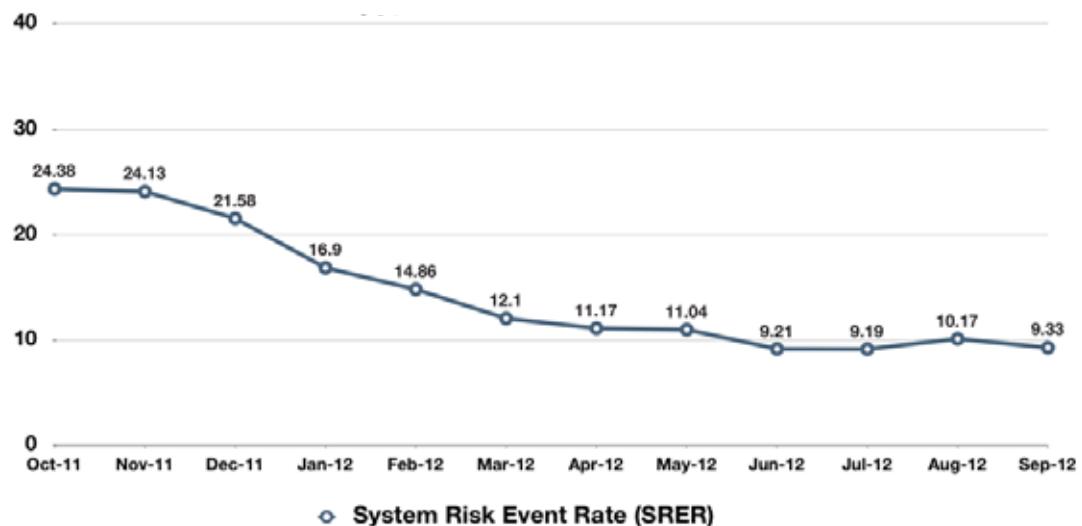


Figure 3

High Risk Event – An event that is classified during the Risk Analysis Process as being “Major” or higher in its severity classification and “Probable” or higher in the likelihood classification matrix.

### FY 2012 Total Risk Analysis Events Compared with High-Risk Events

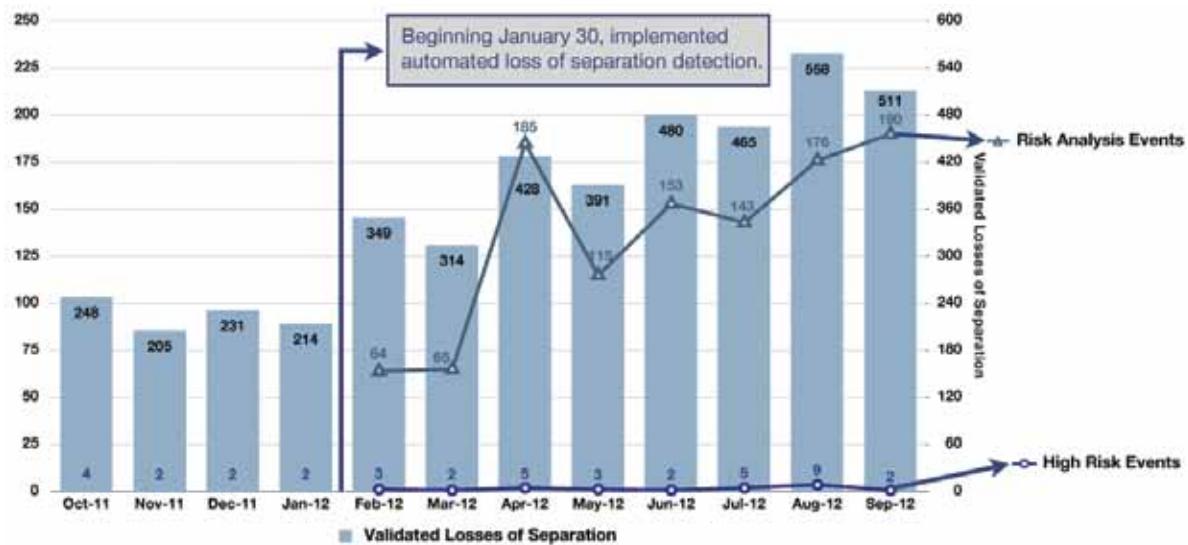


Figure 4

## 2: KEY SAFETY INDICATORS



### Top 5 Safety Hazards

The Top 5, established in 2011, is an ongoing program that annually prioritizes for correction the most serious safety hazards contributing to risk in the NAS, with the aim of focusing resources and activities for corrective action. The RAP is the key element in identifying the Top 5.

To establish the Top 5, analysts review safety data from the RAP and VSRPs. For each Top 5 hazard, corrective action workgroups are tasked with developing plans to reassess the policy, procedures, training, and systems associated with occurrences of that hazard. Resources are then prioritized to implement necessary interventions. Steps to mitigate the 2012 Top 5 have been implemented (Table 2), including training on air traffic procedure changes.

The Top 5 process is an example of the FAA's proactive SMS effectively at work. The SMS prescribes the gathering of data and guides concrete changes to improve safety in the NAS; the RAP improves the ability to accurately identify contributory causes of hazards, understand the risk of hazards and prioritize mitigation strategies; the Top 5 helps to focus efforts and resources on key safety issues.

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In FY 2012, the ATO implemented more than 90% of the mitigations identified for the Top 5 Safety Hazards, exceeding the Department of Transportation's goal of 80%.

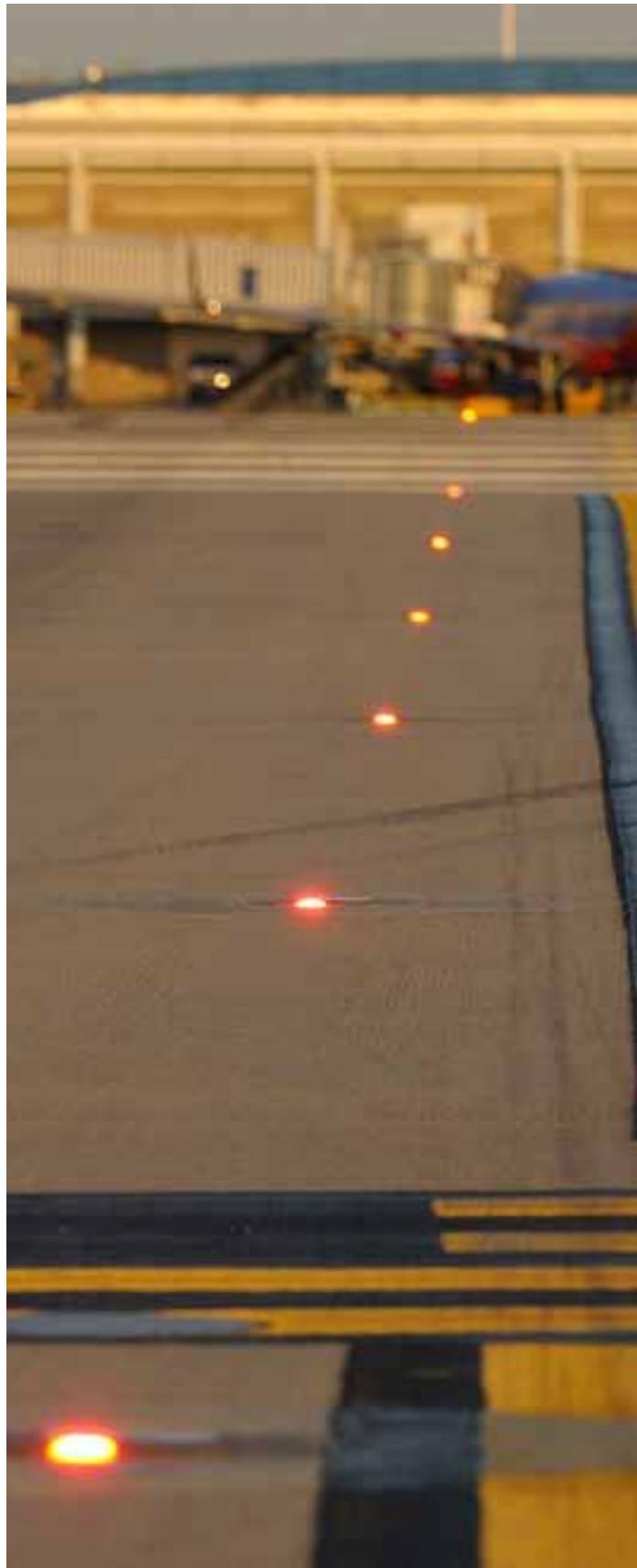
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## FY 2012 Top 5 Hazards and Mitigations

	Top 5 Hazard	Mitigation Status: Description
Turns to Final	Arrival sequencing to final (angle and speed control). Aircraft vectors at a speed and/or angle resulting in an overshoot of final approach.	<b>5 of 5 Planned Mitigations Implemented:</b> Facilities will create speed requirements where vectors are provided to intercept parallel approach courses.
Parallel Runway Operations	Arrival sequencing at the same altitude and on parallel runways. Aircraft overshoots turn to final at the same altitude as arrival traffic to a parallel runway.	<b>5 of 5 Planned Mitigations Implemented:</b> At airports with parallel runways separated by 4,300 feet or more, controllers will now issue headings that allow aircraft to intercept extended centerlines of the runways at an angle of 30 degrees or less. This mitigation will affect the Core 30 airports – the nation's busiest – among other airports.
Go-arounds	Unexpected go-around operations. Arrival aircraft executes an unexpected go-around, resulting in a conflict with departing traffic and false Airport Surface Detection Equipment – Model X (ASDE-X) alarms.	<b>4 of 6 Planned Mitigations Implemented:</b> At each of the 35-40 airports where go-arounds pose a hazard, Safety Risk Management panels with representatives from management and the National Air Traffic Controllers Association (NATCA) will develop procedures to keep go-arounds from flying too close to departures. Facilities will create procedures that require controllers to issue control instructions as necessary to establish the required separation. ASDE-X safety logic will be analyzed to validate/ identify potential improvement.
Clearance Compliance Altitude	Aircraft at an altitude other than expected (for example, due to incorrect hearback/readback).	<b>4 of 5 Planned Mitigations Implemented:</b> Will assess feasibility of voice recognition software to detect incorrect readback. Assess feasibility of using Mode-S to alert controllers of pilot intent. Partner with NATCA and the Aircraft Owners and Pilots Association (AOPA) on outreach to raise awareness.
Coordination	Lack of appropriate or incomplete coordination among operational employees. Aircraft handoff to controller at an altitude or route other than expected.	<b>1 of 1 Planned Mitigations Ongoing:</b> Will develop and provide annual classroom refresher training on coordination requirements contained in facility Standard Operating Procedures and Letters of Agreement.

Table 2

## 2: KEY SAFETY INDICATORS



### Runway Safety Indicators

Runway safety is a critical area of safety management due to the risks associated with operating a complex combination of aircraft, vehicles, and pedestrians in a confined space and at considerably different speeds. The FAA established the Runway Safety Program in 1999 and refined it in 2002, after a rise in the number of runway incursions and other surface incidents. Surface events are reported by controllers, who are required to report any incident that occurs on the surface of a runway environment, runway safety area, or on any other airport movement area. Runway safety activities are specifically designed to foster the continuous examination and correction of surface safety issues.

The FAA currently measures runway safety by the occurrence of runway incursions. Each incursion falls into one of four categories (A, B, C, or D) based on defined criteria. Table 3 provides a description of each category.

Factors such as speed, and the type and extent of any evasive action are considered in determining the classification of an incursion, with Category A and B events considered to have elevated risk. Figure 5 provides a breakdown of runway incursions by category in FY 2012.

Runway incursions are also classified by type (Figure 6) in order to target risk mitigation activities.

Category	Description
A	A serious incident in which a collision is narrowly avoided
B	An incident in which separation decreases, and there is a significant potential for collision, which may result in a time-critical corrective/evasive response to avoid a collision
C	An incident characterized by ample time and/or distance to avoid a collision
D	An incident that meets the definition of Runway Incursion, such as incorrect presence of a single aircraft/vehicle/person on the protected area of a surface designated for the landing and takeoff of aircraft, but with no immediate safety consequences

Table 3

Runway Incursions by Category

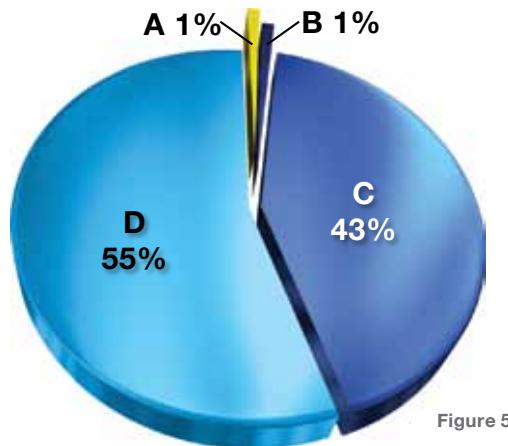


Figure 5

A runway incursion 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 the landing and takeoff of aircraft.

Runway Incursions by Type

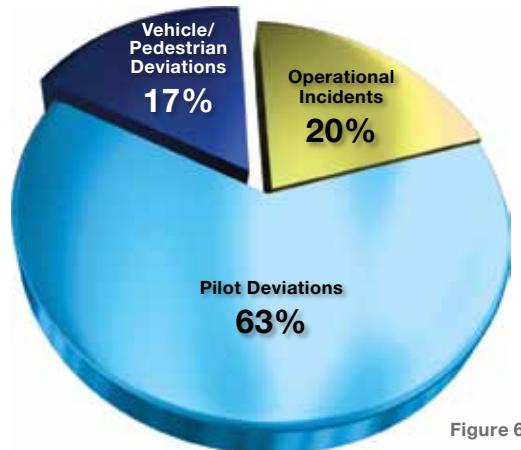


Figure 6



## 2: KEY SAFETY INDICATORS

### Legacy Reporting Runway Incursions

CATEGORY	FY2009	FY2010	FY2011	FY2012
<b>A</b>	<b>9</b>	<b>4</b>	<b>5</b>	<b>7</b>
<b>B</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>11</b>
<b>C</b>	<b>343</b>	<b>386</b>	<b>361</b>	<b>491</b>
<b>D</b>	<b>595</b>	<b>574</b>	<b>586</b>	<b>640</b>
<b>E</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>
<b>RI Total</b>	<b>951</b>	<b>966</b>	<b>954</b>	<b>1150</b>
<b>RI - Operational Deviation</b>	<b>39</b>	<b>29</b>	<b>27</b>	<b>15</b>
<b>RI - Operational Incident</b>	<b>114</b>	<b>127</b>	<b>151</b>	<b>211</b>
<b>RI - Pilot Deviation</b>	<b>599</b>	<b>629</b>	<b>593</b>	<b>722</b>
<b>RI - Vehicle/Pedestrian</b>	<b>199</b>	<b>181</b>	<b>183</b>	<b>200</b>

Category E is assigned if insufficient information or inconclusive or conflicting evidence precludes a severity assessment. Category E does not describe severity.

Table 4

Table 4 provides a breakdown of runway incursions by classification and type over the past four fiscal years. These activities generally focus on three areas: 1) pilot actions, measured as Pilot Deviations; 2) ATC actions, measured as Operational Incidents; and 3) actions by individuals driving or working in the vicinity of taxiways and runways, measured as Vehicle/Pedestrian Deviations.

As was noted with airborne operational incidents, the FAA has recorded an increase in the total number of runway incursions from FY 2011 to FY 2012. The FAA is also experiencing a corresponding increase in event reports from federal contract towers. This increase in the total number of surface events correlates to improvements in reporting systems and several years of safety culture enhancements.

With its increased reporting capabilities and improved knowledge of safety risk management, the FAA recognizes that traditional runway safety risk metrics, which track runway incursion counts and rates, are not sufficient to accurately and comprehensively measure safety performance or the risk of surface operations. Therefore, in September 2012, the FAA completed development of a prototype RAP for surface operations and is working to develop new runway safety-related metrics that will enable identification of the causal and contributing factors associated with the more

serious occurrences. These analytical improvements will assist in focusing resources on mitigating the highest risks to aviation safety in the most effective way possible.

Over the last 10 years, the FAA has made significant strides in improving runway safety, decreasing both the total number and rate of Category A and B runway incursions. With fewer than 0.395 events per million operations, the FAA continues to outperform performance targets (Figure 8). The rate of Category A and B incursions was 30 percent lower in FY 2012 than in FY 2006, and 64 percent lower than at its peak in FY 2000. The total number of Category A and B incursions has similarly fallen, from a high of 67 in FY 2000 to 18 in FY 2012. Notwithstanding the small number of A and B occurrences, the FAA continues to focus on surface safety and made considerable investments in runway safety areas and enhancements to the runway safety program throughout the year.

### Total Number and Rate of Runway Incursions Per Million Operations

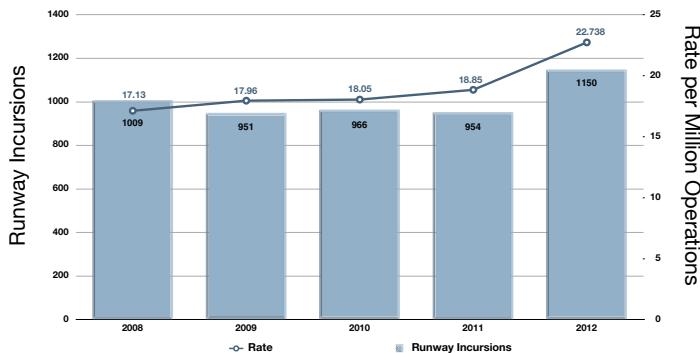


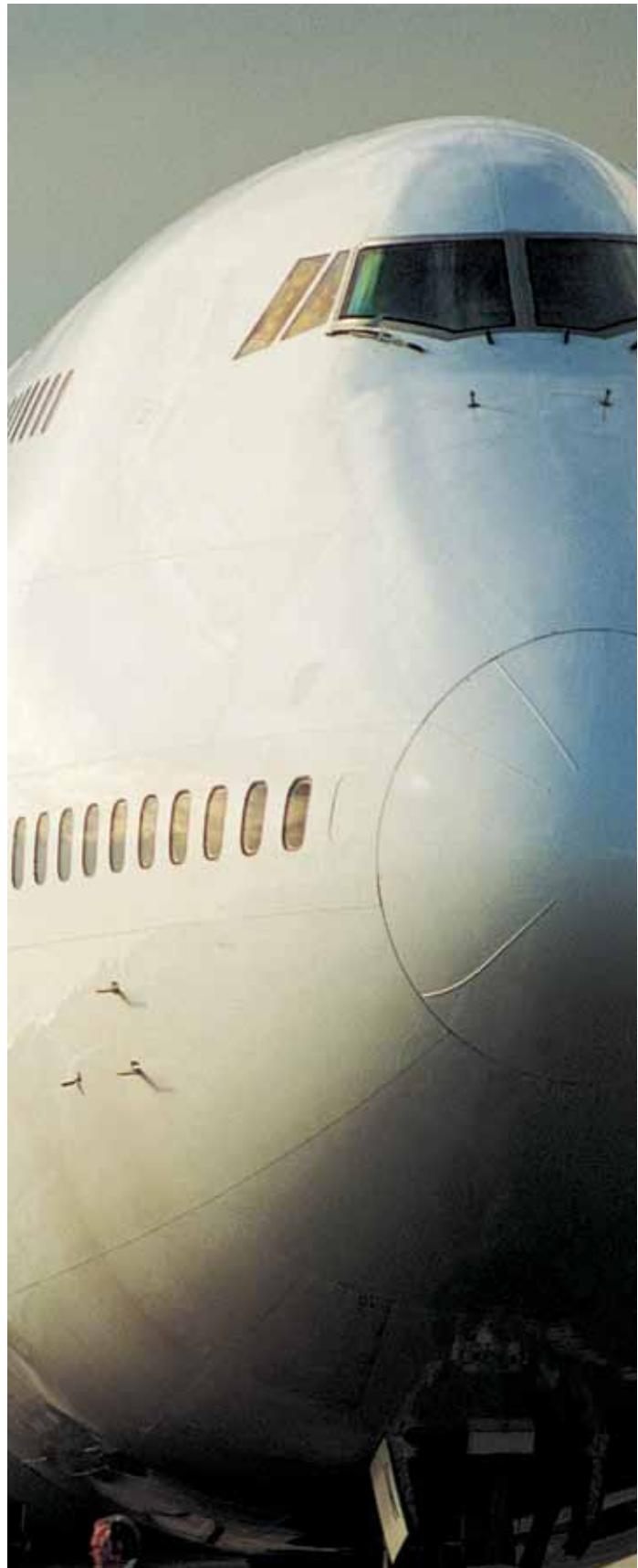
Figure 7

In FY 2012, a total of 1,150 runway incursions were reported at the 538 towered airports in the NAS (Figure 7). More than 98% of these were classified as Categories C and D, which are not associated with elevated risk.

### Number and Rate of Category A and B Runway Incursions Per Million Operations



Figure 8



## 2: KEY SAFETY INDICATORS



### Runway Safety Program

Continually reducing the likelihood of airplanes colliding with obstructions on airport runways—whether other aircraft, vehicles, individuals, or wildlife—is the primary objective of the FAA's Runway Safety Program. To accomplish this, safety risk management techniques are used to focus resources on identifying, quantifying, and mitigating the causal factors with the highest likelihood of contributing to the risk of significant safety events.

The Runway Safety Program and representatives from across the aviation industry have come together to identify and address runway safety issues. Key safety improvements have been achieved through collaborative efforts such as the ACAC, the Runway Safety Council, and Runway Safety Action Teams. Additional focus has been given to the General Aviation community, because the largest portion of runway incursions involve General Aviation pilots. In fact, General Aviation pilots were involved in more than 80 percent of all runway incursions that were categorized as Pilot Deviations in FY 2012 (Figure 9). Consequently, the Runway Safety Program and the General Aviation community are working together on General Aviation-specific runway safety concerns. Table 5 highlights key runway safety initiatives.

The FAA's strategies for runway safety include:

- Cohesive official guidance
- Industry outreach and collaboration
- User education, checking, and training standards
- Advanced risk mitigation measures
- Infrastructure requirements
- New surface safety technologies

**Pilot Deviations by Operation**

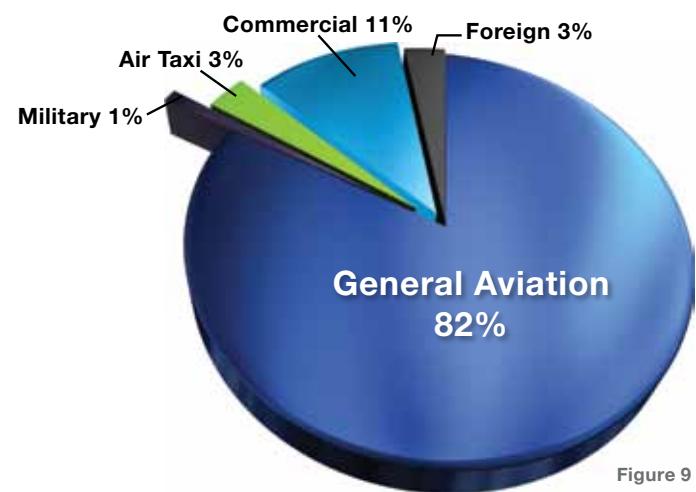


Figure 9

## Key Runway Safety Initiatives

<b>Runway Safety Council</b>	A joint effort between the FAA and private aviation industry stakeholders, including union representatives, to investigate the root causes of runway incursions and develop recommendations on ways to improve runway safety.
<b>Runway Safety Action Teams</b>	<p>Local and regional teams composed of ATC personnel, airport management, airlines, General Aviation pilots, military units, and other stakeholders to discuss surface movement issues and concerns. Achievements include:</p> <ul style="list-style-type: none"> <li>• Increasing surface safety awareness throughout the aviation community;</li> <li>• Identifying and analyzing hazards associated with surface operations;</li> <li>• Identifying and developing mitigations to help reduce risk;</li> <li>• Fostering communications and building relationships within the local aviation community; and</li> <li>• Increasing media advocacy of runway safety at a local level.</li> </ul>
<b>Hot Spots</b>	Locations on an aerodrome movement area with a history or potential risk of collision or runway incursion that necessitate heightened attention by pilots and vehicle operators. Identifying these locations makes it easier for airport users to plan the safest possible movement path and alerts pilots to exercise caution.
<b>Internal Guidance</b>	A collaborative effort between the FAA and industry stakeholders to improve “approach hold” runway guidance, procedures, signs, and markings. Improvements will establish uniform procedures and phraseology for approach hold areas and provide a process to collect data related to approach hold events.
<b>General Aviation Outreach</b>	Significant policy changes enacted by the Flight Standards organization and the Runway Safety Program to reduce the high rate of runway incursions involving the General Aviation community, which resulted in modifications to the Practical Test Standards and the Pilots Handbook of Aeronautical Knowledge, updated Advisory Circulars, a newly published Safety Alert, a new remedial training process to address pilot deviations, and incorporating runway safety training into the Designated Pilot Examiner curriculum.
<b>Runway Safety Tracking System</b>	The database in which more than 500 open safety issues resulting from Runway Safety Action Team visits have been entered and tracked. The Runway Safety Program works with Regional Administrators and the Flight Standards and Airports organizations to correct identified deficiencies.
<b>International Leadership</b>	Supporting the International Civil Aviation Organization in its efforts to improve runway safety globally by using integrated safety management approaches, sharing safety data, and highlighting the interaction and effects of factors that elevate risk. Continuing to work with Chinese aviation authorities on airport safety improvements and an annual runway safety training program.
<b>Runway Safety Research</b>	<p>A diverse portfolio of airport and runway safety-related programs, conducted internally and in partnership with organizations such as the University of Virginia, the MITRE Corporation, and the Netherlands National Research Laboratory. Examples of research areas include:</p> <ul style="list-style-type: none"> <li>• Scenario-based methods to measure and determine risk;</li> <li>• An algorithm to prioritize location selection for Runway Safety Action Team attention;</li> <li>• An enhanced Final Approach Runway Occupancy Signal system to alert arriving pilots when their intended runway is occupied;</li> <li>• A real-time, low-cost runway safety mobile device application for General Aviation pilots; and</li> <li>• Low-cost surface surveillance to detect aircraft, human, and vehicle traffic.</li> </ul>

Table 5

## 2: KEY SAFETY INDICATORS



### Airport Construction Advisory Council (ACAC)

The FAA created the ACAC, a group of air traffic managers and industry stakeholders from across the United States, to address the complex task of identifying and mitigating the potential dangers associated with airport construction projects.

In FY 2012, the ACAC collaborated with the Surface Operations Office to improve the visibility and accuracy of construction-related capacity limit notices, and with the Terminal Simulation System Program Office to ensure that airport configuration changes are reflected in that office's visual database. As a result of these and other collaborative efforts, the ACAC has improved the processes used to plan and approve construction, clarified runway safety phraseology in the ATC Handbook, and developed a runway construction safety website that compiles best practices and a variety of construction checklists. The ACAC also assisted with the coordination of graphical Notices to Airmen (NOTAMs), the accelerated fielding of the NOTAM Manager software, and clarification of the actions that trigger suspension of approach/departure procedures when a runway is closed, shortened, or decommissioned.

Other ACAC initiatives included:

- Helping air traffic facilities realize that NOTAMs do not supersede the negotiated movement area(s) found in their Letters of Agreement (LOAs) with the airport authority;
- Quickly responding to and helping arrange changes in lighting/markings and bulletins to pilots/dispatchers following confusion regarding construction at San Francisco International Airport;
- Adding members to ACAC from the National Air Traffic Controllers Association, Airline Dispatchers Federation, and Aircraft Owners and Pilots Association;
- Greatly increasing collaboration and communications with the International Civil Aviation Organization (ICAO) and air navigation service providers globally;
- Collaborating with the FAA Airports organization and the Strategic Event Coordination Network to improve the transparency and accuracy of future construction project details;
- Reaching out to several airports faced with significant hazards and traffic impacts related to surface limitations (these airports took immediate steps to remove hazards and mitigate risks identified by the ACAC); and
- Coupling Geographical Information Systems data and text from active NOTAMs during an ACAC demonstration program to create two-dimensional, layered Construction Notices of the open and closed tarmacs at over 60 airports and more than half of the Core 30 airports; over 1,000 updated Construction Notices were published and used to graphically depict closed/shortened runways in the past year.

### Construction Safety Summits

With increased focus on the hazards that construction brings, many airports have initiated Construction Safety Summits before their largest projects begin. Airports with multi-year projects (e.g., Chicago O'Hare, Baltimore/Washington, Los Angeles, Denver, Salt Lake City, San Francisco International Airports, and others) are meeting throughout the project lifecycle to find proactive approaches to the challenges of airport construction.

## Runway Excursions

While runway incursions serve as the FAA's current runway safety performance metric, the Runway Safety Program is also looking at safety improvements related to runway excursions. According to the National Transportation Safety Board (NTSB) 2007–2009 Review of United States Civil Aviation Accidents, runway excursions are one of the top six defining events for commercial air transport accidents, accounting for seven of 91 accidents. Runway excursions also accounted for seven of 109 fixed-wing air taxi accidents and 205 of 4,653 General Aviation accidents.

A runway excursion is a veer-off or overrun off the runway surface.

The FAA is currently sponsoring studies and compiling data that will lead to a better understanding of the factors that contribute to runway excursions, such as aircraft energy states on approach. Developing metrics associated with the risk of runway overruns for arrivals and departures, including long landings and rapid deceleration rates, will support efforts to reduce such incidents.

The FAA provides international leadership through collaboration with the Civil Air Navigation Services Organization (CANSO) on runway safety initiatives, including the publication of an educational booklet titled “Unstable Approaches — ATC Considerations” and development of a Global Runway Safety Risk Model, with an initial focus on runway excursions.

Two highly effective FAA programs, Runway Safety Areas (RSAs) and the Engineered Materials Arresting System (EMAS), are designed to reduce the risk of human injury and minimize or eliminate aircraft damage in the event of an undershoot, overrun, or excursion from the runway.

### Example Design of a Runway Safety Area



Figure 10



The benefits of EMAS are clearly exhibited in this photo of a plane that was stopped at Burbank Airport.

An RSA is a defined surface surrounding the runway that is prepared or suitable for reducing the risk of damage to aircraft in the event of undershoot, overrun, or excursion from the runway (Figure 10). RSA dimensional standards have increased over time to improve safety, and the program to improve RSAs has evolved over the years as the agency continues to refocus and accelerate efforts to complete RSA improvements.

To date, EMAS has a 100% success rate.

The FAA completed Airport Improvement Program (AIP) improvements at 26 RSAs and Facilities and Equipment (F&E) improvements at 74 RSAs in FY 2012. This brings the total number of AIP improvements to 528 and F&E improvements to 106. As of the end of FY 2012, 61 percent of the RSAs on commercial runways at Part 139 airports have been improved to the extent practicable. EMAS bed, composed of engineered materials built at the end of a runway, provides a safety enhancement on runway ends where there is not enough level, cleared land for a standard RSA. Engineered materials are defined as “high energy absorbing materials of selected strength, which will reliably and predictably crush under the weight of an aircraft.” The loss of energy required to crush the EMAS material slows the aircraft. To date, EMAS has a 100 percent success rate. Currently, 43 commercial airports have installed an EMAS at the end of 64 runways in the United States, with plans to install four additional EMASs at three more airports.

### 3: VOLUNTARY SAFETY REPORTING PROGRAMS



# The ATO continues to increase safety data collection by creating a culture in which employees are encouraged to provide essential, safety-related information through confidential non-punitive Voluntary Safety Reporting Programs modeled after those in use at approximately 100 aviation companies in the United States.

The use of VSRPs in the aviation industry is widely acknowledged to be a leading factor in the dramatic reduction in commercial aviation accidents over the past 20 years. Similarly, the FAA has found that ATSAP for controllers, the CISP with airlines, and T-SAP for Technical Operations employees have significantly increased safety data collection and analysis efforts, supporting more targeted, and therefore effective, risk mitigation.

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This culture change can be largely attributed to ATSAP, which is currently the largest aviation VSRP in the world.

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These programs have contributed to a significant change in the FAA's safety culture. The FAA now actively encourages employee participation, gathering data directly from frontline employees, those with the best view of and hands-on recommendations for addressing operational risk, thereby expediting the correction process. By removing the fear of reprisal, non-punitive VSRPs have helped to change FAA employee attitudes about sharing safety incidents or issues, increasing accountability at the individual level and growing a proactive safety culture.

This culture change can be largely attributed to ATSAP, which is currently the largest aviation VSRP in the world. ATSAP allows air traffic controllers and managers to report risks confidentially. As of January 1, 2013, more than 58,000 reports have been filed, and 160 safety risks have been identified and mitigated. Approximately 80 percent of the

reports describe specific events, and the rest provide insight into policy, procedural, and equipment issues. More than 60 percent of air traffic personnel have submitted at least one ATSAP report, demonstrating the value of wide participation in raising awareness of issues that might otherwise never have been discovered and opening the door to their speedy resolution. And the program continues to grow: 300-350 ATSAP reports are now filed each week, and there was an 18.8 percent increase in the number of reports from Calendar Years 2011 to 2012.

ATSAP by the Numbers FY 2012	
16,553	ATSAP reports filed (a 7.5% increase from FY 2011)
20	ATSAP Information Requests issued
24	Corrective Action Requests issued
8	Corrective Action Requests closed
25	ATSAP Positives (Positive resolutions from ATSAP reporting)
300-350	Reports filed per week
Since ATSAP Inception (as of January 2013):	
59,000	ATSAP reports filed
160	ATSAP Positives
64%	Eligible employees who have filed at least one ATSAP report

Table 6

### 3: VOLUNTARY SAFETY REPORTING PROGRAMS

The CISP was created to allow ATSAP and participating airline reporting programs to share data and consider issues from both the air traffic and flight crew perspectives. The CISP is the first program of its kind in the industry, with 3,170 reports exchanged in FY 2012 (2,235 reports submitted by airlines to the FAA, and 934 ATSAP reports submitted by the FAA to participating airlines). The exchange of information raises awareness of issues from both pilot and controller perspectives, elevates managers' awareness of safety issues, and provides a more complete picture of safety incidents.

T-SAP by the Numbers FY 2012	
107	T-SAP reports filed
97	T-SAP Information Requests Issued
40	Corrective Action Requests issued
11	Corrective Action Requests closed
13	T-SAP Positives

Table 7

In addition to improving the FAA's safety culture, VSRPs have documented success through ATSAP/T-SAP Positives, or positive resolutions to safety issues reported by employees. In FY 2012, 25 ATSAP Positives were recorded, including the following examples:

- At the Houston Air Route Traffic Control Center, with an airspace that overlays several military bases and which, last year, handled more than 300,000 military flights, Letters of Agreement did not reflect the current procedures and separation requirements surrounding military aircraft—a situation that could have led to confusion and potential losses of standard separation. Facility management and the military revised the LOAs and shared the changes with frontline employees.
- At the Asheville Air Traffic Control Tower, a loud static noise with faint sounds of Morse code was interrupting radio communications. Technical Operations personnel, working with FAA Flight Check Aircraft and Spectrum Management personnel, were able to determine the

source of and eliminate the interference.

- At the Dallas–Fort Worth Air Traffic Control Tower, the Spirit Airlines safety department was notified that its pilots were not receiving Preferential Departure Clearances due to the unavailability of certain fixes

**A voluntary safety report “Positive” is a resolution to a safety issue reported by employees.**

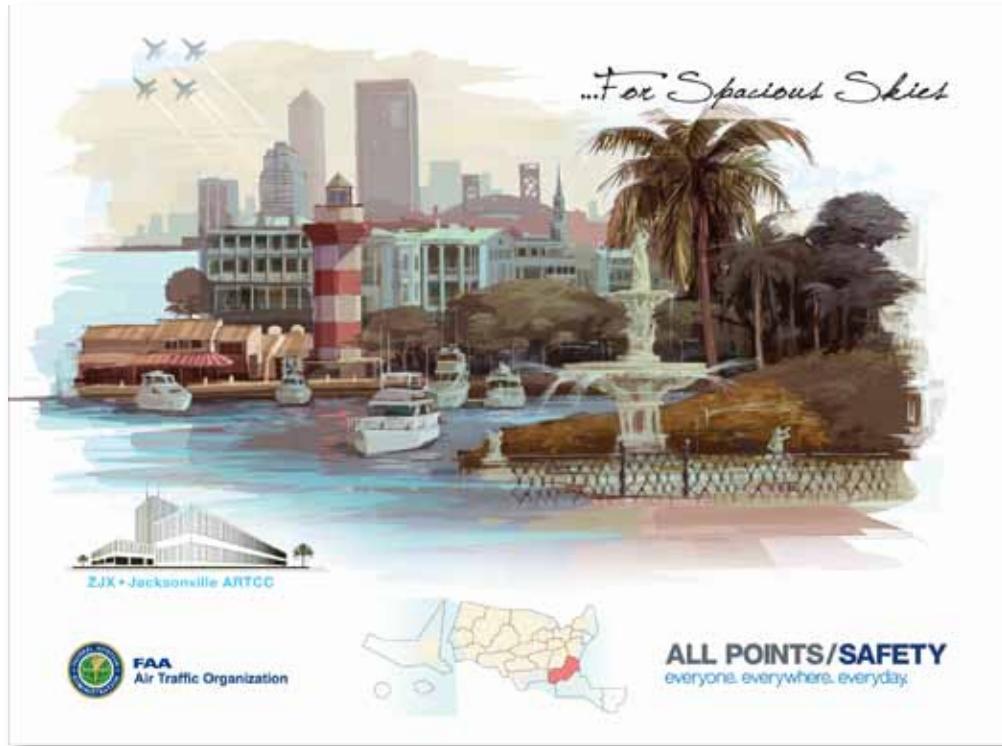
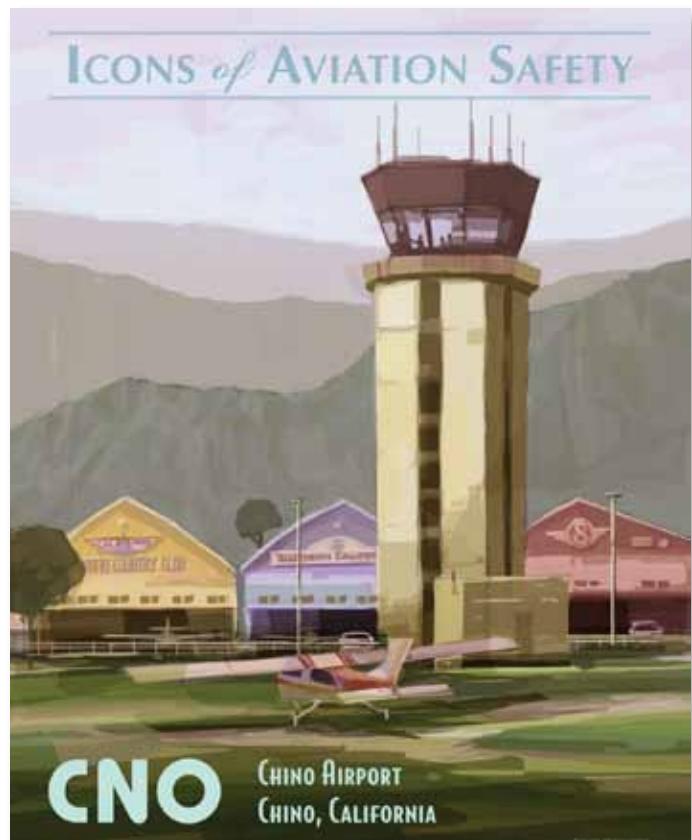
in the navigation database onboard their aircraft. The airline was able to correct the issue by updating its Flight Management Computer database.

In FY 2012, 13 T-SAP Positives were recorded, including the following examples:

- A maintenance alert was issued and a corrective action plan implemented to address a potential fire hazard associated with the incorrect installation of electric heaters in certain airport surveillance radar engine generators.
- A warning about hazardously misleading information was added to the Remote Monitoring and Logging System after the high frequency of such information in the Simplified Automated Logging system was discovered.
- A maintenance alert was issued with procedures designed to prevent maintenance data terminal screen saver and session log-out functions from interfering with the monitoring of Airport Surface Detection Equipment – Model X.
- FAA orders were updated to correct tolerances listed for Remote Radio Control Systems and to eliminate errors that could have contributed to service outages or other adverse effects in the NAS.



## 4: OTHER SAFETY PROGRAMS



"Icons of Aviation Safety" and "...For Spacious Skies" artwork are used to recognize employees who make significant contributions to safety through the All Points Safety campaign.

# The FAA has deployed many other safety initiatives, all of which maintain our high standard of performance and ensure continuous improvement.

Programs such as Safety Promotion and Training, Partnership for Safety, Fatigue Risk Management, Independent Operational Assessments and Audits and Assessments are among the most unique and effective in operation today, setting our air transportation system apart from the rest.

## Safety Promotion

Safety within the FAA is promoted by disseminating safety education messages and information to agency employees, helping them to identify, understand, and communicate hazards in the NAS. The All Points Safety campaign, a multimedia communications effort intended to increase awareness of and participation in the FAA's proactive safety management, is one of the highlights of the FAA's efforts to promote a positive, proactive safety culture within the agency.

## ATC Training

A number of innovative ATC Training initiatives intended to draw on the most current safety data available and on proven training techniques have been implemented in recent years.

- Recurrent Training is a mandatory training program that uses data drawn from ATSAP reports, RAP reports, MORs, and the Top 5 to identify and fulfill training needs. It is designed to increase controller proficiency, enhance awareness of the human factors affecting aviation, and promote behaviors essential to the identification and mitigation of risks. The content includes Crew Resource Management training—initially designed for flight crew personnel—that has been tailored to meet the needs of controllers and focuses specifically on human factors and the operational aspects of the ATC team environment.
- National Air Traffic Professionalism (NATPRO) Training focuses on visual sensory perception and is designed to enhance cognitive skills, situational awareness, memory, and reaction time for controllers in radar and tower

facilities. NATPRO II is a complementary training initiative that uses auditory exercises to target hearback/readback skills.



## Partnership for Safety

The Partnership for Safety was launched in 2010 to help proactively identify and mitigate operational safety problems in the NAS by establishing Local Safety Councils and encouraging frontline employees to participate in safety culture improvement. In FY 2012, the program expanded to include the first comprehensive data portal, which will be accessible to all FAA facilities. Currently in the prototype stage, the portal—which includes data and analysis tools addressing facility traffic counts, runway use, and missed approaches, among other measures—has been undergoing beta testing at 10 facilities since May 2012 and will be nationally deployed in early 2013. The FAA processes up to two terabytes of data every day in order to generate an online “dashboard” of information (simple, easy-to-understand graphs and charts representing everything from overall safety performance to individual events) that Local Safety Councils can use to target safety hot spots in their facility’s airspace.

## Fatigue Risk Management

The FAA's Fatigue Risk Management team was established in September 2009 to provide fatigue risk expertise, guidance, and support to the ATC workforce; to develop fatigue reduction strategies for the mitigation and management of operational fatigue risk in the NAS; and to enhance the safety and well-being of FAA employees through fatigue safety awareness. The air traffic Fatigue Risk Management

## 4: OTHER SAFETY PROGRAMS

System, launched in September 2012, is led by the Fatigue Safety Steering Committee and facilitates collaboration and decision-making on fatigue-related issues across FAA management and union representation.

### Audits and Assessments

The FAA's Audits & Assessments program conducts on-site and remote independent assessments to evaluate suspected risk trends and to determine the effectiveness of mitigation efforts in order to maintain and improve the safety of air traffic services. In FY 2012, multiple assessments of SMS compliance and performance were conducted, focusing on safety risk management, safety promotion, and compliance. These assessments ensure that risk mitigations have been implemented; determine whether any additional potential safety hazards exist; and ensure that safety management processes and procedures align with policy. Below are two examples of the numerous evaluations conducted each year:

- **Independent Operational Assessments**, a proactive measure to ensure that new or modified systems do not introduce undue safety risk to the NAS, are conducted in operational environments prior to national deployment to identify potential safety risks. If a safety risk is identified, a corrective action plan with specific risk mitigations must be put in place, and these items must be tracked through completion.
- Assessments are also performed to evaluate the effectiveness of Quality Control efforts performed by the **NAS Technical Evaluation Program (NASTEP)**. These assessments determine whether NASTEP issues were correctly closed within the specified timeframe and whether the proper corrective actions were taken on these issues. Separate evaluations are conducted to verify that flight inspection procedures are followed in accordance with requirements and to identify any systemic problems in pre- and post-flight-check activities. These assessments provide Technical Operations management with data that can be used to enhance policies, processes, and/or programs, as well as to improve safety-related decision-making.

- The **ASIAS Program**, another FAA-Commercial Aviation Safety Team (CAST) initiative, is a safety analysis and data sharing program that proactively analyzes the extensive data received from the FAA, airline safety programs, manufacturers, and others to advance aviation safety. ASIAS enables the aviation community to identify systemic risks and evaluate them (by estimating probabilities, assessing severities, uncovering event precursors, and diagnosing event causation); formulate interventions; and monitor the effects of those interventions.

### International Leadership

The FAA provides leadership and support to a number of international bodies, including ICAO, CANSO, EUROCONTROL, and others, with the aim of improving aviation safety and ensuring the global harmonization of safety management in the provision of air navigation services. Each year, the FAA provides direct and indirect technical assistance and training to regulators and air navigation service providers in more than 100 countries, continually seeking to expand the agency's network of collaborative partners.

Highlights among these international efforts include:

- International safety data sharing initiatives, such as CAST/ICAO Common Taxonomy Team (CICTT), contribute to the FAA's air traffic safety improvement objectives. The CICTT includes experts from a variety of backgrounds, all tasked with developing common taxonomies and definitions for aviation accident and incident reporting systems. The result will be a standardized industry language that will improve the quality of information and communication and greatly enhance the aviation community's capacity to focus on common safety issues. In FY 2012, the FAA led the ATC portion of CICTT efforts that resulted in a mapping taxonomy that relates the EUROCONTROL Risk Analysis Tool/FAA RAP Tool classification system to that of ATSAP, as the first step toward a harmonized international taxonomy.

- The **CANSO Safety Standing Committee**, with FAA leadership and support, is responsible for developing and disseminating guidance and best practices to elevate the safety performance and management practices of air navigation service providers across the globe. Committee contributions to air traffic safety include:
  - Publishing SMS Implementation Guidance and Standard of Excellence documents;
  - Developing and sharing information on key safety metrics;
  - Distributing and managing an SMS Maturity Measurement Survey, which served as the basis for the first CANSO Safety Report;
  - Developing processes for runway safety risk analysis;
  - Conducting regional safety seminars; and
  - Collaborating with ICAO-sponsored safety initiatives.
- ICAO benefits from FAA support and participation in multiple safety-related panels and initiatives, examples of which include:
  - The Aerodromes Panel, which works toward global consensus on runway safety-related issues;
  - The Operations Panel and Aeronautical Surveillance Panel, which help to develop standards and recommended practices;
  - The Aviation Safety Intelligence initiative;
  - Common standards for airport construction planning and operational limits;
  - The Operational Data Link Panel to support the implementation of emerging data-link technology, an essential element of the Next Generation Air Transportation System (NextGen) vision for runway operations; and
  - Materials and expertise for regional runway safety.
- A formal **Memorandum of Cooperation** between EUROCONTROL and the FAA to align aviation safety issues has resulted in increased information sharing and technology development. Successes include the publication of the European Action Plan for the Prevention of Runway Incursions, which was used to support the production of the 2007 ICAO Manual for the Prevention of Runway Incursions; an integrated risk picture analysis using detailed modeling of causal factors involved in incidents and accidents; and the sharing of airport construction-related lessons learned and best practices.



## 5: THE FUTURE OF AIR TRAFFIC SAFETY



# The FAA is moving toward an increasingly integrated SMS.

A more integrated SMS will ensure that the various air traffic system domains (e.g., communications, navigation, automation, weather, surveillance) become more cohesive and interdependent. In doing so, however, the performance of one domain can and will affect the safety performance of other domains; the SMS, therefore, must be able to consider safety risk earlier in the concept/development phases and must provide the capabilities necessary to assess and manage risk in an integrated fashion across implementation timeframes and organizations.

The ability to effectively and objectively assess safety risk and measure overall safety performance is critical to maintaining and improving the safety of the NAS in the face of increased air traffic volume, tightly coupled air navigation support systems, and the changing functions of humans and automated systems as technology continues to evolve. Current efforts are focused on developing metrics to:

- Objectively measure demonstrated system risk, which manifests through reportable accidents, such as mid-air collisions, ground collisions, controlled flights into terrain, and runway excursions, all of which serve as lagging indicators of the FAA's success in efforts to reduce risk; and
- Measure safety performance, which describes the agency's ability to identify potential safety problems and its success in correcting them.

The FAA is also looking to develop methods to better understand and measure exposure to potential safety hazards during normal flight operations—that is, operations in which a particular safety barrier may have been breached or ineffective, but the flight proceeds without incident and in full compliance with safety standards and procedures—through continued advances in data collection and analysis technologies.

## Common Taxonomy

The Common Taxonomy project originated as an effort to standardize causal and contributory factor definitions and terminology across the FAA's major data collection systems.

ATM Common Taxonomy Version 1, completed in the fall of 2011, successfully mapped the taxonomies of two key safety programs: the RAP and ATSAP. In parallel with the CICTT international common taxonomy initiative to standardize first-, second-, and third-level classifications for air traffic causal factors, the FAA is completing a detailed, element-by-element taxonomy that drills down to seven or more levels. While the detailed taxonomy is intended for agency analysts, it will also be made available to international partners. The detailed taxonomy will be available via a web-based tool and will be implemented in FAA safety data systems in 2013.

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The envisioned **OARS** will automate and standardize data-sharing between legacy and future safety risk analysis systems, databases, and tools in use across the NAS by merging redundant and maintenance-intensive systems. Integrating existing systems will also save funding.

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## Operational Analysis Reporting System (OARS)

Air traffic analysis tools and techniques must be developed in parallel with improved safety performance measurement methodology and increased safety data collection capabilities. To date, analysis of safety data has been challenging because there is no efficient means for analysts to process the vast amounts of data now being collected by systems and programs such as TARP and ATSAP. The FAA is therefore developing the Operational Analysis Reporting System (OARS) to integrate numerous sources of safety data, including automation data, VSRP reports, and audit/compliance information with analysis programs. This integrated system will expedite access to a much broader range of accurate, safety-related data while ultimately providing analysts with the ability to achieve more robust, comprehensive, predictive and proactive analyses of risk.

# 5: THE FUTURE OF AIR TRAFFIC SAFETY

## Future ATO Safety Analysis Process

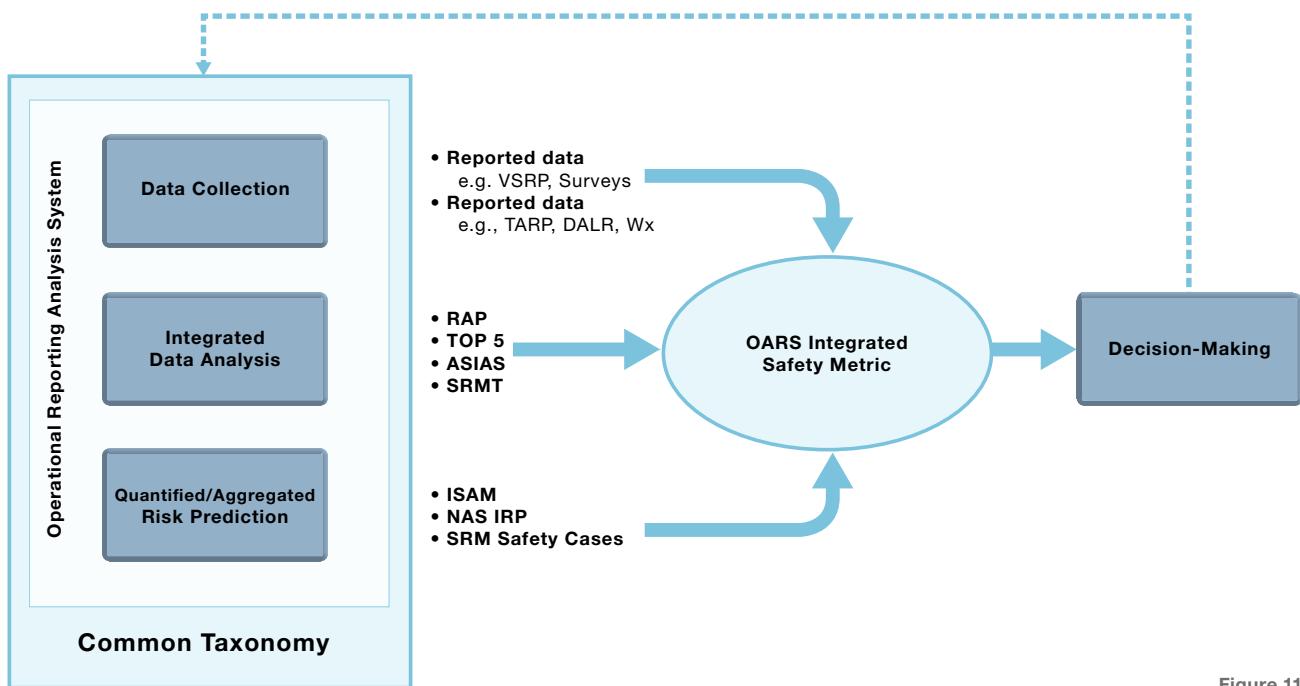


Figure 11

Figure 11 illustrates the overall future analysis process. Using common taxonomy as a foundation, the OARS will integrate safety metrics that inform decision-making, which will, in turn, determine the types of data collected and the programs used to collect and analyze them.

### Integrated Risk Picture (IRP)

As a whole, the FAA is considering safety risk earlier in system concept/development phases through a variety of safety assurance processes being developed in parallel with NextGen. The future safety of the NAS will be assured through the development of NextGen safety standards, tools, and methodologies to determine whether the risks associated with new concepts and prototypes meet air traffic safety standards. Draft safety guidance on integrated safety management, scoping, and capability safety assessments have been completed to ensure that concepts and systems are developed using an integrated, risk-based assessment approach. Research has also been conducted into the availability of risk-based modeling tools and the validation of these tools for use in assessing risk for NextGen concepts.

A key NextGen risk-based modeling effort is the development of an Integrated Risk Picture (IRP) for the NAS. The IRP provides a detailed understanding of air traffic contribution to the overall risk of accidents at the system level. With the IRP, it will be possible to identify system interdependencies that could not be determined from individual subsystem-level risk analysis. To predict the future risk picture, the IRP will define all expected ATM changes attributed to NextGen and increased traffic volume and identify their contributions to the system accident risk.

## 6: CONCLUSION

In high-reliability industries such as air transportation, safety risk and safety performance cannot be solely measured by the absence of fatalities or by traditional methods that rely on counting the numbers of observed precursor incidents.

It is this constant search for new ways to measure and improve safety that has led the ATO to continuously improve safety performance. As has been detailed in the previous pages, the ATO has transformed air traffic management to make the largest and most significant improvements in the last 30 years to the way air traffic control risk and safety performance are managed.

The ATO will continue to be guided by an evolving proactive SMS that produces fundamental safety culture changes, sophisticated data collection and analysis, advancements in safety monitoring and measurement, and new capabilities in risk-prediction. Most importantly, as future challenges are presented, we will continue to embrace correction as the ultimate measure of progress. This will ensure that we continue to operate the safest and most efficient airspace system in the world.



# APPENDIX: ACRONYMS

<b>ACAC</b>	Airport Construction Advisory Council	<b>NOTAM</b>	Notice to Airmen
<b>AIP</b>	Airport Improvement Program	<b>NTSB</b>	National Transportation Safety Board
<b>ASIAS</b>	Aviation Safety Information Analysis and Sharing	<b>OARS</b>	Operational Analysis Reporting System
<b>ATC</b>	Air Traffic Control	<b>RAE</b>	Risk Analysis Event
<b>ATM</b>	Air Traffic Management	<b>RAP</b>	Risk Analysis Process
<b>ATO</b>	Air Traffic Organization	<b>RSA</b>	Runway Safety Area
<b>ATSAP</b>	Air Traffic Safety Action Program	<b>SMS</b>	Safety Management System
<b>CANSO</b>	Civil Air Navigation Services Organization	<b>SRER</b>	Safety Risk Event Rate
<b>CAST</b>	Commercial Aviation Safety Team	<b>TARP</b>	Traffic Analysis and Review Program
<b>CEDAR</b>	Comprehensive Electronic Data Analysis and Recording	<b>T-SAP</b>	Technical Operations Safety Action Program
<b>CICTT</b>	CAST/ICAO Common Taxonomy Team	<b>VSRP</b>	Voluntary Safety Reporting Program
<b>CISP</b>	Confidential Information Sharing Program		
<b>EMAS</b>	Engineered Materials Arresting System		
<b>EOR</b>	Electronic Occurrence Report		
<b>F&amp;E</b>	Facilities and Equipment		
<b>FAA</b>	Federal Aviation Administration		
<b>FY</b>	Fiscal Year		
<b>ICAO</b>	International Civil Aviation Organization		
<b>IRP</b>	Integrated Risk Picture		
<b>LOA</b>	Letter of Agreement		
<b>MOR</b>	Mandatory Occurrence Report		
<b>NAS</b>	National Airspace System		
<b>NASTEP</b>	NAS Technical Evaluation Program		
<b>NATPRO</b>	National Air Traffic Professionalism		
<b>NextGen</b>	Next Generation Air Transportation System		





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