NATIONAL ACADEMIES Sciences Engineering Medicine

# Emerging Hazards in Commercial Aviation – Report 1

## Initial Assessment of Safety Data and Analysis Processes

AUGUST 2022 PUBLIC BRIEFING

# Year 1 Study Origin

## CONSOLIDATED APPROPRIATIONS ACT of 2021
## SEC. 132. EMERGING SAFETY TRENDS IN AVIATION

*(a) **General**—Not later than 180 days after the date of enactment of this title, the Administrator shall enter into an agreement with the Transportation Research Board for the purpose of **developing an annual report identifying, categorizing, and analyzing emerging safety trends in air transportation.***

*(b) **Factors**—The emerging safety trends report should be based on the following data:*

*(1) The NTSB's investigation of accidents under section 1132 of title 49, United States Code 554.*

*(2) The Administrator's Investigations of accidents under section 40113 of title 49, United States Code.*

*(3) Information provided by air operators pursuant to safety management systems.*

*(4) International investigation of accidents and incidents, including reports, data, and information from foreign authorities and ICAO.*

*(5) Other sources deemed appropriate for establishing emerging safety trends in the aviation sector, including the FAA's annual safety culture assessment required under subsection (c)*

# Year 1 Study Origin (continued)

*(c) **Safety Culture Assessment -** The Administrator shall conduct an annual safety culture assessment through fiscal year 2031, which shall include surveying all employees in the FAA's Aviation Safety organization (AVS) to determine the employees' collective opinion regarding, and to assess the health of, AVS' safety culture and implementation of any voluntary safety reporting program.*

*(d) **Existing Reporting System** – The Executive Director of the Transportation Research Board, in consultation with the Secretary of Transportation and Administrator, may take into account and, as necessary, harmonize data and sources from existing reporting systems within the Department of Transportation and FAA.*

*(e) **Biennial Report To Congress** – One year after the Administrator enters into the agreement with the Transportation Research Board as set forth in subsection (a) and biennially thereafter through fiscal year 2031, the Executive Director, in consultation with the Secretary and Administrator, shall submit to the congressional committees of jurisdiction a report identifying the emerging safety trends in air transportation.*

# Committee Members
# Year 1

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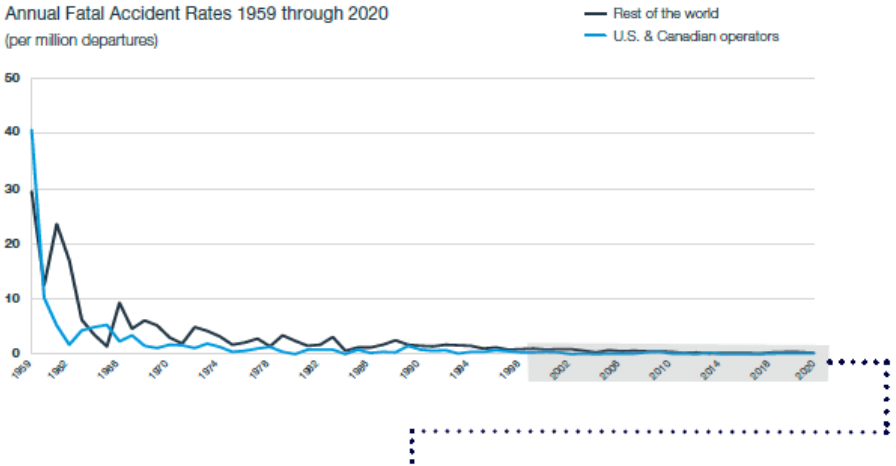
# Year 1 Study Objectives

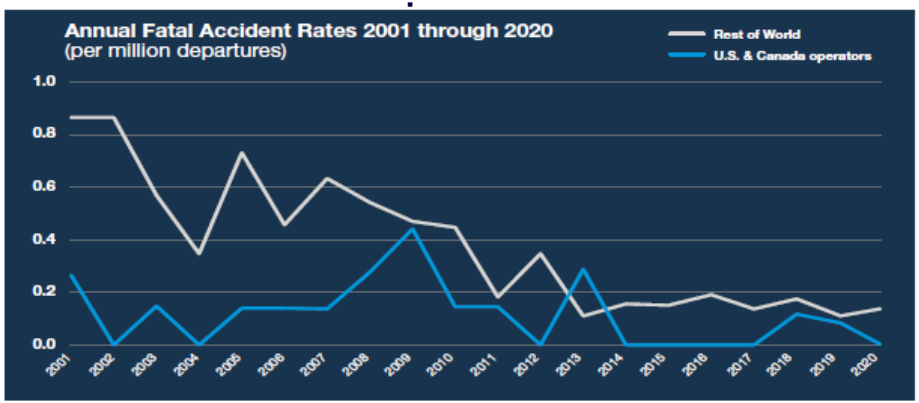
High-level assessment of domestic public and private sources of data and analysis methods for assessing emerging risks.

Identify approach the committee will pursue in subsequent biennial reports to identify emerging aviation safety trends.

***Emerging***
***(def): becoming apparent or prominent (Oxford)***
***(def): newly formed or prominent (Webster)***

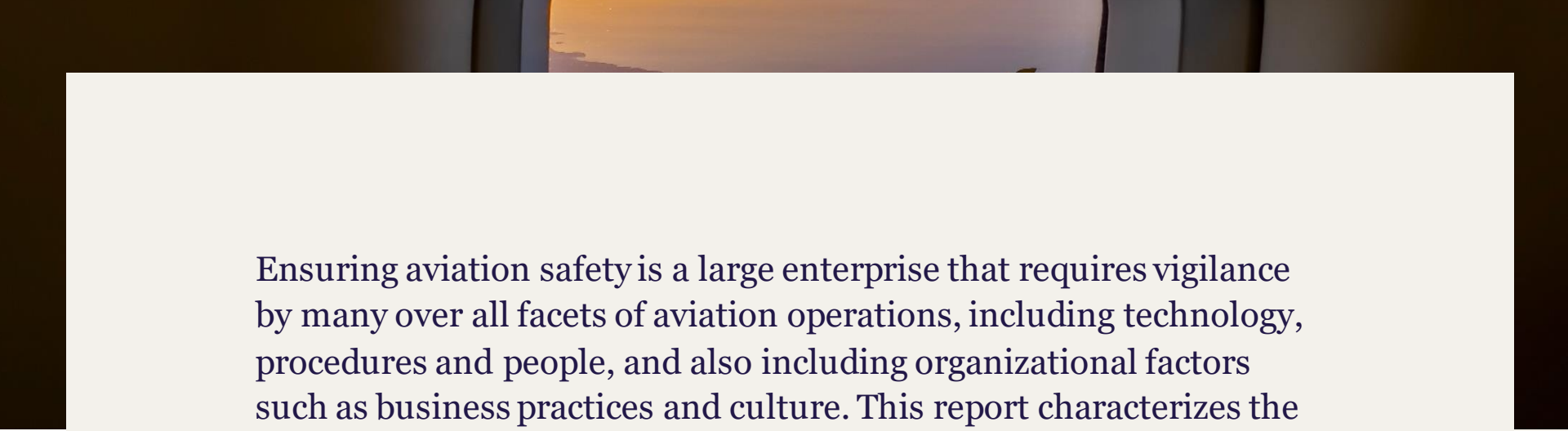
# The Challenge of Current Safety Levels



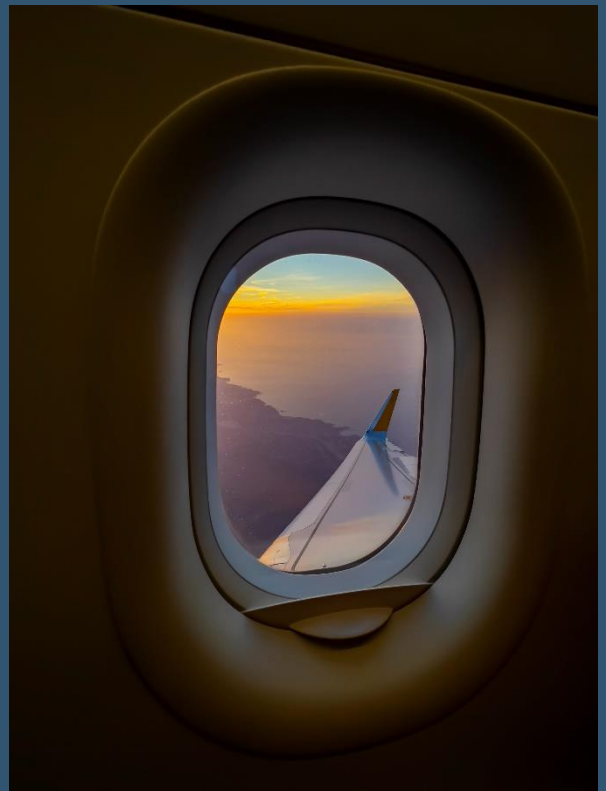

The challenge and opportunity now is getting ahead of accidents

SOURCE: Boeing, 2021



Ensuring aviation safety is a large enterprise that requires vigilance by many over all facets of aviation operations, including technology, procedures and people, and also including organizational factors such as business practices and culture. This report characterizes the range of activities that are currently occurring. While many processes were found to examine known concerns in current-day operations, the report also noted where new data methods would contribute. The challenge and opportunity now is getting ahead of accidents by identifying potential safety concerns before they are revealed by operational data.

# Year 1 Assessment



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# Assessment of Safety Data
# Federal Efforts – CAST and ASIAS

These programs provide valuable efforts to identify and monitor precursor measures that provide both deeper insight into the underlying hazard and more predictive measures of patterns of behaviors that suggest the development of a hazardous state.

- These federal efforts could benefit from bringing in outside experts who are knowledgeable about both the multiple dimensions of aviation safety controls and the most advanced data mining applications and tools.
- Restrictions on participants puts limits on the extent that these programs can draw on the insights of others. Thus, they may benefit both from routinely rotating specific subject matter expert (SME) participants such that they are consistently bringing in fresh perspectives from within their member organizations, and from coordinating with outside experts for cross-talk and information sharing.
- The CAST/ASIAS collaboration has an invaluable role in immediate safety management, but it may not be the best forum for application of tools and methods for analyses of hazards that are not yet known or not prevalent in current day operations.

# Assessment of Safety Data
# External Efforts

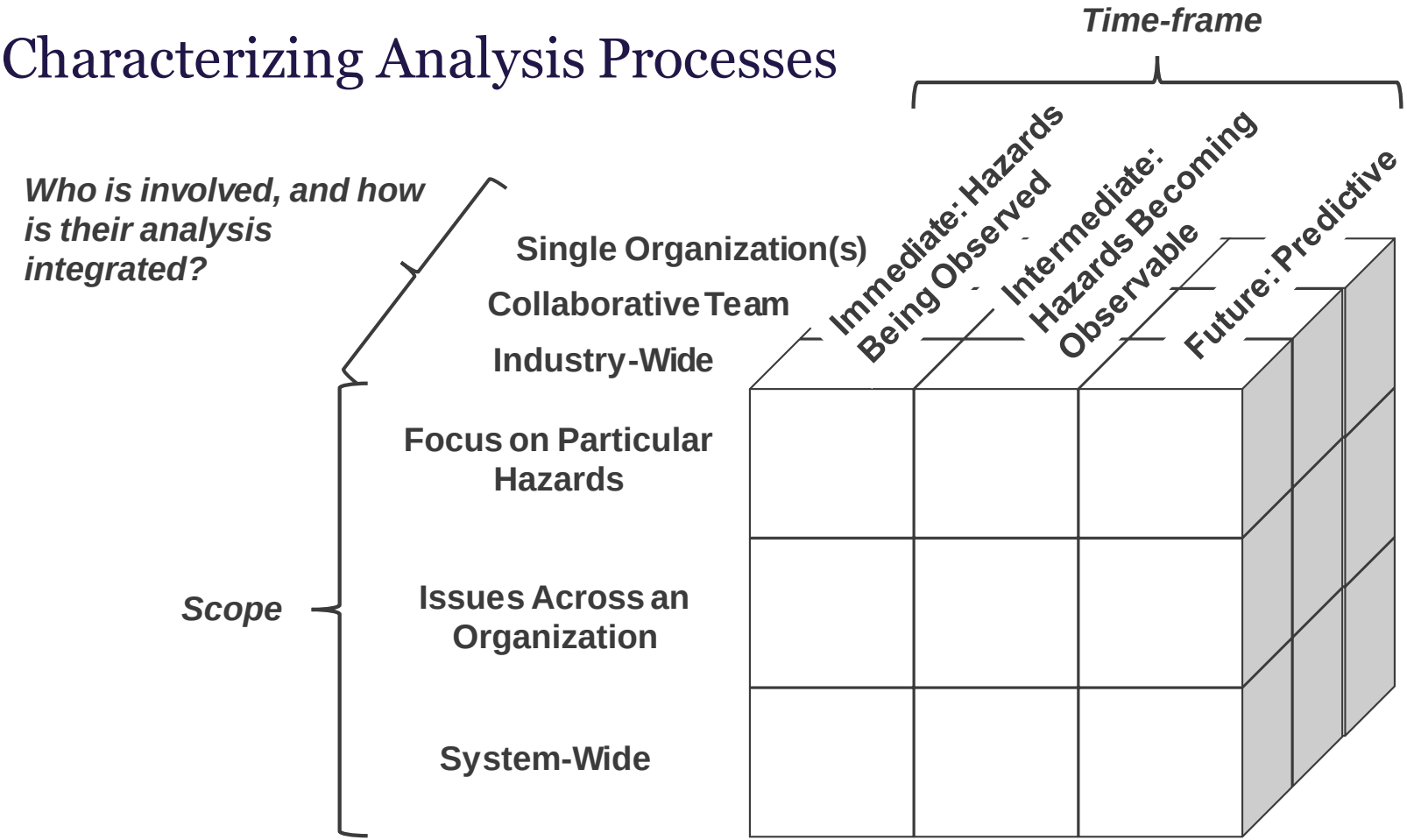
The aviation industry comprises many independent entities that each gather information for their own purposes. Thus, sharing and integrating data can be difficult for both pragmatic reasons and for policy reasons.

- There are many on-going data collection and analysis efforts in the aviation enterprise. Some are focused on specific concerns or specific organizations, and use appropriate specific data – others are attempting to look system-wide. Having a range of data analysis like this is good.
- The FAA's role varies, from directly analyzing the data in some cases, to co-chairing and sponsoring collaborative activities, to regulating standards for things like SMS and LOSA and AQP that are then conducted within airlines.
- There is value in collaborating by sharing best practices and, where possible, sharing data, as well as collaboration in making sense of the data analysis and in handling safety concerns as they appear.
- Feedback loops within the system, and monitoring for precursors, will need to be constructed deliberately in a manner that best supports safety control within the constraints imposed on data sharing and integration.

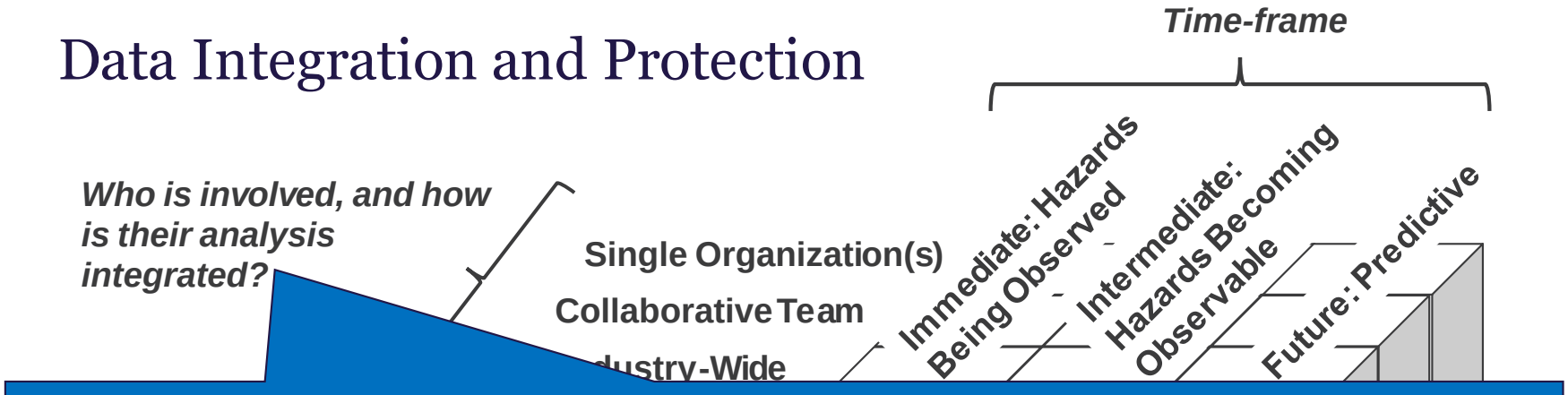
# Safety Culture in Aviation: Current Efforts

- The committee has a specific task to assess and report on AVS's safety culture assessment.
- We were briefed by AVS on its plans to survey its staff and will address this item more fully in its next report after the first AVS safety culture assessment is complete.
- This report reviews the best practices in a safety culture assessment and its analysis – for the FAA, but also for other organizations, such as aircraft operators, that can-and-should assess safety culture.

# Characterizing Analysis Processes



# Data Integration and Protection




While theoretically ideal, pragmatic and policy concerns with integrating data:

- Who owns it, and why would they agree to share it?
- Different format and content, difficult to merge
- Cost and delay of collecting, reformatting, and merging

May be better to:

- Only collect data that is absolutely necessary for purpose of analysis
- Allow data-owners to separately analyze data using common methods, share their results

Regardless of method, collaboration is important – and widespread

# Summary of Data Sources and Processes

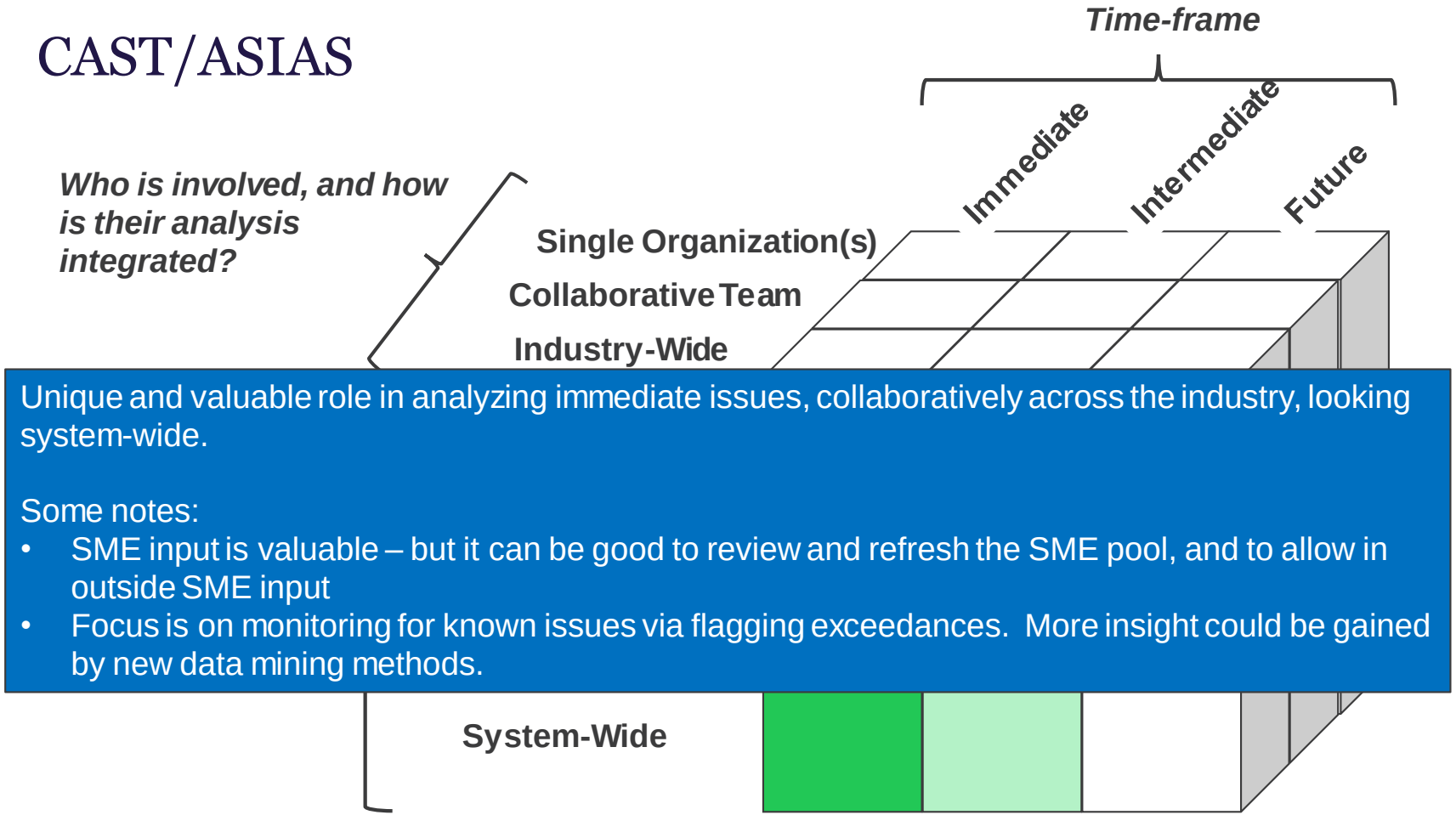
- There are many! Important components include:
  - Voluntary Safety Reports (ASRS, ASAP, ATSAP, etc.)
  - Flight Operational Data
  - Incident and Accident Reports
  - Safety/Risk Management System Data

- Some potential gaps noted by the committee
  - More indication of flight control software functioning and concerns – and better use of software to report-out issues
  - Maintenance – and perhaps improved cross-talk with knowledge and assumptions from design and certification

# For Good Reasons, Many Different Analyses Occurring

- Committee received briefings on several collaborative teams focused on particular hazards:
  - E.g. Pilot interaction with autoflight systems
  - E.g. Simulator training to guard against loss of control
- Committee briefed on on-going regular analysis conducted by airlines – with forums for comparing their methods and findings
  - E.g. Flight Operations Quality Assurance (FOQA)
  - E.g. Line Operations Safety Audit (LOSA)
  - E.g. Advanced Qualification Program (AQP)

# CAST/ASIAS

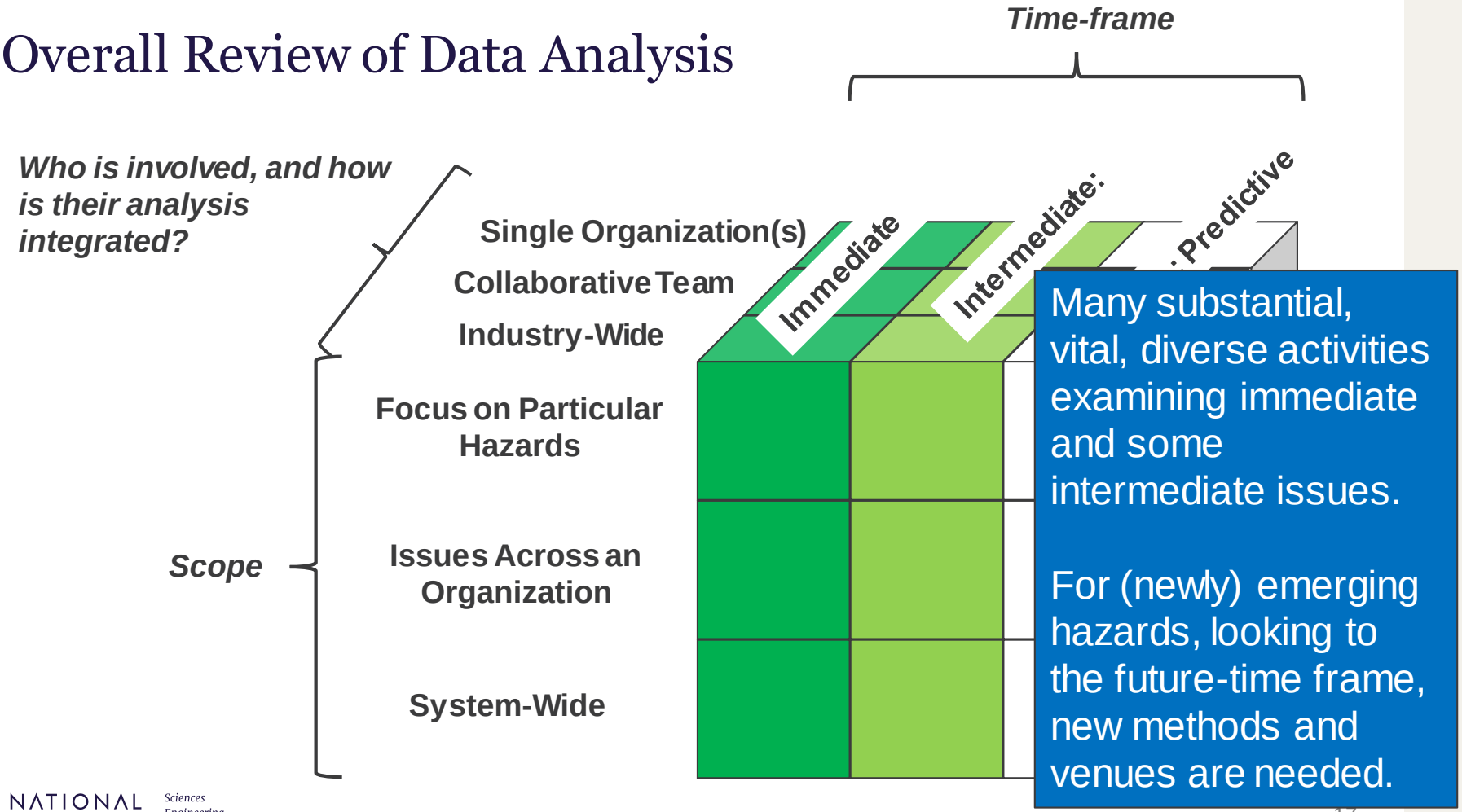



Unique and valuable role in analyzing immediate issues, collaboratively across the industry, looking system-wide.

Some notes:

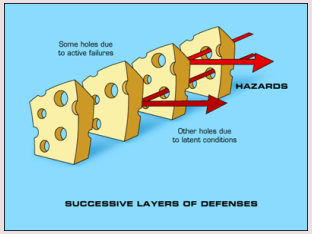
- SME input is valuable – but it can be good to review and refresh the SME pool, and to allow in outside SME input
- Focus is on monitoring for known issues via flagging exceedances. More insight could be gained by new data mining methods.

# Overall Review of Data Analysis



# Potential Sources of New Emerging Trends

CHANGING BUSINESS MODELS




Pilot/Staff Training, Experience in Safety, Org Protections

CLIMATE

Extreme WX, Alternate Fuel

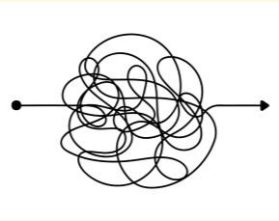
NEW TECHNOLOGIES

Additive Manufacturing, Many Others!

NEW ENTRANTS

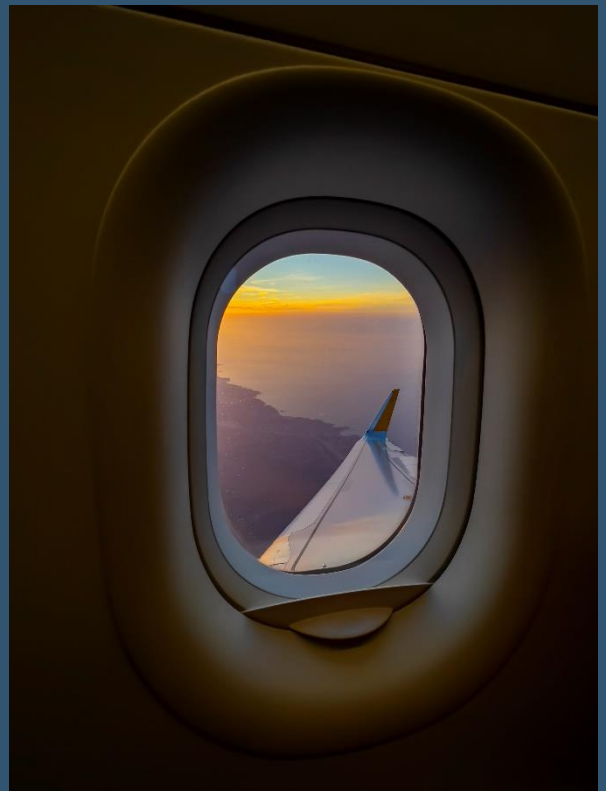
UAS, Comm Space, Air Taxis, Supersonic

INCREASINGLY COMPLEX SYSTEMS



Autonomy, Software, Inter-dependencies

# Approach for the Next Phase of the Study



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# Scanning for Emerging Aviation Safety Hazards

- Horizon scanning is a structured and facilitated activity that helps prepare for an uncertain and complex future.
- The scan seeks input from participants with a variety of perspectives, guided on strategies to manage cognitive biases and examine weak signals that could bring about potential change.
- The FAA – and others across the industry – will be invited to participate.

- Note, committee will also continue efforts to:
  - Assess FAA safety culture survey
  - Review other aspects of data analysis, including data availability and gaps, data analysis methods, and more.

REPORT RELEASED AUG 1, 2022

A free pdf of the report is accessible through the National Academies Press (NAP.edu).

Questions?