Aviation R&D Landscapes

REDAQ

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What is a Landscape?

A Landscape is a collection of research drivers that provides information about their potential impacts to the industry.

– Research Drivers
  • A force or motivation that stimulates R&D investment

– Impacts
  • Industry Objectives
  • Emerging Technologies
  • Envisioned Operations
Developing the R&D Landscapes

- Research drivers and their impacts will be described within the context of each of the 6 research domain areas.
- A document will be produced to effectively communicate Aviation Industry Landscape.

### R&D Research Domain Areas

- **Airport Technology**
- **Aircraft Safety Assurance**
- **Digital Systems & Technologies**
- **Human and Aeromedical Factors**
- **Environment & Weather Impact Mitigation**
- **Aviation Performance & Planning**

### Research Domain Leads

- **Michel Hovan, ANG-E2**
- **Ryan King, ANG-E2**
- **Eric Neiderman, ANG-E2**
- **Ken Knopp, ANG-E2**
- **Eric Neiderman, ANG-E2**
- **Hossein Eghbali, ANG-E2**
- **Kenneth Allendoerfer, ANG-E2**
- **Stacey Zinke, AAM (CAMI)**
- **Carla Hackworth, AAM (CAMI)**
- **Dan Herschler, ANG-C1**
- **Jim Hileman, AEE**
- **Randy Bass, ANG-C6**
- **Warren Fellner, ANG-C6**
- **Francisco Bermudez, ANG-C5**
R&D Landscape Process

• Team composed of FAA research domain leads, MITRE, ANG-E4 and senior management
  – R&D Landscape team formed and initiated on October 31, 2018.
  – Bi-weekly team meetings, with additional research domain specific meetings as needed.

• Tasks involved:
  – Develop structure for data collection
  – Ensure traceability of research drivers to source documentation
Derivation of Drivers

**FAA’s Strategic Initiatives**
- Make aviation safer and smarter
- Deliver benefits through technology and infrastructure
- Enhance global leadership
- Empower and innovate with the FAA’s people

**Goals**
- NextGen Evolution
- Benefits of the Future NAS
- Delivering Improved Services
- Seamless Integration
- Meeting New Challenges

**RedAC Emerging Issues**
- Meeting societal and market needs
- Industrial leadership
- Environment and energy supply
- Ensuring safety and security
- Prioritizing research, testing, and education

**Example Research Drivers**
- Supersonic Flight
- Urban Air Mobility
- Non-Traditional NAS Access Points
- Space Operations
- Electric Propulsion
- Future Fuel Technologies
- Artificial Intelligence
- Remote/Virtual Technologies

**TRB Critical Issues in Transportation**
- Transformational Technologies and Services
- Serving a Growing and Shifting Population
- Energy and Sustainability
- Resilience and Security
- Safety and Public Health

**DoT Strategic Plan**
- Safety
- Infrastructure
- Innovation
- Accountability

**Future of the NAS - 2030**
- Supersonic Flight
- Urban Air Mobility
- Non-Traditional NAS Access Points
- Space Operations
- Electric Propulsion
- Future Fuel Technologies
- Artificial Intelligence
- Remote/Virtual Technologies

**ACARE – Strategic Research & Innovation Agenda**
- Meeting societal and market needs
- Industrial leadership
- Environment and energy supply
- Ensuring safety and security
- Prioritizing research, testing, and education
Research Landscapes and Planning

**Research Drivers**
A force or motivation that stimulates R&D investment.

**Impact Analysis**
What is the driver impact on industry objectives, emerging technologies or envisioned operations?

**Planning**
- **FAA Research Portfolio**
  - By research domain: prioritized research projects w/FAA's role (Lead, Watch, Participate)
- **National Aviation Research Plan (NARP)**
  - Documented approach for achieving FAA’s research goals/objectives

**Execution**
- **Research**
  - FAA’s research serving to meet FAA NARP objectives

**Results**
- **Research Outputs**
  - Results of FAA’s research and Technology Transfer
R&D Landscape Schedule

✓ Develop plan for Landscape development
  Completed November 2018

✓ Deliver Landscape to REDAC for input
  Completed Spring 2019

  ▪ Produce Landscape Document
    June 2019
Subcommittee Scope

- Help FAA understand the aviation industry’s strategic focus
  - Review the driver list and identify any missing items.
  - Identify the characteristics or individual components of each driver and the timeframe to maturity.
  - Identify if the driver presents challenges that the FAA should pay attention to.
  - Identify entities (academia, government, or industry) that are currently conducting work related to this driver.
- Separate from F&Rs, provide subcommittee Workbook input to the DFO’s prior to the full REDAC meeting on 4/11.
- Be prepared to summarize during the full REDAC meeting on 4/11.
Research Driver List

- Supersonic Flight
- Urban Air Mobility
- Growth of Mixed Operations (Piloted, Autonomous, Unmanned)
- New Mission Types
- Non-Traditional NAS Access Points
- Space Operations
- Enable Routine Small UAS Operations Beyond Visual Line of Sight (BVLOS)
- Autonomous ground service equipment at airports
- Aircraft Command and Control Using Automation and Remote Sensing Technology
- New Vehicles or their Components Which Make Use of New Technologies, Software, or Materials
- Certification using New Technologies, Standards, or Processes
- Remote/Virtual Technologies
- Advances in Electric or Hybrid Electric Propulsion

- Future Fuel Technologies
- New Technologies to Airport Pavement Infrastructure and Design
- Information Assurance and Security for All Operations (cyber-security)
- Big Data Analytics and Techniques
- Human-Machine Teaming and New Technology Interfaces
- Artificial Intelligence
- Increased Connectivity by Cyber-Physical Systems (Internet of Things Technologies)
- Crowd Sourcing Weather Data
- Advancement in Position, Navigation, & Timing Technology
- Risk-Based Decision-Making techniques and analytics
- Infrastructure Resiliency and Continuity of Operations
- New Medical Technologies and New Substances (Medications, Drugs, Etc.)
Subcommittee Roundtable Discussion

- Impressions
- Approach
- Summary of comments
Backups
Subcommittee Approaches

**Airports**
- Evaluated each driver based on importance (1-5)
- Identified any links between drivers
- Discussed concerns_issues at a high level
- Identified subcommittee members to develop workbook response for each of the drivers

**Aircraft Safety**
- Went through full list of drivers as a group
- Identified major issues concerning each driver
- Identified some additional source documentation
- Captured notes and planned for additional coordination among members.

**NAS Operations**
- Reviewed full list of drivers, identifying ones that pertained to their subcommittee and grouped them as:
  - Emergent Operations
  - Infrastructure
  - Data
- Assigned all subcommittee members task of filling out workbook and providing back to the chair for consolidation

**Environment and Energy**
- Struggled with the overall intent of the exercise and how FAA planned to utilize inputs
- Identified top five drivers related to E&E
- Identified subcommittee members to develop workbook response for each of these 5.

**Human Factors**
- Struggled with the overall intent of the exercise and how FAA planned to utilize inputs
- Reviewed the drivers and had discussion as to definitions of each to ensure full understanding
- Discussion about how their present emerging issues document mapped to these drivers.
Subcommittee Driver Changes/Additions – Initial Feedback

**Airports**
- **Added Drivers:**
  - Aviation System Sustainability
  - Aviation System Capacity
  - Future Security Technologies

**Environment and Energy**
- **Changed Drivers:**
  - New Vehicles or their Components Which Make Use of New Tech, Software or Mats → Sustainable Growth of Subsonic Transports Through Novel Vehicle Configurations, Operational Concepts and New Technologies

**Aircraft Safety**
- **Changed Drivers:**
  - Enable Routine Small UAS Operations
  - **Added Drivers:**
    - In-Time System-Wide Safety assurance (e.g. Digital Twinning)
    - Runway Friction & Braking

**NAS Operations**
- **Changed Drivers:**
  - Increased Connectivity by Cyber-Physical Systems (Internet of Things Technologies) & Spectrum (4G/5G)

**Human Factors**
- **Changed Drivers:**
  - Human-machine Teaming & New Technology Interfaces – Split into two separate drivers
  - Artificial Intelligence – Category needs to be broadened or reframed
  - **Added Drivers:**
    - Training
    - Pilot Demographics
    - Larger UAS Integration

**Future Security Technologies**
- **Added Drivers:**
  - Artiﬁcial Intelligence → Category needs to be broadened or reframed
  - In-Time System-Wide Safety Assurance (e.g. Digital Twinning)
  - Runway Friction & Braking

**Human Factors**
- **Changed Drivers:**
  - Aviation System Capacity