CAAFI – Biennial General Meeting

Dr. Jaiwon Shin
Associate Administrator, Aeronautics Research Mission Directorate
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NASA Aeronautics Six Strategic Thrusts

**Safe, Efficient Growth in Global Operations**
- Enable full NextGen and develop technologies to substantially reduce aircraft safety risks

**Innovation in Commercial Supersonic Aircraft**
- Achieve a low-boom standard

**Ultra-Efficient Commercial Vehicles**
- Pioneer technologies for big leaps in efficiency and environmental performance

**Transition to Low-Carbon Propulsion**
- Characterize drop-in alternative fuels and pioneer low-carbon propulsion technology

**Real-Time System-Wide Safety Assurance**
- Develop an integrated prototype of a real-time safety monitoring and assurance system

**Assured Autonomy for Aviation Transformation**
- Develop high impact aviation autonomy applications
Sustainable Alternative Jet Fuels – Strategic Relevance

Ultra-Efficient Commercial Vehicles

- Efficiency (use less energy)
- Emissions (use less energy)
- Noise (less perceived noise)

Airframe

Propulsion – Advanced Gas Turbines and Propulsors

Vehicle System Integration

Transition to Low-Carbon Propulsion

Aviation Alternative Fuels (Drop-In)
- Reduce specific carbon (use cleaner energy)
- Clean, compact combustion
- Gas turbines needed for foreseeable future

Alternative Energy/Power Architectures
- Energy sector convergent technology*
- Promise of cleaner energy
- Potential for vehicle system efficiency gains (use less energy)
- Leverage advances in other transportation sectors
- Address aviation-unique challenges (e.g. weight, altitude)
- Recognize potential for early learning and impact on small aircraft

*energy sector includes other government agencies, industry, and academia
New Aviation Horizons Flight Demo Plan

FY17 Budget Request

Purpose-Built Ultra-Efficient Subsonic Transport (UEST) Demonstrators

- Hybrid Electric Propulsion (HEP) Demonstrators
  - Transport Scale
  - Ground Test Risk Reduction
  - Preliminary Design
  - Design & Build
  - Flight Test

- “Purpose-Built” Ultra-Efficient Subsonic Transport (UEST) Demonstrators
  - Small Scale “Build, Fly, Learn”
  - Flight Test
  - Design & Build
  - Flight Test

- Ground Test Risk Reduction
  - Preliminary Design
  - Design & Build
  - Flight Test

- Preliminary Design
  - Design & Build
  - Flight Test

- Fully integrated UEST Demonstrator
  - Design & Build
  - Flight Test

- Potential Candidates

Validated ability for U.S. Industry to build transformative aircraft that use 50% less energy and contain noise within the airport boundary.

Validated HEP concepts, technologies and integration for U.S. Industry to lead the clean propulsion revolution.

Enables low boom regulatory standard and validated ability for industry to produce & operate commercial low noise supersonic aircraft.

Images Credit: Lockheed Martin
### NASA Response to Community Drivers

#### Transition to Low-Carbon Propulsion

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<th>Community Outcomes</th>
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### NASA Strategies

#### Sustainable Alternative Jet Fuels (drop-in)
- Explore and demonstrate combustor concepts that exploit future alternative fuels
- Characterize the performance and emissions of an increasing spectrum of alternative jet fuels in advanced combustors
- Advance scientific understanding relating fuels to combustion to emissions to atmospheric impact

#### Alternative Propulsion Systems (Energy/Power Arch)
- Explore and demonstrate vehicle integration synergies enabled by electrified aircraft propulsion
- Enable increasingly electrified aircraft propulsion systems with minimal change to aircraft outer mold lines
- Gain experience through integration and demonstration on progressively larger platforms
## Federal Alternative Jet Fuel Strategy
### Fuel Development Path

**Federal Partner Agency Contributions**

- **Diverse industry contributions along full development path**
- **Academia contributions in low TRL and FRL**

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*TRL: Technology Readiness Level, FRL: Fuel Readiness Level*
A Vision for the Future of Civil Aviation

• There will be a radical increase in new and cost-effective uses of aviation
• The skies will accommodate thousands of times the number of vehicles flying today
• Travelers will have the flexibility to fly when and where they want in a fraction of the time that it takes today
• All forms of air travel will be as safe as commercial air transport is today
• Subsonic transports will remain the backbone of long-haul global and domestic travel
• Significantly reduced carbon and noise footprints from aviation

Low-carbon propulsion –
• will be designed into vehicles of all sizes and missions
• will have its largest impact on aviation’s carbon footprint via subsonic transports
• will enable new vehicles that create economic benefit for unique missions/services.
Sustainable alternative jet fuels will be the norm.