# REDAC Read-Ahead

## Submitted to the Subcommittee on Airports

**2/23/2022**

# CONTENTS FOR REVIEW

*The following decks are current for Subcommittee review as of 2/23/22.*

## DAY 1: March 8, 2022



## DAY 2: March 9, 2022

# Airport Safety R&D

**Program Update**

Presented to:
REDAC Sub committee on Airports

**Ryan King**
March 8 – 9, 2022

## Agenda

- Technical Support
- Safety Program Overview
- Research Projects and Updates

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## Technical Support

- Updates to Support Contracts

## Safety Program Overview

- Project Areas

## Airport Safety Research Areas

Research is organized in Research Program Areas:

- S1 – Airport Planning and Design
- S2 – Airport Safety Data Mining
- S3 – Aircraft Rescue and Fire Fighting
- S4 – Wildlife Hazard Abatement
- S5 – Visual Guidance
- S6 – Runway Surface Safety Technology
- S7 – Airport Safety and Surveillance Sensors
- S8 – Unmanned Aircraft Systems Integration (*transitioning to UAS/New Emergent*)
- N1 – Airport Noise
- E1 – Airport Environmental

## Everything Airport Safety

Placeholder for slide exhibiting the broad scope and organization of the Who, What, Why and How of Airport Safety R&D

# Research Projects and Updates

## Visual Guidance

**New Contract Established just for Visual Guidance**

- Airport Lighting and Infrastructure
- Airport Surface Markings, Signs and Vehicle Operations
- Lighting Innovations & Special Projects
- National Airspace System (NAS) Visual Aids
- Operations and Maintenance of Photometric Laboratory

**EMAS Signs**

**Lighted X – Evaluation of NIST Recommendations**

**Closed Runway Conspicuity**


Space to provide definitions/clarification of terms that will be referenced through the slide deck (EX: definition of Type I and Type III glass beads)

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## Airport Safety Databases

**Airport Safety Database**
Manage, categorize, and analyze a database of reported safety incidents that occur on airfields in the US. Contains a repository for airport diagrams dating back to 2004. Current efforts include upgrading the software and hardware of the database, and working with to improve user interfaces for quicker data categorization. Categorizing second half of 2021 data and compiling FY20 report.

**Foreign Object Debris Database**
Manage and collect information about FOD found on airfield surfaces in the US. Software engineering team is currently updating all user interfaces in preparations for an anticipated increase in reporting.

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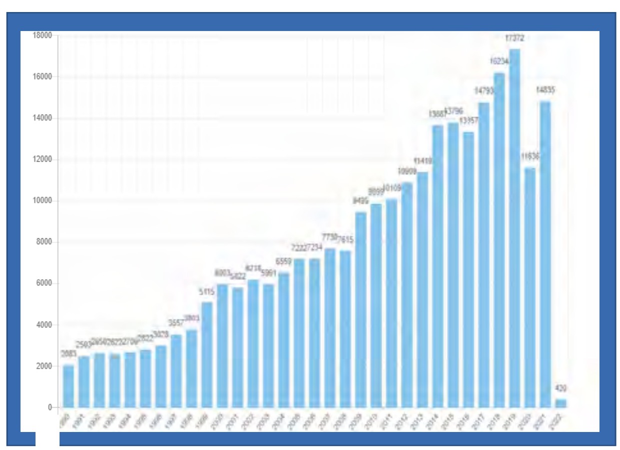
## Airport Safety Databases

**Wildlife Strike Database**
Manage, validate, and analyze wildlife strike reports for civil aviation. Over 268,000 wildlife strikes are validated and available to the public to date.

In 2021, there were 14,835 reported strikes. We are currently beginning to draft the 2021 annual report. As a result of software and user interface improvements, strikes continue to be validated within 14 days of submission, this is an improvement from early 2020 when it was 30-60 days. Looking for new ways to produce visuals of data on a continuous basis.

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## Paint Marking Research

**Retro-Reflectivity and Chromaticity**

Collecting retro-reflectivity and chromaticity data on FAA approved paint and bead types in various climates (hot and dry, hot and humid, winter ops).

Work was has been delayed by COVID-19.

Continued to collect monthly readings and data collection at Ft Lauderdale-Hollywood (FLL) and Atlantic City International (ACY).

Anticipated to wrap up data collection by end of calendar year or early 2023

Reviewing submitted report on Phoenix Sky Harbor International (PHX) data

Based on test deck being installed for 3 years and 23 months of readings.

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## Wildlife Research

**Avian Perception**
Ongoing work with Purdue University's biology department to analyze and map the visual system of the Canada Goose. A prototype light was developed by Rensselaer Polytechnic Institute, and Purdue is currently testing responses of caged geese. This work was delayed by COVID.

**Avian Radar CONOPS**
The FAA has been working with USDA in finalizing a concept of operations documents pertaining to avian radar. We expected the report to be complete by winter 2022.

**Translocation**
Characterizing the movement patterns and habitat use of raptors and other translocated avian species Delayed due to COVID and travel restrictions.

**UAS Applications for Wildlife**
Evaluating unmanned aircraft systems (UAS) technology for wildlife hazard management (surveillance/monitoring).

Developing standard procedures for UAS platform and sensor selection for airport wildlife monitoring.


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## Other Projects to be Briefed

**Solar Lighting for Airports**
Darian Byrd

**UAS Applications on Airports**
Mike DiPilato

**Aircraft Rescue and Firefighting**
Keith Bagot

**Airport Planning & Design**
Lauren Vitagliano


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## Questions?

**Contact the FAA Program Manager**

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Research Project Area – S3: Aircraft Rescue and Fire Fighting

Presented to:
REDAC Sub committee on Airports

**Keith Bagot**

March 8 – 9, 2022

## Agenda

- Project Background
    - Background
    - Project Status
    - Program timeline

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## Project Background

**THE RESEARCH REQUEST:**

**FAA Reauthorization Act of 2018** directed that FAA cease requiring fluorinated chemicals in AFFF in order to meet fire performance standards

**PROJECT DESCRIPTION:**

- **Testing foam proportioning systems**
  - Eliminates the discharge of AFFF into the environment for any operations other than actual emergency responses
  - Testing must be within acceptable means under NFPA 412 and Part 139
- **Researching and testing AFFF Replacements**
  - Conducting Live Fire Tests and Chemical Analyses of the potential replacements
  - Collaborating with Department of Defense (DoD), Environmental Protection Agency (EPA), foam manufacturers, and other industry partners

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## AFFF Replacement

- **Conduct Live Fire Testing**
  - MIL-F-24385F (FAA requirement)
  - ICAO Level C
  - Product Selection Based on Lit Review
  - Performing assessments at manufacturer request
  - New, emerging extinguishing agents
  - Work with manufacturers on new formulations (BAA)
  - Testing impacts of changing variables in the protocols
- **Conduct chemical analysis of potential replacements**
  - Utilizing existing Interagency Agreement between FAA & USAF Civil Engineering Center (Tyndall AFB)
  - Ensure no PFAS or emerging contaminants present


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## Test Summary

- 2 baseline fluorinated AFFF tested (1 MilSpec, 1 ICAO C)
- 34 Fluorine-Free Foams have been evaluated
  - 11 Commercially off-the-shelf foams
  - 23 Prototype fluorine-free foam formulations
- Over 450 fires have been conducted
  - No FFF passed MilSpec or ICAO Level C
  - Modified MilSpec/ICAO Level C tests were conducted (eg. Fuels, active and stationary FF, flow rate & pre-burn)
  - Conducted ICAO Level C tests both outside and inside because of test results
  - Preparing for MilSpec tests with modified CAFS nozzle

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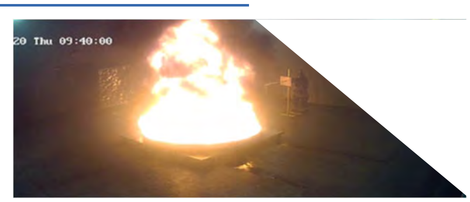
## Observations: Modifying Test Protocol Variables

- Modified MilSpec and ICAO tests
- Only ICAO test modification was active FF
- Stationary nozzle takes longer to extinguish fire than active FF
- Jet A is easier to extinguish than unblended gasoline
- Used heat flux data to determine optimum pre-burn times for Jet A and gasoline
- 90 second Jet A pre-burn created similar results to gasoline test
- Developing new nozzle designs for 3 gpm discharge as well as CAFS

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## Department of Defense (DoD) Interaction

### Collaboration through DoD SRDEP and ESTCP

- Participate in bi-annual seminars (deep dive research updates)
- Review proposals for future PFAS-Free Foam (PFF) research projects
- Participated on the NAVSEA spec writing team for new FFF MilSpec

### Monthly FAA/DoD Meetings

- Program management level discussions
- Research updates
- Policy/Implementation progress discussions

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## Next Steps

- Governmental review of the first FFF MilSpec draft underway.
- April timeframe for next revision of FFF MilSpec which should have a more public distribution.
- DoD on track for the NDAA deadline of publishing by Jan. 31, 2023.
- Final Report on testing of commercially available agents and test modifications is in editing.
- FAA and DOD continue to research new FFF formulation.
- Work is ongoing for transition planning from legacy AFFF to new FFFs.

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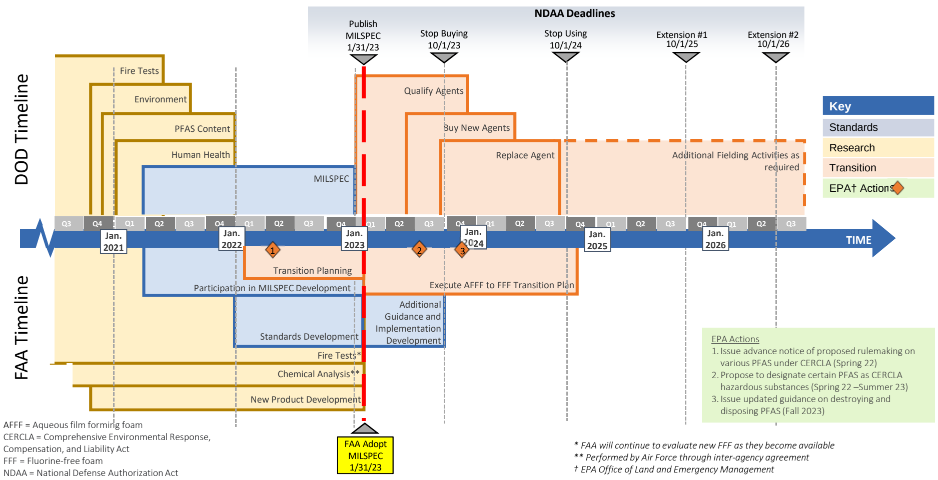
## General AFFF Replacement Schedule




AFFF = Aqueous film forming foam
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
FFF = Fluorine-free foam
NDAA = National Defense Authorization Act

** FAA will continue to evaluate new FFF as they become available*
*** Performed by Air Force through inter-agency agreement*
*† EPA Office of Land and Emergency Management*

## Questions?

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FAA Airport R&D Airport Safety Research Published Papers and Technical Notes:

http://www.airporttech.tc.faa.gov/Products/Airport-Safety-Papers-Publications

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# References

## Testing Comparisons

| Test | MilSpec | ICAO Level C |
|---|---|---|
| Refractive Index | X | |
| Viscosity | X | X |
| pH | X | X |
| Spreading Coefficient | X | |
| Surface Tension | X | |
| Interfacial Tension | X | |
| Foamability | X | |
| Film Formation and Sealability | X | |
| Corrosion | X | |
| PFOA and PFOS | X | |
| Dry Chemical Compatibility | X | |
| Stability | X | |
| Compatibility | X | |
| Environment Impact | X | |
| Toxicity | X | |
| Chemical Oxygen Demand | X | |
| Biodegradability | X | |
| Fire Test | X | X |
| Stratification | X | X |
| Precipitation | X | |
| Fluorine Content | X | |

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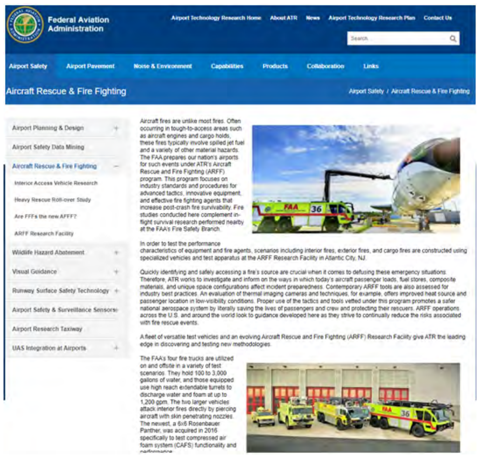
# ARFF Resources




ARFF Website


ARFF Fact Sheet

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# Emerging Entrants Update: Vertiport Design Standards for Advanced Air Mobility

RPA S1.5 VTOL

Presented to:
REDAC Sub committee on Airports

**Jonathan Torres**

March 8 – 9, 2022

## Agenda

- Research Purpose
- Goals
- Request for Information
- NASA National Campaign
- Vertiport Research Efforts
  - o Vertiport Design Study
  - o Vertiport Electrical Infrastructure Study
  - o Future Studies

## Purpose of Vertiport Research Projects

**To provide the evidence FAA needs to develop sound vertiport guidance and help build safe, effective facilities now that AMM technology has evolved.**

- Previously published guidance – Advisory Circular on Vertiport Design (AC 150/5390-3) – was cancelled in 2010 due to lack of compatible aircraft
- New Advisory Circular is needed

Source: NASA.gov

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## Goals for new “Vertiport Design” Advisory Circular

- ✓ Define parameters for a minimally developed facility for the boarding and off-boarding of passengers and cargo by VTOL aircraft.
- ✓ Considerations for the variety of facility configurations - depending on the level of throughput expected at the facility, and the characteristics of the aircrafts.
- ✓ Future standards needs to be performance based.

**Facility Operational Requirements include:**

- Landing area design and layout/geometry
  - The dimensional requirements of the landing area will depend on an aircraft’s Critical Dimensions (CD) & maximum gross takeoff weights
- Approach/Departure paths
- Load bearing requirements
- Electric propulsion and charging stations
- Safety requirements for batteries and other hazardous materials
- Noise requirements

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## Request For Information (RFI) - Background and Findings

- April 2019 - October 2019: FAA posts RFI seeking information from industry:
  - o VTOL aircraft design and specifications
  - o Concepts of operations
  - o Infrastructure design
  - o Takeoff and landing profile
- Nine responses received, some incomplete.
- Industry initially reluctant to share data due to Intellectual Property concerns.

| RFI Responses | Aircraft Design & Specifications | Concept of Operations | Infrastructure Deign | Takeoff and Landing Profile |
|---|---|---|---|---|
| RFI Responder #1 | ✓ | ✓ | ✓ | ✓ |
| RFI Responder #2 | ✓ | ✓ | | |
| RFI Responder #3 | ✓ | | | |
| RFI Responder #4 | ✓ | ✓ | | ✓ |
| RFI Responder #5 | ✓ | | | ✓ |
| RFI Responder #6 | | ✓ | | ✓ |
| RFI Responder #7 | | ✓ | | |
| RFI Responder #8 | ✓ | ✓ | ✓ | |
| RFI Responder #9 | ✓ | ✓ | ✓ | ✓ |

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## NASA National Campaign - Background and Findings

### ATR's participation:

ATR provides input for creating a baseline design of landing areas that will be used during evaluations.

### Data Sharing:

Data collected through the NC regarding vehicle performance will aide in the development of vertiport guidance.

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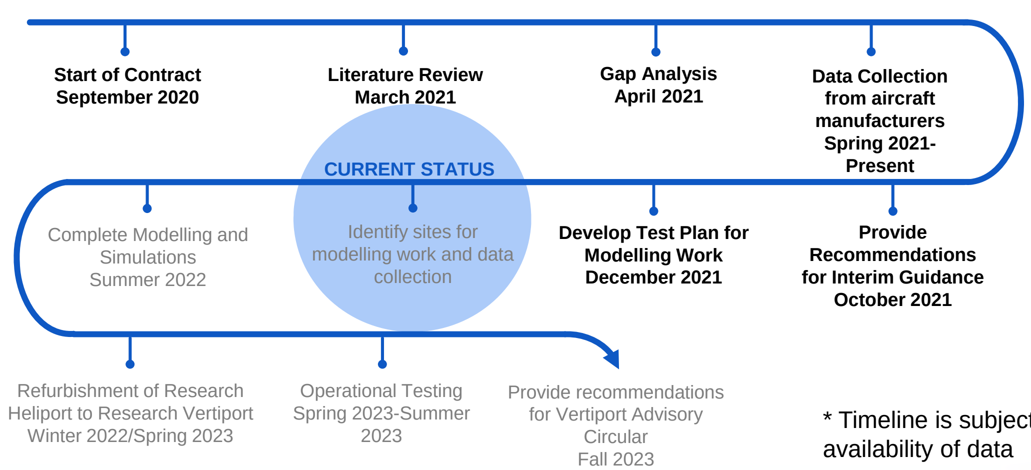
## Vertiport Research Efforts

- Vertiport Design Study
- Vertiport Electrical Infrastructure Study
- Future Studies

## Vertiport Design Study Timeline




* Timeline is subject to availability of data

## Research Study: Literature Review & Gap Analysis

### Purpose

Use findings to develop first round of recommended design categories for vertiport infrastructure.

### Research Background

Over 150 AAM related documents compiled regarding Aircraft Design Groups (ADG), Environmental Impacts, Safety Considerations, and existing Regulations.

### Findings

- Gap Analysis identified vehicle performance as a necessary research focus area to address design parameters



## Vertiport Design Study: Data Gathering from Aircraft Manufacturers

- Partnered with FAA's Aircraft Certification Service to facilitate introductions with OEMs.
  - Made contact with a dozen OEMs to discuss aircraft performance.
  - Coordinated with FAA attorneys to determine how IP will be protected.
- Sent two sets of inquires to OEMs to gather data needed for infrastructure considerations.
  - Second inquiry focused on data needed for vertiport interim guidance.
  - Additional inquiries may be made as research progresses.
- Responses from the manufacturers have provided researchers a good idea of the maturity of each vehicle.
  - OEMs committed to provide the FAA any missing data from the inquiries once they obtain through simulations or performance testing.

## Vertiport Design Study: Interim Guidance

- Provided interim design recommendation to AAS-110 in October 2021.
- Aided in the development of interim guidance in the form of a Vertiport Engineering Brief.
- Draft EB will be shared for public comment first quarter of calendar year 2022.

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## Vertiport Design Study: Modelling and Simulation

### Purpose

- Test, at a conceptual level, the draft vertiport design standard recommendations contained in the draft interim guidance.

### Objectives

- Conceptually test standards from the draft guidance through six case studies that simulate planning of and model operations for a vertiport.
  - Identify additional gaps in the draft guidance and recommendations for updating the guidance.
  - Identify areas of additional research recommended beyond the draft guidance to support advisory circular development.
  - Ensure that sizing requirements are realistic for numerous areas.

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## Vertiport Design Study: Modelling and Simulation

- Case Study/Scenario
  - On-airport vertiport at large hub airport
  - On-airport vertiport at small hub/general aviation airport and converted heliport
  - Rural/suburban greenfield (new) vertiport
  - Off-airport vertiport in close proximity to high-operations airport
  - Temporary facility
- Research team is working on identifying sites and gathering data from sites.

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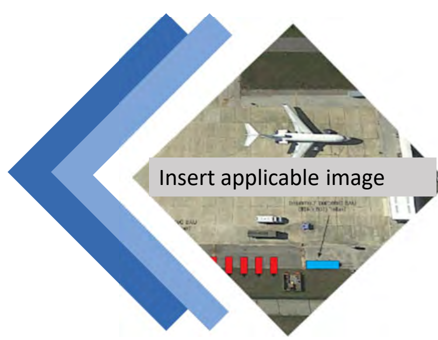
## Vertiport Eletrical Infrastructure Study

**Research Program Goal:** Produce a detailed AAM Charging Infrastructure Energy Analysis/Assessment Study to determine energy needs related to the energy resiliency of AAM.

**June 2021**
Beginning of Study

**Fall 2021-Present**
Collect necessary data from OEM
Identify Sites and collect data
Review regulations related to hazards and cybersecurity concerns regarding charging stations

*** 2022**
Infrastructure Study Report Complete
August 2022*

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## Research Study: Vertiport Electrical Infrastructure Study

### Purpose

- ATR and National Renewable Energy Laboratory (NREL) established an agreement to conduct an 18-month vertiport electrical infrastructure study.
- Study focuses on key areas, including:
  - Vertiport charging needs
  - Cybersecurity concerns
  - Hazards evaluations

### To Date

- FAA has coordinated communications between NREL and aircraft manufacturers.
- FAA is initiating communication with landing sites that could be part of the study.
- NREL is developed inquiries for both the aircraft manufacturers and site owners.

### Updates/Challenges

- NREL will be delivering a two reports to ATR in Spring 2022:
  - Hazard Report
  - Cybersecurity Report
- NREL is has faced delays receiving necessary data from sites. Submission of Final Report might be delayed.

NREL
National Renewable Energy Laboratory

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## Future Studies

- Hydrogen Infrastructure for Vertiports
  - A detailed AAM Hydrogen Infrastructure Energy Analysis/Assessment Study to determine energy needs related to the energy resiliency of AAM.
- Small-Scaled Outwash and Downwash Study for Vertiports
  - Development of a small-scale test methodology to study downwash and outwash from VTOL aircraft, and determine how they will affect vertiport design parameters.

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## Questions?

**Contact the FAA Program Managers**

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# sUAS Airport Application Research Update

**RPA S8: UAS Integration at Airports**

Presented to:
REDAC Sub committee on Airports

**Mike DiPilato**
March 8 – 9, 2022

## Agenda

- **The FAA is conducting research to determine minimum performance specifications and guidance for the following airport sUAS applications (use-cases).**
  - Obstruction Analysis
  - Pavement Inspections
  - Perimeter Security Inspections
  - Aircraft Rescue and Firefighting (ARFF) – Live Monitoring and Accident Documentation
  - Wildlife Hazard Management – Dispersal and Monitoring
  - FOD Detection* *(Initiated in February 2022)*
- **The FAA has concluded their initial research and are preparing final reports that summarize the research and results.**
- **Summary / New Research Initiatives**

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## Obstruction Analysis

- Research was initiated in 2019 and will conclude in 2022.
- Conducted testing at six airports :
  1. McCormick County Airport (S19), South Carolina *(Proof of Concept Testing)*
  2. Cape May County Airport (WWD), New Jersey
  3. Granbury Regional Airport (GDJ), Texas
  4. Weather Perry-Foley Airport (FPY), Florida
  5. Cincinnati West Airport (I67), Ohio
  6. Suffolk Executive Airport (SFQ), Virginia* *(final validation)*
- The FAA tested various types of sUAS (i.e. fixed wing, multi-rotor, and hybrid), as well as different optical red-green-blue (RGB) cameras (visual spectrum cameras).
- sUAS data (imagery) at each airport was compared to imagery collected via 'traditional methods': manned aircraft and ground survey data.
- Government Collaborator:

National Geodetic Survey
Positioning America for the Future



## Obstruction Analysis Conclusions and Next Steps

- The results from this research conclude that it is feasible to use sUAS for small area surveys.
  - UAS datasets were capable of meeting AC 150/5300-18B vertical and horizontal accuracy standards.
- sUAS collect a significant amount of images compared to manned aircraft.
- Final Report will be completed in 2022.
- Further Research:
  - Develop process for ingesting, verifying and validating sUAS obstruction survey data.
  - Conduct testing at altitudes > 400'.
  - Explore new processing/analysis methods (e.g. traditional stereo analysis vs. point cloud).

UAS Flight Plan: Obstruction Survey
Lanai Airport, Hawaii (LNY)

## Pavement Inspections

- Research was initiated in 2020 and will conclude in 2022.
- Conducted testing at 8 airports
  - Various pavement types (asphalt and concrete)
  - Various locations: runways, taxiways, ramps (grooved and non-grooved)
  - Various distress types and severities
  - Different geographic regions
- Pavement data collected with the sUAS was compared to data collected via 'traditional' foot-on-ground pavement surveys at each airport.
- Data was collected with numerous sUAS platforms (multi-rotor and Hybrid) and sensors (RGB, thermal, and LiDAR).
  - Testing focused mostly on optical RGB cameras
- FAA SME: Matthew Brynick

Foot-on-Ground (FOG)

Digital Vehicle Survey

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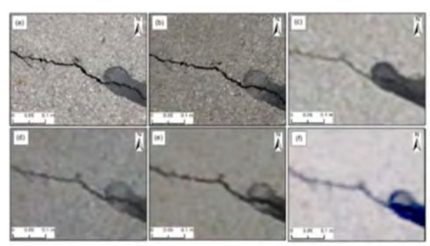
## Pavement Inspections Conclusions and Next Steps

- sUAS are a suitable tool for supplementing, but not replacing traditional pavement inspections.
  - The results from this research conclude that sUAS effective for inspecting a significant majority of available portland cement concrete distresses (2 not available) and asphalt cement distresses (6 not available)
- Testing focused on identifying the optimum imagery resolution (and data collection characteristics) to accurately identify pavement distresses.
- Final reports will be completed in 2022
- Further Research:
  - More extensive testing on different payloads (e.g. LiDAR)
  - Collect data on remaining distresses that were not available to collect during initial testing.



Example of Unsealed L&T Cracks on ACC Pavement

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## Perimeter Fenceline Inspections

- Research was initiated in 2019 and will conclude in 2022.
- Testing focused on fence line inspections and surveillance for 'public protection' purposes.
- Completed testing at four airports:
  - Cape May County Airport (WWD), NJ
  - McGhee Tyson (TYS), TN
  - Savannah/Hilton Head (SAV), SC
  - Cincinnati/Northern Kentucky International Airport (CVG), KY
- Testing Elements:
  - Various sections of fence / environments
  - Multi-rotor platforms on pre-programmed flight plans
  - Various payloads (RGB, IR, and spotlight)
  - Various altitudes, offset distance from the fenceline, and camera angles
  - Streaming technologies
  - Times of day (day, dusk, and nighttime)
- Received feedback from airport sponsors on the use of UAS for perimeter fenceline inspections.

Fenceline Inspection

Identify Potential Intruders

## Perimeter Fence Conclusions and Next Steps

- The results from this research conclude that sUAS are most effective for inspecting hard to reach locations.
- sUAS are a suitable tool for supplementing, but not replacing traditional inspections.
- Further autonomy will increase the benefit of using sUAS for this application.
- Final Report will be completed in FY 22.
- Further Research:
  - Autonomously Deployed sUAS (i.e. 'drone-in-a-box')

Ideal for Inspecting 'Hard to Reach' Fencelines

## ARFF Live Monitoring

- Research was initiated in 2021 and will conclude in 2022.
- The FAA initiated testing at the FAA Technical Center / Atlantic City International Airport (ACY), NJ.
- Testing Elements:
  - With various multi-rotor platforms and payloads (visual and IR cameras)
  - During various times of day (day, dusk, night)
  - Different variables: fire, smoke, heat source inside aircraft, rescue Randy's, baggage, aircraft seats, live personnel.
- The FAA integrated sUAS Operations into DFW Fire Training Research Center's 'Advanced Classes'.
- Received feedback from firefighters who were able to watch live sUAS feed via streaming software.
- FAA SME: Keith Bagot

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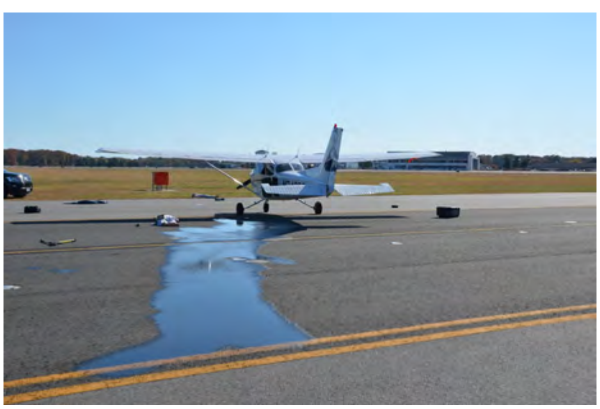
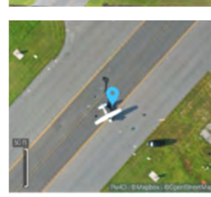
## ARFF Accident Documentation



Simulated Aircraft / Vehicle Collision



Ability to Zoom and Mark Passengers/Debris/Evidence/etc.

Measurements (Tire Marks)

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## ARFF Live Monitoring and Accident/Incident Documentation Conclusions and Next Steps

**ARFF Live Monitoring**

- The results from this research conclude that sUAS provide enhanced situational awareness to incident responders.
- ARFF Live Monitoring Final Report will be completed in 2022.
- Future Research:
  - Tether research
  - Integrate sUAS into an airports full-scale emergency response exercise

**ARFF Accident/Incident Documentation:**

- The initial results from this research conclude that sUAS can be a useful tool to provide rapidly generated high resolution maps of an accident/incident scene. This information will be useful for situational awareness and preserving evidence at the scene.
- ARFF Accident Documentation Interim Report will be completed in 2022.
- It is anticipated that additional research is needed to test different variables, such as camera settings and environments (fields, terrain, etc.).

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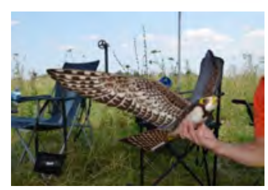
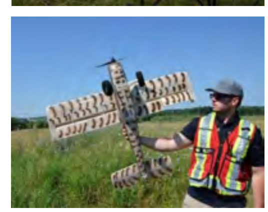
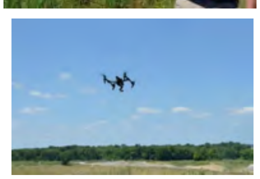
## Wildlife Dispersal







- The FAA and U.S. Department of Agriculture – National Wildlife Research Center are collaborating to examine bird responses to various sUAS platforms
  - Fixed wing, fixed wing 'predator model', quadcopter, and ornithopter (Robird®)
- Completed testing in four locations (off-airport):
  - Agriculture field in North Dakota (captured birds in an enclosure)
  - Landfill in Ohio (free-range)
  - Rooftop locations in Ohio (free-range)
  - Rooftop location in Illinois (free-range)
- Subject birds:
  - Turkey vultures, gulls, and red winged black birds.
- Conducted direct and overhead flights
- FAA SME: Wesley Major
- Government Collaborators:

USDA Wildlife Services NWRC National Wildlife Research Center

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## Wildlife Dispersal Conclusions and Next Steps

- The initial results from this research indicate that sUAS are a potential tool for dispersing specific species of birds. Effectiveness varies between the bird species, UAS platform, and flight profile.
- Two Peer Reviewed Publications:
  - Testing a key assumption of using drones as frightening devices: Do birds perceive drones as risky? *(March 2020)*
  - Responses of turkey vultures to unmanned aircraft systems vary by platform. *(November 2021)*
- Further Research:
  - Conduct a 'pilot program' to validate the initial findings and recommendations (e.g. platform and flight profile) in an airport environment.
  - Evaluate additional bird responses when exposed to various sUAS platforms.
    - Continue to focus on species with a high number of reported strikes, damage, negative effect on flight, economic loss (e.g. aircraft down time).
  - Couple 'avian' lighting research with sUAS research to possibly increase the likelihood of dispersal.

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## Wildlife Monitoring

- **Initiated UAS wildlife monitoring study with USDA and Mississippi State University (MSSU) in FY 2020 and will conclude in FY 2023.**
  - Study includes monitoring birds and mammals
  - Will identify optimum altitude, camera angle, payload performance specifications, etc.
- **Literature Review / Outreach**
  - Developed and published 'systematic map' (standard process for conducting literature review). This was a peer-reviewed publication.
  - ~250 articles will be included in the review
  - Collecting non-published information on how sUAS have been used for wildlife monitoring:
    - https://msstate.co1.qualtrics.com/jfe/form/SV_d9WaZb5QHuSSa0K
- **Developing repository of overhead wildlife images (to be used for Artificial Intelligence / Machine Learning processing)**
- **Field Testing**
  - Currently taking place at MSSU campus with 'decoys' and live animals. Plans to test at an airport in the near future.
- **FAA SME: Wesley Major**
- **Government Collaborator:**

USDA Wildlife Services NWRC National Wildlife Research Center


Decoy Experiments


Heating Thermal Decoys

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## Summary / New Research

### Summary

- **The FAA is in the process of completing final reports that summarize the research in the following applications:**
  - Obstruction Analysis
  - Pavement Inspections
  - Perimeter Security Inspections
  - Aircraft Rescue and Firefighting (ARFF) Live Monitoring
  - ARFF Accident Documentation (Interim Report)
- **The FAA and USDA published two peer reviewed journals (March 2020 and November 2021) that summarize the initial sUAS wildlife dispersal research.**
- **Wildlife monitoring research is in process.**

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### New Research Initiatives

**Existing Applications**

- **Obstruction**
  - Develop process for ingesting, verifying and validating UAS obstruction data.
  - Fly > 400'
  - Explore new processing/analysis methods
- **Pavement**
  - More extensive testing on different payloads (e.g. LiDAR)
  - Collect data on distresses that were not available during initial tesitng
- **Perimeter Inspections**
  - Assess autonomously deployed sUAS ('drone-in-a-box')
- **ARFF**
  - Integrate sUAS into an airports full scale emergency response exercise
  - Additional accident/incident documentation testing
- **Wildlife**
  - Conduct validation dispersal testing at an airport
  - Evaluate additional bird responses when exposed to various sUAS (and sensors)
  - Continue wildlife monitoring research

**Initiate New Applications**

- FOD Detection *(initiated February 2022)*
- Construction Monitoring *(recommended by REDAC)*
- Airfield Lighting Inspections *(proof of concept laboratory testing in process)*
- Tether Research *(draft outreach report complete)*
- EMAS Inspections
- Further Integration

## Questions?

**Contact the FAA Program Manager**

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# Trapezoidal Grooving Research Update

**RPA S1.4: Trapezoidal Grooving Testing and Design**

Presented to:
REDAC Sub committee on Airports

**Jonathan Torres**

March 8 – 9, 2022

## Agenda

- Original Project Purpose
- Initial Research Approach Limitations
- Current Research Approach
- Phase 1 Research
  - Tire-Water Pavement Interaction Model
  - Laboratory Test Platform
  - Challenges
- Next Steps

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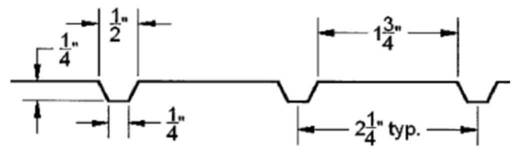
## Original Project Purpose

- Research Request dated 11/14/2014 to evaluate performance of trapezoidal-shaped runway grooving relative to FAA standard grooving for maintaining skid-resistance and to prevent hydroplaning of aircraft tires during wet weather conditions.
- Instrumented B727 aircraft (R&D 40) to be utilized in conducting high speed braking test runs on wetted transverse grooving test bed.
- Test bed will include both trapezoidal-shaped runway grooving and FAA standard grooving sections on ACY Runway 4-22.
- Objective is to determine whether trapezoidal-shaped runway grooving should be identified in FAA AC's 150/5320-12 and 150/5370-10 as an acceptable alternative to FAA standard grooving.




Example of trapezoidal groove

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## Initial Research Approach Limitations

- Cost of Constructing Trapezoidal Grooving Test Bed.
- Very Limited Window (60 Days) Being Offered by ACY for Conducting of Full Scale Performance Testing.
- ACY has Concerns Regarding Use of Runway 4-22 with Half-Depth Grooving and Un-Grooved Section Under Wetted Runway Conditions.
- ACY Runway 4-22 Lacks Adequate Length to Conduct Testing at 140 Knots or Greater.
- Runway Grooving Test Bed with Five 300-Foot Sections Does Not Allow For Required 3 Seconds of Friction Limited Braking Minimum at 100 Knots in Each Individual Section.

## Current Research Approach

- Work with Rutgers University in developing a laboratory test platform and finite element based computer model to assess braking friction under conditions directly relatable to instrument test aircraft.
- Lab testing and FE modeling will be used to assess the influence of half-depth trapezoidal-shaped and FAA standard runway grooving on aircraft braking friction under wetted runway conditions.
- This approach allows us to evaluate different grooving designs while being cost effective.
- Research will be conducted in two phases.
  - Phase 1 expected to be finished by March 2022
  - Phase 2 will run for 18 months after Phase 1 is complete.
- Updated Research Request was provided on December 2021 reflecting new approach.

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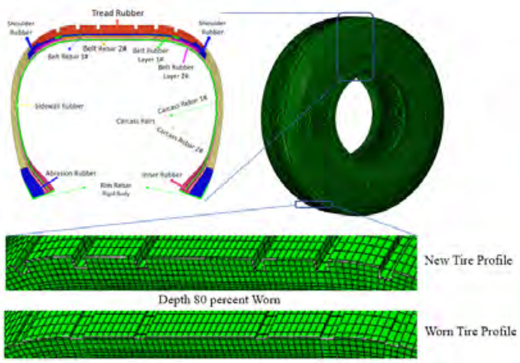
## Phase 1– Develop Tire-Water-Pavement Interaction Model

- Calibrate aircraft tire model
  - Aircraft tire dimensions (Goodyear 2002)
  - Measured tire deflection and footprint data (NASA data)
  - Measured tire contact stresses and area using the test tire used at NAPTF

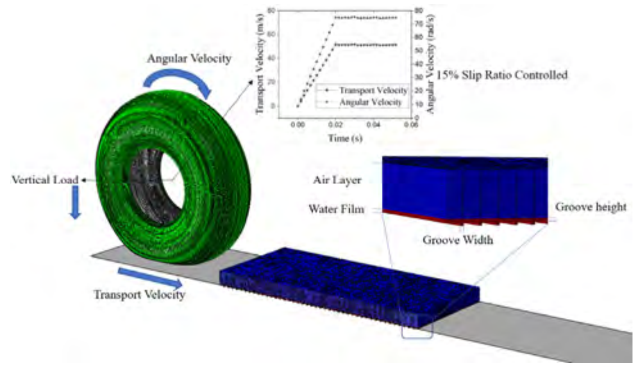
Geometries of New and Worn Aircraft Tires

| Parameters | Values | Parameters | Values |
|---|---|---|---|
| Number of Grooves | 6 | Rib Width (mm) | 69/32/64 |
| Maximum Diameter (mm) | 1244 | Groove Width (mm) | 8\9\8 |
| Maximum Width (mm) | 427 | New Tire Groove Depth (mm) | 8 |
| Maximum Height (mm) | 351 | Worn Tire Groove Depth (mm) | 1.6 |

## Phase 1– Develop Tire-Water-Pavement Interaction Model



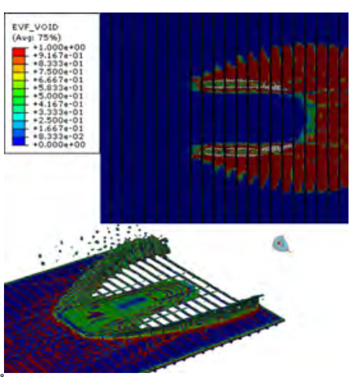

Demonstration of 2D aircraft tire structure and tread profile



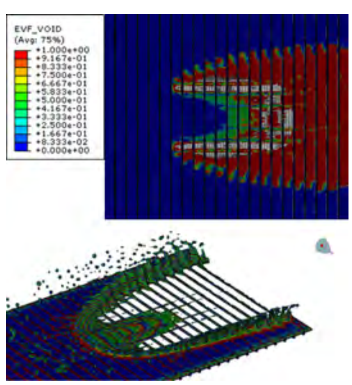

Tire-water-pavement interaction model on grooved pavement

## Phase 1– Develop Tire-Water-Pavement Interaction Model

**Illustration of tire-pavement contact area from bottom view and side view at (a) 75.6 m/s; (b) 46.3 m/s; and (c) 36.5 m/s**



(a)



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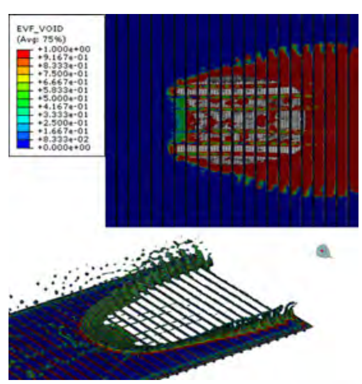
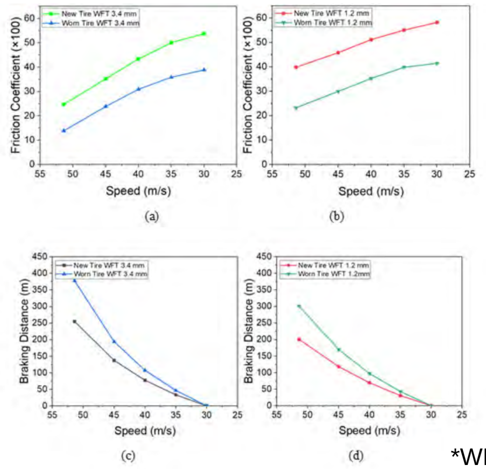


(c)

## Phase 1– Develop Tire-Water-Pavement Interaction Model

Effect of tire wear on friction coefficients at: (a) 3.4-mm *WFT; (b) 1.2-mm WFT and on braking distance at: (c) 3.4-mm WFT; (d) 1.2-mm WFT

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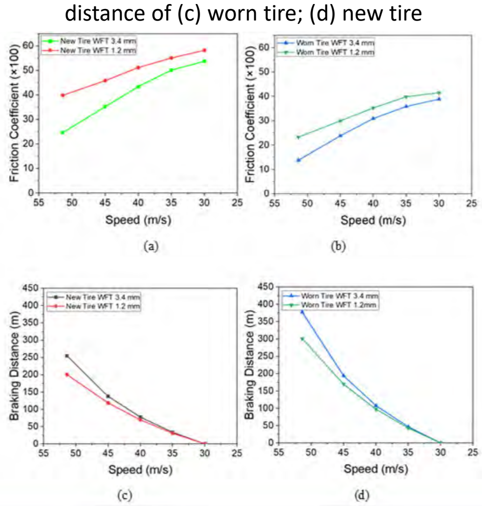
*WFT= Water Film Thickness

## Phase 1– Develop Tire-Water-Pavement Interaction Model

Effect of water film depth on friction coefficients of (a) worn tire; (b) new tire; and on braking distance of (c) worn tire; (d) new tire

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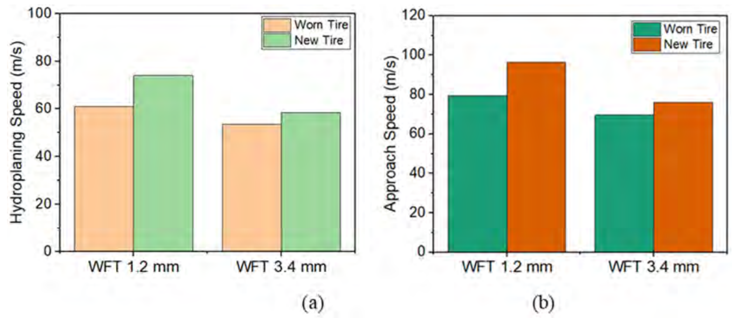
## Phase 1– Develop Tire-Water-Pavement Interaction Model

(a) Predicted hydroplaning speed after touchdown; (b) Maximum touchdown speed before hydroplaning

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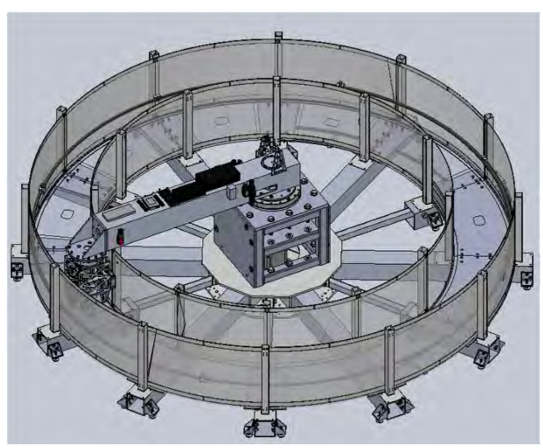
## Phase 1 – Development of Laboratory Test Platform

- Three platform designs were considered but a circular track was selected.
  - A circular track design provides the ability of maintaining relatively high speeds continuously for data collection in the compact space environment.
- The laboratory test platform is composed of center motor, rotating arm, wheel carriage, pneumatic loading system, track structure, and drainage system.
- The system will be real-time controlled to measure friction forces of tire on different grooved surfaces at various operating speeds, slip ratios, loads, and water depths.



## Phase 1- Challenges

- Parts of the test platform had to be redesigned due to various variables:
  - Vibration concerns
  - Feasibility
  - Vendor not guaranteeing performance of parts
- Supply chain issues have delayed the delivery of essential parts and delayed construction
- Delays in contract transitions

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## Next Steps- Laboratory Test Platform

- The laboratory test platform will be used to simulate model tire braking that relates most to the real condition of aircraft braking.
- The circular track of platform will use two different groove configurations (square vs. trapezoidal).
- The measurements of braking friction force and braking distance at different speeds, slip ratios, water film depths, and groove depths will be obtained and compared.

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## Next Steps- FE Modelling

- Flow simulations will evaluate water evacuation and drainage capability of different configurations of standard and trapezoidal-shaped groove (width, depth, and spacing) and the influence of wear (new and worn grooves).
- A range of rainfall intensity values considering different runway geometries (length, width, and slope) will be considered in the analysis.
- The simulation results will be used to compare drainage capability of different groove configurations.

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## Questions?

**Contact the FAA Program Manager**

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# Degraded Braking Friction Update

**RPA S6.1: Aircraft Braking**

Presented to:
REDAC Sub committee on Airports

**Somil Shah**
March 8 – 9, 2022

## Agenda

- Machine Learning & Big Data Analytics
- Machine Learning Effort with MIT
  - Overview
  - Machine Learning Models and Results
  - Findings from MIT work
- Machine Learning Effort with Georgia Tech
  - Overview
  - Data Fusion
  - Unsupervised Learning
  - Supervised Learning
  - Findings from Georgia Tech work

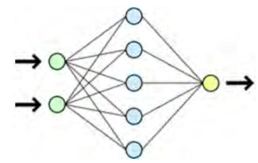
2

## Machine Learning & Big Data Analytics

- The research team has been exploring the use of **big data analytics, machine learning, and artificial intelligence** technologies to complement flight testing efforts and gain deeper insights into the issues at hand

  <u>**Premise**</u>: use readily available big data (aircraft data, weather data, field condition reports, pilot braking action reports, etc.) to **identify** degraded braking cases, **determine** contributing factors and conditions, and **predict** when degraded braking may occur in the future

- Working with two **academic partners**: MIT (using AST data) and Georgia Tech (using flight data)



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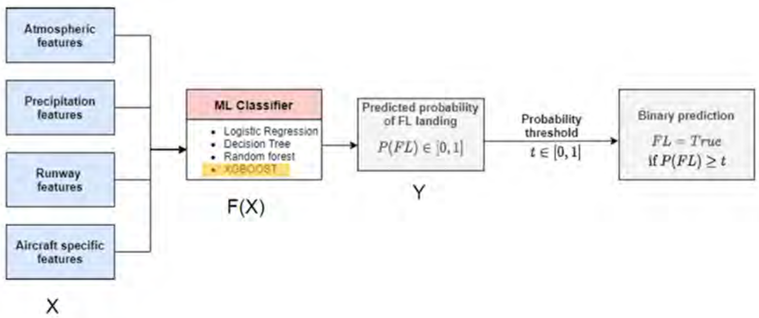
## Machine Learning Effort with MIT

## Machine Learning Effort with MIT

- Using data from **Aviation Safety Technologies (AST)**
  - 4.9 million recorded landings, of which 8,693 are "friction-limited" (0.18% of total)
  - Labeled as either "friction-limited" or "not friction-limited"
  - Also includes weather/precipitation information, aircraft information, airport/runway information, and friction measurements, among other things
- Machine learning models were trained to **map input "features" to the probability** of a given landing being friction-limited

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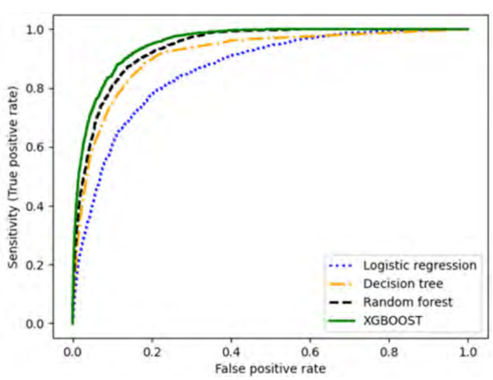
## Machine Learning Models

- Four different models were tested using the AST data
- The AUC value is used as a metric to evaluate the performance of the models → XGBOOST performed the best




| MODEL | AUC |
|---|---|
| Logistic regression | 0.863 |
| Decision tree | 0.912 |
| Random forest | 0.939 |
| XGBOOST | 0.958 |

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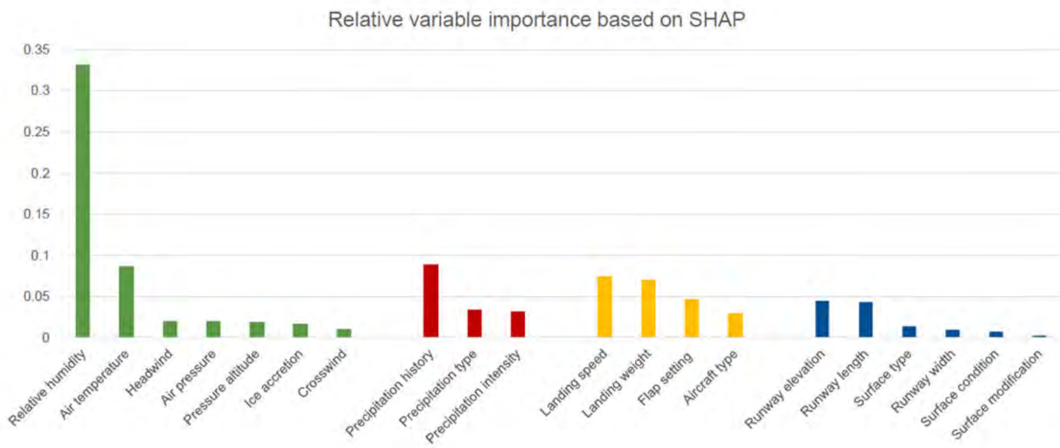
## Feature Importance Provided by XGBOOST

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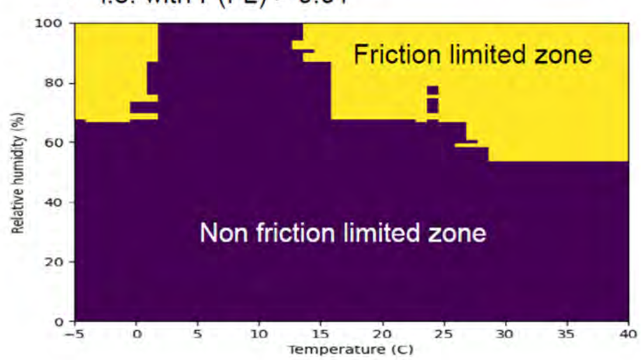
## Decision Plots

- Visualizations were created of decision boundaries for a given runway if certain conditions are held constant
- Example to the right:
  - Constant runway information (surface, length, width)
  - Given weather information (precipitation, wind, pressure)
  - Sampled relative humidity and temperature

Decision plot – yellow indicates friction limited
- i.e. with P(FL) > 0.01

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## Findings for MIT Work Using AST Data

- Machine learning classifiers show remarkable performance in detecting friction limited landings when "truth" data is available
  - XGBOOST can flag **63% of friction limited cases with only 2.8% false alarms**
- **Algorithm is conservative** – particularly good at detecting severe degraded braking cases
- Model can also be used to **assess runway maintenance practices** and flag possible issues

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## Machine Learning Effort with Georgia Tech

## Machine Learning Effort with Georgia Tech

- Using **flight data from partner airlines**, and fusing it with weather data, runway data, and other relevant data sources

**Objectives**:

- Use ***unsupervised machine learning*** to identify degraded braking cases (landings) from normal landings
- Use ***supervised machine learning*** to build models to predict when degraded braking may occur given known conditions
- ***Identify critical parameters/conditions*** in degraded braking circumstances

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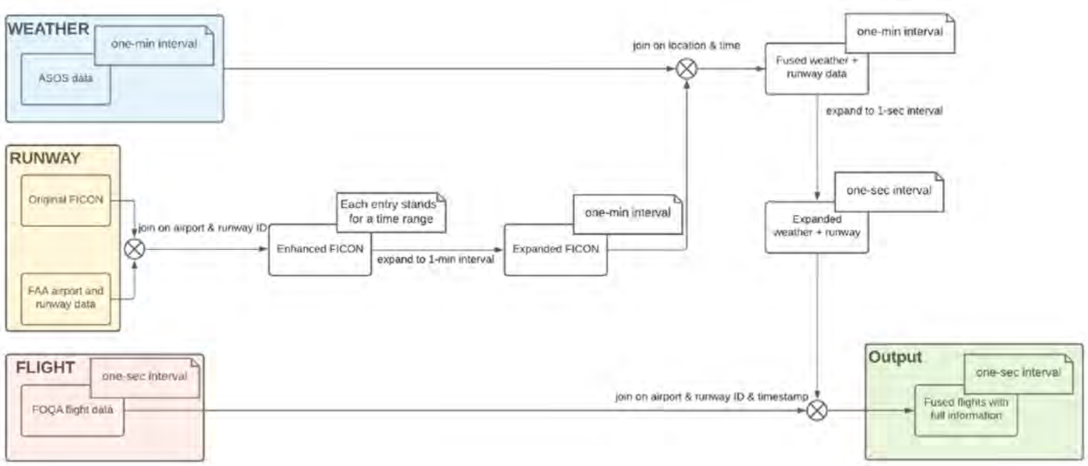
## Data Fusion Pipeline




**Takeaway:** Data fusion can be very powerful. The output file now allows the computer/machine learning models to correlate flight performance with runway properties and weather conditions.

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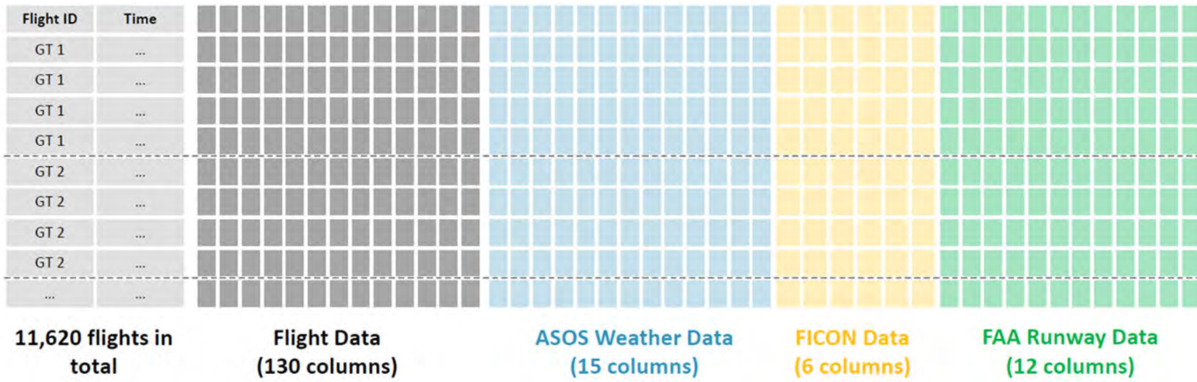
## Data Fusion Output

**The final output of the data fusion has the following structure:**

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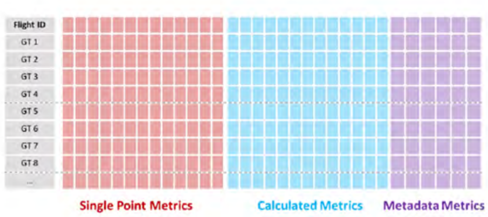
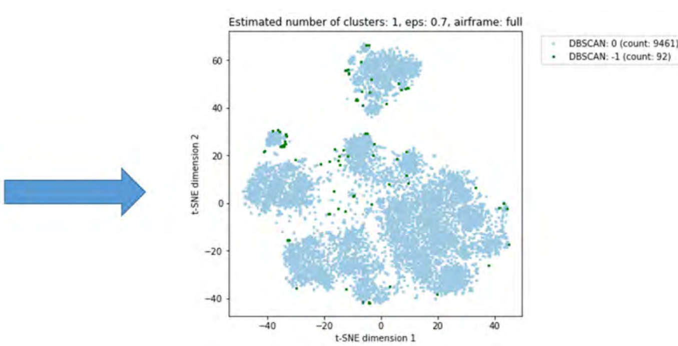
## Unsupervised Learning

- Prior to beginning unsupervised learning, **metrics of interest** need to be defined for assessing the braking performance of aircraft on non-dry runways
  - **Single point metrics** (e.g., ground speed)
  - **Calculated metrics** (e.g., speed bleed off during flare)
  - **Metadata metrics** (e.g., aircraft type)

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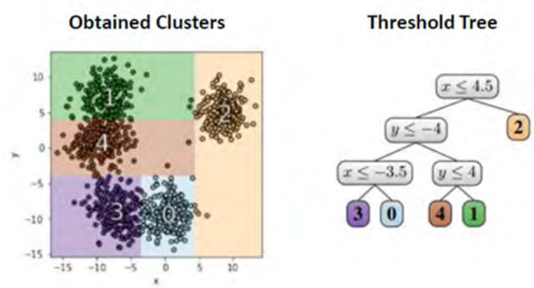
## Supervised Learning

- Following the unsupervised learning analysis, multiple clusters of the data were formed. Each cluster was given an ID, and so **the ID served as the label for the supervised learning analysis**.
- **Decision trees were then fit to the clustering results** to better understand how the clusters were formed and what factors were used by the computer to cluster the data

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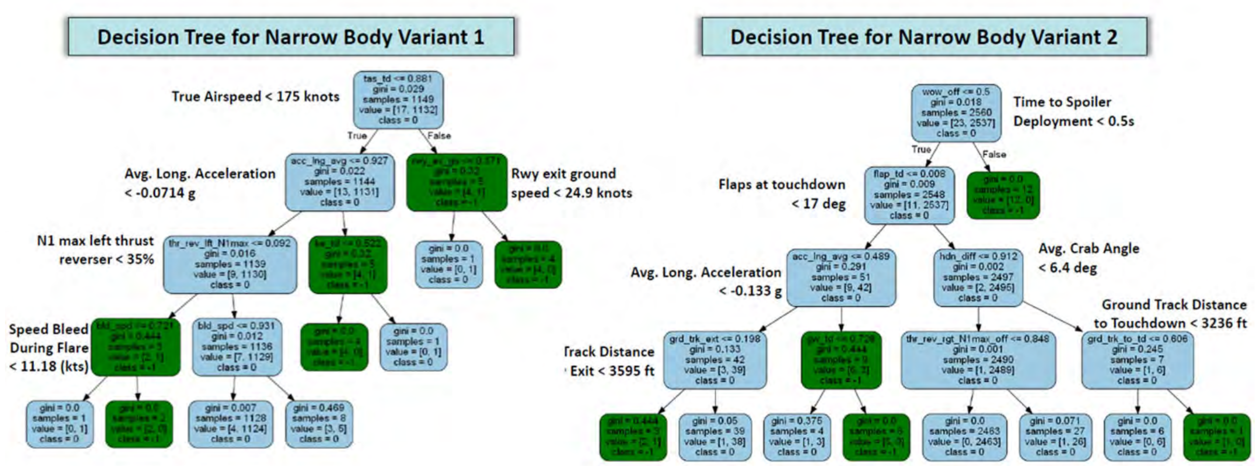
## Findings from Supervised Learning

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## Findings from Georgia Tech Work Using Flight Data

- Overall, the decision tree shows high correlation between landing performance and identified outliers
- Flight conditions before touchdown are shown to have some contribution to landing performance
- Unsupervised and supervised machine learning methods proved to be sufficient in identifying interesting outliers from a braking performance perspective, **but not sufficient to model degraded braking performance itself**
- The biggest challenge to the successful use of flight data is the **availability of friction limited data or the ability to apply labels** to the existing datasets

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# Resilience and Addressing Climate Change – Embodied Carbon and Environmentally Friendly Pavements

**RPA P2 & P3**

Presented to:
REDAC Sub committee on Airports

**Navneet Garg, Ph.D.**
March 8 – 9, 2022

## Presentation Outline

- Introduction
- Full-scale Accelerated Pavement Tests
  - o Evaluate environmentally friendly materials
  - o Laboratory characterization
  - o Structural model to evaluate material performance
- Life Cycle Assessment (LCA)
- Other Initiatives

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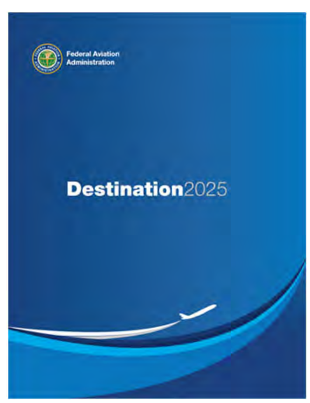
# Introduction

## Introduction

**Strategies**

1. Improve scientific knowledge of environmental impacts.
2. Develop effective decision support tools.
3. Foster research and development.
4. Develop sustainable airport facilities.

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## Introduction

**OST's Embodied Carbon Working Group**

1. Multi-modal Informal Working Group on embodied carbon.
2. The Working Group is tasked with developing an action memo to the Secretary on embodied carbon. Provide content and recommendations for a memo that will be submitted to S1.
3. First meeting on 6/22/2021.
4. Draft memo - Andrew Wishnia, Deputy Assistant Secretary for Climate Policy, DOT

**ACTION MEMORANDUM TO THE SECRETARY**

**From:** Andrew Wishnia
Deputy Assistant Secretary for Climate Policy

**Prepared By:** Working Group on Embodied Carbon

**Subject:** Embodied Carbon Policy Implementation

**ACTION REQUESTED**

I request that you approve implementing policies for reducing emissions from embodied carbon and authorize the Embodied Carbon Working Group to begin the development of workplans associated with each.

Embodied carbon refers to the GHG emissions arising from the manufacturing, transportation, installation, maintenance, and disposal of transportation infrastructure construction materials.

As embodied carbon is inherent to the process of constructing infrastructure, rather than something that could be addressed after a project is completed, there is an urgent need to address embodied carbon now, before significant Federal infrastructure dollars flow out through Bipartisan Infrastructure Law programs.

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## Introduction

Page 12 of 13.
"Agencies with activities and responsibilities for CCU and CDR regulations, standards, and greenhouse gas reporting, such as EPA, DOE, the National Institute of Standards and Technology, and other relevant agencies, should consider consolidating and publishing a repository for life-cycle analysis (LCA) methodology, results, and information related to CCU and CDR, building on existing collaboration through the Federal LCA Commons. As DOE further develops standards and certifications needed to facilitate the commercialization of CCU technologies as required in the IIJA, CEQ recommends that DOE and other agencies with equities in CCUS standards consider evaluating how standards and certifications can increase Federal procurement of CCU, CCUS, and CDR technologies."

**CEQ Issues New Guidance to Responsibly Develop Carbon Capture, Utilization, and Sequestration**

February 15, 2022 • Press Releases

Today, the White House Council on Environmental Quality (CEQ) delivered new guidance to Federal agencies to help ensure that the advancement of Carbon Capture, Utilization, and Sequestration (CCUS) technologies is done in a responsible manner that incorporates the input of communities and reflects the best available science. The development of this guidance was mandated by the Utilizing Significant Emissions with Innovative Technologies (USE IT) Act, which was signed into l... er, 2020.


https://www.lcacommons.gov/memorandum-understanding-o

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## Introduction

**The purchasing specifics...**Its purchasing efforts include efforts from the General Services Administration to buy low-carbon concrete and asphalt. It also includes efforts to use cleaner materials in federal transportation projects at the Department of Transportation including a pilot program incentivizing the acquisition of low carbon materials and the creation of a DOT working group that will assess and take actions to cut emissions from construction materials used in transportation infrastructure.

And it will expand a State Department effort known as the First Movers Coalition, which aims to help companies use their purchasing power to drive demand for clean goods, to include the aluminum, cement, chemicals and carbon removal sectors.

Hill's Environment & Energy Daily Report

Biden officials try to tackle industrial emissions

The Biden administration announced a slew of actions on Tuesday aimed at promoting green manufacturing and taking on climate change contributions from the industrial sector.

A new fact sheet from the White House said it would aim to do so through a series of initiatives aimed at bolstering clean hydrogen energy and using the

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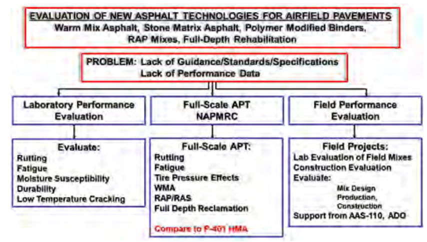
## Full-Scale Accelerated Pavement Tests

## Full-Scale Accelerated Pavement Tests (APT) at FAA's National Airport Pavement & Materials Research Center (NAPMRC)

1. Generate performance data for recycled/sustainable materials under aircraft loading.
2. Develop standards/specifications for recycled/sustainable materials.
3. Update AC 150/5370-10

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## Full-Scale Accelerated Pavement Tests (APT) at FAA's National Airport Pavement & Materials Research Center (NAPMRC)

1. Research continues to evaluate new asphalt material technologies for use on airport pavements. **Currently evaluating WMA & RAP.**
2. Reduces production fuel costs, increases the hauling distance, lengthen the paving season, is environmental friendly, and ensures safer working conditions.

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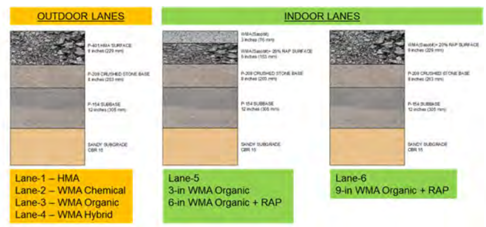
## Full-Scale Accelerated Pavement Tests (APT) at FAA's National Airport Pavement & Materials Research Center (NAPMRC)

1. High temperature rutting tests completed, results shared in last REDAC meeting.
2. Fatigue tests are currently in progress.
3. All six lanes have been aged

AGING OF TEST AREA:

- Pavement Temperature: 120 deg. F measured at a depth of 2-inch below pavement surface.
- Test Lane will be subjected to these conditions for a period of 336 hours (14 days).
- After 336 hours of aging, heaters will be turned off and insulation panels removed.
- Wait till the pavement temperature stabilizes to ambient conditions.
- Place insulation panels back and prepare for Response Tests & Traffic Tests.
- Fatigue Test Pavement Temperature – 68 deg. F.

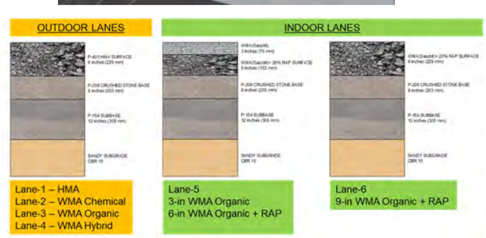




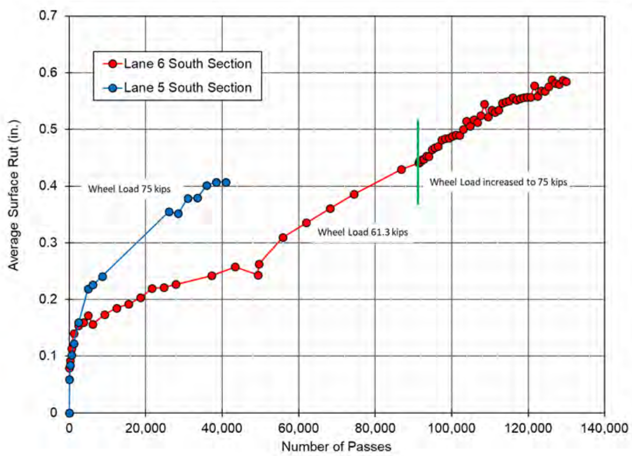

## Full-Scale Accelerated Pavement Tests (APT) at FAA's National Airport Pavement & Materials Research Center (NAPMRC)

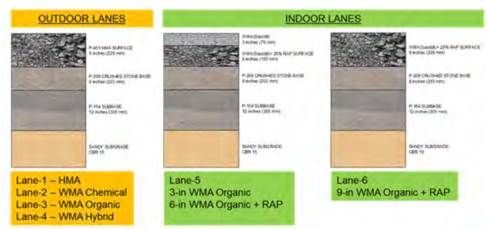
1. Lane-6S fatigue tests completed.
   - Traffic tests started at 61.3 kip wheel load
   - After 91326 passes wheel load increased to 75 kips.
   - Traffic tests terminated after 129,952 passes with no evidence of cracks.

2. Fatigue tests are currently in progress on Lane-5S.
   - Traffic tests started at 75 kip wheel load
   - Passes completed – 42,428.



## Full-Scale Accelerated Pavement Tests (APT) at FAA's National Airport Pavement & Materials Research Center (NAPMRC)

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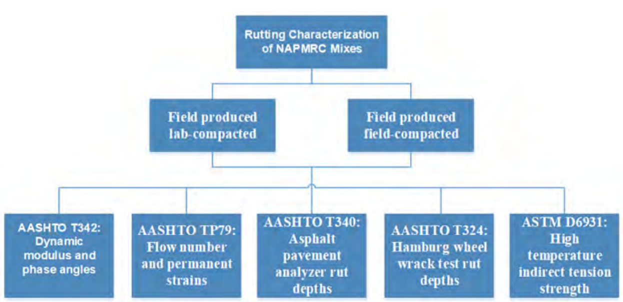
## Laboratory Characterization





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## Structural Model to Evaluate Material Performance

Developing advanced pavement analysis tool PANDA-AP to use material characterization properties – improved pavement life prediction, compare two materials before being placed on airport.

1. Software delivered.
2. Currently playing with it to get familiar.
3. Model TC-2 test sections
    - Use lab material properties
    - Compare predicted performance with APT performance

PANDA: A Fortran code in which a number of sophisticated material models is implemented.

- Includes Models for Performance Related Mechanisms
- Includes Models for Environmental Effects
- Models are Developed for General 3D Multi-Axial Stress States
- Mechanical and Environmental Models are Coupled and Can Occur Concurrently
- Flexible: Other models can be implemented to supplement/substitute current models in the future

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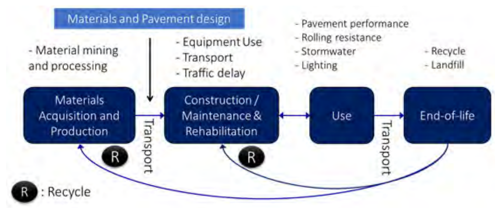
## Life Cycle Assessment (LCA)

## Life Cycle Assessment (LCA)

1. Life Cycle Cost Analysis (LCCA) calculates costs over life cycle
2. Life Cycle Assessment (LCA) calculates environmental impacts, energy use, and finite resource depletion over life cycle




*Adapted from:* Kendall et al., *2010*

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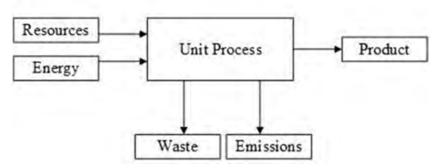
## FAA Web-based LCA Tool

1. Develop a simple interface to the Federal Commons Portal.
2. Use it to evaluate the Federal Commons API, working with the FHWA and Federal Commons lead investigators (under separate funding arrangements with their federal agencies);
3. Review the availability of public data sources needed for airfield pavement LCA in the Federal Commons and document any additional data needs to create a tool with only publicly accessible data.
4. Develop a detailed user interface to facilitate inputting of user data, such as mix designs, material types, quantities, dimensions and other data defining the project-level problem (referred to as primary or foreground data);
5. Develop internal tool relationships to connect the interface to the life cycle inventory data for processes in the Federal Commons OpenLCA database, such as fuels, materials extraction and background processing, energy production (referred to as secondary or background data), using the Federal Commons API;
6. Update the background data as necessary per the given goal and scope for a web-based airfield pavement LCA tool.

Basic Unit Process Used in LCA




- Example processes:
  - Produce one ton of asphalt concrete
  - Produce one cubic yard of concrete
  - Haul 25 tons of aggregate base
  - Place a slurry seal

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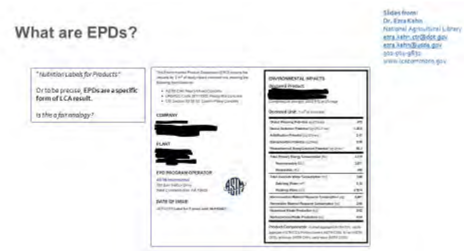
## FAA Web-based LCA Tool

7. Develop the web-based airfield pavement LCA tool and support it
8. FAA first, pavement only
9. Convert to FHWA as alternative interface, with potential for alternative data where differs from airfields (foreground data, default materials), if funded by FHWA.

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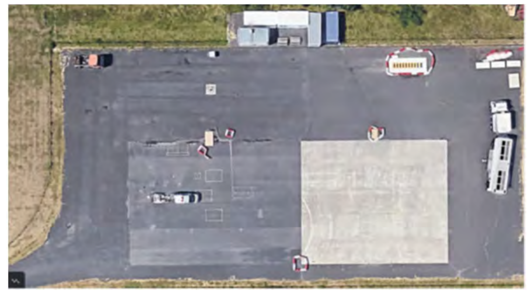
## Other Initiatives

## Other Initiatives

1. Working with French DGAC/STAC on
   - RAP in HMA mixes.
   - Bio-binders



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## Program Accomplishments to Date

- ✓ High temperature rutting tests on HMA, WMA, and RAP completed.
- ✓ LCA framework for airport pavements completed and technical report published.
- ✓ Contract for developing web-based LCA tool has been awarded.

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## Questions?

**Contact the FAA Program Manager**

Navneet Garg, Ph.D.
(609)485-4483
Navneet.Garg@faa.gov

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# Airport Environmental

**RPA Environmental**

Presented to:
REDAC Sub committee on Airports

**Lauren Vitagliano**
March 8 – 9, 2022

## Agenda

- Future Climate Scenarios for Runway Length
- Resilience at Vulnerable NPIAS Airports with Climate Change and Severe Weather
  - Purpose of the project
  - Background
  - Updates since last REDAC meeting
  - Program status and timeline

2

# Future Climate Scenarios for Runway Length

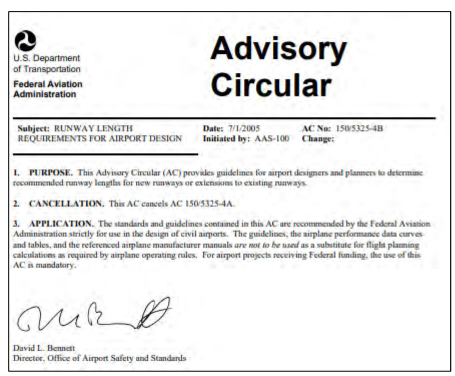
## Purpose of the Project

***What:*** Use future climate models to predict future temperature and precipitation estimates that can be input into runway length analysis tools for future infrastructure projects at airports.

Both temperature and precipitation are driving factors that affect the underlying physics used to determine the runway length under the current FAA procedures in Advisory Circular (AC) 150/5325-4.

***Why:*** Airports have expressed concern that current methods (which do not currently consider projected changes in hot day temperatures and/or frequency of wet runway conditions) may risk undersized runway lengths that are inadequate to meet service level needs.

***How***: Review of National Climate Assessment's Climate Resilience Toolkit and analyze historical data.



U.S. Department of Transportation
Federal Aviation Administration

**Advisory Circular**

**Subject:** RUNWAY LENGTH REQUIREMENTS FOR AIRPORT DESIGN
**Date:** 7/1/2005
**Initiated by:** AAS-100
**AC No:** 150/5325-4B
**Change:**

1. **PURPOSE.** This Advisory Circular (AC) provides guidelines for airport designers and planners to determine recommended runway lengths for new runways or extensions to existing runways.

2. **CANCELLATION.** This AC cancels AC 150/5325-4A.

3. **APPLICATION.** The standards and guidelines contained in this AC are recommended by the Federal Aviation Administration strictly for use in the design of civil airports. The guidelines, the airplane performance data curves and tables, and the referenced airplane manufacturer manuals *are not to be used* as a substitute for flight planning calculations as required by airplane operating rules. For airport projects receiving Federal funding, the use of this AC is mandatory.

David L. Bennett
Director, Office of Airport Safety and Standards

**Runway Length Requirements for Airport Design**

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## Project Accomplishments to Date

- Published 11/30/21:

  **Future Climate Scenarios for Runway Length: Assessment of Future Temperature and Precipitation Trends**

  DOT/FAA/TC-21/43 Authors: Annick Dewald and John Hansman

- Published 12/09/21:

  **Future Climate Scenarios for Runway Length: Assessment of Wet/Dry Runway Surface Conditions With Observational Precipitation Data**

  DOT/FAA/TC-21/41 Authors: Jasenka Rakas and Jelena Lukovic

- These reports will provide input to runway calculations and Runway Length Tool in development by MITRE

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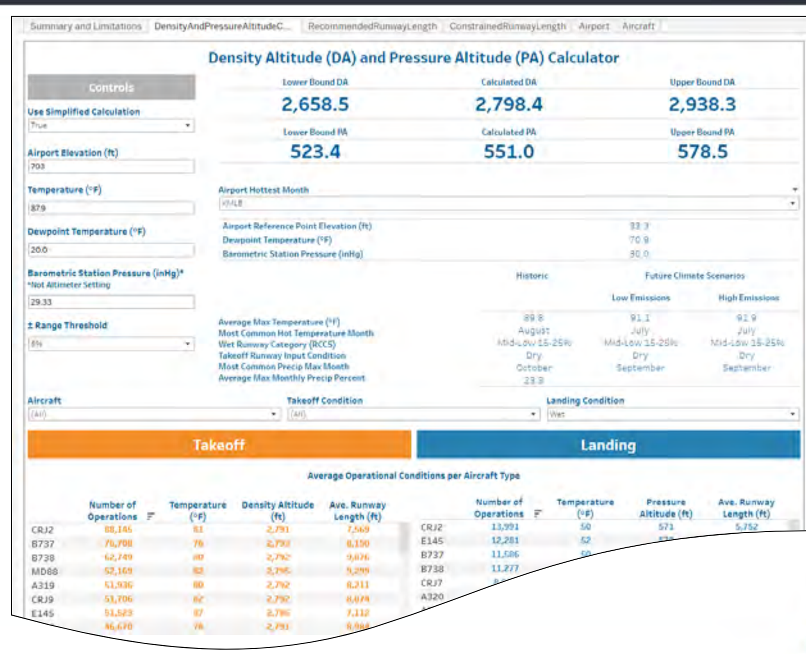
## RWLSET Prototype Density Altitude & Pressure Altitude Calculator

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## RWLSET Prototype Runway Length Recommendation


7

## Resilience at Vulnerable NPIAS Airports with Climate Change and Severe Weather

## Purpose of the Project

- Develop prioritized, risk-based recommendations for how FAA and airport operators can address climate change and severe weather impacts.
- Develop tools that will help FAA determine which airports are the most vulnerable.

**FAA/AEE Climate Action Plan submittal to U.S. Department of Transportation (March 11, 2021):** ***"The FAA does not currently have a formalized process in place to evaluate facilities."***

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## Research Outcomes

- Develop a framework airports and consultants can use when conducting resilience assessments
- Develop a prioritization framework to assist FAA in selecting National Plan of Integrated Airport Systems (NPIAS) and other eligible AIP project proposals

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## Project Timeline

| Current Status | Months 1 – 4 | Months 5 – 10 | Months 11 – 18 | Follow On Research |
|---|---|---|---|---|
| ✓ **Work Plan Finalized**<br>**Next Steps**<br>o Continue drafting Annotated bibliography/summary document | o Project Management Plan<br>o Work Plan<br>o Annotated bibliography /summary document | o Airport Resiliency Analysis Framework<br>o FAA Resiliency Project Prioritization Framework<br>o Case Study Selection | o Airport Case Studies<br>o Framework finalization and testing | **POP ends Sept 2026** |

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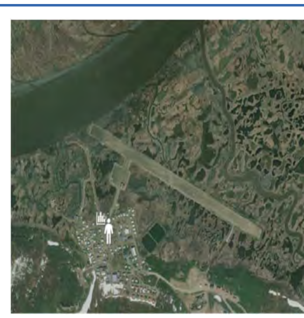
## Updates

- **Met with FAA Alaska Region**
  - Will engage with State of Alaska
  - Feasibility studies
- **Case Study locations**
  - Active projects that can help formulate and test framework (SFO, SAN)



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## Questions?

**Contact the FAA Program Manager**

Lauren Vitagliano
Airport Research Specialist
Lauren.Vitagliano@faa.gov

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# Solar Powered Lighting

**RPA S5.1: Airport Lighting and Infrastructure**

Presented to:
REDAC Sub committee on Airports

**Darian Byrd**
March 8 – 9, 2022

## Agenda

- Project Background
  - Background
  - Purpose of the project
- Technical Report
  - Project Accomplishments
  - Project updates
  - Current Status

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## Benefits of Solar Lighting at Airports

- Produces onsite electricity
- Reduces electricity use long-term
- Leverages vast amount of open land
- Facilitates energy independence

- Improves safety at GA airports
- Requires little maintenance
- Provides more flexibility*

- Reduces energy costs
- Reduces airport operating costs
- Lessens burden to install and maintain*
- Opens eligibility for Federal tax credits

- Contributes to sustainability goals
- Requires no fuel
- Improves air quality

3

** Compared to standard airfield lighting components*

## Background on Solar Powered Lighting Systems at Airports

- Solar technology has matured and now presents an opportunity for airports
- FAA Airport Technology Research and Development Branch (ATR) is examining solar powered lights as an alternative to standard lighting at General Aviation (GA) airports
- ATR is evaluating:
  - Suitability and reliability of solar powered lighting systems
  - Compliance with safety standards
  - Mitigation strategies and optimum siting requirements
- FAA guidance will then be provided on the installation and use of solar powered light systems

Solar lighting is an efficient lighting solution for small, remote, or off-grid General Aviation (GA) airports

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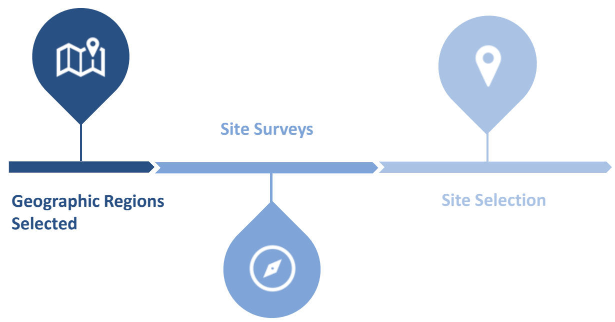
## Evaluation of Solar Powered Lighting Systems on Airports

**Research Request:** Conduct research to evaluate solar lighting Systems at 5 GA airports in diverse geographic regions based on varied solar insolation, ambient temperature range, and snow fall.

1. **Geographic regions selected**
2. **Site Surveys:** conduct surveys at candidate GA airports in each region to identify most suitable locations
3. **Site Selection:** Select one GA airport from each region for evaluation
4. **Timeframe:** Conduct evaluations over a sufficient period of time to allow for assessment of seasonal solar insolation and related battery charging capabilities.

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## Research Objectives

1. Determine compliance:
    - FAA photometric requirements
    - Reserve battery requirements
2. Assess functionality and durability:
    - Various environmental conditions
    - Outside of controlled laboratory conditions
3. Compare installation and operating costs of:
    - Decentralized solar airfield devices
    - Conventionally-powered versions of these devices

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## Components

- Airfield Components (total of 46):
  - L-861 Runway Edge/Threshold Lights
  - L-861T Taxiway Edge Lights
  - L-810 Obstruction Lights
  - Elevated Runway Guard Lights
  - Wind Cones
  - Airfield Guidance Signs
- Each component is “decentralized” i.e. each component has its own solar panel and battery charging system
- Two manufacturers
  - Carmanah
  - AvLite



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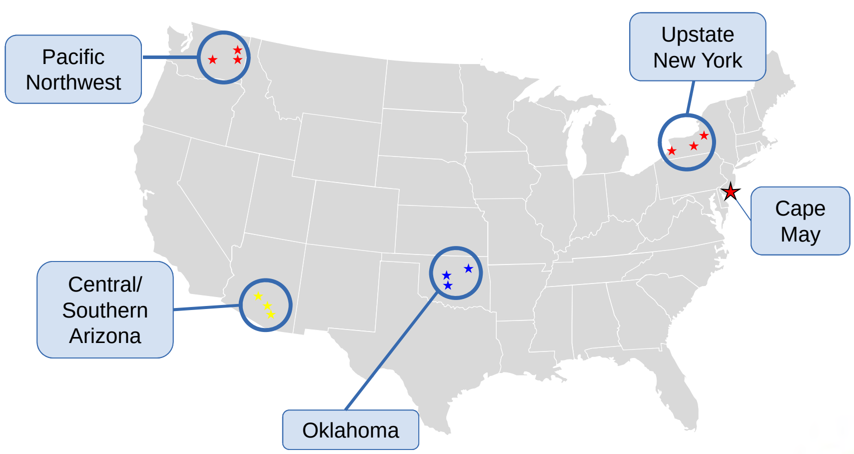
## Proposed Test Sites and Candidate Airports

1. **Cape May (WWD)**
2. Central Upstate New York
   - Oswego County (FZY)
   - Dunkirk (DKK)
   - **Penn Yan (PEO)**
3. Central Arizona
   - Phoenix Goodyear (GYR)
   - Casa Grande (CGZ)
   - Pinal Airpark (MZJ)
4. Pacific Northwest
   - Felts Field (SFF)
   - Deer Park (DEW)
   - Ephrata Municipal (EPH)
5. Central Oklahoma
   - U. of Oklahoma (OUN)
   - Wiley Post (PWA)
   - William Pogue (OWP)

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## Overview of Data Collection: Cape May Airport (WWD) – Prototype

- Field testing at WWD primarily consists of:
  - Visual observations utilizing cameras to monitor the environmental conditions at the test bed
  - Data collected from field instrumentation.
- The instrumentation and data acquisition (DAQ) systems are used to collect and record data on various accessible performance parameters for the solar devices
  - **Battery voltage:**
    - Allows for tracking the charge level for the device
    - If the charge begins to degrade, it will limit how long the light can remain operational, which provides an indication of the performance of the device
  - **Relative light intensity (or LED drive current) of the device:**
    - Signifies if the light output has degraded due to reduced driver power
    - In some cases, the LED drive current provides an indication if the device begins to reduce its power to the LED driver, thereby falling below its required performance level

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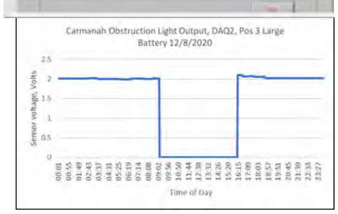
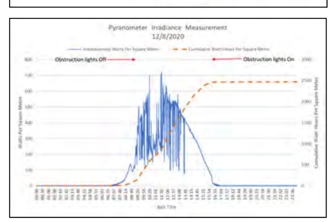
## Data Analysis

- Raw test data collected during the tests will be combined with the temperature sensor, pyranometer, and weather-related data.
- The performance of the units under test will be analyzed in view of the environmental factors in place.
- It is expected that the available watt hours of energy available will influence the performance of the devices.
- The analysis will use this information and to the extent possible identify these influences on the performance of the devices.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## Final Reporting

- **Reports will include the following information:**
  - Description of each solar-powered lighting device
  - Details for each site location
  - Impacts to the airport
  - Conclusions/recommendations derived from results
  - Cost comparison

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## Program Accomplishments

- Laboratory Testing at Intertek & RPI
- Cape May “Protype” Installation
- Data Acquisition formally began on Feb. 1, 2021
- Site Survey Report for candidate sites in Upstate NY Delivered on Dec. 31, 2020
- Interim (~30% submittal) field test data report delivered on Dec. 31, 2020
- Penn Yan (PEO) Installation on Sept. 30, 2021
- Data Acquisition formally began on Nov. 5, 2021

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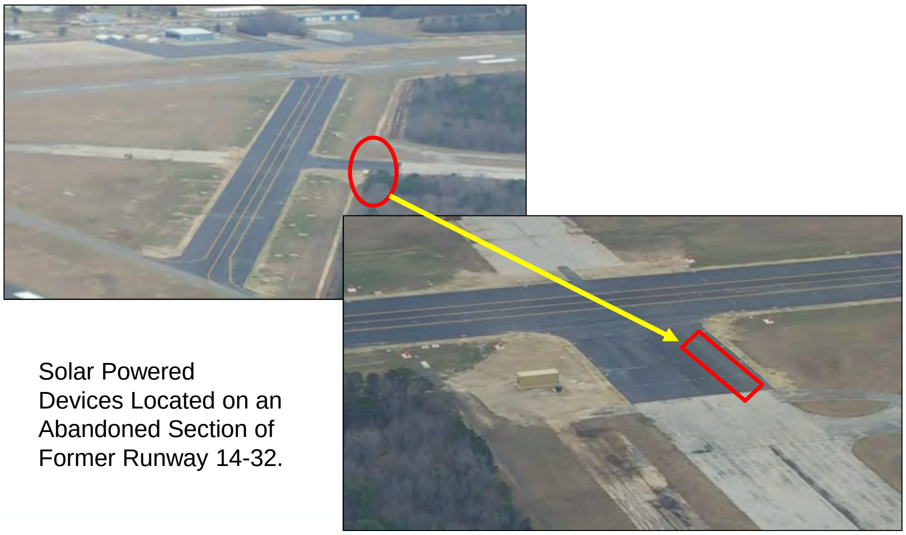
## Cape May Installation



Solar Powered Devices Located on an Abandoned Section of Former Runway 14-32.

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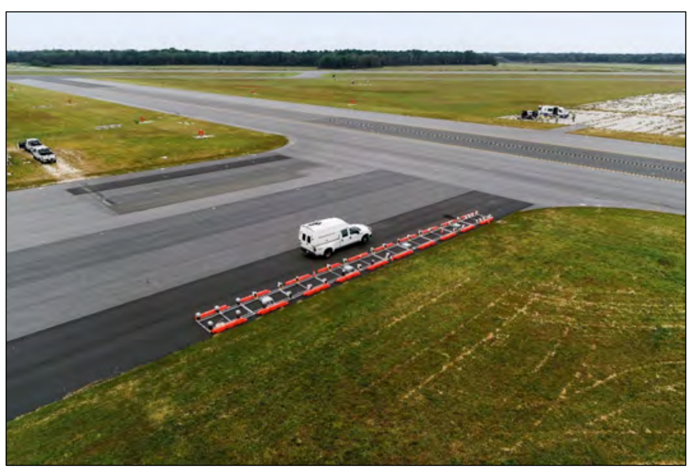
## Cape May Installation

Solar Device Test Beds will have a combined foot print of approximately 100 feet x 70 feet.



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## Portable Test Beds

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## Lights are baffled

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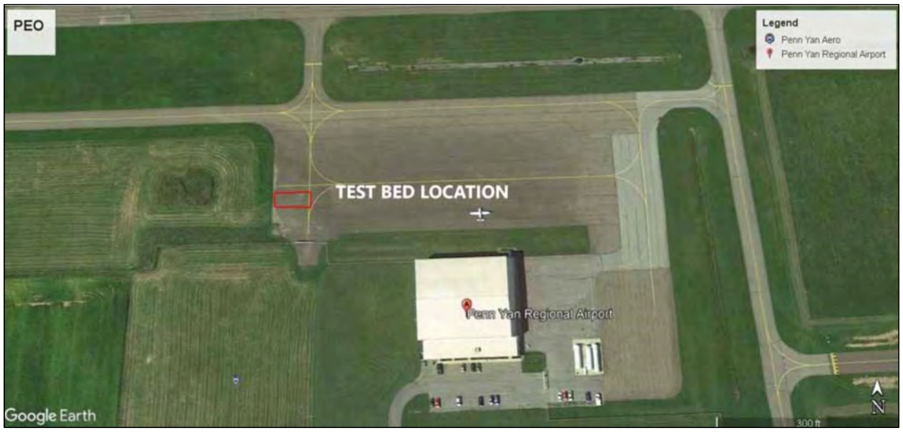
## Penn Yan (PEO) Airport Installation: Test Bed Location

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## PEO Test Bed Construction

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## PEO Test Bed Full Installation

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## PEO Test Bed Full Installation

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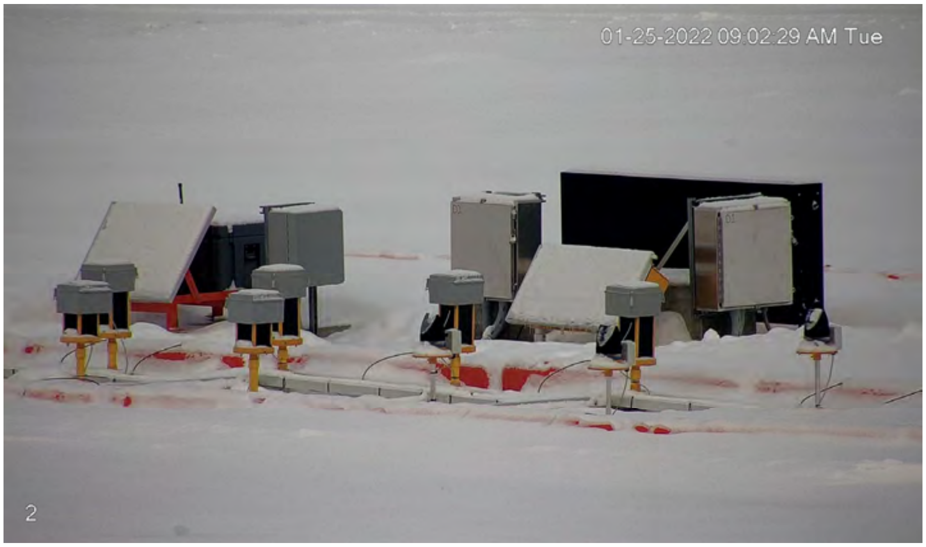
## PEO Test Bed January

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## PEO Test Bed February


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## Current Status

**In Progress**

- Site Survey for three candidate airports in Arizona
- Procurement of equipment for Arizona test array
- Updated Data Analysis report reflecting 1 year of data collected at WWD

**Next Steps**

- Selection of candidate airport in Arizona region
- Installation of test array at selected Arizona airport
- Selection of next test sites: Oklahoma & Washington State

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## Questions?

**Contact the FAA Program Manager**

Darian Byrd
(609) 674-4873
darian.a.byrd@faa.gov

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# Airport Pavement R&D

**Program Update**

Presented to:
REDAC Sub committee on Airports

**Jeffrey S. Gagnon**
March 8 – 9, 2022

## Agenda

- Technical Support
- 2030 Airport Pavement R&D Plan
- Research Requests Update

2

## Technical Support

- Updates to Support Contracts

## Contracts

- Pavement Consultant Support
  - Applied Research Associates (ARA) Selected
  - Contract awarded
- Materials Laboratory O&M
  - Applied Research Associates (ARA) Selected
  - Award on Sept 28, 2021
- Facilities Operation & Maintenance
  - General Dynamics GDIT Selected
  - Award on Sept 28, 2021

6

# 2030 Airport Pavement R&D Plan

- Project Areas

## 2030 Airport Pavement R&D Plan

- Final Draft Completed and reviewed
- Ready for Distribution

## 2030 Airport Pavement R&D Plan


Table of Contents



**Four (4) Main Programs**

1. Airport Pavement Design
2. Airport Pavement Materials
3. Airport Pavement Evaluation
4. Special Projects

9

## Research Request Updates

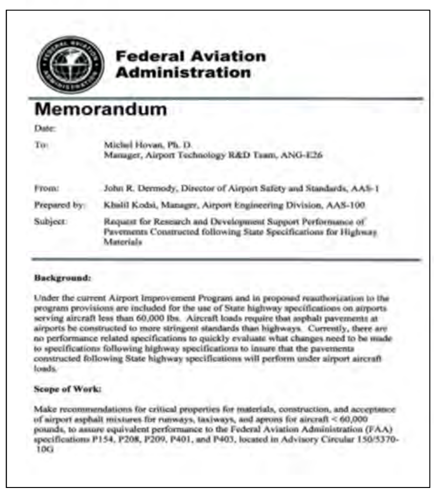
## Research Requests

1. In-Service Pavement Roughness
2. Stabilized Base Requirements
3. Use of State Highway State Specifications
4. Acceptance of Unbound Materials
5. Surface Treatments
6. Seasonal Frost and Permafrost
7. P401/403/P404 Mix Design for Different Loads



## Research Requests

1. Performance tests for asphalt pavements – State Specifications
   Date: Aug 13, 2018



**Federal Aviation Administration**

**Memorandum**

Date:

To: Michel Hovan, Ph. D.
Manager, Airport Technology R&D Team, ANG-E26

From: John R. Dermody, Director of Airport Safety and Standards, AAS-1

Prepared by: Khalil Kodsi, Manager, Airport Engineering Division, AAS-100

Subject: Request for Research and Development Support Performance of Pavements Constructed following State Specifications for Highway Materials

**Background:**

Under the current Airport Improvement Program and in proposed reauthorization to the program provisions are included for the use of State highway specifications on airports serving aircraft less than 60,000 lbs. Aircraft loads require that asphalt pavements at airports be constructed to more stringent standards than highways. Currently, there are no performance related specifications to quickly evaluate what changes need to be made to specifications following highway specifications to insure that the pavements constructed following State highway specifications will perform under airport aircraft loads.

**Scope of Work:**

Make recommendations for critical properties for materials, construction, and acceptance of airport asphalt mixtures for runways, taxiways, and aprons for aircraft < 60,000 pounds, to assure equivalent performance to the Federal Aviation Administration (FAA) specifications P154, P208, P209, P401, and P403, located in Advisory Circular 150/5370-10G

# Use of State Highway Specifications

- Objectives:
  - Make recommendations for critical properties for materials, construction and acceptance of airport pavements for aircraft <60,000 lbs to assure equivalent performance to FAA Specificaions.
  - Material Properties to consider:
    - Quality of fine and course aggregate
    - Aggregate angularity
    - Durability and reactivity of aggregate
    - Gradation of aggregates
    - Type of binder

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# Use of State Highway Specifications

- National Center for Asphalt Technology (NCAT)
  Auburn University, Auburn, Alabama
  Principal Investigator: Dr. Randy West
  Duration: 24 months
  Awarded: September 11, 2019

STATUS:
- Study completed for Flexible Pavements
- Final report (after addressing FAA comments) submitted 12/30/2021
- In editing process
- contract scope expanded to include rigid pavements, contract awarded on 2/22/2022. Final report due by 2/21/2023.

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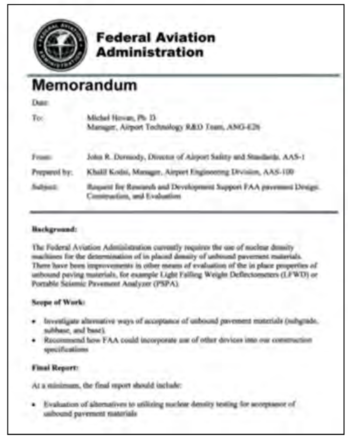
# Research Requests

2. Alternate methods of acceptance of unbound materials

Date: Aug 13, 2018



Federal Aviation Administration

**Memorandum**

Date:

To: Michel Hovan, Ph. D
Manager, Airport Technology R&D Team, ANG-E26

From: John R. Dermody, Director of Airport Safety and Standards, AAS-1

Prepared by: Khalil Kodsi, Manager, Airport Engineering Division, AAS-100

Subject: Request for Research and Development Support FAA pavement Design, Construction, and Evaluation

**Background:**

The Federal Aviation Administration currently requires the use of nuclear density machines for the determination of in placed density of unbound pavement materials. There have been improvements in other means of evaluation of the in place properties of unbound paving materials, for example Light Falling Weight Deflectometers (LFWD) or Portable Seismic Pavement Analyzer (PSPA).

**Scope of Work:**

- Investigate alternative ways of acceptance of unbound pavement materials (subgrade, subbase, and base).
- Recommend how FAA could incorporate use of other devices into our construction specifications

**Final Report:**

At a minimum, the final report should include:

- Evaluation of alternatives to utilizing nuclear density testing for acceptance of unbound pavement materials

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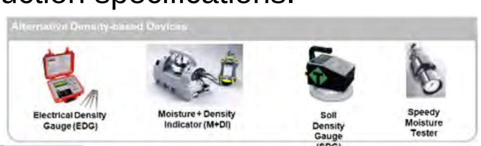
## Acceptance of Unbound Materials

- **Objectives:**
  - Investigate alternative ways of acceptance for unbound pavement materials.
  - Recommend how to incorporate the use of other devices into the construction specifications.





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## Acceptance of Unbound Materials

- Center for Transportation Infrastructure Systems (CTIS)
  University of Texas at El Paso (UTEP), Texas
  Research Grant
  Principal Investigator: Dr. Soheil Nazarian
  Duration: 18 months (POP extended due to pandemic)
  Awarded: September 26, 2019

STATUS:
- Final report submitted 12/30/2021
- Report review in process

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## Research Requests

3. Stabilized Bases
   Date: Aug 13, 2018

**Federal Aviation Administration**

**Memorandum**

Date:

To: Michel Hovan, Ph. D.
Manager, Airport Technology R&D Team, ANG-E26

From: John R. Dermody, Director of Airport Safety and Standards, AAS-1

Prepared by: Khalil Kodsi, Manager, Airport Engineering Division, AAS-100

Subject: Request for Research and Development Support FAA Pavement Design, Pavement Materials, Construction and Evaluation

**Background:**

In the late 1960's the FAA adopted the requirement for the use of stabilized bases when aircraft greater than 200,000 lbs. gross weight were included in the aircraft traffic. At some point in time, the FAA reduced this requirement to when aircraft greater than 100,000 lbs. gross weight were included in the aircraft traffic to require stabilized bases. In both the FAA pavement design criteria and in the FAA construction specifications and aggregate exhibiting a California Bearing Ratio > 100 has been considered to be equivalent to providing a stabilized base.

**Scope of Work:**

There is a need to determine:

- When is a stabilized base required?
- When is a stabilized base recommended?
- What are the minimum requirements for a material to be considered a stabilized base (must it be chemically stabilized or are there other criteria, e.g. minimum strength and/or modulus of elasticity that it must provide.

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## Stabilized Base Requirements

- Objectives:
  - When should stabilized base be required or recommended?
  - What are the minimum requirements for a material to be considered a stabilized base?
  - What performance benefits are expected from use of stabilized base courses?
  - What are the appropriate stabilized base thickness requirements for rigid pavements/ flexible pavements?

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## Stabilized Base Requirements

- Applied Research Associates, Inc. (ARA), under consulting support contract (Task Order 03)
  Principal Investigator: Tim Parsons
  Duration: 12 months (current POP)
  Awarded: May 26, 2021

STATUS:

- Report "Development of Stabilized Base Requirements for Airports" submitted 12/14/2020.
- Contractor developed test plan for full-scale test of flexible test items with stabilized base, submitted 1/26/2021 (resubmitted after comment by FAA).
- Acquisition of stabilized base materials for laboratory test/characterization program in progress.

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# Research Requests

4. Pavement Roughness
Date: Aug 13, 2018

**Federal Aviation Administration**

**Memorandum**

Date:

To: Michel Hovan, Ph. D. Manager, Airport Technology R&D Team, ANG-E260

From: John R. Dermody, Director of Airport Safety and Standards, AAS-1

Prepared by: Khalil Kodsi, P.E., Manager, Airport Engineering Division, AAS-100

Subject: Request for Research and Development Support for FAA Pavement Design, Construction, and Evaluation

**Background:**

The Federal Aviation Administration (FAA) currently recommends that airports check the smoothness of pavements when being constructed; and then once pavements are put into service, the FAA recommends the airports periodically check in service pavement roughness. Technical procedures and evaluation for pavement roughness is provided in Advisory Circular (AC) 150/5380-9 Guidelines and Procedures for Measuring Airfield Pavement Roughness, which references the Boeing Bump Index (BBI) for evaluation. The BBI was developed and is currently structured around the point that pavement gets so rough that it may damage the aircraft operating on the pavement. Technology for measuring pavement roughness has progressed since AC 150/5380-9 was last updated in 2009. In support of the technical content in this AC, it is necessary to investigate the index-evaluating runway (RW) roughness as well as the methods available to measure roughness. Boeing is currently initiating a research initiative with Tongji University The FAA should consider working with Boeing in evaluation of any updates to the measurement of pavement roughness as it affects the safe operation of aircraft on runways.

## In-service Pavement Roughness

### FAA AC 150/5380-9 and ProFAA

- Objectives
  - Development of New Runway Roughness Standards – Runway Roughness Index (RRI)
  - Measurement, Specifications and Guidance for Multiple Bump Events
  - Taxiway Roughness Index

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## In-service Pavement Roughness

### FAA AC 150/5380-9 and ProFAA

- Applied Research Associates, Inc. (ARA), under consulting support contract (Task Order 04)
  Principal Investigator: Anthony Kuncas
  Duration: 12 months (current POP)
  Awarded: June 25, 2021

STATUS:
- Development of New Runway Roughness Standards
- DOT/FAA/TC-21-32 New Index Testing and Verification - Runway Roughness Index published 8/3/2021
- DOT/FAA/TC-21-39 Development of New Roughness Standards for In-Service Airport Pavement published 11/24/2021
- Updated ProFAA

- APR Consultants Inc.
  Principal Investigator: Tony Gerardi
  Duration: 24 months
  Awarded: August 16, 2021

STATUS:
- Incorporated Boeing 737-800 simulation model into ProFAA
- Developing a procedure that locates and quantifies multiple event airport pavement roughness using measure profile data only.
- Phase 1 final report will be submitted 8/15/2022

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## Research Requests

5. Surface Treatments
Date: Jan 26, 2020

**Federal Aviation Administration**

**Memorandum**

Date: JAN 2[illegible] 2020

To: Michel Hovan, Ph. D.
Manager, Airport Technology R&D Team, ANG-E260

From: John R. Dermody, Director of Airport Safety and Standards, AAS-1

Prepared by: Khalil Kodsi, Manager, Airport Engineering Division, AAS-100

Subject: Request for Research and Development to Evaluate FAA Pavement Surface Treatment Relative to Airfield Location

**Background:**

The FAA currently has nine different options for surface treatments of flexible pavement in AC 150/5370-10H. These options are not tied to a specific need or performance. We lack FAA studies that establish the necessary field performance to apply the appropriate surface treatments.

It is beneficial for airport owners to use FAA performance studies to determine the treatment to apply, and where on the airfield, e.g. runway, taxiway or apron. Currently, only P608 is recommended for use on runways; however, it is conceivable that other surface treatments could be used on runways with certain weight and surface friction restrictions.

**Scope of Work:**

- Evaluate field performance of various surface treatments for flexible pavements. As a minimum, evaluate performance of:
  - P608
  - P623
  - P629 (all three options)
  - P632

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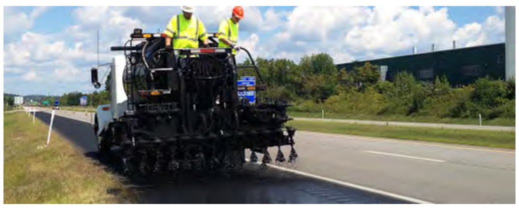
## Surface Treatment

- Objective
  - To develop guidelines for airports to determine which surface treatment to apply, and where on the airfield (runway, taxiway, apron) to best apply the treatment.



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## Surface Treatment

- Applied Pavement Technology, Inc.
  Principal Investigator: David Peshkin
  Duration: 12 months (Phase 1)
  Awarded: June 21, 2021

STATUS:

- Airport Pavement Surface Treatment Literature Review completed 12/20/21. Review for publication in process
- Analysis of Airport Experience with Pavement Surface Treatments Survey completed 12/20/21. Review for publication in process
- Case studies being drafted
- Test site selection, material specifications, site lay-out, and construction planning up comming.

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# Research Requests

6. Seasonal Frost and Permafrost
Date: Jan 27, 2020

**Federal Aviation Administration**

## Memorandum

Date: JAN 27 2020

To: Michel Hovan, Ph. D.
Manager, Airport Technology R&D Team, ANG-E260

From: John R. Dermody, Director of Airport Safety and Standards, AAS-1

Prepared by: Khalil Kodsi, Manager, Airport Engineering Division, AAS-100

Subject: Request for Research and Development Support
FAA Pavement Design and Construction and Evaluation
Design of Pavements for Seasonal Frost and Permafrost

**Background:**

The Federal Aviation Administration (FAA) pavement design subject for seasonal frost and permafrost conditions is based on research done at the United States Army Corps of Engineers (USACE) Cold Regions Research and Engineering Laboratory by Dr. Berg in the early 1970's. (FAA RD 74-30 *Design of Civil Airfield Pavements for Seasonal Frost and Permafrost Conditions*). The FAA Regional Alaska office (AK) has noted some performance issues with flexible pavements at some airports. Based on cursory background inquiry with the FAA AK office, it appears the performance issues may be related to the design and construction of these sections. Without additional investigation, it is not readily apparent as to whether the performance issues are related to design, materials, maintenance, environment or a combination of all items. There is a need to investigate design, construction and performance of both flexible and rigid pavements constructed in AK. Finally after researching the sampling of projects we need to determine if we need to update the FAA design procedure/recommendations for pavements for seasonal frost and permafrost conditions.

**Scope of Work:**

Investigate a limited number (at least two flexible) of runways in AK:

(1) The design requirements for flexible and rigid pavements considering seasonal frost and permafrost conditions:

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# Seasonal Frost and Permafrost

- Objectives:
  - Investigate issues related to design, construction and performance of flexible and rigid pavements
  - Possible update of FAA design procedures / recommendations for seasonal frost and permafrost conditions.

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## Seasonal Frost and Permafrost

- Applied Research Associates, Inc. (ARA), under consulting support contract (Task Order 03)
  Principal Investigator: Ali Ashtiani
  Duration: 12 months
  Awarded: May 26, 2021

STATUS:

- Phase 1 study was completed 11/30/2020 under previous contract.

- Phase 2 - Final report submitted 2/10/2022. Includes recommendations for updated design guidance.

- FAA report review in progress.



# Research Requests

7. Traffic Loads for Asphalt Pavement
Date: Jan 27, 2020

**Federal Aviation Administration**

**Memorandum**

Date: JAN 27 2020

To: Michel Hovan, Ph. D.
Manager, Airport Technology R&D Team, ANG-E260

From: John R. Dermody, Director of Airport Safety and Standards, AAS-1

Prepared by: Khalil Kodsi, Manager, Airport Engineering Division, AAS-100

Subject: Request for Research and Development Support FAA P401, P403 and P404 Minimum Material, Construction and Acceptance Recommendations

**Background:**

The FAA specification for asphalt mixtures (P401/P403 and P404) as published in AC 150/5370-10H do not differentiate the requirement for material, mix design parameters or acceptance standards regardless of the composition of the traffic loads. There is a need to assess the current materials, mix design and acceptance standards for the FAA to determine if the composition of traffic loads should be a factor in these specifications.

**Scope of Work:**

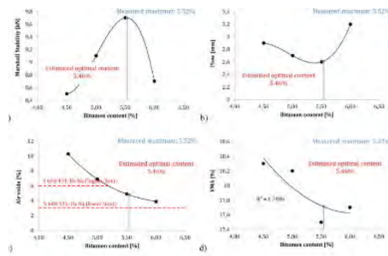
Assess the material properties, mix design parameters and acceptance standards for the current asphalt mixture specifications P401, P403 and P404 as published in AC 150/5370-10H. Evaluate if the specifications should have different material properties, mix design parameters or acceptance standards depending upon the composition of the aircraft traffic loadings. As a minimum use the following gross aircraft load limits: under 30,000 pounds, less than 60,000 pounds and greater than 100,000 pounds.

**Final Report:**

At a minimum, the final report should include:
- Summary of salient material properties, mix design parameters and acceptance standards for each asphalt mixture specification;

## P401/403/P404 Mix Design for Different Loads

- Objectives
  - Evaluate if the specifications for P401/403/404 should have different material properties, mix design parameters or acceptance standards based upon the composition of aircraft traffic.
    - < 30,000 lbs
    - < 60,000 lbs
    - < 100,000 lbs
    - ≥ 100,000 lbs



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## P401/403/P404 Mix Design for Different Loads

- Center for Advanced Infrastructure and Transportation (CAIT)
  Rutgers University, New Brunswick, NJ
  Principal Investigator: Dr. Thomas Bennert
  Duration: 6 months (POP extended due to pandemic)
  Awarded: March 24, 2021

STATUS:
- Final report submitted 9/7/2021
- Report review completed, FAA comments addressed.
- Report in editing process

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## Questions?

**Contact the FAA Program Manager**

Jeffrey S. Gagnon
Manager – Airport Pavement R&D Section
(609) 485-5226
Jeffrey.gagnon@faa.gov

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# Autonomous Vehicles on Airports

## New Efforts

Presented to:
REDAC Sub committee on Airports

**Murphy Flynn**

March 8 – 9, 2022

## Autonomous Vehicles on Airports

- OST has Established AUTOMATION working Group of which FAA is a participant
- Automation is happening across all industries – Airports are no Exception
- FAA should participate for awareness and to shape product development into products that may safely be integrated into the NAS


2

## USAF – Air Mobility Command

I. AMC is comprised of a Total Force effort to execute rapid global mobility and enable global reach – the ability to respond anywhere in the world in a matter of hours

II. Airlift provides the capability to deploy U.S. armed forces anywhere in the world within hours and help sustain them in a conflict. AMC also supports presidential and senior leader airlift

III. Rapid Global Mobility brings humanitarian supplies and assistance to those in need who may live in austere locations.


3

## Projects of Mutual Interest

- **Common Control and Command Architecture**
- **FOD Detection and Retrieval**
- **Automated Mowers (FAA has received request for use in movement areas)**
- Perimeter Patrol – Wildlife detection/Fence line integrity

Mower and Solar Charging Station by ECHO

Sample Commercial Mower by Husqvarna

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## Defense Innovation Unit

### WE DELIVER THE BEST COMMERCIAL TECH TO DOD

DIU facilitates projects between our DoD partners and commercial companies to prototype, transition, and scale advanced technology.

**Department of Defense**

DIU provides...

- Access to leading commercial technology
- Collaborative prototype process
- Delivery of capabilities in 12-24 months
- Solutions at commercial cost curves

**Commercial Companies**

DIU provides...

- Opportunity to solve high-impact national security problems
- Simple process and faster time to award
- Access to large volume defense contracts
- Liaison with DoD partner

Accelerating Commercial Technology for National Security

5

## DIU

### FOD MITIGATION

Autonomous Sensors for Debris Detection

**Problem:** Foreign Object Debris (FOD) on airfields, such as rocks, loose concrete, tools, birds, etc, result in costs of over $2Bn/yr for civil aviation and $200M/yr across the Defense Department, and, more importantly, contribute to catastrophic mishaps. Current mitigation efforts are both highly labor intensive and ineffective.

Problem Curation → Diligence → CSO Process → Prototyping → Transition

**Solution**

- Fused, multi-modal sensors detect damaging objects and degrading surfaces
- AI-driven insights driving risk-based operational decision making
- Autonomous mitigation or removal of hazards

**Impact**

- Increased Mission Readiness Rate
- Reduced FOD rate and costs of engine damage
- Reduced labor demand on maintenance specialists
- Increased airfield efficiency

The F-35's F135 engine, with a stressed supply chain, will benefit from reduced FOD-based engine rejections

| DoD Customers | Commercial Vendors |
| --- | --- |
| NAVAIR | Moog<br>Parasanti<br>Oreyeon<br>XSight |

Accelerating Commercial Technology for National Security

6

## USAF-AMC / FAA

**USAF AMC**

- Identified need to develop solutions for 60+ ground based operations
- DoD will ultimately be the end user/purchaser
- Can accept more risk than commercial operations

**FAA**

- Provide Subject Matter Expertise where applicable
- Input to product testing and development with FAA NAS operations in mind
- Participate in testing at AMC locations – Work to test technologies at ACY

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## Technical Challenges

- Awareness of new technologies FAA may want to adopt
  - REDAC can assist/guide FAA to technologies they see as appropriate for research
  - FAA may influence end state of technology for easier commercial adoption/airport integration
- Secure integrated network for all automated equipment
  - Not 5G now – 5G in the future?
  - Are there commercial solutions? Can they be developed in partnership with FAA?
- Intercommunication/Integration of automated vehicles and equipment
  - AI to allow equipment to rely less on human intervention as time in service lengthens
  - In sync with Smart Airports concept

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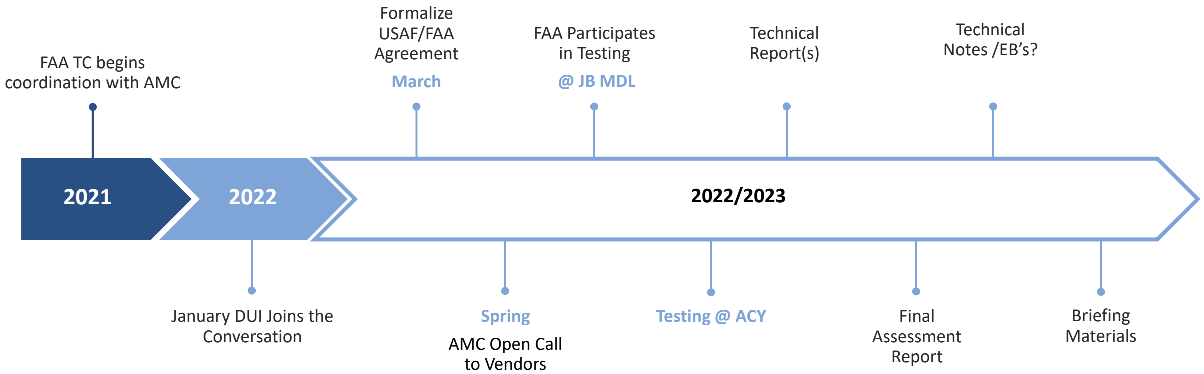
## Sample Program Timeline (Actual not developed yet)

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## Questions?

**FAA Program Manager**

Murphy Flynn
Airport Pavement /Airport Safety Project Manager
Murphy.Flynn@faa.gov
609-485-5318

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# Airport Pavement Design Update – FAARFIELD 2.0

RPA P5.1

Presented to:
REDAC Sub committee on Airports

David R. Brill, P.E., Ph.D.

March 8 – 9, 2022

## Agenda

- FAARFIELD 2.0 Background
  - AC 150/5320-6G and AC 150/5335-5D
  - Program status and timeline
- Technical Report
  - Major changes from FAARFIELD 1.42
  - FAARFIELD 2.0 for PCR Reporting
  - Next Steps:
    - FAARFIELD / PAVEAIR Integration
    - Machine Learning (ML) for Design Stresses
    - Reflection Cracking Design
    - Remaining Life Prediction – PANDA-AP

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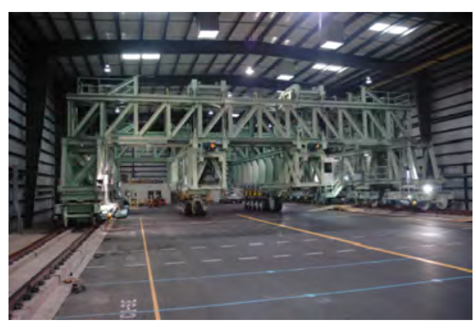
# FAARFIELD 2.0 Background

## Purpose/Background

- In June 2021, the FAA released **FAARFIELD 2.0**, a completely updated and overhauled version of its standard software for airport pavement thickness design and evaluation.
- **FAARFIELD 2.0** supports Advisory Circulars (AC) 150/5320-6G (Airport Pavement Design and Evaluation) and 150/5335-5D (Standardized Method of Reporting Airport Pavement Strength – PCR).
- **FAARFIELD 2.0** includes many new features and improvements over the previous version (FAARFIELD 1.4):
    - Modernized GUI
    - Intuitive screen flow
    - New 3D finite element library (FAASR3D)
    - Updated aircraft library
    - New vehicle editor
    - Support for ICAO ACR-PCR.
    - Ability to work with multiple jobs sections in the same instance.



**FAARFIELD 2.0 is the end product of much of the R&D performed at the National Airport Pavement Test Facility.**

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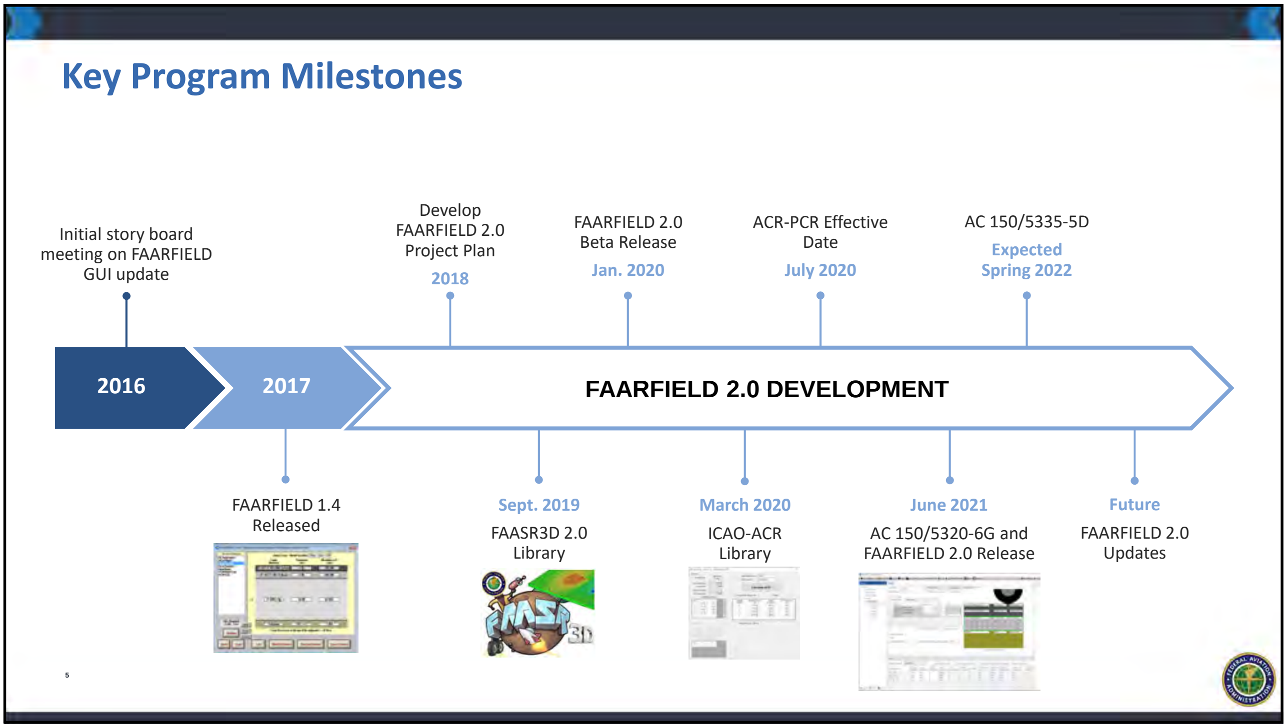
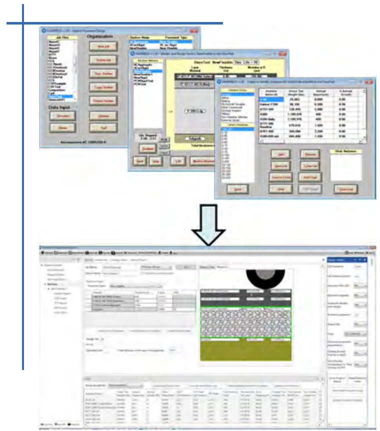

Key Program Milestones
Initial story board meeting on FAARFIELD GUI update
Develop FAARFIELD 2.0 Project Plan
2018
FAARFIELD 2.0 Beta Release
Jan. 2020
ACR-PCR Effective Date
July 2020
AC 150/5335-5D
Expected Spring 2022
2016
2017
FAARFIELD 2.0 DEVELOPMENT
FAARFIELD 1.4 Released
Sept. 2019
FAASR3D 2.0 Library
March 2020
ICAO-ACR Library
June 2021
AC 150/5320-6G and FAARFIELD 2.0 Release
Future
FAARFIELD 2.0 Updates


FAARFIELD 2.0
Technical Report

## FAARFIELD 2.0 – Major Changes from Version 1.4

- **Modern Graphical User Interface (GUI) Features:**
  - **Easier job and section entry.**
  - **Explorer-based navigation.**
  - **Improved screen re-sizing and appearance.**
  - **Improved flow between screens.**
  - **Ability to store traffic mixes.**
  - **On-demand report generation.**
- **Supports the new ICAO ACR-PCR system.**
- **User-Defined Aircraft (UDA) editor.**
- **No change to thickness design requirements in this version.**



**Download:**

https://www.airporttech.tc.faa.gov/Products/Airport-Safety-Papers-Publications/Airport-Safety-Detail/ArtMID/3682/ArticleID/2841/FAARFIELD-20

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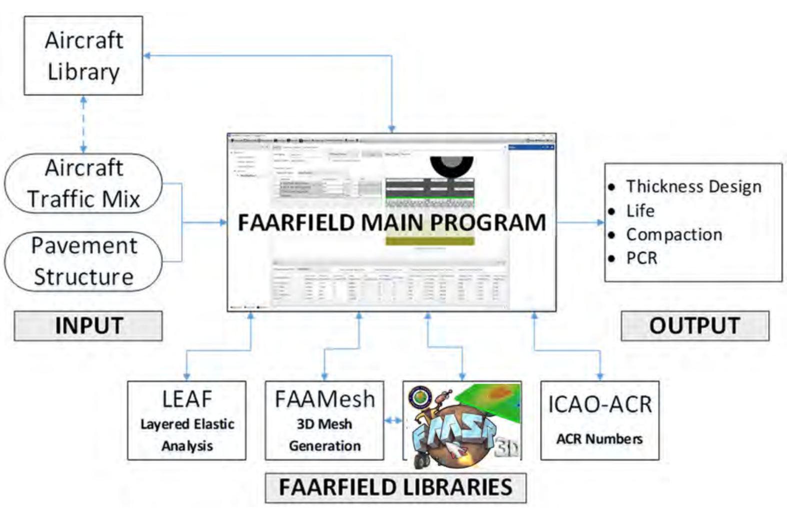
## FAARFIELD 2.0 Organization

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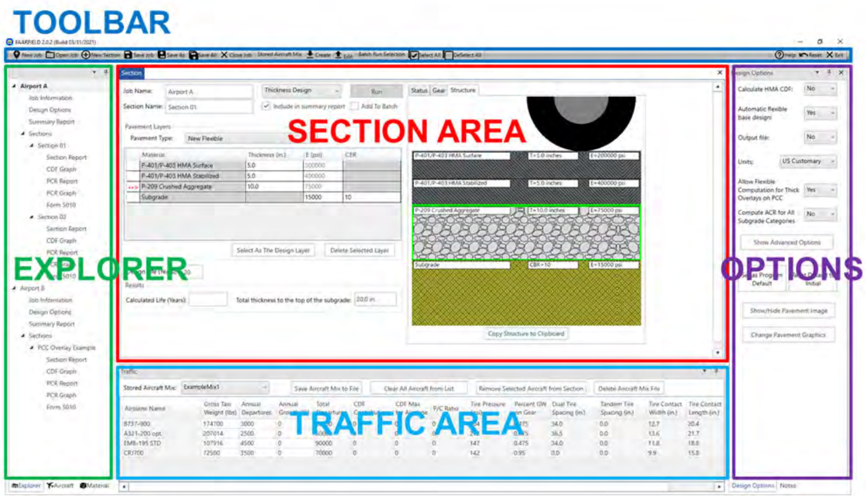
## FAARFIELD 2.0 GUI Layout

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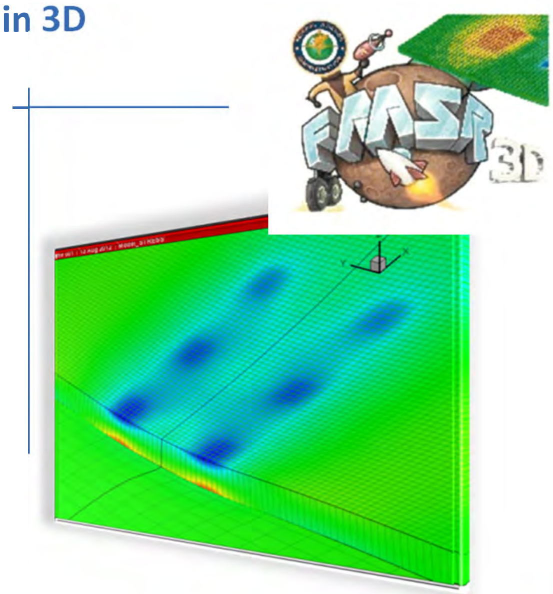
## FAASR3D – FAA Structural Analysis in 3D

- Visual Basic.NET library.
- Replaces obsolete NIKE3D Fortran program.
- Managed Code - compatible with Microsoft .NET memory management services.
- Improves performance. Old code was subject to memory conflicts and crashing.
- Freely distributable code.
- Continued updates to improve speed & efficiency.



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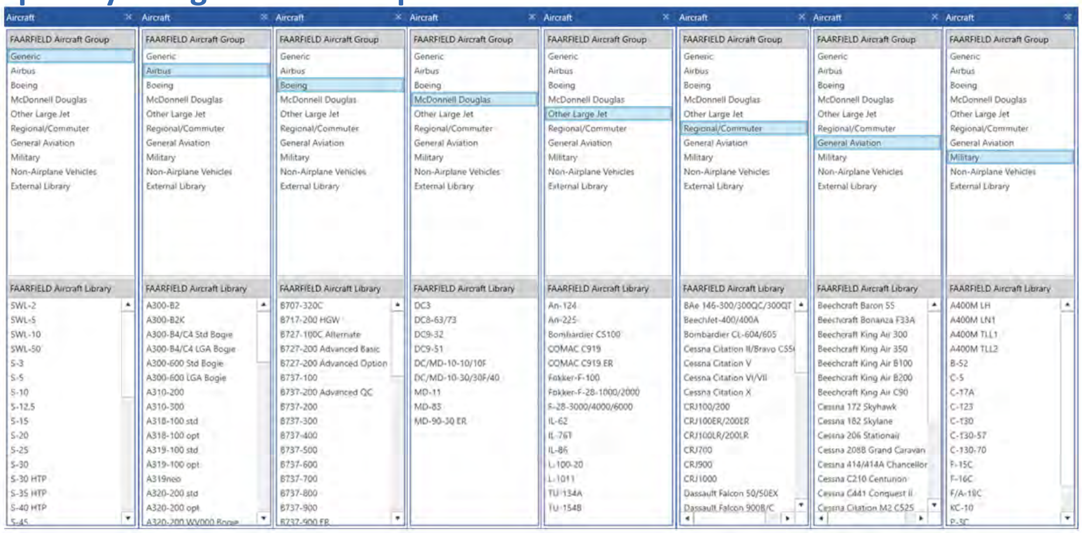
## Aircraft Library –
### Completely reorganized and updated for the FAARFIELD 2.0 release

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## ACR-PCR Current Status

- ICAO Air Navigation Committee (ANC) approved an amendment to Annex 14 on ACR-PCR in 2020.
- Established four-year transition period from ACN-PCN to ACR-PCR.
  - Effective date July 2020 (currently effective).
  - Full applicability November 2024.
  - During transition, both systems will remain available.
- AC 150/5335-5D – Currently in FAA final coordination.
  - Adopts the ICAO Aircraft Classification Rating -Pavement Classification Rating (ACR-PCR) to replace the current ACN-PCN method.
  - Covers the process for calculating pavement strength using the new ICAO ACR-PCR method and FAARFIELD 2.0.

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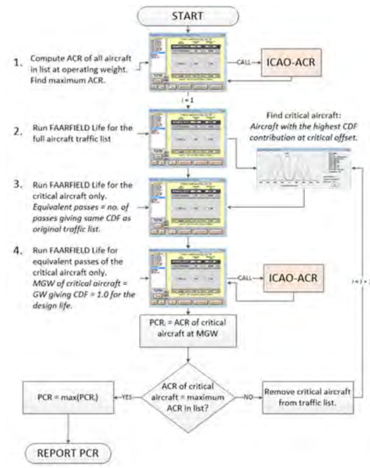
## FAARFIELD 2.0 for PCR Reporting

- **Directly uses FAARFIELD structure and traffic list.**
- **Replacement for COMFAA 3.0 & support spreadsheets.**
- **Implemented in FAARFIELD 2.0.**
  - **One-step PCR procedure.**
  - **Method yields uniquely defined PCR – no more looping through all aircraft in the list.**
  - **Computes PCR for mixed traffic (narrow bodies and LR aircraft) without unnecessary operating weight restrictions.**
  - **Seamlessly handles HMA overlays on rigid pavements.**

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## PCN-PCR Comparisons

| Airport | Runway | PCN as reported on FAA Form 5010 | AC 150/5335-5C PCN (COMFAA) | PCR (FAARFIELD 2.0) |
|---|---|---|---|---|
| A | 10-28 | 105/F/A | Not Valid | 6556/F/A |
| B | 10L-28R | 61/F/C | 71/F/C | 569/F/C |
| B | 10R-28L | 77/F/C | 78/F/C | 771/F/C |
| C | 01-19 | 57/F/B | 65/F/B | 677/F/B |
| F | 9-27 | 65/F/D | Not Valid | 3770/F/D |
| D | 10R-28L | 74/R/B | 77/R/B | 835/R/B |
| E | 10C-28C | 96/R/C | 103/R/B | 1136/R/C |
| G | 16L-34R | 92/R/B | 96/R/B | 1689/R/C |
| I | 17L-35R | N/A | 29/R/A | 263/R/A |

- **As shown here, the PCR number is usually about 10 times PCN. This is due to how PCR is defined in the new system.**
- **Cannot directly convert PCN to PCR. Must use FAARFIELD 2.0 to compute PCR.**
- **Subgrade strength categories may not be the same in the new method.**

## Next Steps

- Integration/data sharing with FAA PAVEAIR via web API.
- Additional internet support.
- New machine learning (ML) based models for concrete pavement top-down cracking and reflection cracking (asphalt overlays).
- Improved remaining life prediction using PANDA-AP (advanced modeling library)

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## FAA PAVEAIR Integration

- **New online functionality:**
  - Use your PAVEAIR login for library updates
  - Perform data exchange with PAVEAIR via WebAPI.
- **Access to user-owned databases.**
  - Download: Job information, existing sections, NDT data.
  - Upload: FAARFIELD job files (alternate designs).
- **In testing – target completion June 2022.**


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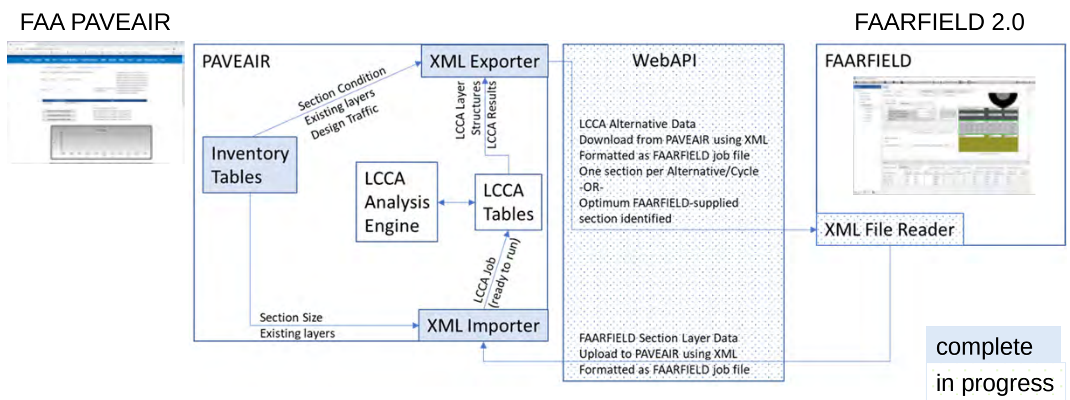
## Improve Data Exchange via WebAPI in PAVEAIR

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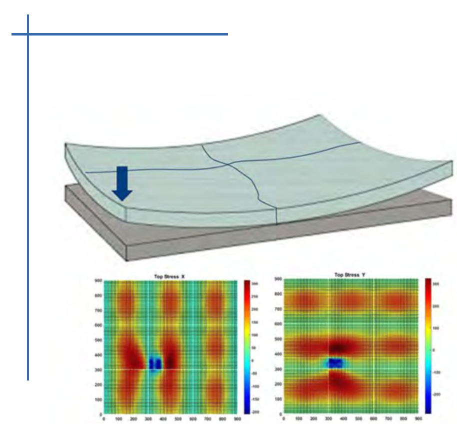
## Machine Learning for Top-Down Cracking

- **Rapidly compute stress for top-down cracks (rigid).**
- **Combined curling and aircraft loading.**
- **Replaces direct 3D-FEM computation for most gears.**
- **"Deep Learning" approach removes the need to train a separate neural network for each aircraft.**
- **General model is suitable for D, 2D and 3D gear configurations.**



**FEAFAA Response Model**

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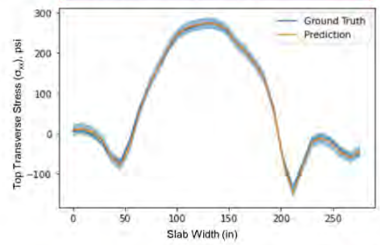
## Machine Learning for Top-Down Cracking

- **Step 1 – Training Database.**
  - **Contractor ran >125,000 combinations of structural, thermal, and aircraft gear parameters.**
  - **Used output matrix to train the deep ANN model.**
- **Step 2 – Machine Learning Model Development.**
  - **New modeling approach.**
  - **Models are significantly more accurate than previous ML techniques for similar problems.**
- **Step 3 – Implement ML Model.**
- **Final Report in editing. Next step – Expand training database to include light load aircraft and thinner slabs.**
- **Will present results at FHWA 1st International Data Science for Pavements Symposium, March 22-24, McLean, VA.**

*Estimated Uncertainty Envelope Around Stress Prediction (Example)*




*Next: Use Open Neural Network Exchange (ONNX) to port the developed Pytorch ML model to a .NET framework (so it will run in FAARFIELD).*

PyTorch → ONNX → .NET Framework

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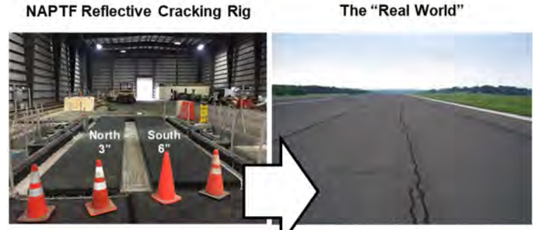
## Reflection Cracking Model Development

- **Contract to Arizona State University (ASU), with participation from University of Illinois. Project awarded May 2021.**
- **Three-year effort will produce a practical reflective cracking model using fracture mechanics principles, for implementation in FAARFIELD.**
- **Data from NAPTF reflection cracking rig and outdoor full-scale tests.**
- **Model inputs include both aircraft load and temperature cycling (joint opening/closing).**

**NAPTF Reflective Cracking Rig** **The "Real World"**




*A key element in this project is the development of* ***transfer functions*** *to relate the theoretical crack growth* (governed by Paris' Law) *to the condition of the affected pavement (PCI). This project will make use of real-world data in FAA PAVEAIR and related databases.*

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## PANDA-AP
## Pavement Analysis using Nonlinear Damage Approach

- **Partners: Texas A&M Univ. and University of Kansas**
- **Standalone PANDA-AP:**
    - **Models failure mechanisms in asphalt and granular materials.**
    - **Supplement to FAARFIELD for remaining life analysis.**
    - **Allows user to define gear configurations, load types, and pavement structures.**
    - **User-friendly and customized for airfield pavements.**
    - **Independent of commercial FE software (will be free to public).**
- **Project Lead: Dr. Navneet Garg**

PANDA: A Fortran code in which a number of sophisticated material models is implemented.

- Includes Models for Performance Related Mechanisms
- Includes Models for Environmental Effects
- Models are Developed for General 3D Multi-Axial Stress States
- Mechanical and Environmental Models are Coupled and Can Occur Concurrently
- Flexible: Other models can be implemented to supplement/substitute current models in the future

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## Questions?

**Contact the FAA Program Manager**

David R. Brill, P.E., Ph.D.
Program Manager
Tel: (609) 485-5198 (office)
Tel: (609) 369-3516 (cell)
David.Brill@faa.gov

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# NAPTF & NAPMRC

**On-Going Projects**

Presented to:
REDAC Sub committee on Airports

**Jeffrey S. Gagnon**
March 8 – 9, 2022

## Agenda

- NAPTF
  - Construction Cycle 8 (CC-8) Concrete
  - Construction Cycle 9 (CC-9) Asphalt
  - Construction Cycle 10 (CC-10) Concrete
  - Construction Cycle 11 (CC-11) Asphalt
- NAPMRC
  - Test Cycle 2 (TC-2)
  - Test Cycle 3 (TC-3)

# NAPTC

## Construction Cycle 8 (CC-8) Concrete

### Primary Objectives

- **PCC-on-Rigid Overlay Test:** Test PCC overlay on existing PCC with target SCI of between 50-80 (Follow-on to CC4 overlay tests)
- **Evaluate Comparative Joint Performance:**
  - Longitudinal Joint: doweled versus alternate sinusoidal key
  - Transverse Joint: doweled versus undoweled (dummy)
- **Improve FAARFIELD Failure Model:** Test full-scale slab strength & fatigue strength for different concrete strength and foundation conditions

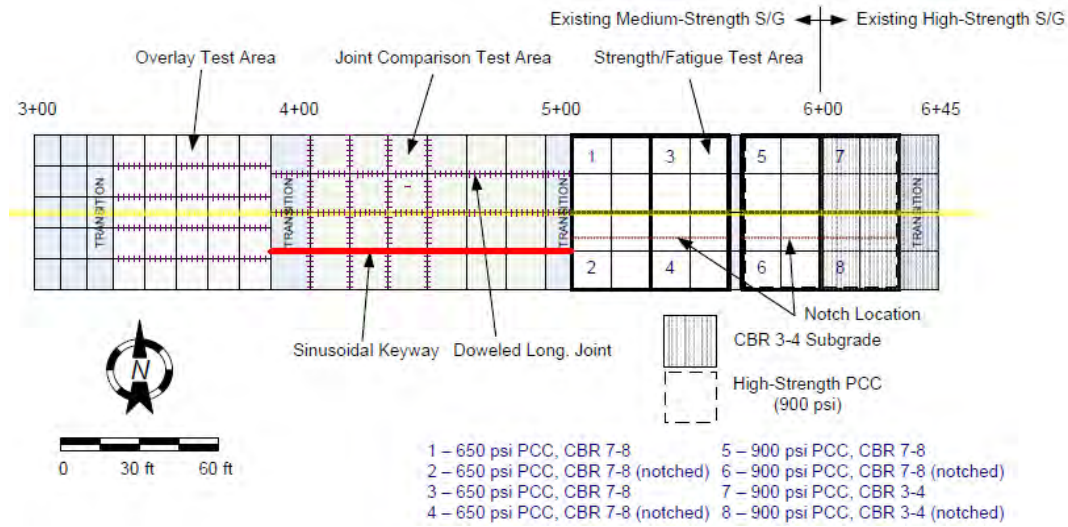
### Secondary Objectives

Develop overload criteria for rigid pavements

Effect of k-value vs. CBR in characterizing rigid subgrade

4

## Construction Cycle 8 (CC-8) Concrete

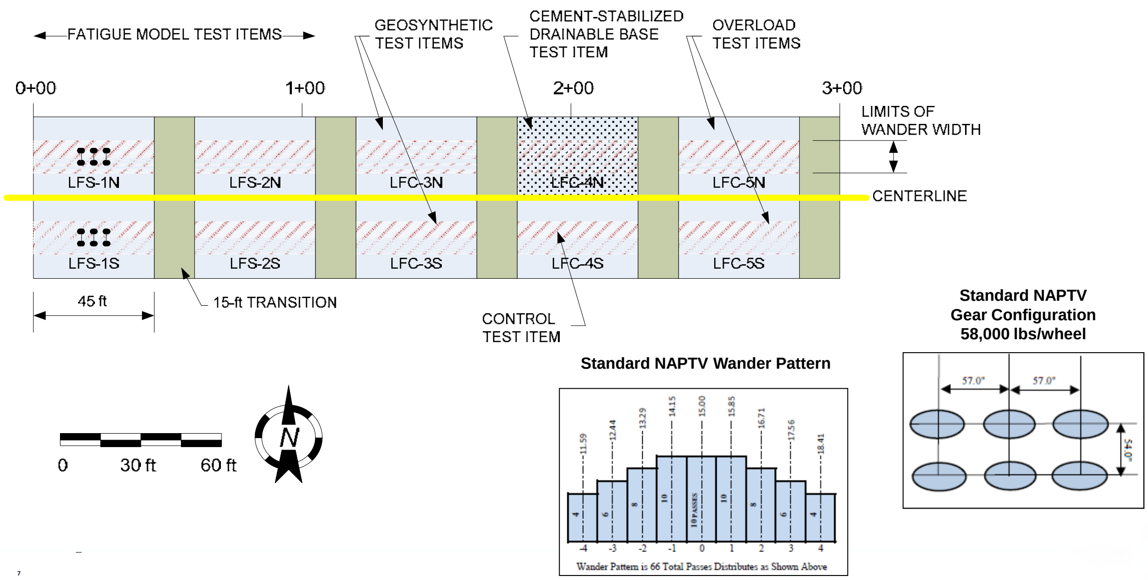



## Construction Cycle 9 (CC-9) - Asphalt

# Objectives

- Verify/Refine/Modify fatigue model based on the ratio of dissipated energy change (RDEC)
- Effect of P-209 Layer Thickness on Pavement Life
- Effect of Geosynthetics use on Flexible Pavement Performance
- Cement Treated Permeable Base Performance
- Strain Criterion for Allowable Overload

## Construction Cycle 09 Layout

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## Construction Cycle 10 (CC-10) - Concrete

### Objectives

- Obtain failure data at higher traffic levels, over 5 years, to better represent extended life conditions.
- Obtain data for realistic slab dimensions and joint spacings.
- Directly compare effect of increased slab thickness on life.
- Investigate fatigue damage accumulation in the major phase of rigid pavement life before the appearance of significant cracks.
- Test structural performance of slabs with light can penetrations.
- Obtain data from instrumented light cans under load in rigid pavement.

8

## Construction Cycle 11 (CC-11) - Asphalt

### Objectives

- Test equivalent performance of various materials to standard P-403 stabilized base.
- Confirm performance of geogrids/geosynthetics as observed in CC9 tests
- Test equivalent performance of various materials to standard P-403 stabilized base

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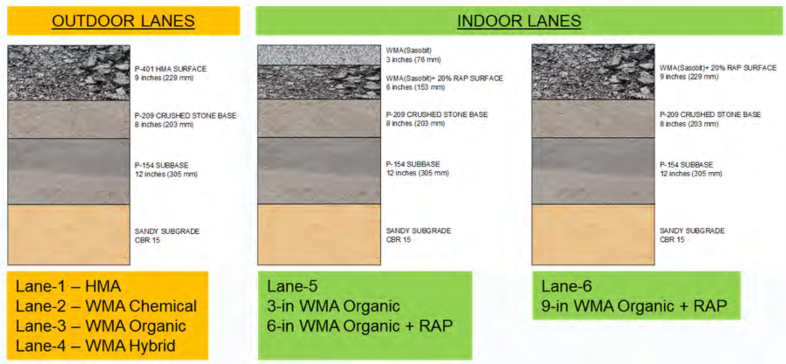
## NAPTF

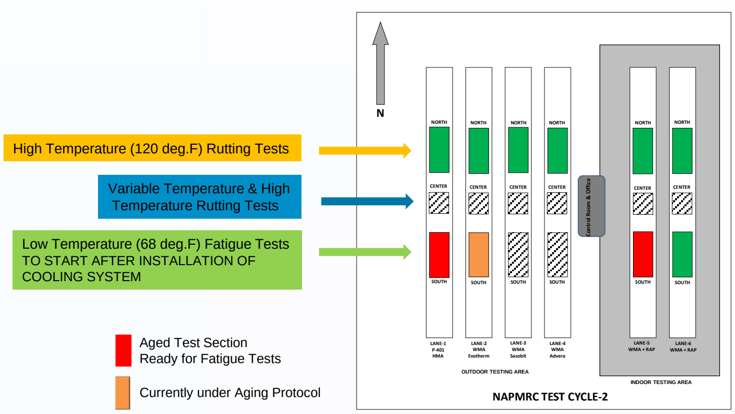
# Test Cycle-2 (TC2)

- Construction May 2019
- Material
  - P-401 HMA
  - WMA (3)
  - RAP (2)
- Tire pressure 254 psi (1.75 MPa)
- Failure criterion:
  - fatigue cracking & rutting
- Testing in progress





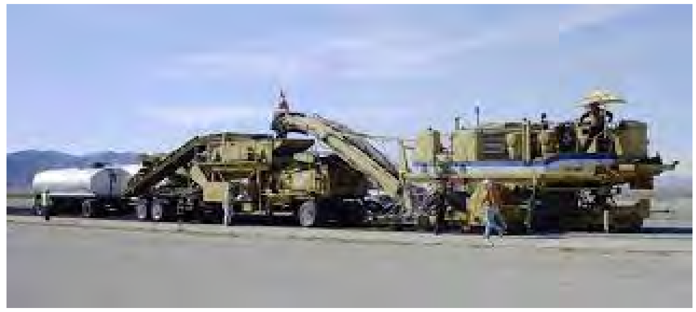

# Test Cycle-2 (TC2) – Test Section Layout




## Test Cycle 3 (TC-3)

### Objectives

- Recycled Products
- Green Technologies
- In-place Recycling (AAPTP Cooperation)



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## Questions?

**Contact the FAA Program Manager**

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# New Pavement Lab Update

**Research Project Area: P4 Advanced Materials**

Presented to:
REDAC Sub committee on Airports

**Murphy Flynn**
March 8 – 9, 2022

## Agenda

- Project Background
  - Purpose of the project
  - Project Drivers
- Design and Funding History
- Next Steps

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# Project Background

## Purpose of the Laboratory

- ***Description***: Civil engineering/geotechnical laboratory focused on airport pavement materials
  - Aggregate
  - Asphalt concrete
  - Asphalt binder
  - Portland cement concrete
- Addition of specialized asphalt binder testing capabilities which do not exist in current lab
- ***Deliverables***: Improved material characterization for input into advanced mechanistic pavement models.
  - *Research use of recycled, environmentally friendly, or reduced carbon foot print materials in airport pavements.*
  - *Research into longer lasting more sustainable pavement materials*

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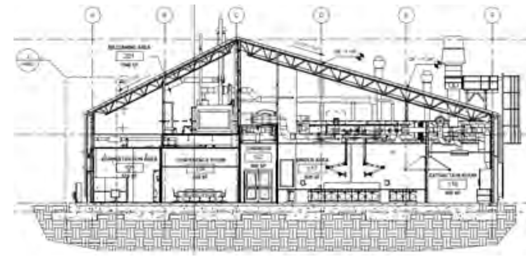
## Project Drivers

- Current Lab size - 5700 sq. ft.
  - HVAC upgraded in 2017
  - Lab is limited by power and HVAC systems as well as floor space
- New lab size – 11,000 sq. ft.
  - Specialized HVAC systems to meet OSHA regulations for dust and fumes
- Addition of asphalt binder testing capabilities which do not exist in current lab.



Proposed Added Capabilities:

- Dynamic Shear Rheometer
- Bending Beam Rheometer
- Rolling Thin Film Oven
- Pressure Aging Vessel
- Rotational Viscometer
- Ductilometer
- Flash Point
- Centrifuge Extractor
- Buchi RotaVapor
- Vacuum Degassing Oven
- Sink and Counter Space
- Storage Space

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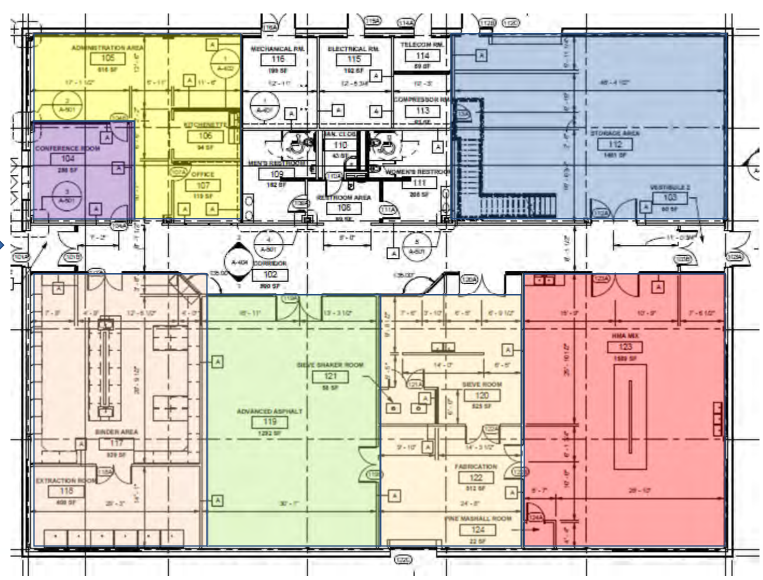
## Laboratory Overview

Entrance



- Conference Room
- Admin Area
- Storage
- Binder Lab
- Advances Asphalt Testing
- Sieve / Fabrication Area
- HMA Mix Lab

# Design & Funding History

## New Pavement Lab Design/Funding History

### 2017

**Dec** COE completed Research TW
~$2M leftover
(IA at $8.9M)

### 2018

**Jan** COE tasked with Lab Design

**June** 30% Design Submission

**Sep** Design suspended – began modification of IA

### 2019

**Jan** Initiated CFO Process for Contract Ceiling increase (Required over $10M)

Furlough affects CFO Office and Contracts Office - delays CFO package development

**May** IA modified to include Design & Construction of Lab

**June** 60% Design submission
Cost estimated at $5.3M

**Aug/ Sep** CFO approved ceiling increase to $12. 66M +/-15% Capped at $14.55M
FAA adds $2M (IA at $10.9M)

### 2020

**March** COE Diverted to COVID Response

**Aug** 90% Design submission

**Sep** FAA adds $3.4M
(IA at $14.35M)

### 2021

**May** 100% Design Submission
Cost increased: $7.7M
Requires new CFO approval

FAA held on new CFO request due to rapid price changes

**Dec** Revised cost estimate: $11.5M !!

**PROPOSED NEXT STEPS: Seek new Chief Financial Officer approval**

# Next Steps

## Next Steps

**WHEN**

- HQ Discussions – March 2022

**WHERE WE NEED HELP**

- Business Case Development
  - AAS Pavement Engineers Support
  - Asphalt/Concrete Industry Support
  - Include Long Term Infrastructure Benefits

**WHEN**

- Submit CFO package Late Spring 2022

**WHAT YOU NEED TO KNOW**

- CFO process can take several months

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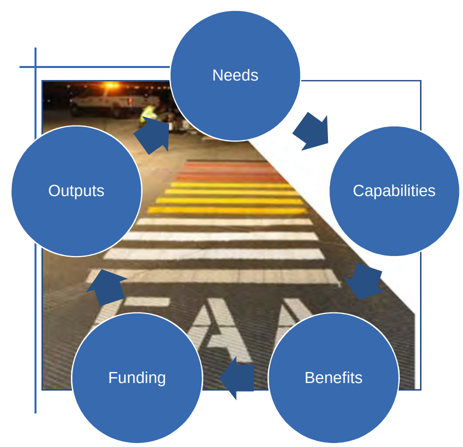
**Airport Pavement Materials Lab**




**Business Case**

## Chief Financial Officer Approval Process

- Coordination Meeting with HQ - Office of Airport Safety and Standards [ATR/AAS]
- Reevaluate Prior Business Case / Develop New Business Case [ATR/AAS]
- Develop Package for Chief Financial Officer (CFO) Approval [ATR]
- Submit to CFO – Respond to Questions/Clarifications [ATR]
- Provide Funding to Inter Agency Agreement [ATR]

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## Questions?

**FAA Program Manager**

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# Airport Noise Research

**RPA Noise**

Presented to:
REDAC Sub committee on Airports

**Lauren Vitagliano**
March 8 – 9, 2022

## Noise Research Projects

- Noise Level Reduction Measurement – Innovative Methods
- Noise Abatement Charting
- National Sleep Study
- FY23 Noise Research Topics

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# Noise Level Reduction (NLR) Measurement – Innovative Methods

## Project Overview: Innovative Methods for NLR Measurement

1. Investigate the feasibility of using a UAS-based loudspeaker for NLR measurement
2. Investigate the feasibility and application of an indoor-outdoor method for NLR measurement
3. Develop a software tool to calculate representative exterior aircraft spectra specific to an individual airport and adjacent community

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## Program Timeline

**Current Status**

- ✓ **UAS Manufacturer Selected**
- ✓ **Indoor – Outdoor Test Method Conclusions**

**Next Steps**

- UAS Testing in April
- Aircraft Spectrum Tool Internal Review

**Months 1 – 3**

- Draft Project Plan
- Evaluate Related Research

**Months 4 – 18**

- Identify/Evaluate UAS Vehicles
  - Test plan
- Conduct Field Measurements & Analysis
- Develop Software

**Months 19 – 24**

- Draft UAS Feasibility Memo
- Draft Indoor – Outdoor (I-O) Feasibility Memo
- Draft Final Report

**Follow Up**

- Draft Briefing Materials upon request

**Project ends June 30, 2022**

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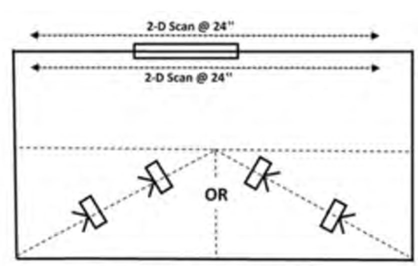
## Findings: Indoor-Outdoor (I-O) Test Method

- **Measurements conducted (3 homes, 10 rooms) demonstrated the feasibility of an I-O procedure for the measurement of noise reduction.**
- **The I-O alternative method is simple and requires only 2 sound level measurements.**
  - Fixed position 1’ from loudspeaker
  - Area scan 24” from outside façade
- **Further investigation is required to develop an I-O testing standard.**



a) Room with Single Exterior Facade

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## Next Steps

### UAS Testing
- Scheduled for April with Hylio
- Conducted at the City Hall in Thompson, TX

### Indoor-Outdoor Test Methods
- Complete literature review
- Add conclusions to draft report

### Aircraft Spectrum Tool
- Continue internal review process
- Obtain data for spectral class IDs (Boeing 7773ER)


Figure 1. Drone Flight Path for Tests 1 and 2


Figure 2. Drone Flight Path for Tests 3 and 4

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## Noise Abatement Charting

## Project Overview: Noise Abatement Charting

**FAA to:**

1. Develop best practice recommendations for charting airport noise abatement procedures in the Chart Supplement.
2. Develop standard nomenclature and taxonomy for describing noise abatement procedures for the pilot and operator community.


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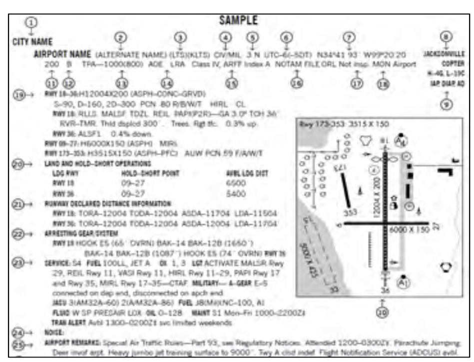
## Updates and Findings

### Industry Outreach

- MAA and MDOT briefed Sept 1, 2021
- ACI-NA Noise Working Group briefed Oct 12, 2021
- FAA Aeronautical Charting Forum, Oct 26, 2021

### Report Documentation

- FAA conducting review of "Best Practices" guidance document




Example of New Noise Section in Chart Supplement

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# National Sleep Study

## Purpose of the Project: National Sleep Study

- **Generate a dose-response relationship between aircraft noise exposure and sleep disturbance.**
- **Develop and use a scientifically sound, yet inexpensive, study methodology to obtain objective measures of sleep disturbance.**
- **Study Scope**:
  - Recruit 400 eligible subjects, statistically sampled in Lnight 5 dB strata between 40dB and 55+ dB, around 77 U.S. airport communities.
  - Using equipment that is sent to them by the research team, eligible participants will conduct a 5-day in-home physiological monitoring of their sleep disturbance from aircraft noise exposure.
- **Research team led by University of Pennsylvania School of Medicine**

**Physiological & body movement equipment (left)**

**Sound recording equipment (right)**

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# Project Timeline

**Research Program Goal:** Generate a dose-response relationship between aircraft noise exposure and sleep disturbance

**Dec 2017 – Sept 2021**
Study Preparation

**Sept 2021 – Sept 2023**
Data Collection

**FY24**
Data Analysis

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# Data Collection: National Sleep Study

### Eligibility

- Adjacent to selected runway ends
- 21 + years old, within specified BMI criteria, no sleep disorders, no sleep aids
- No night shift, no dependents requiring frequent care, not pregnant

### Noise Metrics

- Average annual Lnight, based on same foundation as Day-Night Average Sound Level (DNL), but Lnight only considers noise between 10pm – 7am.

Methodology approved by University of Pennsylvania and Westat Corporation Institutional Review Boards; the Dept. of Transportation Bureau of Transportation Statistics; OMB Office of Information and Regulatory Affairs.

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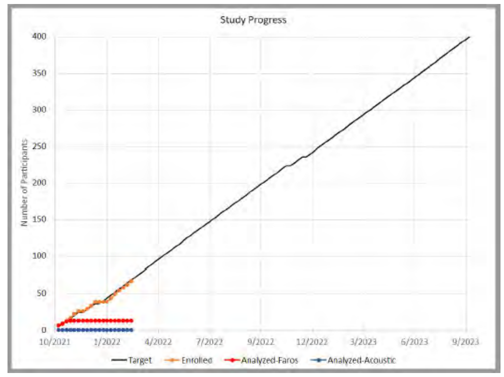
## Updates

- September 7: first 1,120 recruitment surveys mailed

| | | |
|---|---|---|
| Delivery #: | 20 | |
| Wave #: | 5 | |
| First Mailing of Last Wave Sent on: | 1/4/2022 | Last Update: 2/2/2022 |
| Total Deliverable Surveys (12.4% non-deliverable*) N: | 4695 | Surveys mailed N: 5360 |
| **Return Rate** | | |
| Returned Surveys N (% of Deliverable): | 851 (18.1%) | Expected*: 20.5% |
| Online Mode N (% of Returned): | 113 (13.3%) | |
| **Interest Rate** | | |
| Not Interested N (% of Returned): | 457 (53.7%) | Expected*: 41.8% |
| Interested N (% of Returned): | 394 (46.3%) | Expected*: 58.2% |
| **Eligibility Rate** | | |
| Eligible N (% of Interested): | 186 (47.2%) | Expected*: 33.3% |
| Ineligible N (% of Interested): | 208 (52.8%) | Expected*: 66.7% |
| Unclear Eligibility (% of Interested) | 0 (0%) | |
| **Enrollment** | | |
| Enrolled N (% of Interested and Eligible): | 72 (38.7%) | Expected*: 87 |
| Enrollment Ongoing N (% of Interested and Eligible): | 26 (14%) | |
| Declined N (% of Interested and Eligible): | 2 (1.1%) | |
| Unable to Contact N (% of Interested and Eligible): | 83 (44.6%) | |
| Dropped out (% of Interested and Eligible): | 3 (1.6%) | |
| **Reasons for Ineligibility (>1 possible)** | | |
| Hearing (% of Interested but Ineligible): | 61 (29.3%) | |
| Night Work (% of Interested but Ineligible): | 26 (12.5%) | |
| Sleep Meds (% of Interested but Ineligible): | 62 (29.8%) | |
| BMI (% of Interested but Ineligible): | 49 (23.6%) | |
| Dependents (% of Interested but Ineligible): | 28 (13.5%) | |
| Sleep Disorder (% of Interested but Ineligible): | 60 (28.8%) | |

* based on OMB submission

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## FY23 Noise Research Topics

## Standardization of Noise Abatement Aircraft Operations

**PROBLEM:**

- There are inconsistencies in determining the impacts and capability of implementing noise abatement and mitigation alternatives identified during Part 150 studies.
- FAA does not provide guidance on which method to use.

**OBJECTIVE:**

Evaluate various methods used in Part 150 studies to analyze preferential runway use, IFR/VFR and PBN procedure implementation.

- Identify the methods used to analyze the noise abatement aircraft operations.
- Recommend a standard analysis method to be incorporated into FAA's policies and procedures on Part 150 studies.

**PERIOD OF PERFORMANCE: 24 months**

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## Best Practices on Communicating Noise to the Public

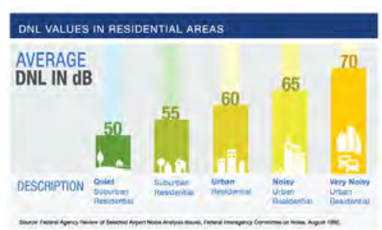
**PROBLEM:**

There is a lack of understanding of how to communicate effectively and clearly about aviation noise with the public.

**OBJECTIVE:**

Evaluate various methods and approaches to engage and educate the public on aviation noise topics to include how supplemental noise metrics can be used to present the information more clearly.

**PERIOD OF PERFORMANCE: 18 months**





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## FAA Influence on Local Land-Use Decisions

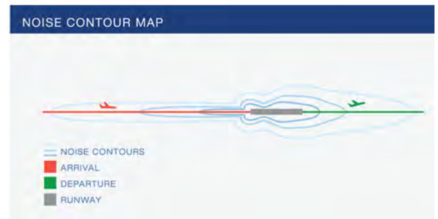
**PROBLEM:**

- FAA has no influence on local land-use decision and planning around airports, yet FAA is often requested by public and political members to exert control over land-use.
- In anticipation of noise level threshold reduction, FAA will need to consider how to support noise mitigation and compatible land-use via Part 150.
  - Ex. Sound insulation may not be viable, so what are other options?

**OBJECTIVE:**

- Conduct an analysis of the current policies, practices and limitations on FAA's influence and/or control of land-use surrounding airports.
- Recommend changes to current policies or practices to encourage additional influence on local zoning and land-use decisions to improve compatibility around airports.

**PERIOD OF PERFORMANCE: 12 – 18 months**

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## Questions?

**Contact the FAA Program Manager**

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