

# Artificial Intelligence at the U.S. Federal Aviation Administration

and some pseudo-random thoughts on a roadmap

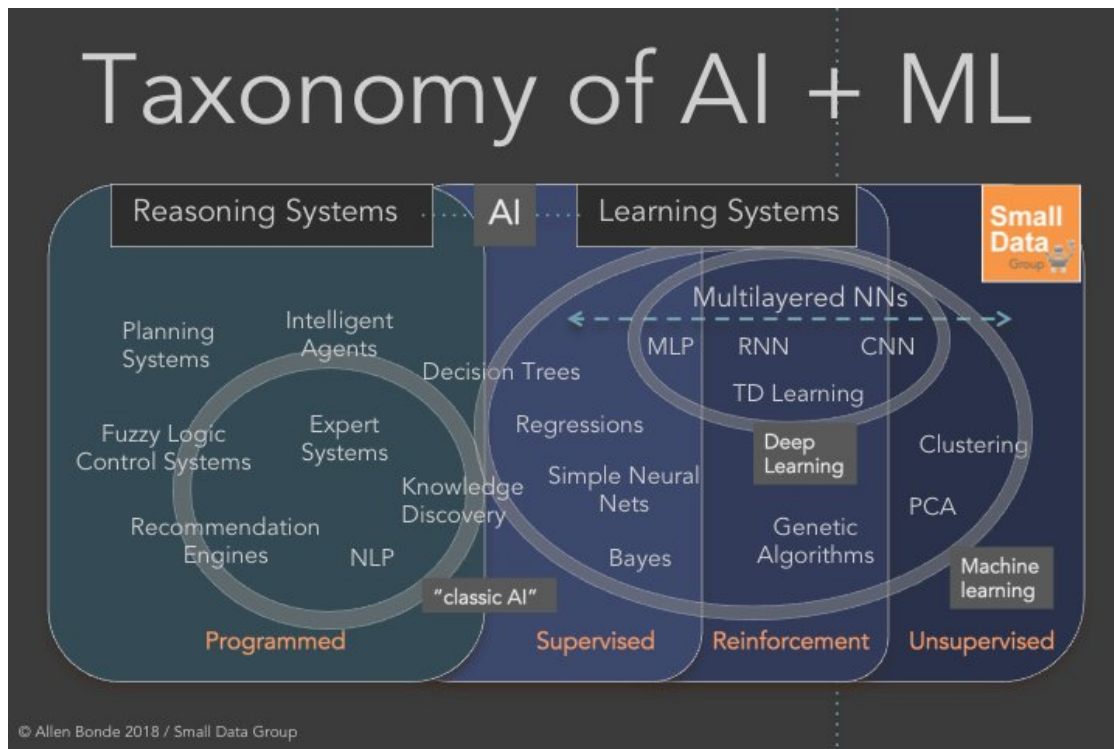
J. Post | February 1 2021



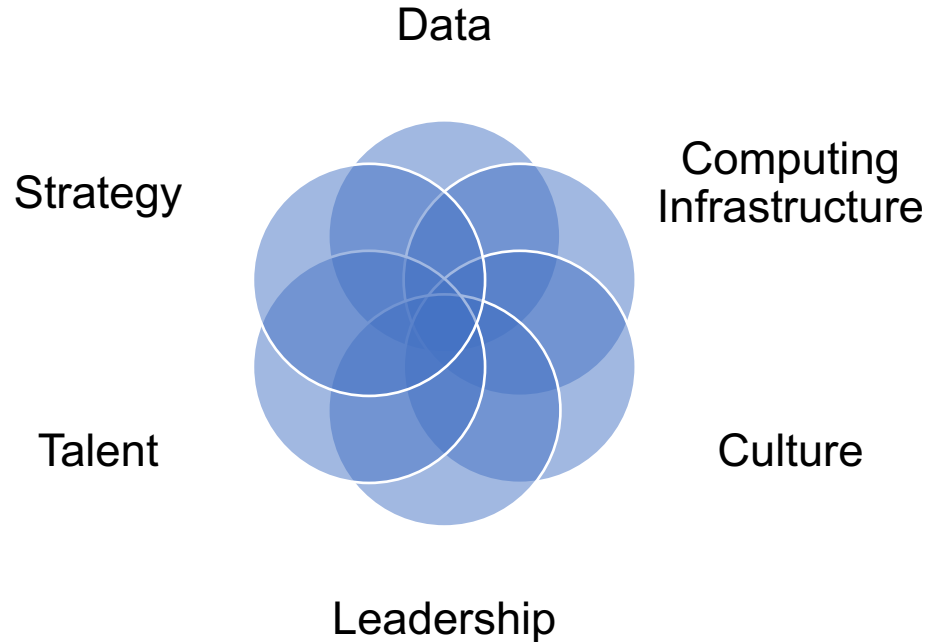
# Agenda

- AI Enablers
- FAA Research Activities and Enterprise Architecture
- Potential Applications
- Roadmap Considerations

# But first, What is AI?



# AI Adoption Enablers



# FAA EIM Platform

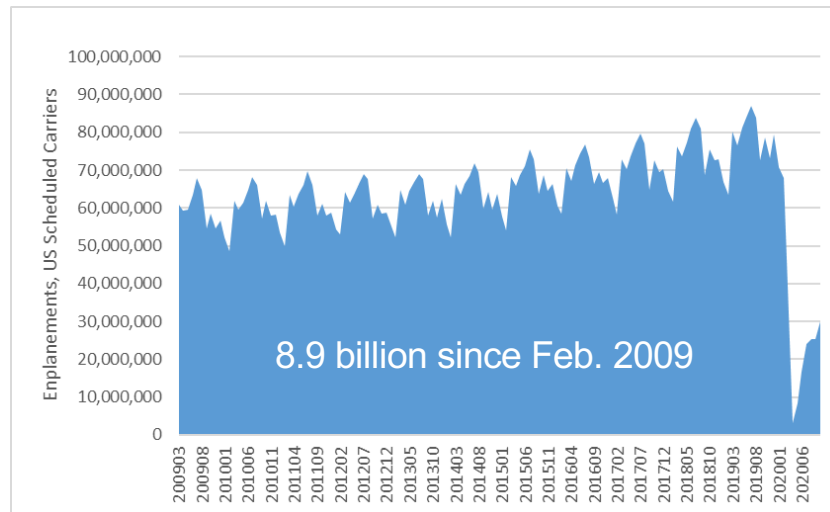
- Cloud-based Big Data platform consisting of:
  - A “Data Mall”
  - An “App Mall”
- System developers may either
  - Integrate their applications with the platform in order to leverage the large data sets
  - Build and host their applications on the platform

## Enterprise Information Management - FAA's Data Management



# ATM Culture

- Strong safety culture
- Safety Management System
- Little up-side potential
  - Safety
  - Capacity
  - Efficiency...
- Huge down-side risk
- Most proposed applications are for analytical and planning functions



# **Executive Order 13859 - Maintaining American Leadership in Artificial Intelligence**

**Feb. 2019**

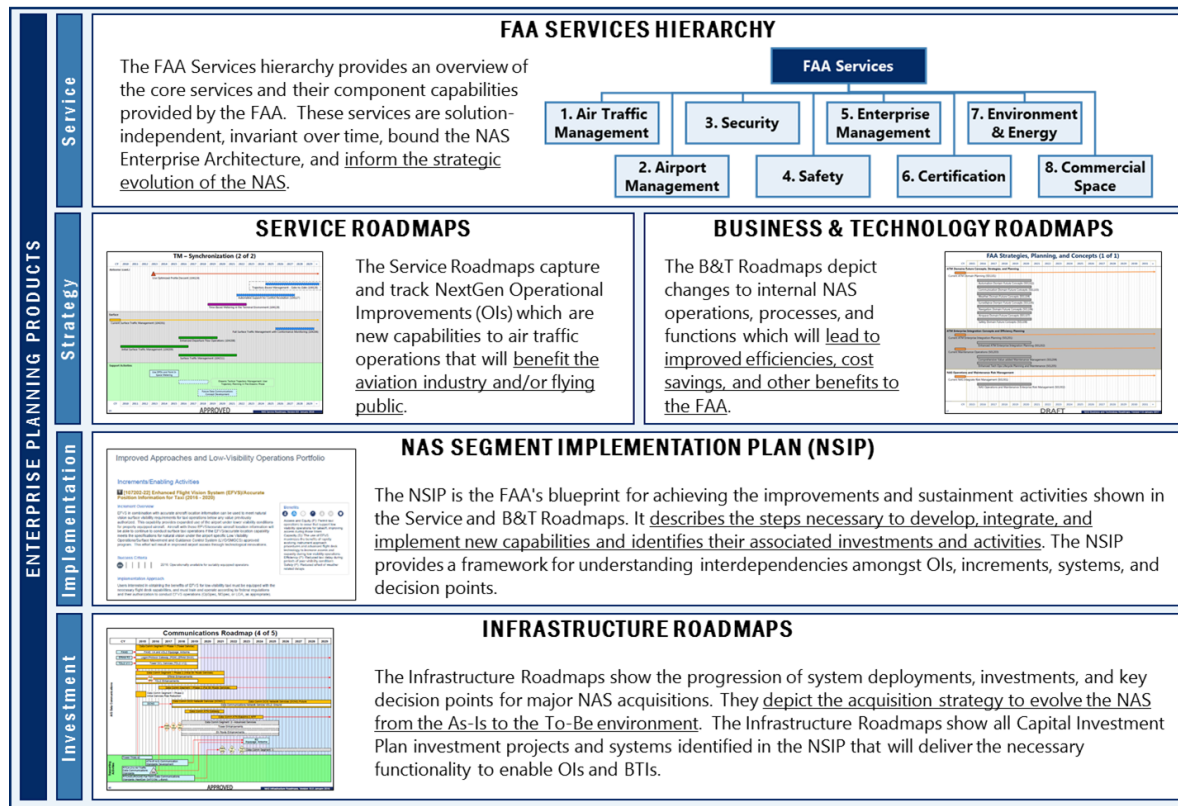
- Policy & principles
- Federal investment in R&D
- Data & computing resources
- Guidance for regulation of AI applications
- Workforce development
- Action Plan for the protection of the US advantage in AI

# **Executive Order 13960 - Promoting the Use of Trustworthy Artificial Intelligence in the Federal Government Dec. 2020**

- Principles for the use of AI in government
- Common policy for implementing principles
- Catalogue of agency use cases for AI
- Enhanced AI implementation expertise



# National Airspace System EA



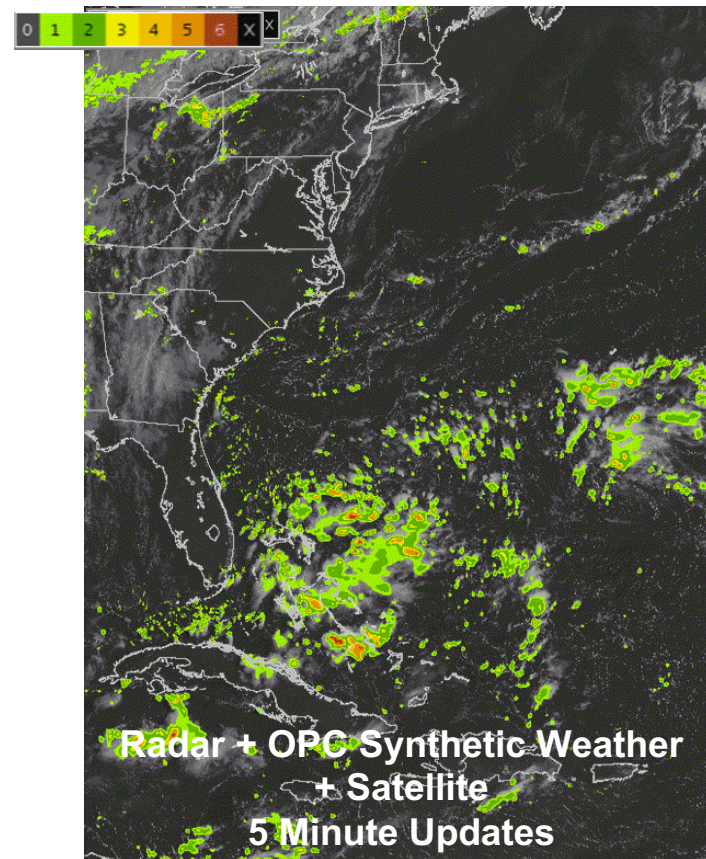
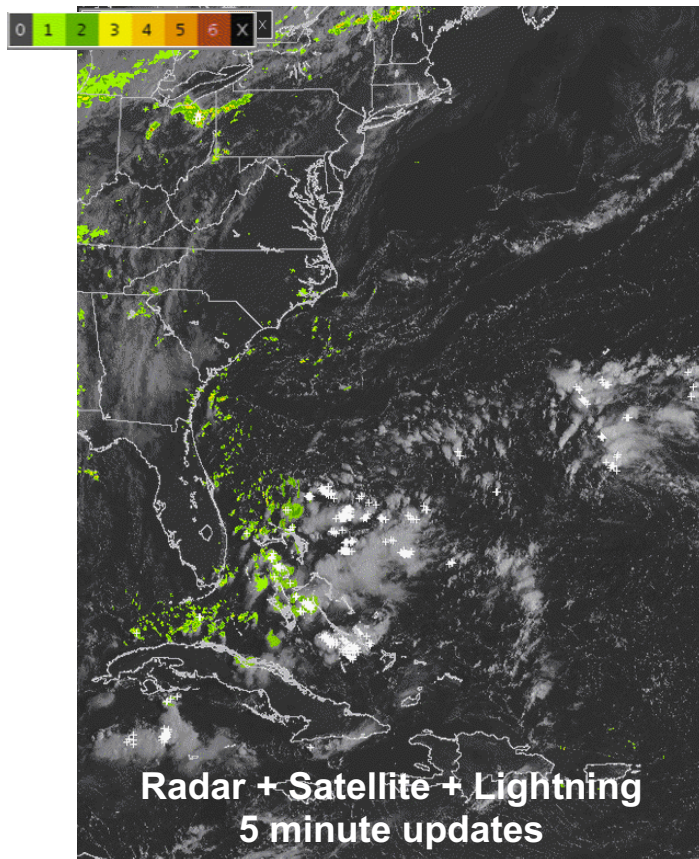
# AI in the EA

- Operational Improvements
  - 601104 – Automated Safety Information Sharing and Analysis (ASIAS)
- Business & Technology Improvements
  - 501303 – Critical NAS Services Recovery
  - 505102 – Enhanced Enterprise Monitoring
  - 505105 – Comprehensive Value-Added Maintenance Management
  - 509107 – Enhanced Maintenance and Enterprise Monitoring Data/Information Interoperability (Information Exchange Services)

# FAA AI Research Initiatives (1/2)

- Safety
  - Speech Recognition
    - Data: Controller/pilot voice communications
    - Example Application: Closed runway operation detection
  - Text Data Mining
    - Data: Various safety reports
    - Example Application: Trend monitoring and risk identification
  - Trajectory Analysis
    - Data: Surveillance data
    - Example Application: Anomaly Detection
- Weather Now-Casts, Forecasts, and Impacts
  - Image Processing
    - Data: Radar, satellite data
    - Example Application: Synthetic weather radar generation
      - Offshore Precipitation Capability (OPC) Model

# MIT/LL Offshore Precipitation Capability



# FAA AI Research Initiatives (2/2)

- Traffic Flow Management
  - Trajectory prediction
    - Data: Surveillance data
    - Example Application: Time Based Flow Management (TBFM)
  - Arrival metering
    - Data: Surveillance, weather, and demand data
    - Example Application: TBFM
  - TMI recommendations
    - Data: Surveillance, weather, and demand data
    - Example Applications: Traffic Flow Management System (TFMS), Route Availability Planning Tool (RAPT)
- Surveillance
  - Radar Processing
    - Data: Radar data
    - Example Application: Chaff Detection Algorithm
- Instrument Procedure Design
- Cybersecurity

# So you want an AI roadmap.

What is a technology roadmap?

A planning tool that links technologies with an enterprise's products, services, and/or capabilities.

What is it used for?

To align investments in technology with desired new products/services/capabilities.

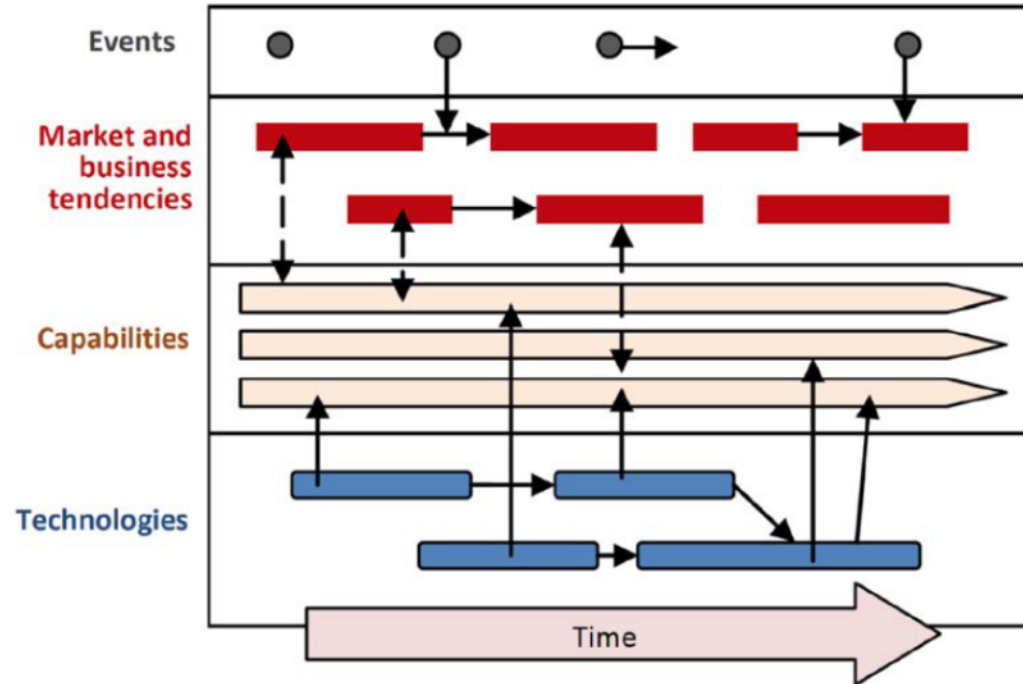
What should an AI roadmap include?

1. A starting point
2. A destination
3. A path!
4. Relationships between investments, technologies, and capabilities

What are the dimensions that the path should traverse?

1. Time
2. Maturity?

# Service/Capability Technology Roadmap



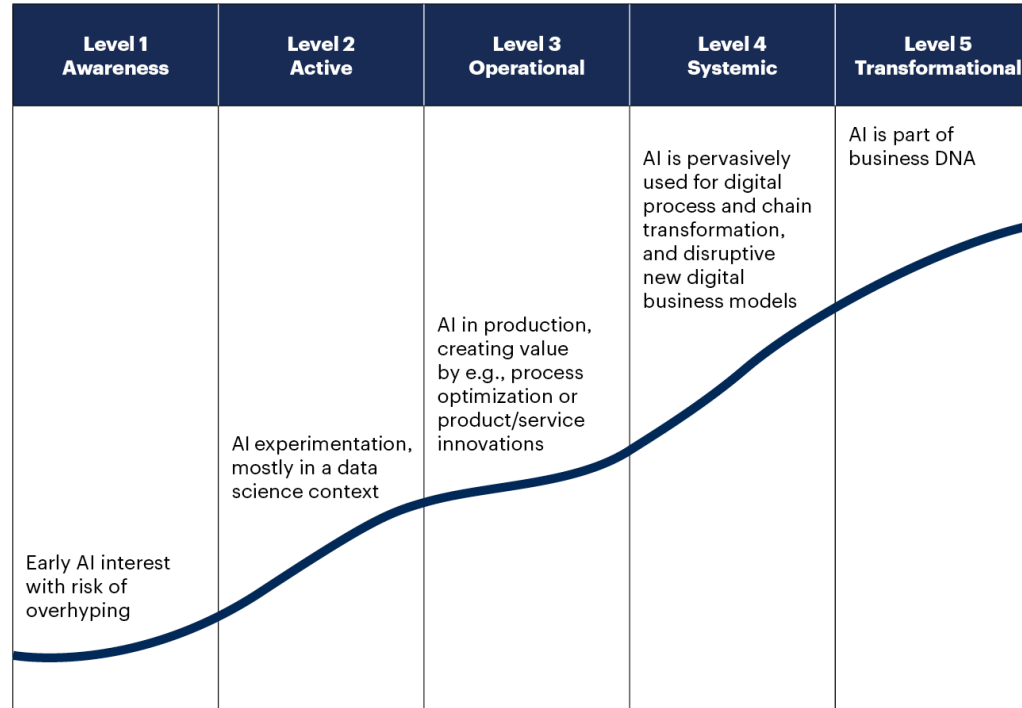
Source: Bernal et al., 2009





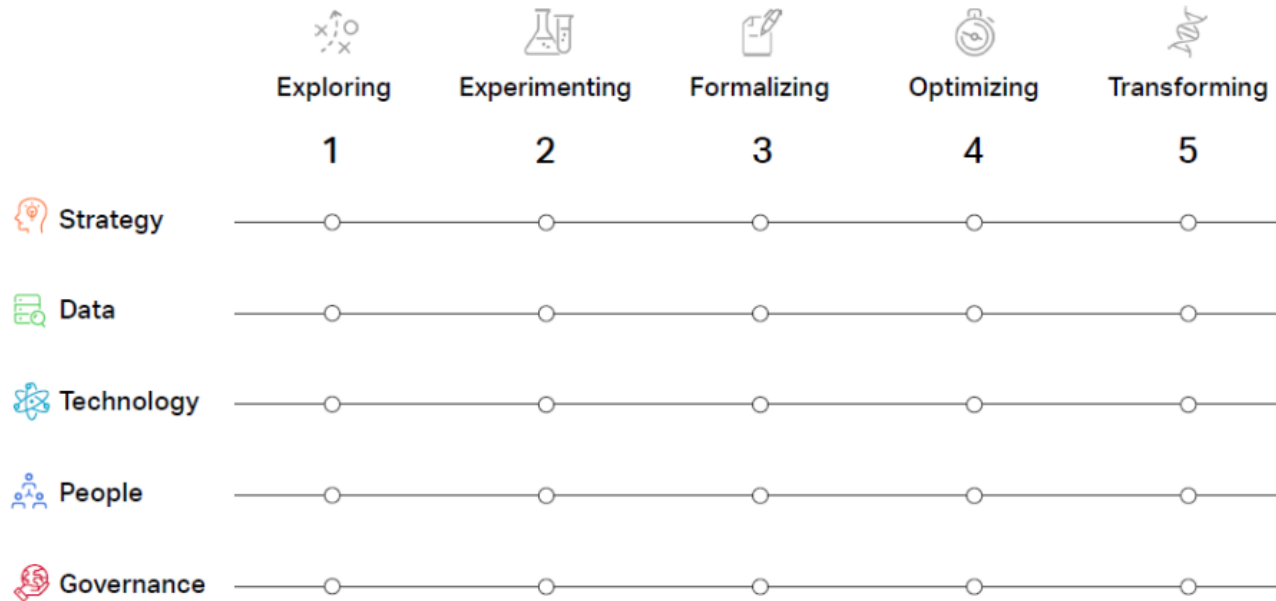


# The *Gartner* AI Maturity Model

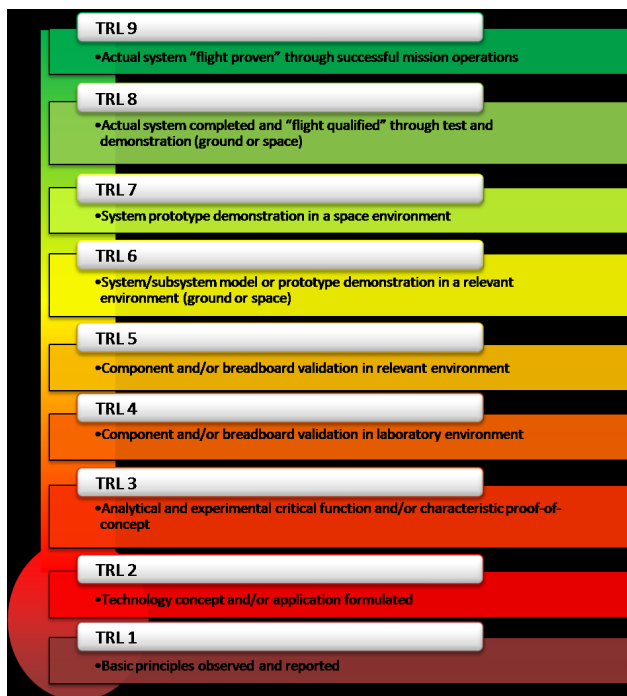


Source: Gartner, 2019.

# The *Element AI* Framework

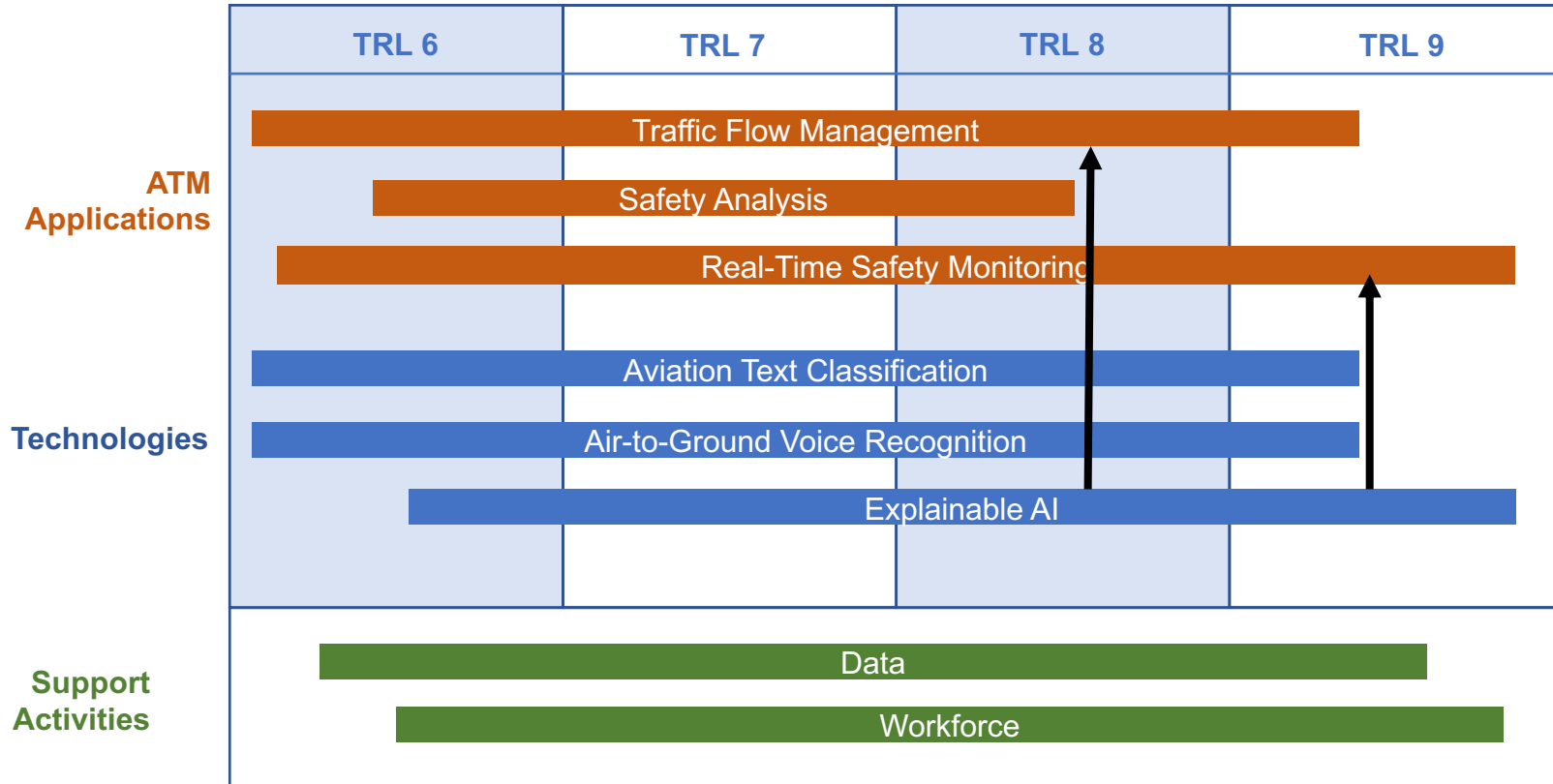


# NASA Technical Readiness Model



| EU TRLs |   |
|---------|---|
| TRL 9   | Actual system proven in operational environment (competitive manufacturing in the case of key enabling environments; or in space) |
| TRL 8   | System complete and qualified   |
| TRL 7   | System prototype demonstration in operational environment   |
| TRL 6   | Technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)      |
| TRL 5   | Technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)         |
| TRL 4   | Technology validated in lab   |
| TRL 3   | Experimental proof of concept   |
| TRL 2   | Technology concept formulated   |
| TRL 1   | Basic principles observed   |

# Notional Roadmap



A photograph of the Marshall University Student Center, a modern building with a curved facade and large glass windows. In the foreground, two bronze statues of running bulls are positioned in a shallow pool of water. The scene is set against a clear blue sky with some greenery on the left. The text "Thank You!" is overlaid in the center.

Thank You!