

In-Time Safety Management for Part 139 Airports

August 2, 2024



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System-Wide Safety Project
Airspace Safety and Operations Program

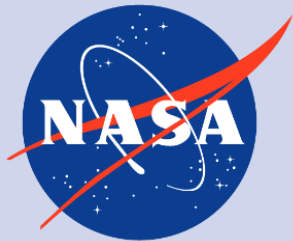
An In-time Aviation Safety Management System (IASMS) Concept of Operations for Part 139 Airports

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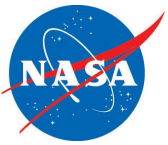
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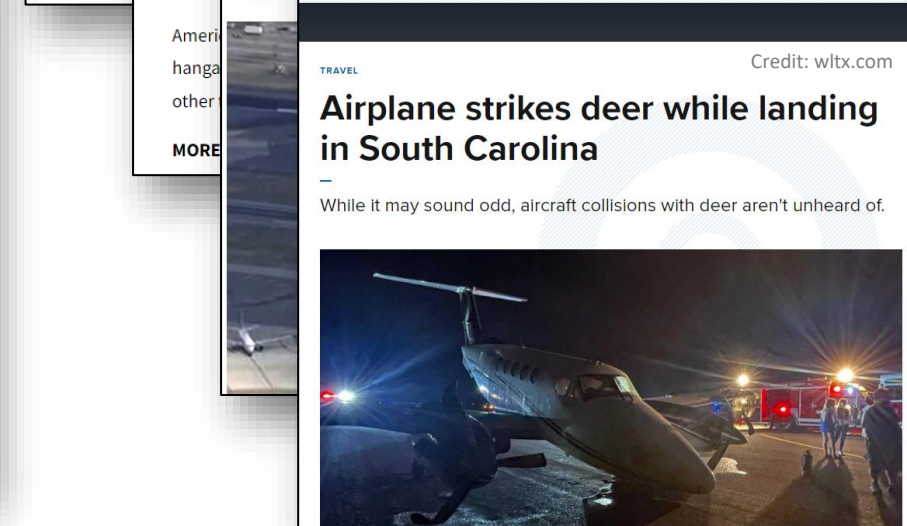
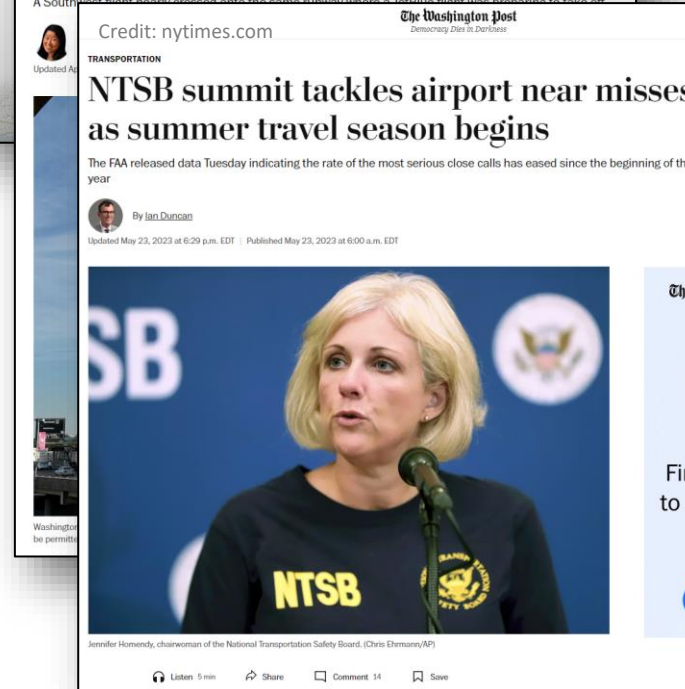


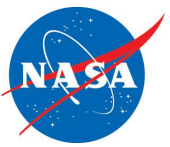
Recent Airport Safety Events



System Wide Safety

- Demand for air travel expected to continue growing
- Safety systems will need to be more responsive and effective to a wide array of hazards



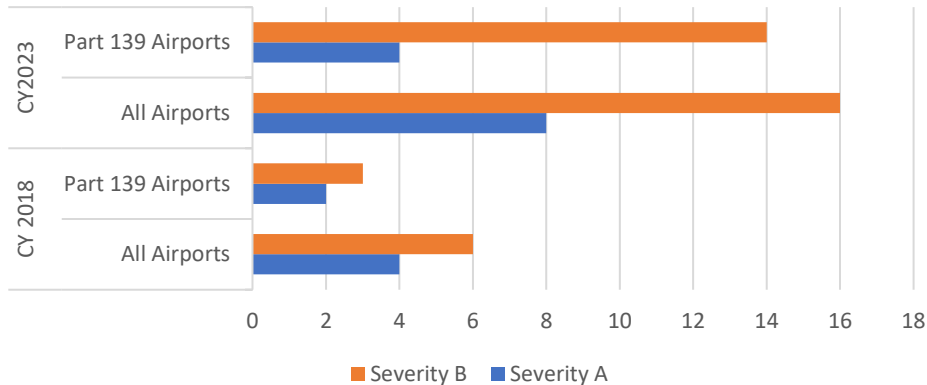


Runway Incursion By Severity and Type

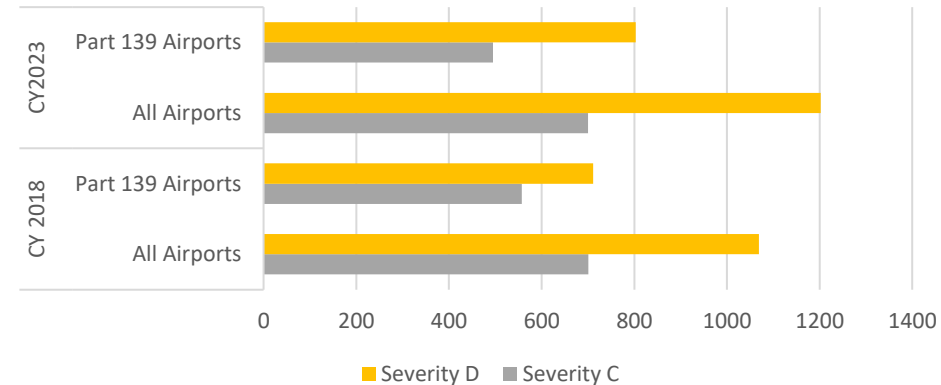


System Wide Safety

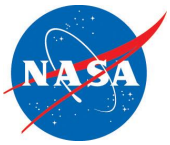
Severity A and B Runway Incursions: 2018 vs 2023



Severity C and D Runway Incursions: 2018 vs 2023



- Category A – A serious incident in which a collision was narrowly avoided.
- Category B – An incident in which separation decreases, and there is a significant potential for collision (requiring time-critical corrective/evasive response to avoid a collision).
- Category C – An incident characterized by having ample time and/or distance to avoid a collision.
- Category D – An incident that meets the definition of runway incursion (e.g., incorrect presence of a single vehicle/person/aircraft on the protected area of a surface designated for the landing and take-off of aircraft) but has no immediate safety consequences.



FAA Final Rule for Part 139 SMS



System Wide Safety

- SMS Advisory Circular 150/5200-37A: Some part 139 airports are required to develop, implement, maintain and adhere to a safety management system
 - Intended to cover 90% of passenger enplanements
 - Airport Certification Manual:
 - Map identifying terrain features
 - Movement area description for reducing damage due to: runway undershoot, overshoot or excursion from a runway or unintentional departure from a taxiway, procedures for conducting a self-inspection program
 - Wildlife hazard management
 - Emergency Management plan:
 - Aircraft accidents
 - Natural disasters
 - Terrorism
 - Fires
 - Hazardous materials
 - Water rescue
 - Power failure



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

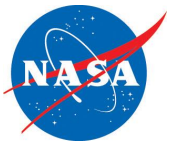
Subject: Safety Management Systems for
Airports

Date: 2/16/2023

Initiated By: AAS-300

AC No: 150/5200-37A

Change:



Part 139 Airports By Classification

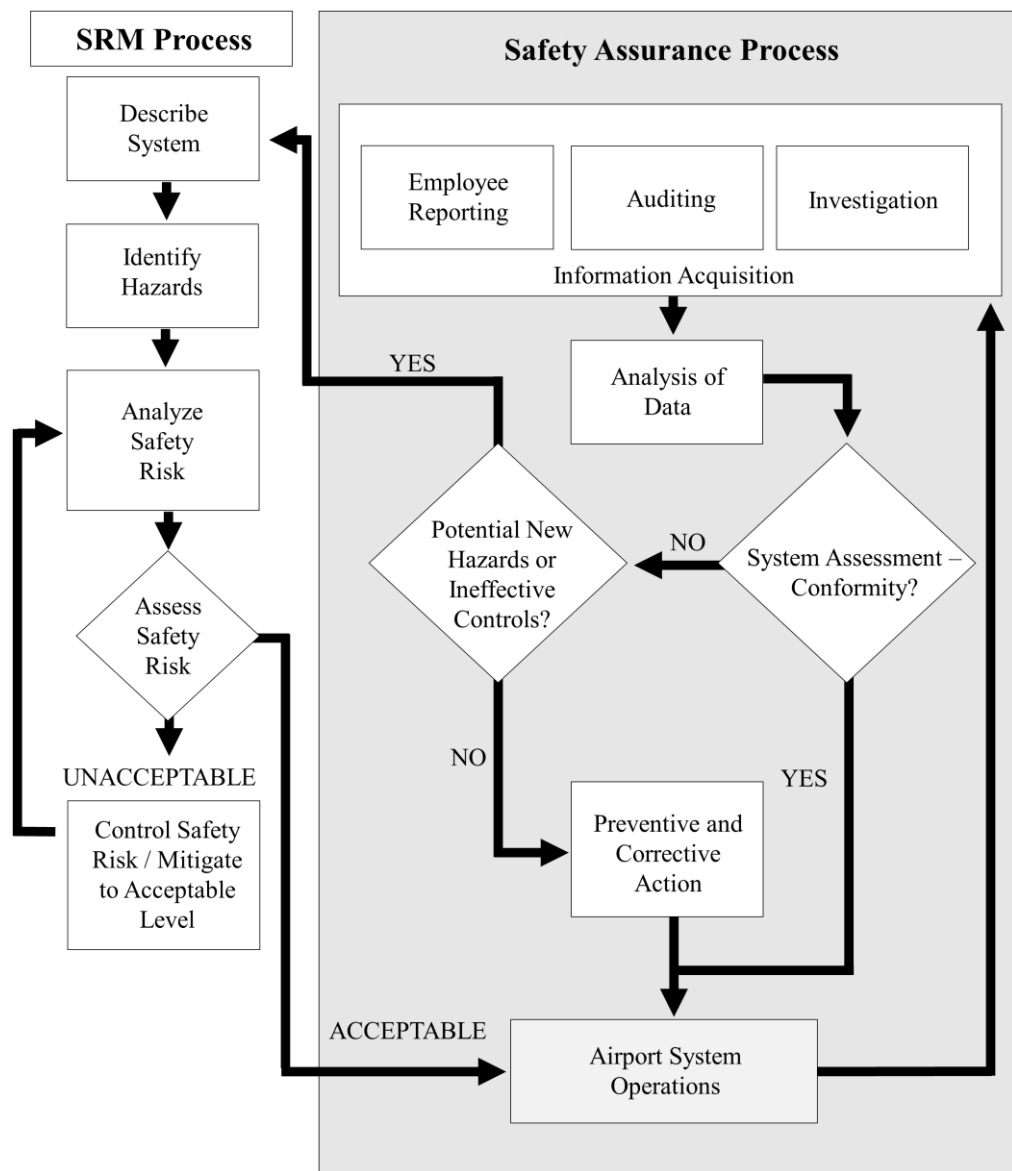


System Wide Safety

Airport Class	Description	Number	ATC Tower	SMS
Class I	Scheduled and unscheduled operations of large air carrier aircraft having 30 or more seats and scheduled small air carrier aircraft having 10–30 seats	415	326	237
Class II	Scheduled operations of small air carrier aircraft having 10–30 seats, and unscheduled large air carrier aircraft having 30 or more seats.	10	3	2
Class III	Scheduled operations of small air carrier aircraft having 10–30 seats	13	3	0
Class IV	Unscheduled large air carrier aircraft having 30 or more seats	79	55	31
Total Part 139 Airports		517	387	270



FAA SMS for Part 139 Airports



- Safety Risk Management (SRM) ensures hazards, and their associated risks, are identified, analyzed, and assessed so that necessary mitigations can be established
- Safety Assurance (SA) processes analyze operational data to evaluate whether the mitigations are having the desired effect

SRM and SA processes have proven to be effective in a wide array of applications *but.....*

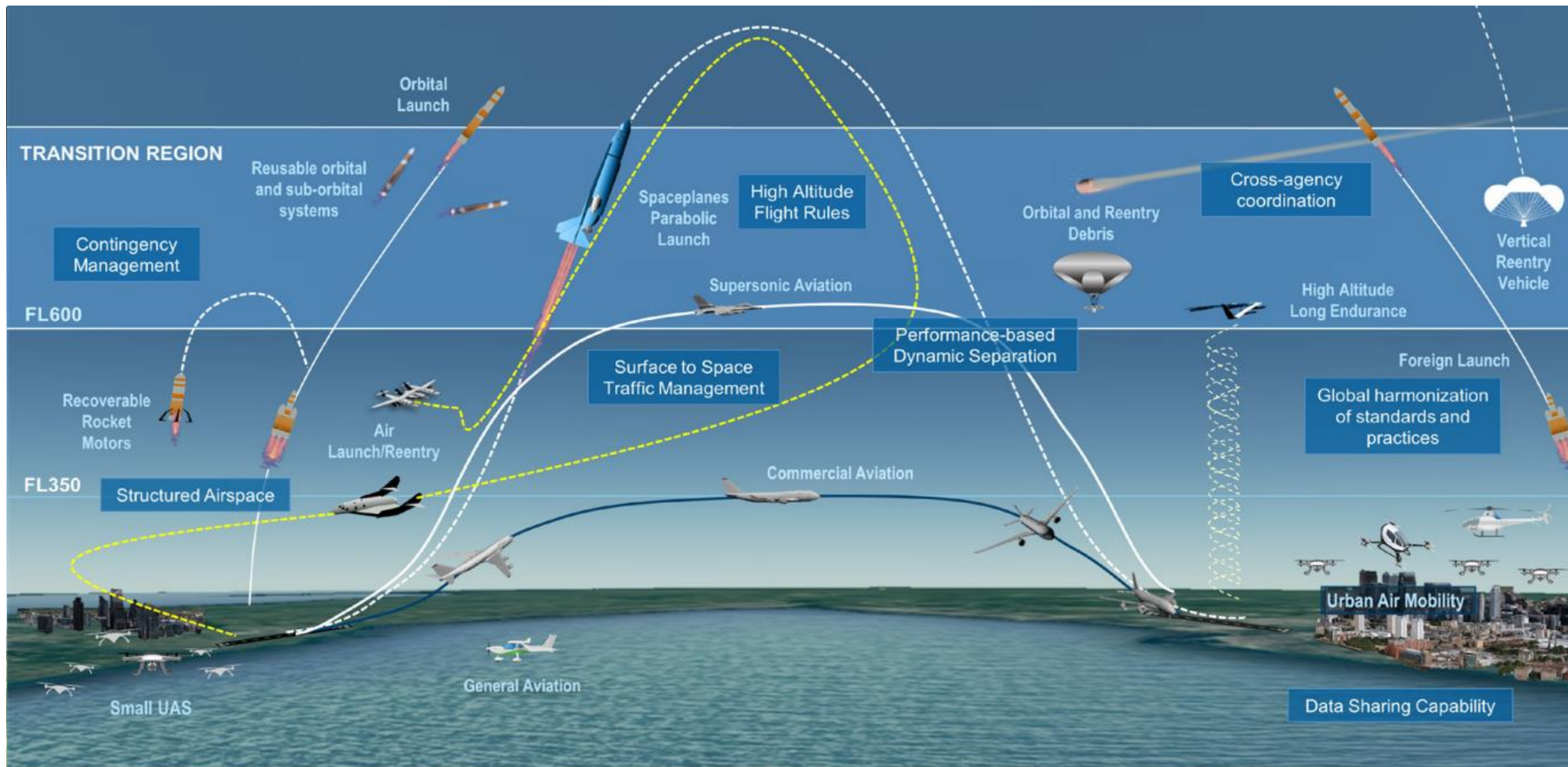




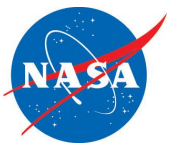
Future Air Transportation System



System Wide Safety



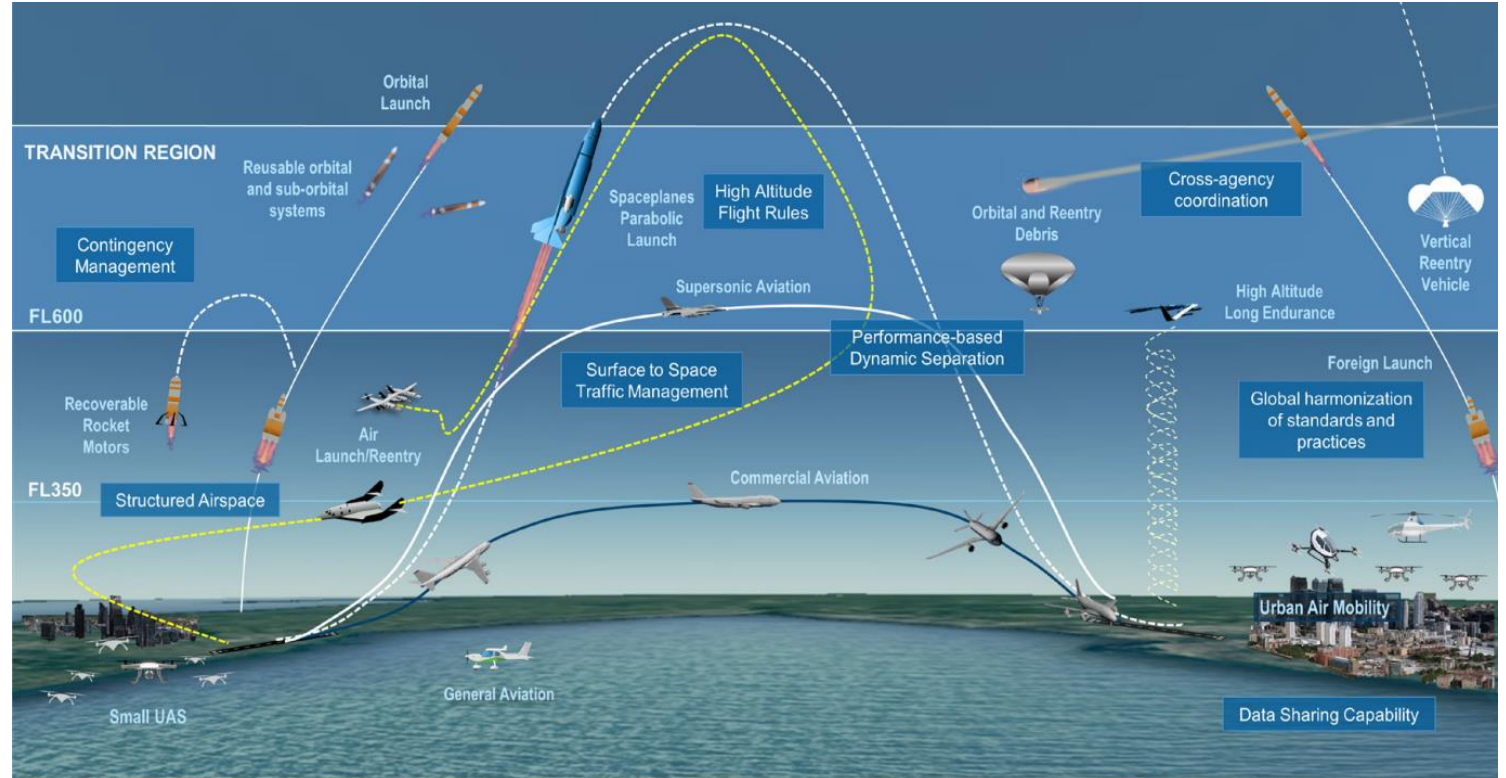
Credit: FAA



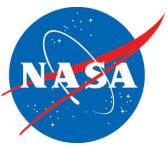
FAA 2035 Vision (Info-Centric NAS)



System Wide Safety



Credit: FAA



NASA 2050 "Sky for All"*



System Wide Safety

* White Paper Now Available



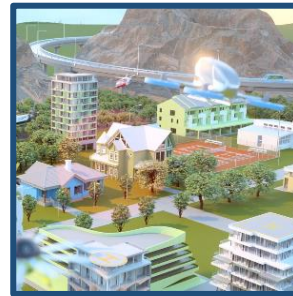
Achieve Scalable, Secure Digital Aviation System



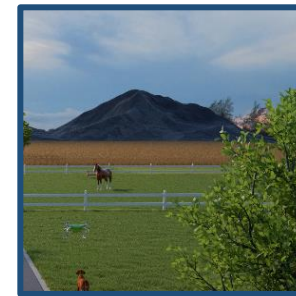
Assure Safety As Operations Diversify And Grow



Design For Sustainability and Resiliency



Enable Equitable Access For Diverse Operations



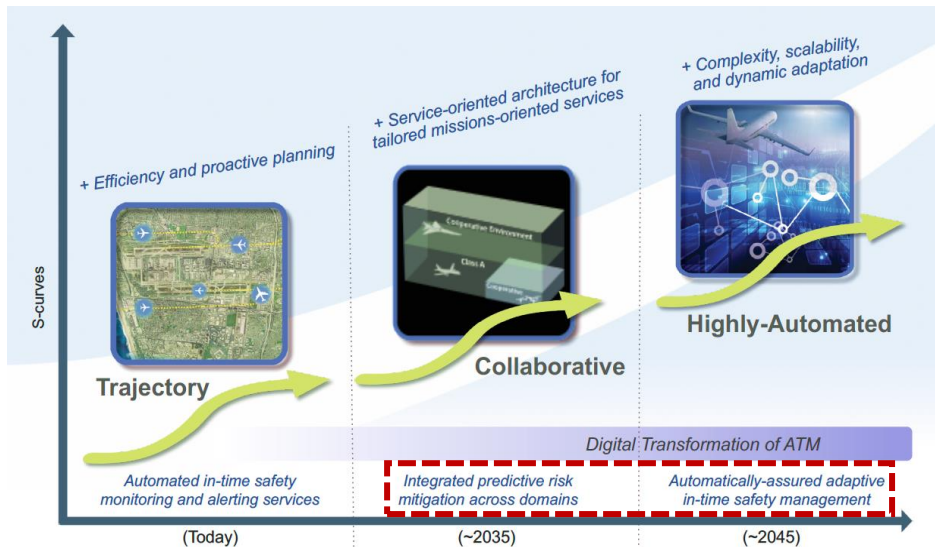
Enhance Quality Of Life



Promote And Empower Operator Mobility



Transform Existing Aviation Ecosystem



SKY FOR ALL

<https://www.nari.arc.nasa.gov/skyforall/>

Outlines need for evolution of the existing
Safety Management System








In-Time Aviation Safety Management
System (IASMS)

Identifies 4 Fundamental System
Element Development Areas:

1. **Concept of Operations and Risk Prioritization**
2. **System Monitoring**
3. **System Analytics**
4. **Mitigation and Implementation**

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This PDF is available at <http://nap.edu/24962> SHARE    



In-Time Aviation Safety Management: Challenges and Research for an Evolving Aviation System (2018)

DETAILS

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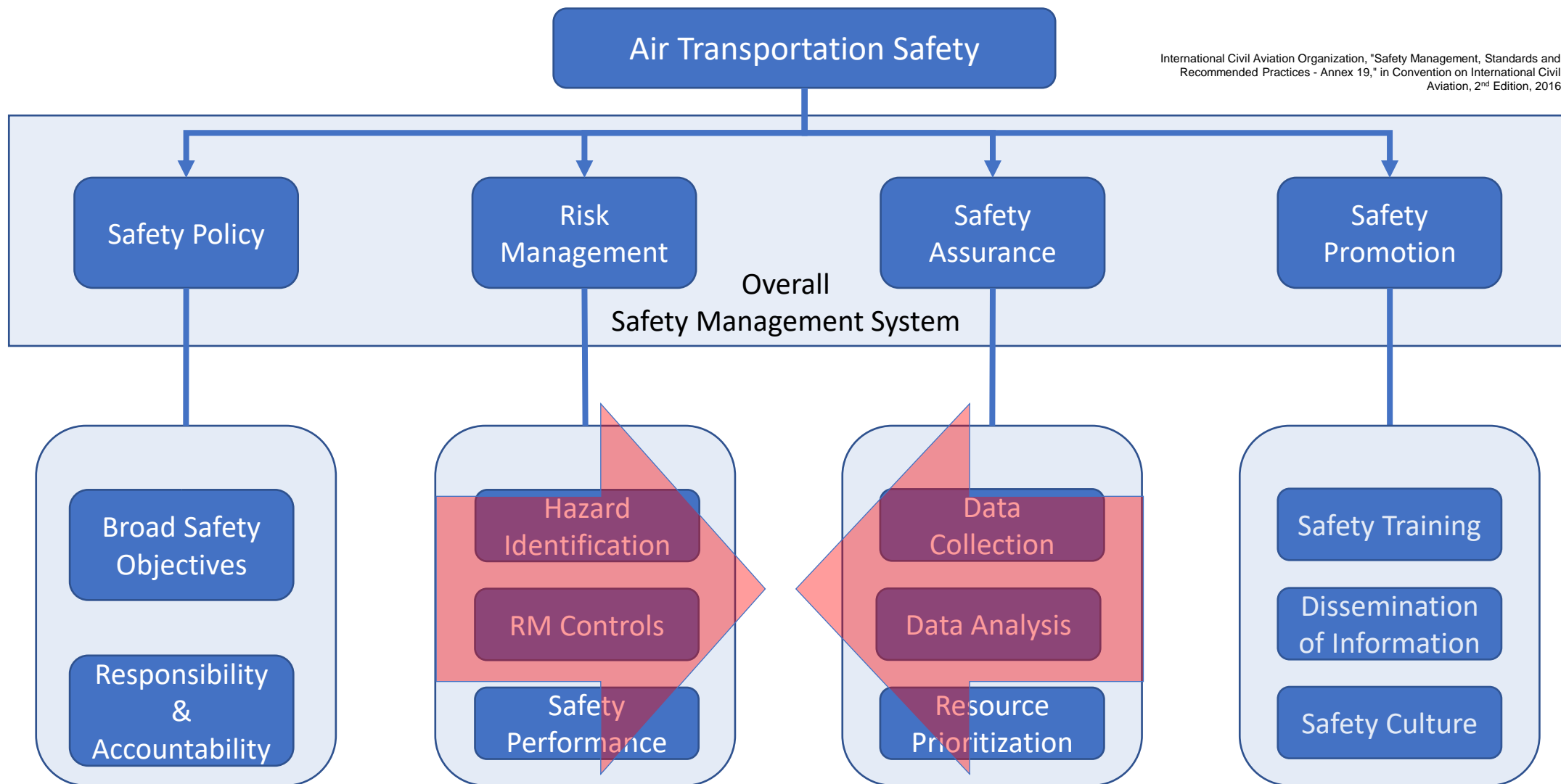
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International Civil Aviation Organization, "Safety Management, Standards and Recommended Practices - Annex 19," in Convention on International Civil Aviation, 2nd Edition, 2016



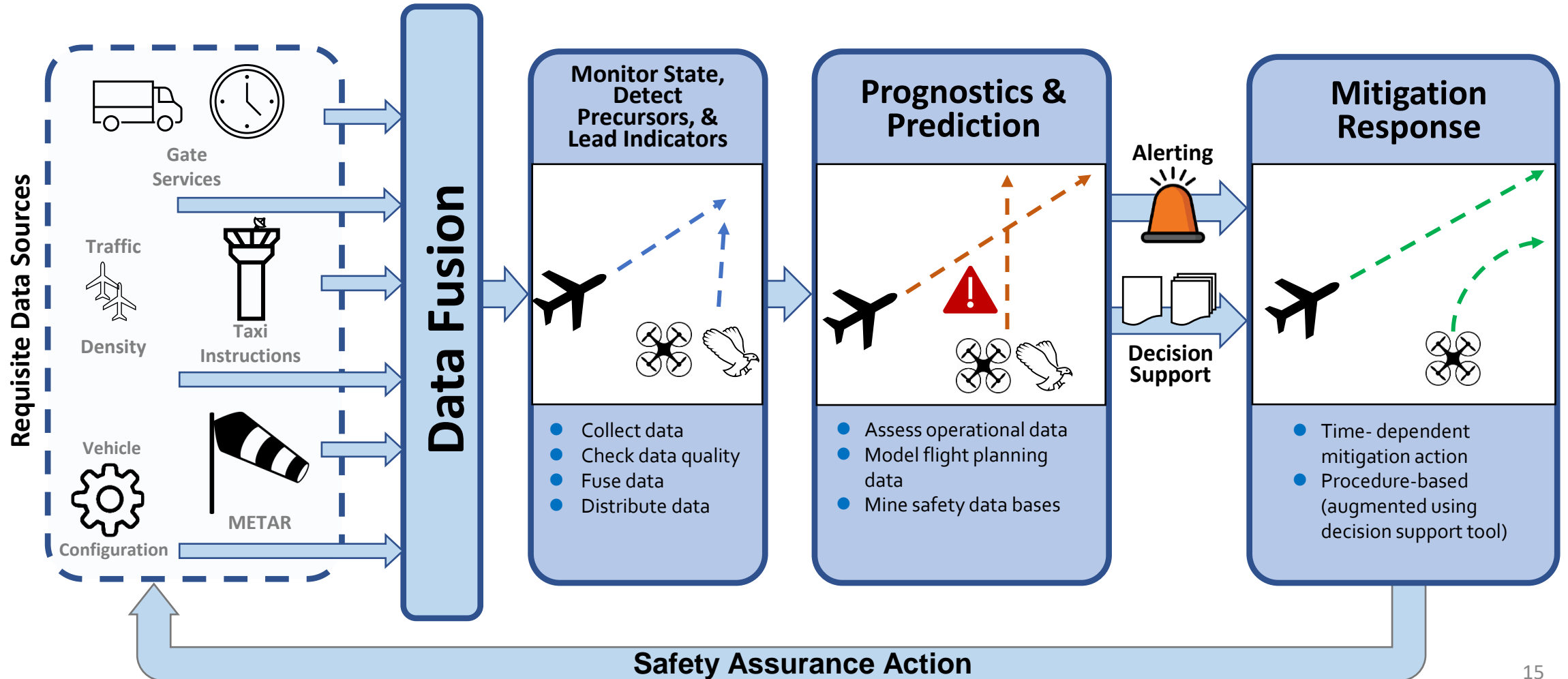
Risk Management and Safety Assurance functions must merge to identify and mitigate emergent risks and hazards much more rapidly than today.

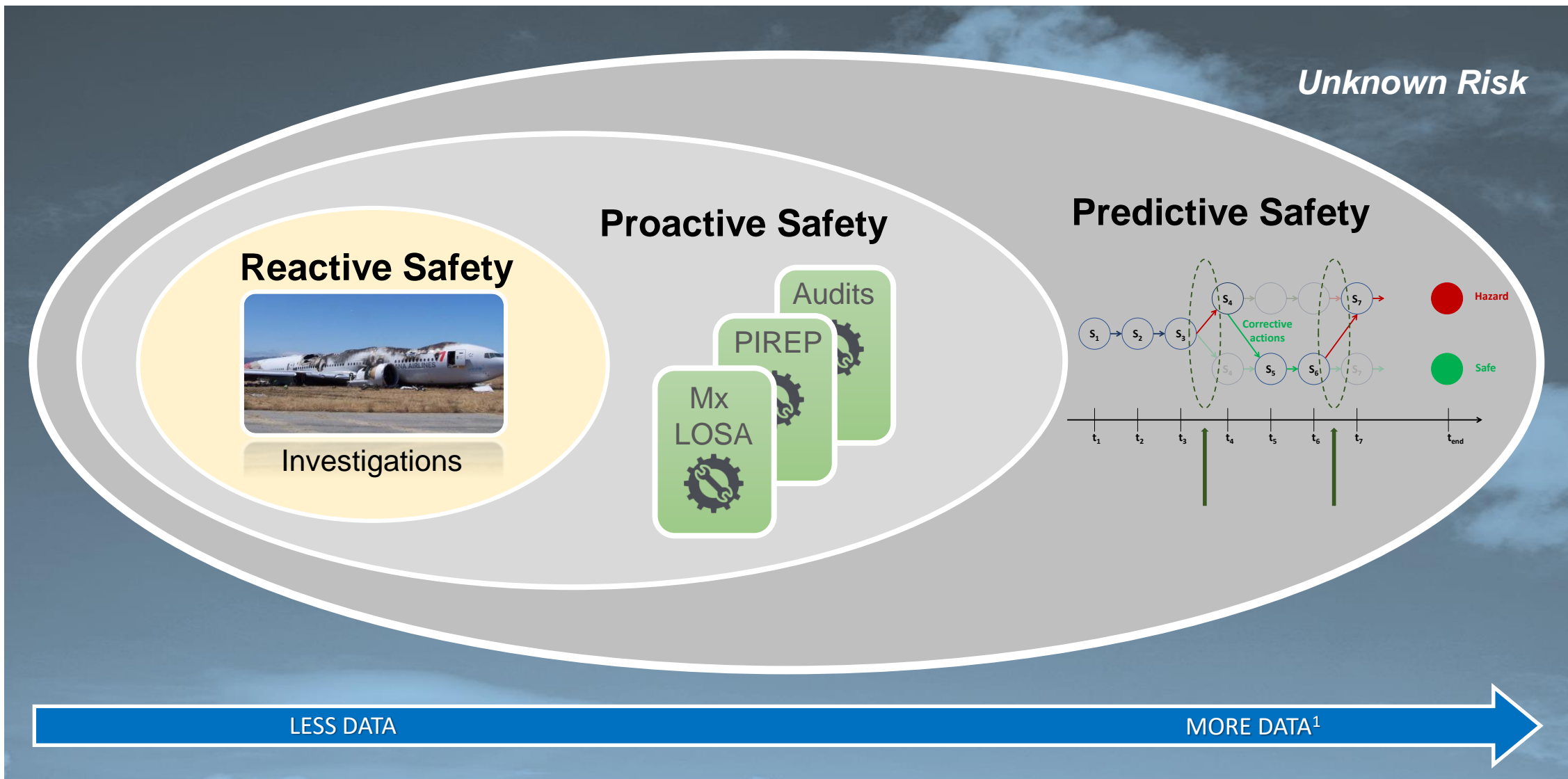
Monitor

Assess

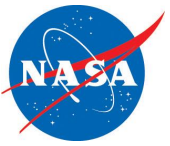
Mitigate

National Airspace System → Data → NAS System State → Elevated Risk State → Safety Assurance Action





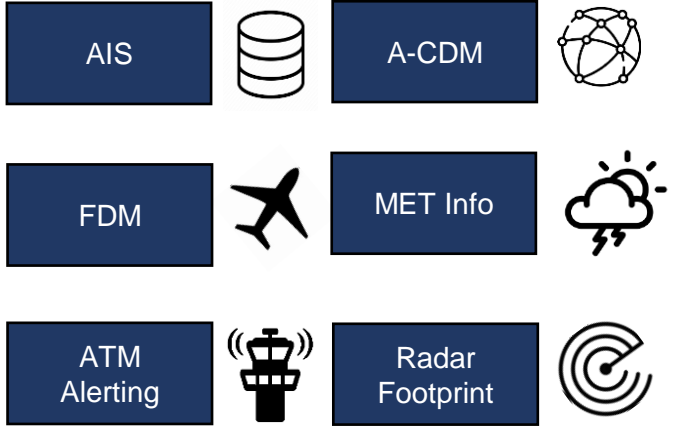
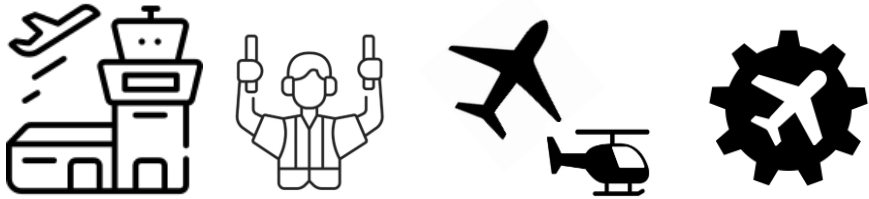
¹More data volume, complexity, and types



Predictive Safety Intelligence



System Wide Safety



Machine Monitored

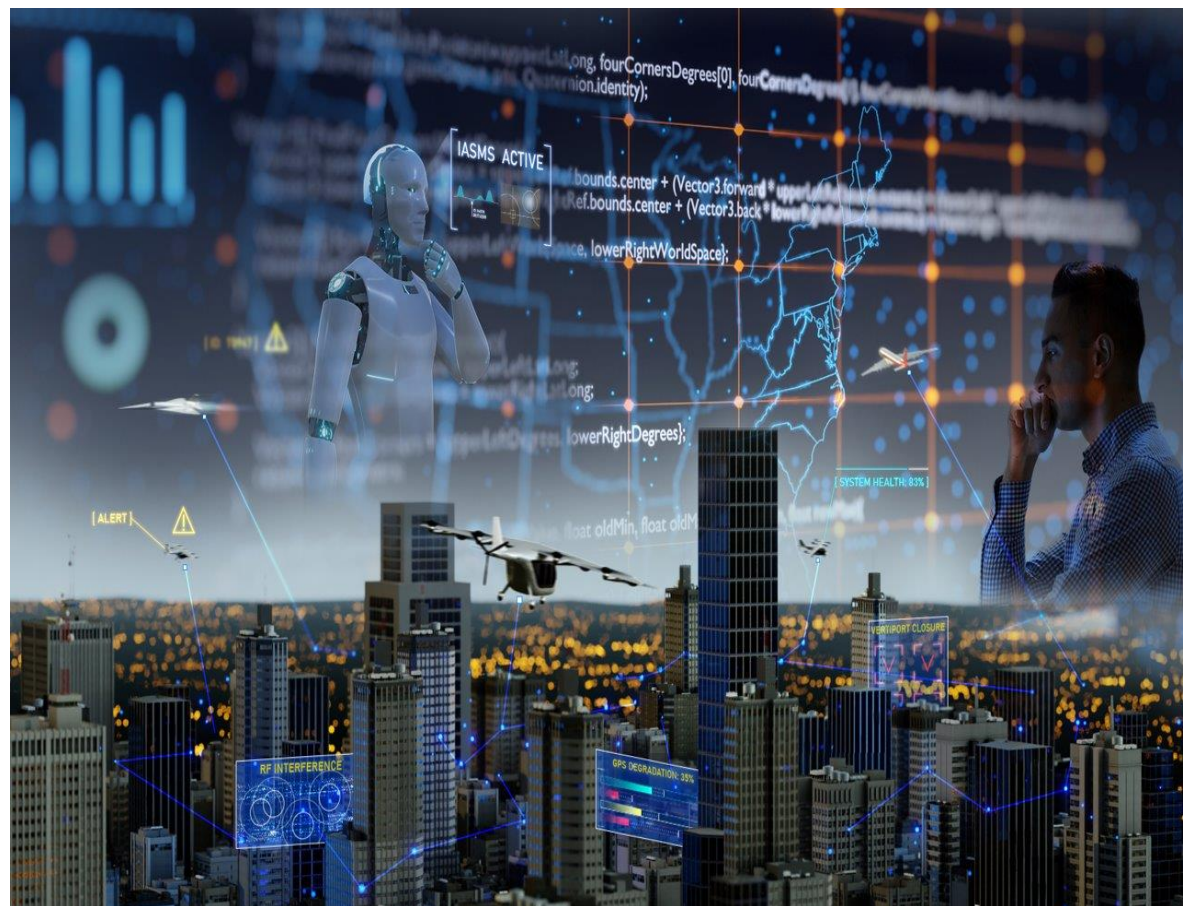


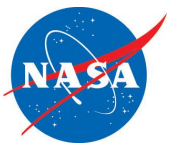
Human Monitored

¹ Adapted from: Safety Intelligence Initiative One Step Forward into Advanced Safety Management Systems. ALG Transportation Infrastructure & Logistics. White Paper. November 2017. p. 3.

What Is (and Is Not) an IASMS

- It **IS** a tailored set of integrated safety technologies that monitor, assess, and mitigate operational risks
- It **IS** an advanced implementation of the ICAO SMS framework that addresses risks “in-time” to prevent accidents and incidents
- It is **NOT** a singular design, on-size-fits all monolithic system-of-systems
- It **IS** intended to be:
 - In-Time
 - Effective
 - Scalable
 - Modular/Interoperable
 - Assured
 - Teaming
 - Value





Design and Operational Safety Assessments



System Wide Safety



Credit: NASA

Commercial Space Launch



Credit: NASA

Urban Air Mobility



Credit: NASA

Upper Class E



Credit: Dura-Ace²

MRO



Credit: Akradecki³

Medical



Credit: FAA²

General Aviation



Credit: loc.gov²

Manufacturer



Credit: FAA

Commercial Aviation (Part 121)



Credit: NTSB

On-Demand (Part 135)



Credit: NASA

Vertiports/Vertiplex



Credit: Rama³

Military



Credit: FAA

International



Credit: FAA

Data & Protection

Active Assessments



Credit: formulaone (Flickr)¹

Part 139 Airports



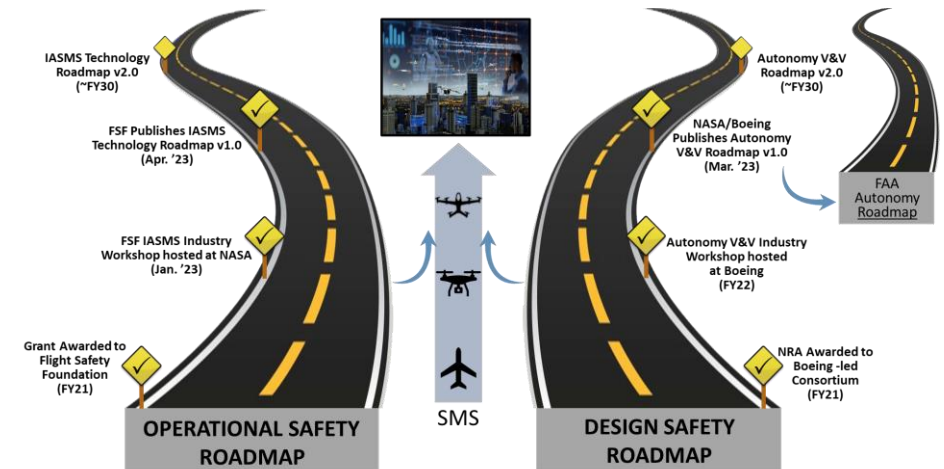
Credit: FAA

Air Traffic Management



Credit: NASA

Disaster Response



Credit: NASA

Completed Assessments

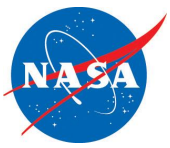
Published Roadmaps

¹ Public domain image (unlimited use license)

² Public domain image (unlimited use license). <https://www.loc.gov/item/2017881052/>

³ Wikimedia Commons

NOTE: If you want to combine slides 19 and 20 into 1 slide



IASMS Assessment Focus To Date



System Wide Safety



Credit: NASA

Commercial Space Launch



Credit: NASA

Advanced Air Mobility/Urban Air Mobility



Credit: NASA

Upper Class E



Credit: FAA

Commercial Aviation (Part 121)



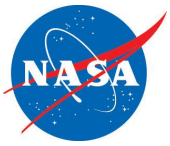
Credit: NTSB

On-Demand (Part 135)



Credit: NASA

Vertiports/Vertiplex



IASMS Current & Planned Assessment Focus



System Wide Safety



Credit: formulaone (Flickr)

Part 139 Airports

Current Focus



Air Traffic Management



Manufacturer



MRO



Disaster Response



Medical



General Aviation



Military

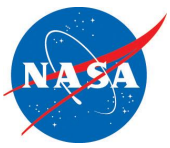


International



Data & Protection

Future Focus



Part 139 Safety Challenges

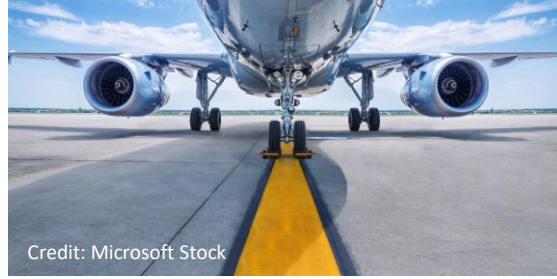


System Wide Safety



Credit: Microsoft Stock

Wildlife Strikes



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Runway Excursions



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Runway Incursions



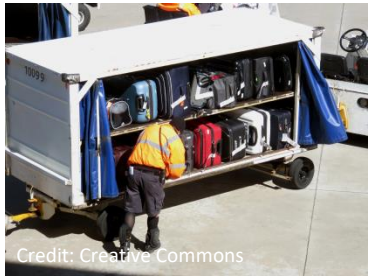
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Near Misses



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Un-stabilized Approach



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Surface Collisions



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Weather Hazards



Credit: Creative Commons

FOD



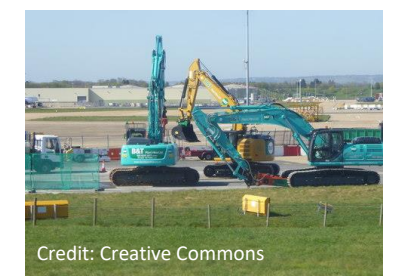
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Equipment Failures



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Unauthorized Drones



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Surface Obstacles



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Natural Disasters



Credit: FAA

Intentional Threats



Credit: Creative Commons

Fuel Spillage



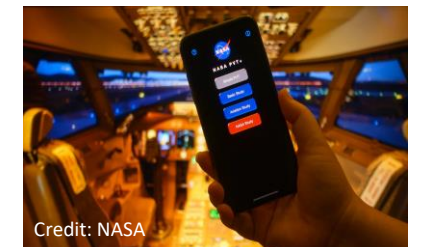
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Mechanical Hazards



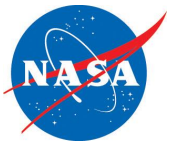
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Structural Hazards



Credit: NASA

Personnel Fatigue



Currently Available Data Sources



System Wide Safety

Wildlife Strike Database



Credit: Microsoft Stock

Wildlife Strikes



Credit: Microsoft Stock

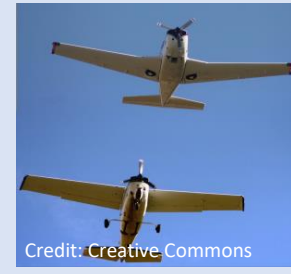
Runway Excursions

ASDE-X
SWSL
RIPS
ASRS



Credit: Creative Commons

Runway Incursions



Credit: Creative Commons

Near Misses

PAPI



Un-stabilized Approach

LVO/SMGCS
SURF-A



Credit: Creative Commons

Surface Collisions

LVO/SMGCS
RVR
LLWAS



Weather Hazards

FAA FOD
Program



Credit: Creative Commons

FOD



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Equipment Failures

RID



Unauthorized Drones

NOTAMS



Surface Obstacles

Emergency Plans



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Natural Disasters



Credit: FAA

Intentional Threats



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Fuel Spillage



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Mechanical Hazards



Credit: Creative Commons

Structural Hazards

PVT+



Credit: NASA

Personnel Fatigue



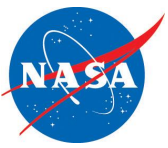
Currently Available Systems



System Wide Safety

- Runway Safety Technologies
 - Runway Status Lights (RWSL)
 - Airport Surface Detection Equipment, Model X (ASDE-X)
 - ASDE-X and ADS-B Airport Surface Surveillance Capability (ASSC)
 - Taxiway Arrival Prediction (ATAP)
 - Electronic Flight Bag (EFB) with Moving Map Displays
 - Runway Incursion Mitigation (RIM)
 - Runway Safety Areas
 - Airport Hot Spot Standardization
 - Arrival Alert Notices
 - Automated Closure Notice Diagrams
- Special Aircraft Authorization Required (SAAR) for Category II or III Instrument Landing System (ILS) procedures
- Runway Visual Range (RVR)
- Low-Level Wind Shear Alert System (LLWAS)
- Low Visibility Operations/Surface Movement Guidance and Control Systems (LVO/SMGCS)
- Flight vision systems - Enhanced Vision Systems (EVS), Synthetic Vision Systems (SVS), Combined Vision Systems (CVS), and Enhanced Flight Vision Systems (EFVS)
- Precision Approach Path Indicator (PAPI) lights
- Juneau Airport Wind System (JAWS)

Current systems/data sources are varied in how proactive/predictive they are and do not provide integrated picture of risk



Opportunities for Future Systems



System Wide Safety

Active Surveillance
Migration Modeling



Credit: Microsoft

Wildlife Strikes

Realtime Energy State
Prediction



Credit: Microsoft

Runway Excursions

RIPS



Credit: Creative Commons

Runway Incursions



Credit: Creative Commons

Near Misses



Un-stabilized Approach

Surface Movement
Prediction



Credit: Creative Commons

Surface Collisions



Weather Hazards

Active
Surveillance



Credit: Creative Commons

FOD



Credit: Creative Commons

Equipment Failures

RID
Rebroadcast



Credit: istockphoto.com

Unauthorized Drones

Airport Digital
Twins



Surface Obstacles

Airport Digital
Twins



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Natural Disasters



Credit: FAA

Intentional Threats



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Fuel Spillage

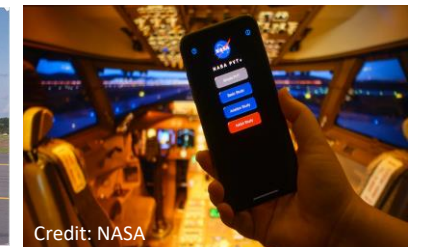


Mechanical Hazards



Credit: Creative Commons

Structural Hazards

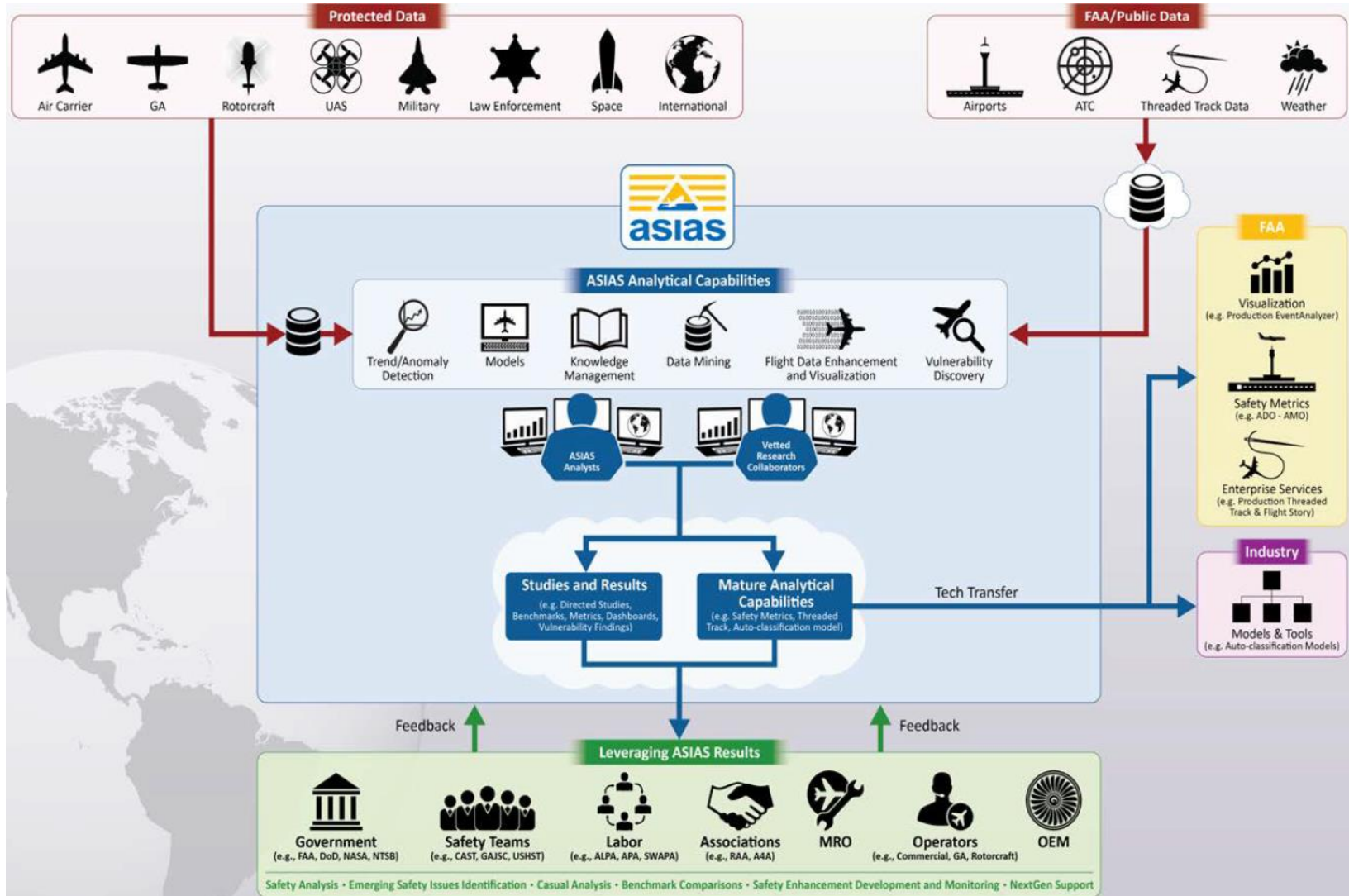


Credit: NASA

Personnel Fatigue

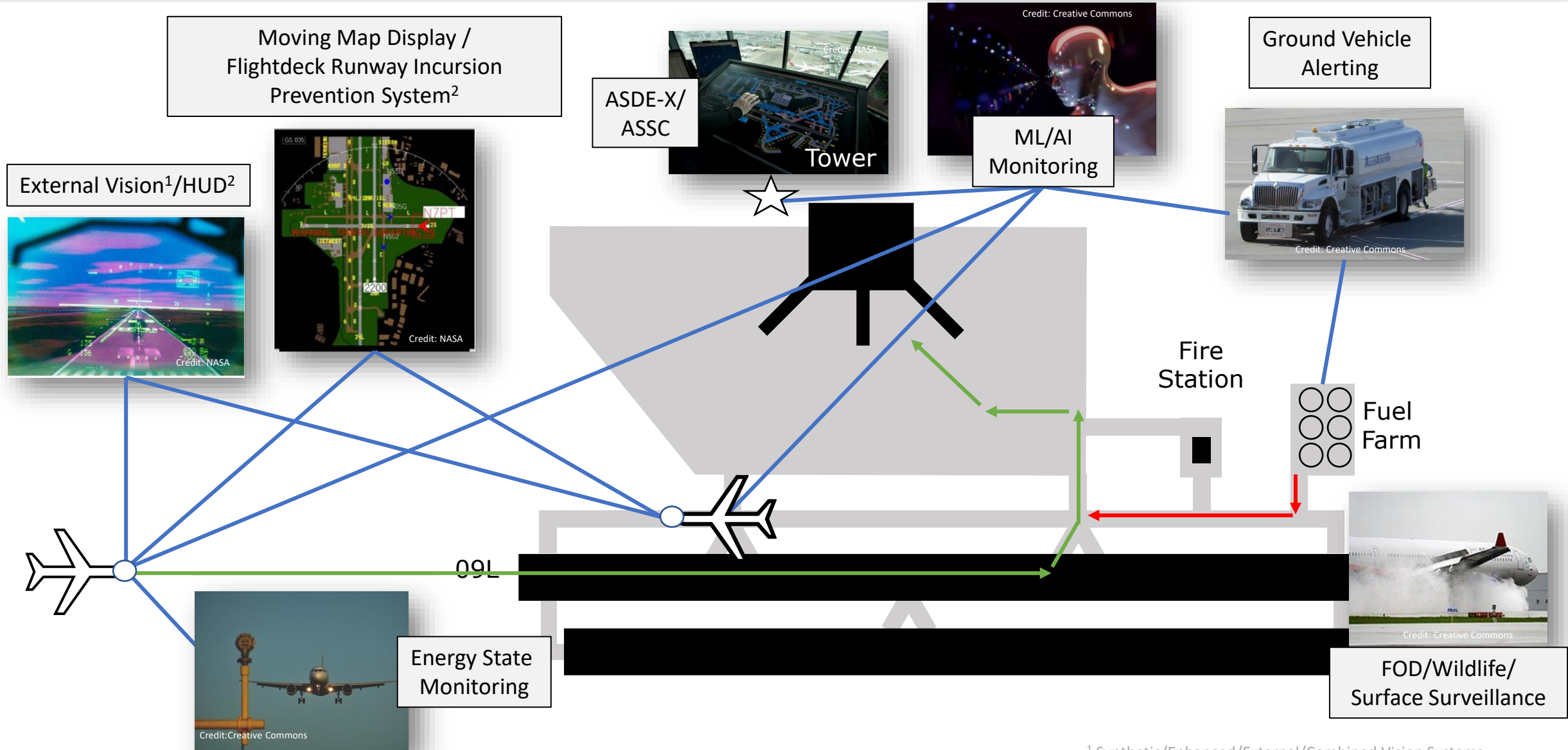


Aviation Safety Information Analysis and Sharing (ASIAS)



Proactive sharing of data between operators, ATC, airports facilitates system-wide safety intelligence and enhanced in-time, integrated safety management

Future IASMS Case Study



¹ Synthetic/Enhanced/External/Combined Vision Systems

² NASA Runway Incursion Prevention System (SURF-IA) – HUD, PFD, NAV



EXPLORE FLIGHT

WE'RE WITH YOU WHEN YOU FLY

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michael.j.Vincent@nasa.gov