National Aeronautics and Space Administration

NAC Aeronautics Committee Report

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Chair
NASA Headquarters
May 30, 2019

Areas of Interest Explored at Current Meeting

Topics covered at the Aeronautics Committee Meeting held on March 20, 2019 at NASA Headquarters:

- FY20 ARMD Strategy and Budget Overview*
- Airspace Research Vision Beyond NextGen*
- Progress on University Leadership Initiative*
- 2019 Work Plan Discussion

* All of the topics have related findings provided by the Aeronautics Committee

Aeronautics FY 2020 Budget Request

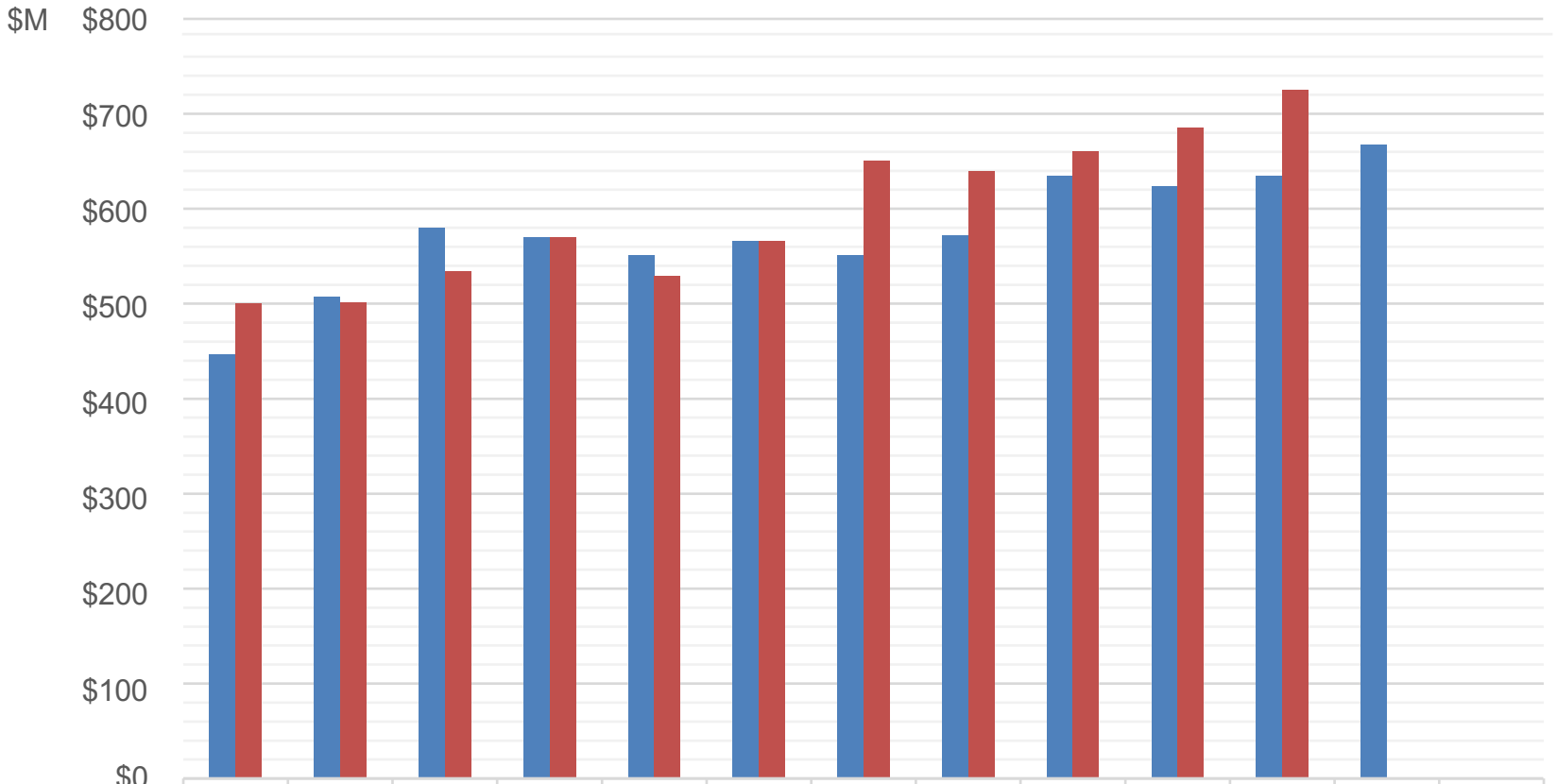
($M)	2020	2021	2022	2023	2024
Aeronautics	$666.9	$673.6	$680.3	$587.1	$587.0

- Completes the X-59 aircraft for the Low Boom Flight Demonstration and ground-work for scientific data of community response for regulatory organizations.
- Advances technology for the next generation of subsonic transport including electric propulsion.
- Accelerates research in urban air mobility to support industry readiness: safety and operations testing.

- Completes air traffic management demonstrations with the FAA, airlines, and airports that validate new capabilities to improve airport operating efficiency including UAS in the NAS.
- Transfers Aeroscience Evaluation and Test Capabilities Project (AETC) from Aeronautics to Safety, Security, and Mission Services (SSMS).

Aeronautics Budget FY 2009 to FY 2020

- FY 2019 is the 5th straight year Congress has appropriated funding above the President's budget.
- FY 2020 ARMD President's Budget Request is $667M and excludes Aeronautics Evaluation and Capabilities Project ($56M) which was transferred to the SSMS account.

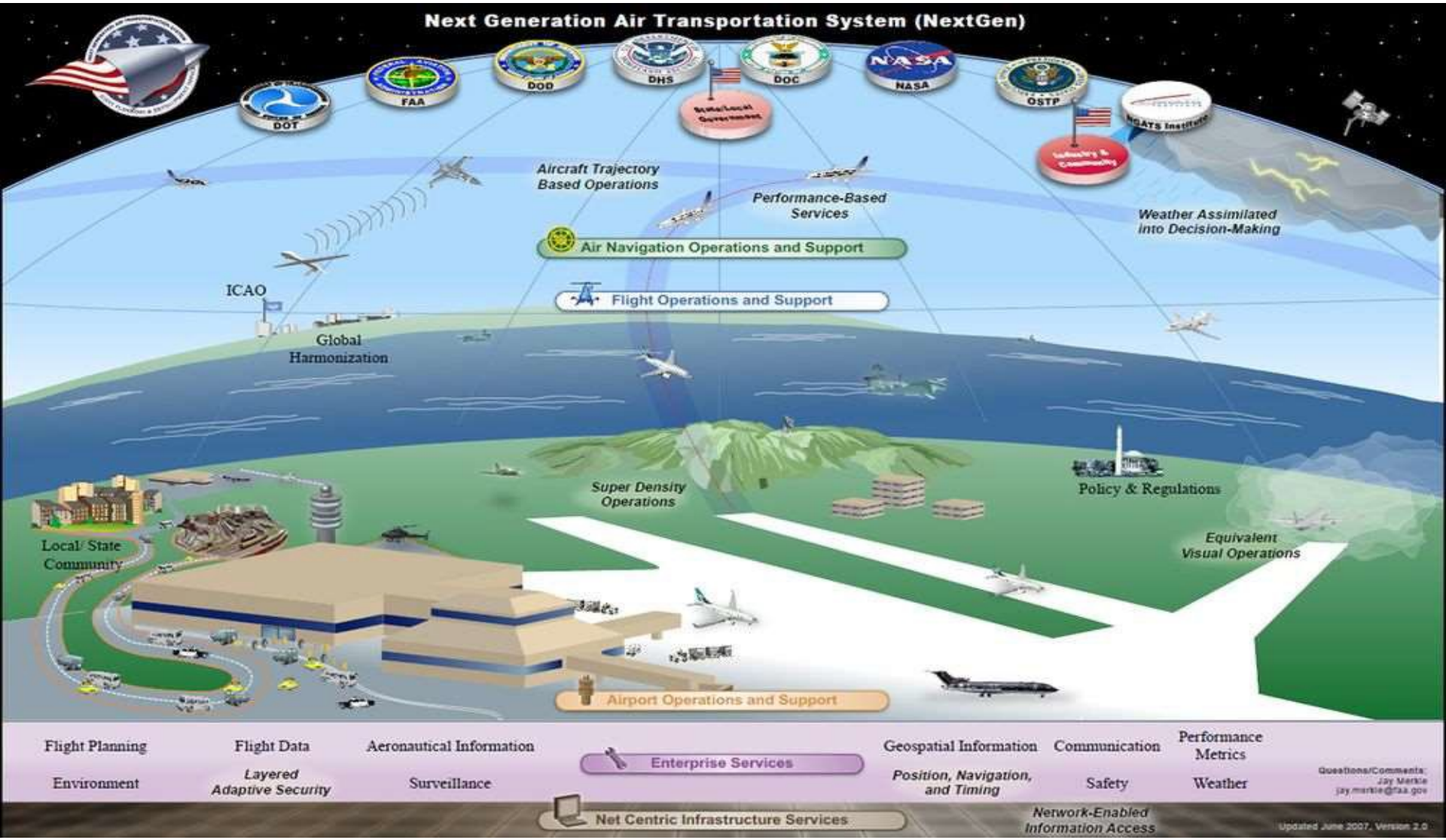


	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20
Pres Budget	$447	$507	$580	$569	$552	$566	$551	$571	$634	$624	$634	$667
Enacted	$500	$501	$534	$570	$530	$566	$650	$640	$660	$685	$725	

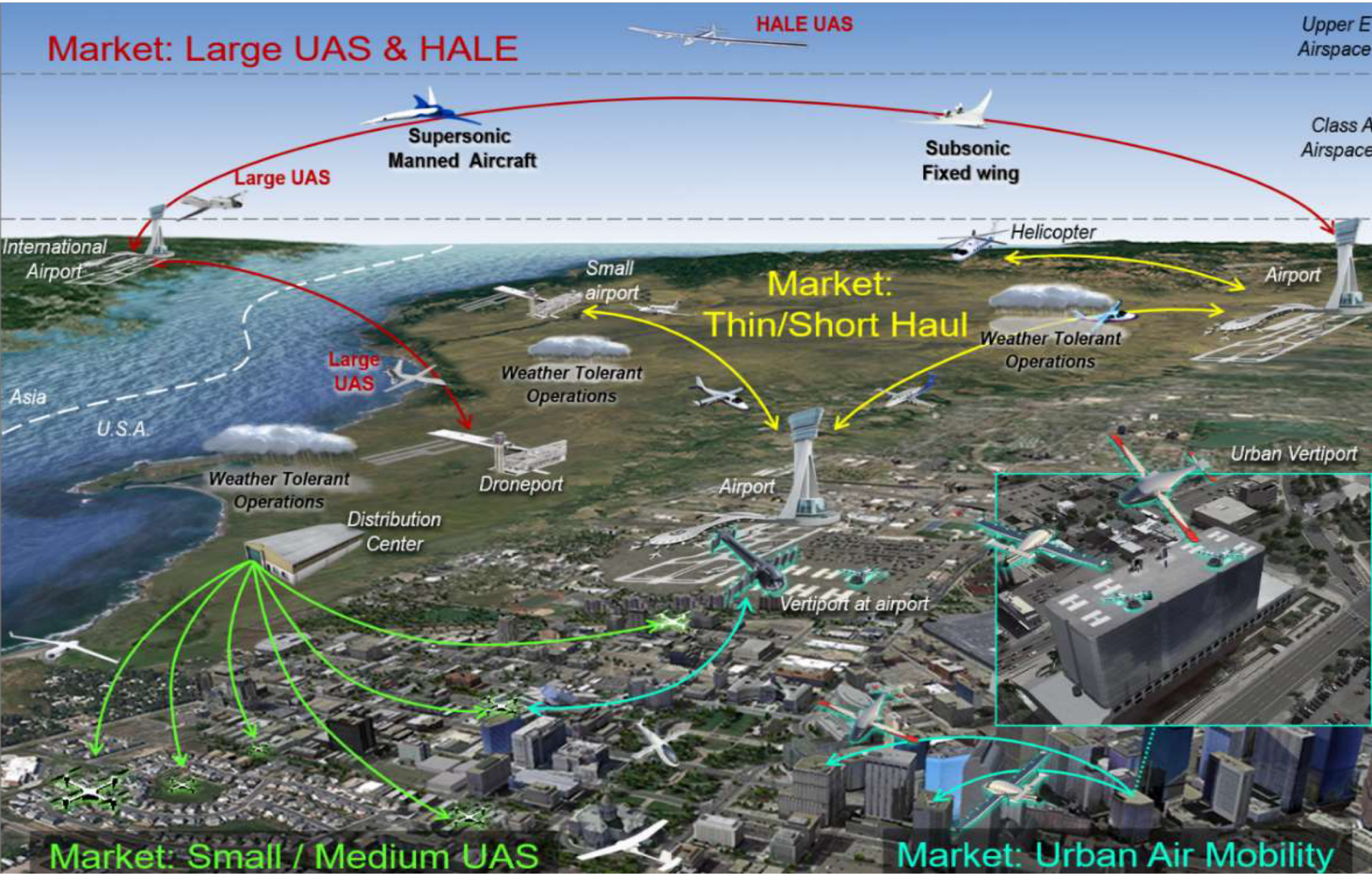
Committee Finding for ARMD AA – ARMD FY20 Budget

While very optimistic regarding the 2020 proposed budget, the Committee expressed concern about the transfer of the Aeroscience Evaluation and Test Capabilities Project (AETC) from Aeronautics to the Mission Support Directorate. The main concern is ARMD's utilization of these facilities in terms of the agency priorities in the future. Given the focus by NASA to establish a presence in the Moon, the Committee has concerns over ARMD's future ability to resolve scheduling and related resource conflicts when it comes to wind tunnel facilities.

Current Next Gen Operational View



Future Airspace Operational View



Beyond NextGen Research Strategy

- Safe efficient airspace access for all users, vehicles, and missions by transformed airspace

- Anchor around Service Oriented Architecture
  - Enables address of both traditional and emergent user needs

- Research needs to stay ahead of the need
  - Narrow the trade space, evolve concept of operations and technologies
  - Allow sufficient time for maturation of viable capabilities for validation/demonstration/transfer

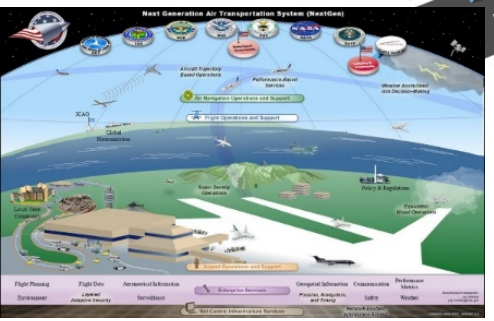
- Conduct pathfinder research to breakdown barriers for NAS Transformation
  - Lay the path for leveraging by varied users for their needs and applications

Objective and Focus Beyond 2020

- Early focus on enabling UAM operations and market entry
  - Full support of UAM Grand Challenge (Unlock UML2, work towards UML 3/4)
  - UAM initial Concept of Operation
  - UAM airspace design
  - UTM/ATM Integration
  - High altitude airspace management

- NAS Transformation to a federated service oriented architecture
  - Concept of Operations
  - Data/Communication requirements
  - Data for implementer/user investment decisions
  - Data for standards and certification

Pathway to Airspace Transformation



FAA TBO

UTM/ATM Integration

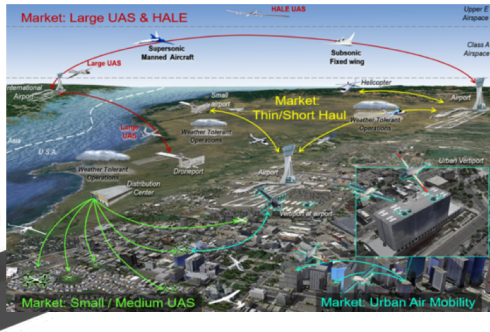
GC 1

High Altitude Airspace

GC 2

Autonomous Freighters

Autonomous UAM/UAS



Pathfinder Research to Breakdown Barriers

Leverage Community Engagement

- Build on NASA/OGA relationships for acceptance/coordination/transition
  - Excellent coordination between ARMD and FAA Future NAS, Air Traffic, Safety and Certification, Environment and Energy, and International
  - NASA/FAA Research Transition Teams
  - Trust and leadership recognition gained from 12 significant technology transitions*

- Build on Industry relations for acceptance/coordination/transition
  - Airlines (United, American, Alaska, Southwest, Delta, JetBlue Airlines)
  - Boeing, GE, Rockwell Collins, Honeywell, Google, Amazon, Intel, Uber, Kitty Hawk
  - 8 USS providers which will play a large part in UAM and transformed NAS
  - 100's of emergent industry UTM partners
  - Airlines for America, Commercial Aviation Safety Team, Unmanned Aircraft Safety Team

*EDA, TSAS, FIM, MSP, DWR, DRAW, TASAR, PDRC, IADS, DAC, UTM, SWS

Committee Finding for ARMD AA – Airspace Vision Beyond NextGen

The Committee suggests that NASA show a return on investment on the airspace technology demonstrations (ATD) and what they collectively mean for the future and benefit of the nation. If the Airspace Operations and Safety Program is not successful, we may not have a competitive urban air mobility (UAM) industry. The advancements in the air traffic control system are necessary for achieving a safe and reliable national air transportation capability. The Committee encourages NASA to continue demonstrating the technologies long-term to obtain more data on the impacts of the UAM integration into the airspace.

The Committee noted the reduction of the NASA ARMD budget starting in 2023 and suggested that the success by NASA in these new markets for autonomous vehicles and supersonic flight could justify a higher budget.

University Leadership Initiative (ULI)

- ULI represents a new type of interaction between ARMD and university community, where universities take the lead, build their own teams, and set their own research path
- ULI created to:
  - Promote new, innovative ideas that can support NASA ARMD portfolio and U.S. aviation community
  - Address the most complex challenges associated with six strategic thrusts
  - Accelerate progress toward achievement of high impact outcomes
  - Leverage capability of universities to bring together the best and brightest minds across many disciplines

First Round of ULI Awards (2017)

- Communication capabilities for improving link/network capacity, reliability, security in support of new Air Traffic Management applications (Thrust 1)
- Small real-time outer mold line reconfigurations to minimize boom signatures and drag in response to changing ambient conditions (Thrust 2)
- Slotted, natural laminar flow airfoil to reduce wing profile drag (Thrust 3)
- Advance electric power systems, battery and energy storage, thermal management supporting electric propulsion aircraft (Thrust 4)
- System-wide, real-time prognostics framework with rigorous V&V for proactive health management of NextGen National Airspace System (Thrust 5)

Already Having a Broad Impact

- University teams proposing innovative ideas to solve complex, multi-disciplinary, aeronautics problems
- Integrating diverse participants from the broader community
- Educating students by engaging them in aeronautics research

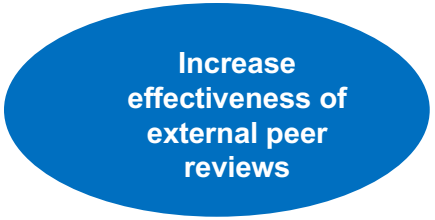
22	*Universities*
48	*Faculty*
136	*Students*
7	*Majors represented*

Boeing interested in flight testing South Carolina communication technologies

NASA Observations on Annual Peer Reviews

STRENGTHS

- ULI awards remain relevant to ARMD strategic thrusts and outcomes
- Positive feedback from peer reviewers on value of ULI
- Progress on most ULI awards is good
- Strong group of technical experts working the awards
- Many students are involved in ULI research
- Student poster sessions were highlights
- Universities are integrating diverse participants



AREAS FOR IMPROVEMENT

- NASA worked with Principal Investigators to ensure that external advisors performed an independent peer review according to NASA expectations
- Pro bono peer reviewers. Not all attend. Uneven review quality depending on reviewer interests
- Reviews ran long. Schedule constraints made interactions with reviewers and NASA challenging at times
- Technical Officers need to provide stronger quality improvement suggestions

Further Improve ULI Processes

- Establish diversity of portfolio and proposers
- Increase continuity of reviewers and effectiveness of external peer reviews
- Support Principal Investigators in defining global context surrounding their work, including policy and economic challenges that complement the technical work for research transition
- Work toward goal of relevant industrial partners continuing "transition-able" ULI research
- Better define ULI value proposition
  - ✓ ULI Activities
  - ✓ ULI Products

ULI Summary

- NASA is successfully executing the University Leadership Initiative
  - Strong and diverse group of technical experts working the awards
  - Progress on ULI awards is good
  - Many students are involved in ULI research
  - Congressional interest in ULI
- NASA is improving research dissemination to catalyze ULI transition
- NASA is assessing ways to improve value of ULI to aviation and the nation

Committee Finding for ARMD AA – ULI Progress

The Committee applauds NASA on its flexibility on trying to find the optimal mechanism on the University Leadership Initiative. The Committee emphasized the need to assure diversity when selecting proposals from the universities and to track and show statistics. The Committee also found that there is a need to drive the message that aeronautics is not only relevant, but serves as a pioneering application for 21st century technology innovation. NASA needs to be more proactive when engaging with and advertising these opportunities to the university community.

Committee Recommendation for NASA – Human Capital

The Committee is excited about the budget and the direction of NASA Aeronautics. The Committee recognizes the need to find a mechanism for NASA to hire engineers & technologists from non-traditional disciplines that are shaping the next generations of aeronautical systems. The Committee recommends that NASA actively engage in bringing on-board innovators to work on the difficult problems that the industry and academia are facing through a new, more flexible hiring and retention process.

Major Reasons for the Recommendation:

Twenty first century aerospace is being rapidly shaped by the digital revolution. In aeronautical systems, new platforms ranging from those enabling urban air mobility to unmanned aircraft are garnering economic momentum, while the relationship between the pilot and airplane is being redefined for even traditional manned systems. The engineering and other technical disciplines required to address digitization are different from those that dominate the current workforce. Moreover, NASA can fulfil an important national leadership role in shaping this future by implementing research and development activities that integrate the complexities of traditional aeronautics with these advanced, emerging technologies to maximize capabilities, assure safety and help the nation gain a competitive edge in an array of these new markets.

Committee Recommendation for NASA – Human Capital (continued)

Major Reasons for the Recommendation continued:

Universities have highlighted the pull by companies for students in STEM fields, particularly in the areas of data analytics, machine learning, deep learning and autonomous systems. Graduates in these fields are in significant demand with correspondingly high salaries. These engineers expect to work on challenging, market-defining problems, while these new disciplines are themselves evolving rapidly. NASA is currently in competition with Silicon Valley to attract these individuals. To recruit and retain this talent, NASA needs flexibility beyond the standard government process for hiring and promotion. DARPA has addressed this challenge by implementing a new hiring process called 1101, adding considerable flexibility to the acquisition of its technical talent pool. NASA needs to think broadly and address this hiring and retention difficulty with their own dynamic hiring process. Perhaps establishing a new category such as Fellow similar to what companies have done is an example of recognizing and retaining specialized engineering talent.

Consequences of No Action on the Recommendation:

The emerging global urban, inter-urban air mobility, and other emerging markets are moving fast and the US is facing global competition. In order for the US to stay competitive and a leader in this industry, NASA needs to address the STEM issues that it and the country are facing.

BACK-UP

2019 DRAFT NAC Aeronautics Committee Work Plan

SPRING	SUMMER	FALL
ARMD Strategy and FY20 Budget Overview	Autonomy	System Wide Safety Assurance
Progress on the University Leadership Initiative	Aero Mobility Transformation – UAS to UAM	**NASA Aeronautics Transformation Planning**
Airspace Research Vision Beyond NextGen	Propulsion Transformation – Electric Propulsion	Supersonic Market Developments and LBFD Status
March 20, 2019 at HQ	**July 24-25, 2019, GRC**	**November 20-21 at TBD**




Acronyms

- AETC - Aeroscience Evaluation and Test Capabilities
- ATD – Airspace Technology Demonstration
- ATM-X - Air Traffic Management Exploration
- ARMD – Aeronautics Research Mission Directorate
- DARPA – Defense Advanced Research Projects Agency
- DAC - Dynamic Airspace Configuration
- DRAW - Dynamic Routes for Arrivals in Weather
- DWR - Dynamic Weather Routes
- EDA - Efficient Descent Advisor
- FAA – Federal Aviation Agency
- FIM - Flight Deck Interval Management
- GC – Grand Challenge
- HALE – High Altitude Long Endurance
- IADS - Integrated Arrival, Departure, and Surface Operations
- MSP - Maintenance Service Provider
- NAC – NASA Advisory Council
- NAS – National Airspace System
- NextGen – Next Generation Air Transportation System
- OGA – Other Government Agencies
- PDRC - Precision Departure Release Capability
- SSMS - Safety, Security, and Mission Services
- STEM – Science, Technology, Engineering and Math
- SWS – System-Wide Safety
- TASAR - Traffic Aware Strategic Aircrew Requests
- TBO – Trajectory Based Operations
- TSAS - Terminal Sequencing and Spacing
- UAM – Urban Air Mobility
- UAS - Unmanned Aircraft Systems
- ULI - University Leadership Initiative
- UML – UAM Maturity Level
- UTM – Unmanned Aircraft Systems (UAS) Traffic Management