

FAA Air Traffic Organization

Safety Management

Presented to: Department of Energy

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Federal Aviation
Administration



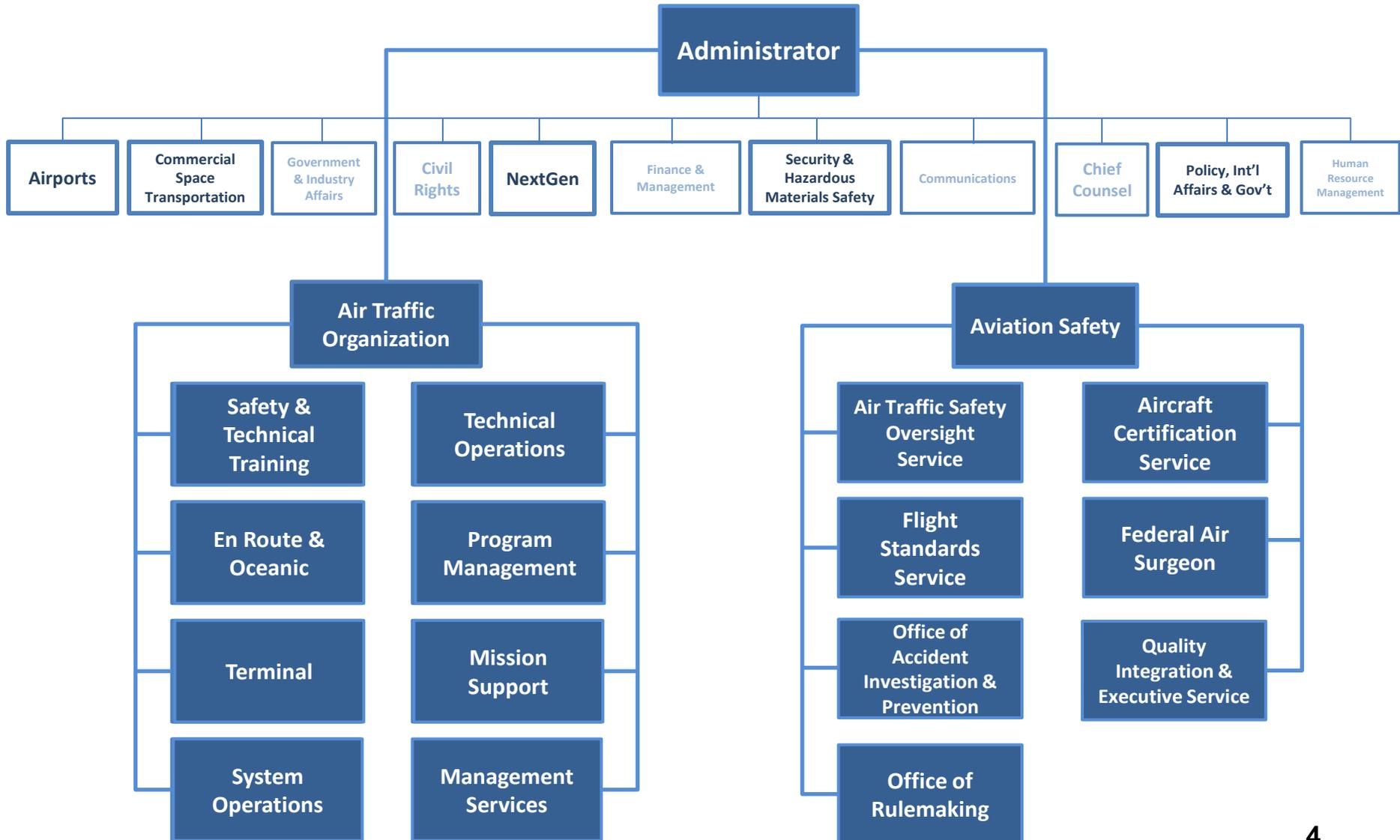
National Airspace System (NAS)

- Approximately 50,000 flights per day
- En Route centers handle 40.5 million aircraft per year
- FAA/contract towers handle:
 - 51.2 million airport operations
 - 39 million instrument operations
- 732 million passenger enplanements
- Over 5,000 civil, public-use airports
- Approximately 33,300 ATO employees
 - More than 15,000 air traffic controllers
 - More than 7,000 technicians and engineers
- 21 ARTCCs, 513 ATCTs, 17 FSSs, 3 AFSSs

NAS Inventory

Discipline	Domains					
	En Route	Terminal	FSS	Support	NDP	Totals
Automation	388	1,859	18	6	8	2,279
Communication	5,517	9,131	3,637	31	606	18,922
Infrastructure	7,905	14,539	592	123	97	23,256
Mission Support	1,238	2,970	142	31	12	4,393
Navigation	2,932	10,409	46	54	14	13,455
Surveillance	461	1,010	0	2	267	1,740
Weather	140	1,845	89	194	0	2,268
Totals	18,581	4,1763	4,524	441	1,004	66,313

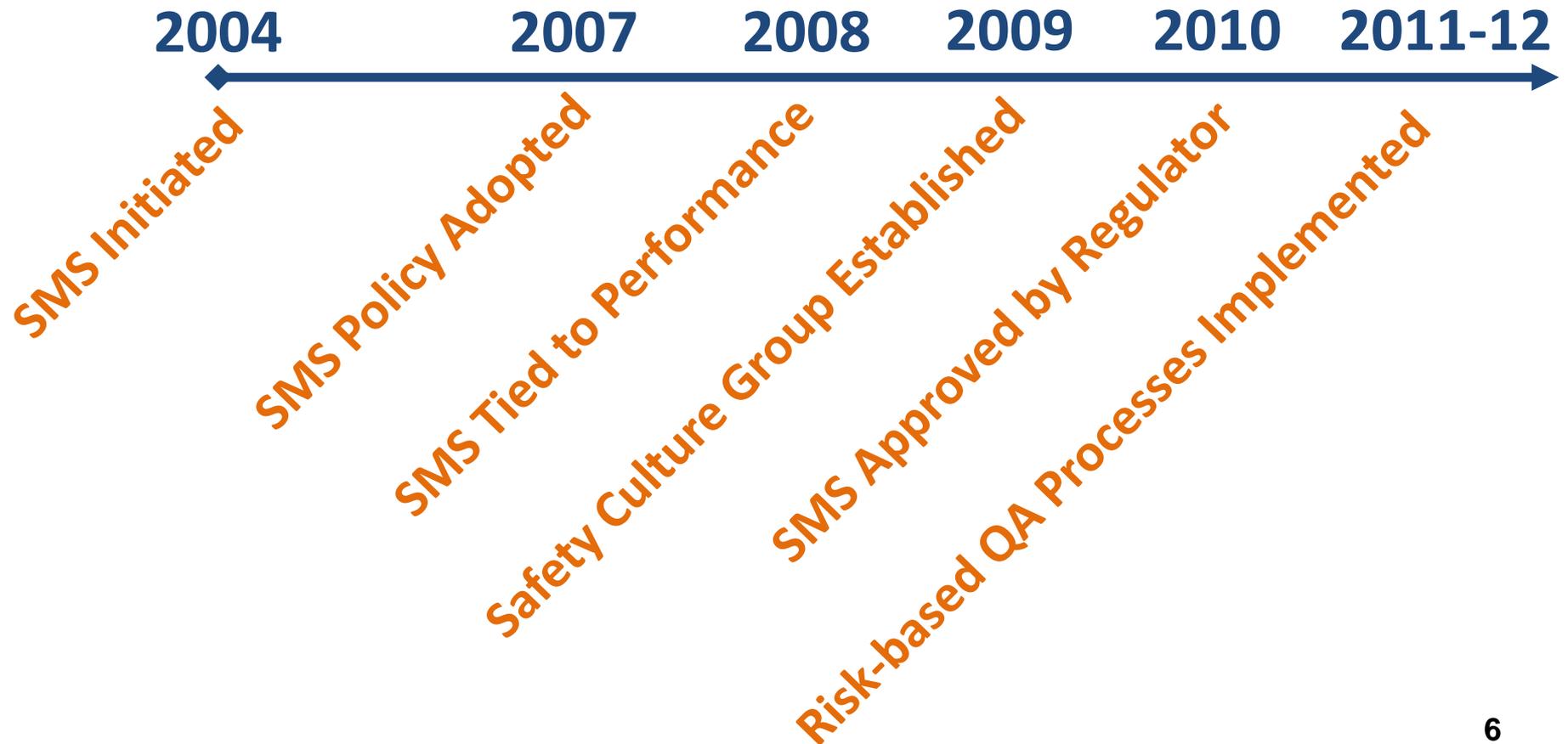
FAA Organization



Public Visibility into Safety Performance



SMS Implementation



International Partnerships



UN: International Civil Aviation Organization (ICAO):
promotes the safe and orderly development of international civil aviation throughout the world



Civil Air Navigation Service Organisation (CANSO):
trade association of Air Navigation Service Providers

Our Goal: Improve Safety

- 1) Improve our safety culture.
- 2) Increase the amount of data collected and analyzed for better understanding.
- 3) Align our approach to safety with our international partners.
- 4) Improve safety performance.



ATO SMS Components

- Safety Policy
- Safety Risk Management
- Safety Assurance
- Safety Promotion



SMS STEW

Key SMS Policy and Guidance

• International

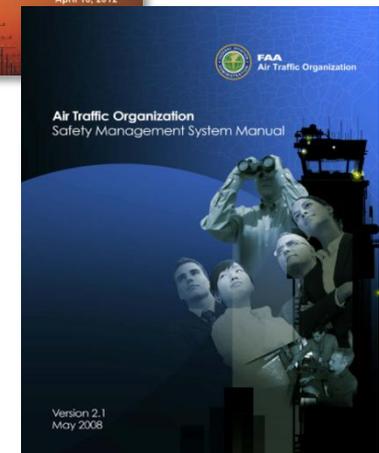
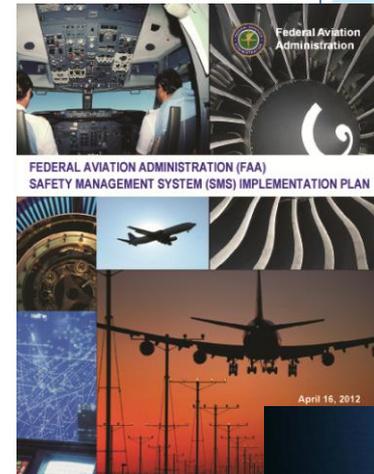
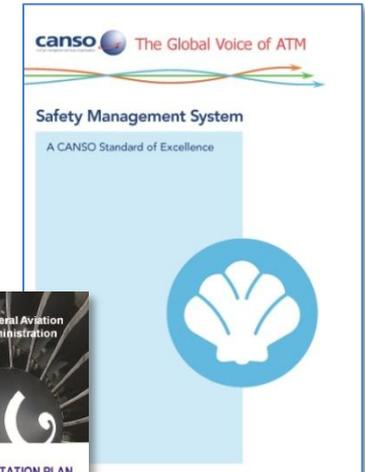
- ICAO Annex 11, *Air Traffic Services*
- ICAO Document 9859, *Safety Management Manual*
- SMS: A CANSO Standard of Excellence

• FAA

- Order 8000.369, *Safety Management System Guidance*
- FAA SMS Implementation Plan
- Order 8040.4, *Safety Risk Management Policy*
- FAA Acquisition Management System Policy

• ATO

- JO 1000.37, *Air Traffic Organization Safety Management System*
- SMS Manual
- Safety Risk Management Guidance for System Acquisitions



Safety Risk Management (SRM): Procedural Hazard and Risk Mitigation

The SRM process leverages data and expertise to properly scope a hazard and then mitigate its risk to an acceptable level of safety.

- **D**escribe the system and its scope
- **I**dentify hazards
- **A**nalyze risk to determine exist controls, potential effects, and the risk level (e.g., low, medium, high) before mitigation
- **A**ssess risk to prioritize hazards for mitigation
- **T**reat risk to determine the appropriate course of action and type of mitigation

Effect On: ↓	Hazard Severity Classification				
	Minimal 5	Minor 4	Major 3	Hazardous 2	Catastrophic 1
ATC Services	<ul style="list-style-type: none"> - A minimal reduction in ATC services - CAT D RI - PE or OD 	<ul style="list-style-type: none"> - A slight reduction in ATC services - Low RAE - CAT C RI or OE 	<ul style="list-style-type: none"> - A partial loss of ATC services - Medium RAE - CAT B RI or OE 	<ul style="list-style-type: none"> - Unplanned ATC Zero - High RAE - CAT A RI or OE 	<ul style="list-style-type: none"> - Ground Collision - Mid-Air Collision - CFIT
Flight Crew	<ul style="list-style-type: none"> - Flight crew receives TCAS Traffic Advisory (TA) informing of nearby traffic - Minimal effect on operation of aircraft 	<ul style="list-style-type: none"> - Potential for Pilot Deviation (PD) due to TCAS Preventive Resolution Advisory (PRA) advising crew not to deviate from present vertical profile - Reduction of functional capability of aircraft but overall safety not impacted (e.g., normal procedures as per AFM) - Event within operating limitations, emergency procedures used, minor human errors/factors, and minor ground safety issues 	<ul style="list-style-type: none"> - PD due to response to TCAS Corrective Resolution Advisory (CRA) issued advising crew to take vertical action to avoid developing conflict with traffic - Reduction in safety margin or functional capability of the aircraft, requiring crew to follow abnormal procedures as per AFM 	<ul style="list-style-type: none"> - Near Mid-Air Collision (NMAC) results due to proximity of less than 500 feet from another aircraft, or a report is filed by pilot or flight crew member that a collision hazard existed between two or more aircraft. - Reduction in safety margin and functional capability of the aircraft requiring crew to follow emergency procedures as per AFM 	<ul style="list-style-type: none"> - Ground Collision - Mid-Air Collision - CFIT - Failure conditions that would prevent continued safe flight and landing
Flying Public	<ul style="list-style-type: none"> - Minimal injury or discomfort to Persons on Board (POB) 	<ul style="list-style-type: none"> - 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 greater than zero to less or equal to 10% of POB 	<ul style="list-style-type: none"> - Physical distress to passengers (e.g., abrupt evasive action; severe turbulence causing unexpected aircraft movements) - Minor injury to greater than 10% of POB 	<ul style="list-style-type: none"> - Serious injury to POB 	<ul style="list-style-type: none"> - Fatal injuries to POB

Likelihood Table – Quantitative

	Operations: Expected Occurrence Rate (Per operation/Flight hour/Operational hour*)
	Quantitative (ATC / Flight Procedures / Systems Engineering)
Frequent A	(Probability) \geq 1 per 1000
Probable B	1 per 1000 > (Probability) \geq 1 per 100,000
Remote C	1 per 100,000 > (Probability) \geq 1 per 10,000,000
Extremely Remote D	1 per 10,000,000 > (Probability) \geq 1 per 1,000,000,000
Extremely Improbable E	1 per 1,000,000,000 > (Probability) \geq 1 per 10^{14}

*It is important to note that the close correlation between flight hours and operations is entirely coincidental; average flight time is roughly two hours, and each flight has about two Tower and two TRACON operations. The two numbers are not interchangeable.

Risk Assessment Matrix

Severity \ Likelihood	Minimal 5	Minor 4	Major 3	Hazardous 2	Catastrophic 1
Frequent A	Low Risk	Medium Risk	High Risk	High Risk	High Risk
Probable B	Low Risk	Medium Risk	High Risk	High Risk	High Risk
Remote C	Low Risk	Low Risk	Medium Risk	High Risk	High Risk
Extremely Remote D	Low Risk	Low Risk	Low Risk	Medium Risk	High Risk
Extremely Improbable E	Low Risk	Low Risk	Low Risk	Low Risk	Medium Risk *

High Risk
Medium Risk
Low Risk

* Unacceptable with single-point and/or common-cause failures

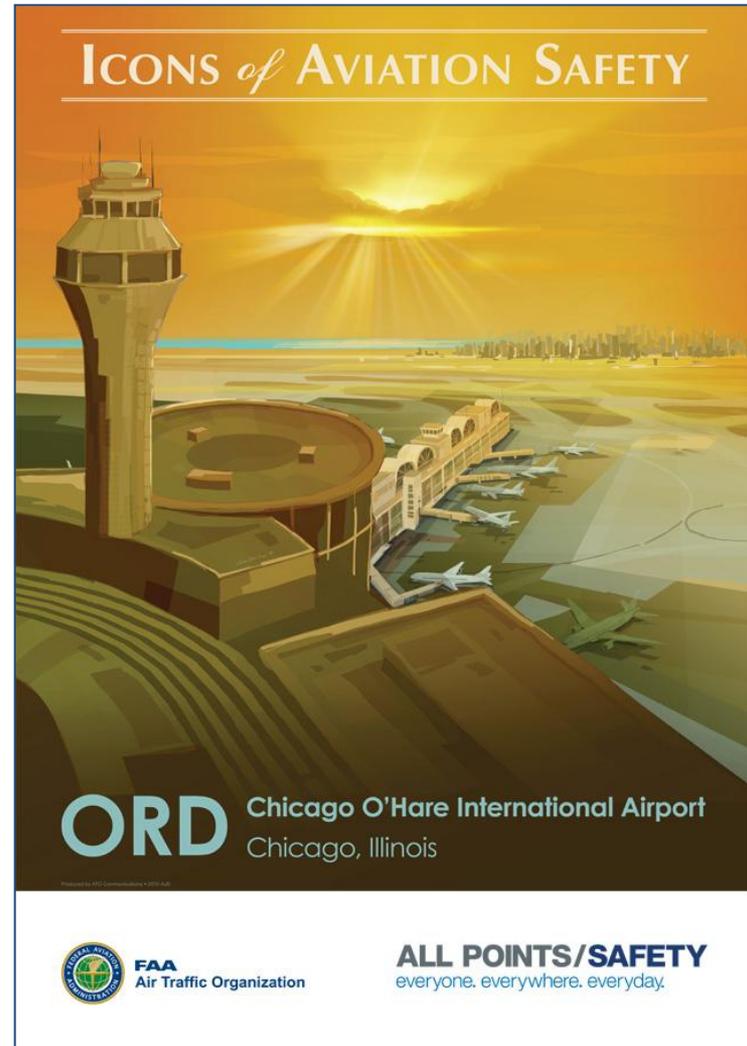
SRM and Safety Assurance: Seeking Answers

- Was the risk mitigated as expected?
 - Have the mitigations been implemented?
 - Have the mitigations proven effective?

Quality Assurance

Safety Promotion

- Disseminate safety information
- Promote safety culture
 - All Points Safety campaign
 - Just culture pilot program
 - International outreach and collaboration
 - Recurrent training workshops



ATO Safety Strategy



We are listening to our dedicated front-line employees.



We have deployed automated tools that collect safety-critical data.



We have improved the analytical capabilities necessary to critically assess NAS safety performance.



We have embraced correction as a means to mitigate risk.



We are listening to our
dedicated front-line employees.

- Voluntary Safety Reporting
- Mandatory Occurrence Reporting
- Crew Resource Management

Voluntary Safety Reporting Systems



We have deployed automated tools that collect safety-critical data.

- Traffic Analysis and Review Program
- Operational Error Detection Program
- Digital Voice Recording



We have improved the analytical capabilities necessary to critically assess NAS safety performance.

- Comprehensive Electronic Data Analysis and Recording
- Air Traffic Quality Assurance Database
- Risk Analysis Process
- SRM Tracking System

Analyzing NAS Safety Performance

FROM: Tracking, analyzing, and counting operational errors as measurement of safety performance

TO: Identifying existing risks and measuring safety performance based on their mitigation

TOWARD: Examining normal operations for exposure to potential hazards



We have embraced correction as
a means to mitigate risk.

- Top 5 Safety Hazards
- Runway Safety Program

Top 5 Safety Hazards

Challenges and Lessons Learned

- Safety culture and continuous improvement
 - Executive support
 - Priorities
 - Actions
 - \$\$\$\$
 - Other Resources
 - Operational unit ownership and bottom-up approach
 - Each operational unit responsible for implementing and continuously improving the SMS
 - Disparities in resource allocation, prioritization, and in achieving SMS goals