



Aeronautics Research and Technology Roundtable

Updated ARTR Scope and Path Forward

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ARTR Focus Areas

First Instantiation  ***ARMD Strategic Implementation Plan***

Second Instantiation  ***Advanced Air Mobility Mission***

Proposed Third Instantiation  ***Sustainability***

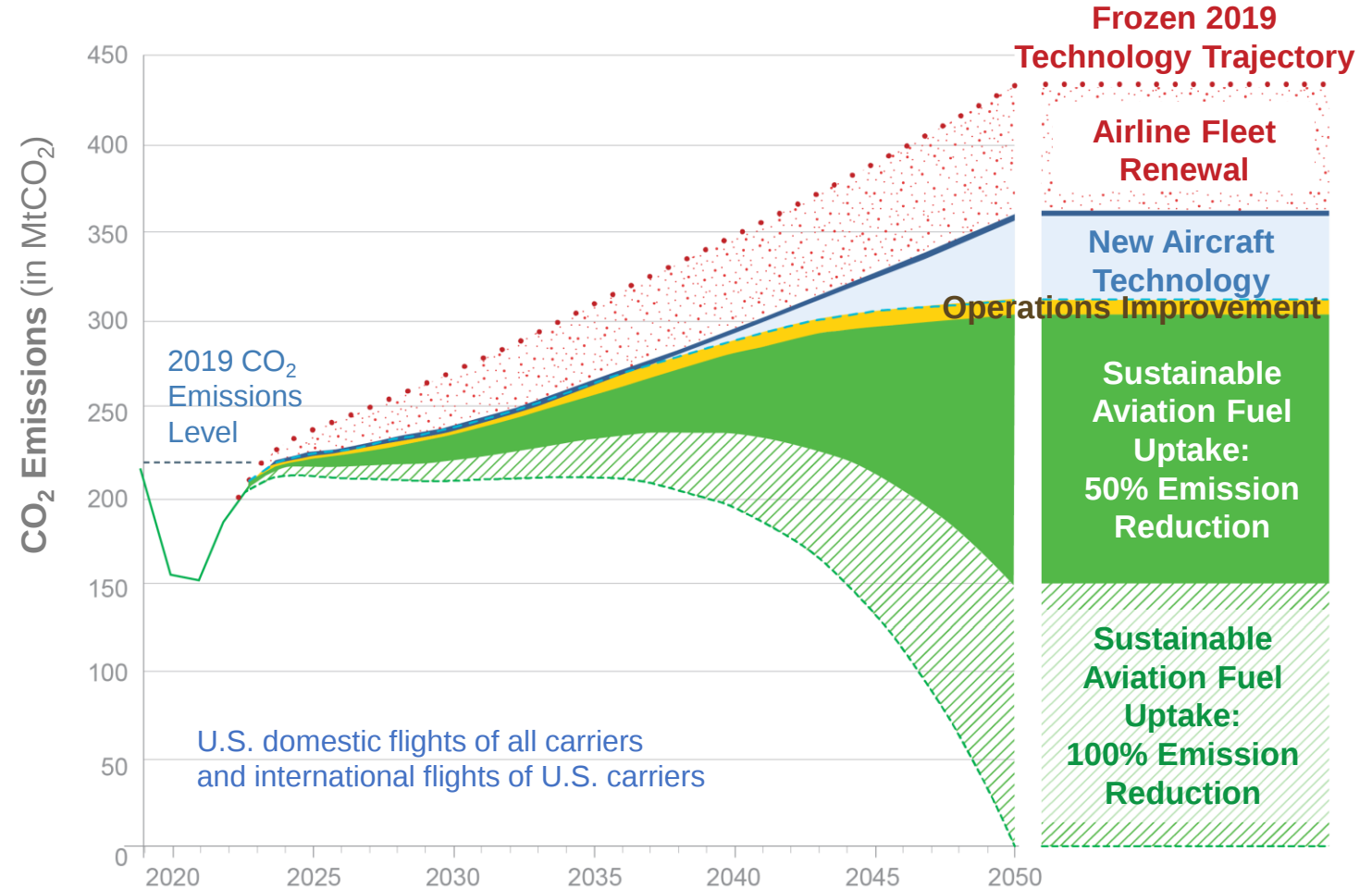
U.S. Aviation Climate Action Plan

Global Context for Sustainable Aviation

U.S. aviation goal is to achieve **net-zero greenhouse gas emissions by 2050.**

U.S. Aviation Climate Action Plan is aligned with

- U.S. economy-wide goal
- International Civil Aviation Organization
- Air Transport Action Group



The U.S. is working with the global community to achieve net-zero greenhouse gas emissions by 2050 using a common basket of measures.

Aviation Pillars for a Sustainable Future



Global Aviation Industry GOAL: net-zero carbon emissions by 2050

TECHNOLOGY



NASA = Primary Role

SUSTAINABLE
AVIATION FUEL



NASA = Supporting Role

OPERATIONS
AND INFRASTRUCTURE



NASA = Primary Role

Sustainable Flight National Partnership

Mature Technology to TRL6 by 2028



Advance engine
efficiency and
emission reduction

Enable integrated
trajectory optimization

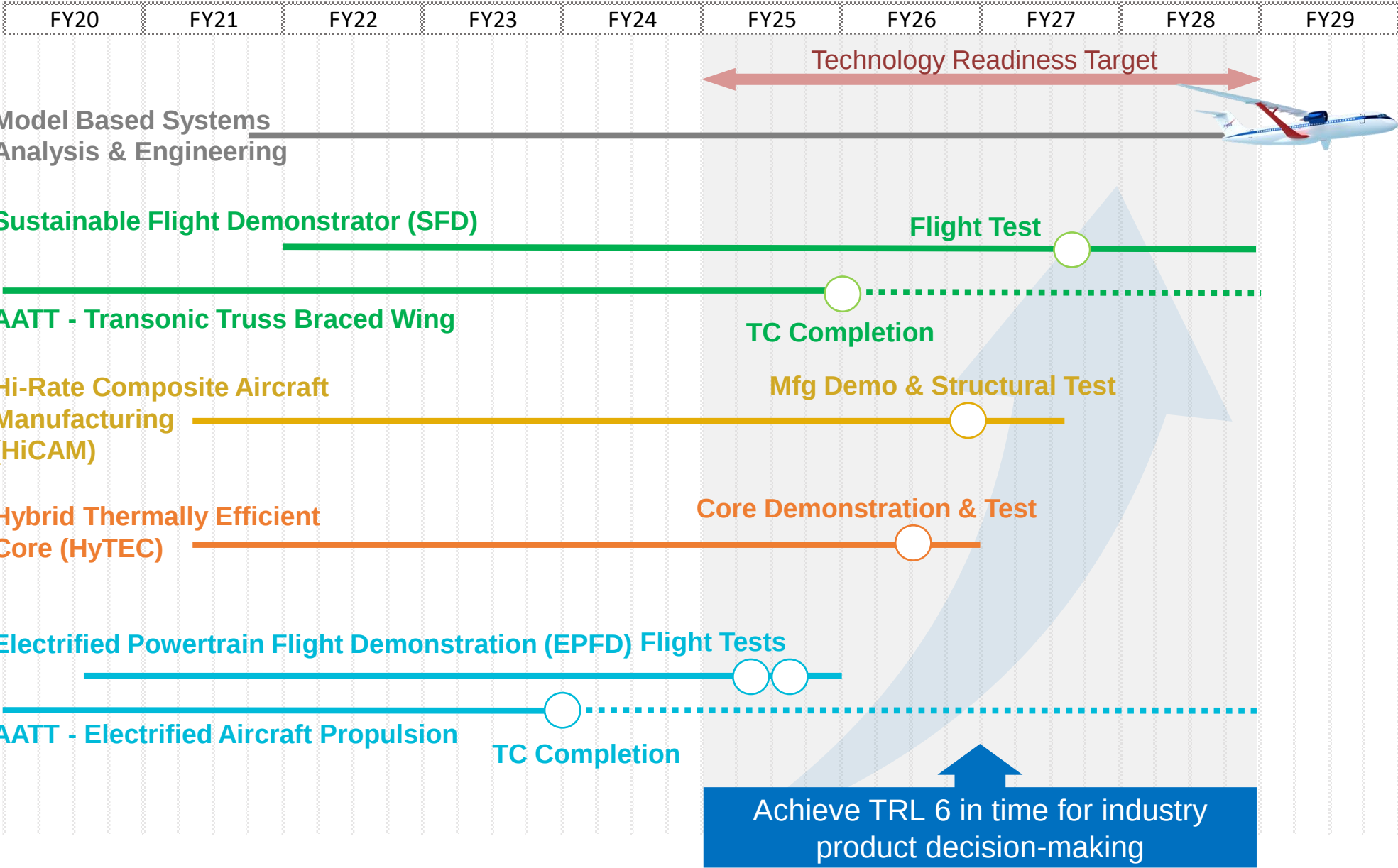


Advance airframe
efficiency and
manufacturing rate

Enable use of 100%
sustainable aviation fuels

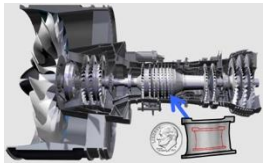
Achieve net-zero greenhouse emissions by 2050 through 25-30% energy efficiency improvements in next generation transports, 100% sustainable aviation fuel, and optimal trajectories.

Subsonic Transports: Integrated Technology Development



Leverage the Asset
-
Future Spirals

Planned
Notional



NASA's X-57 is Pathfinder for Electric Propulsion

First flight is summer 2022



Enable new configurations



Ground and flight validation of electric motors, battery, and instrumentation

Share technical insights and lessons learned



LEAPTech experiment



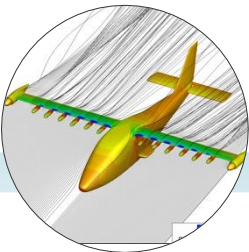
Wind-tunnel validation



Motor nacelle design & testing



Structural testing



Computational simulations



Operational checkouts

Inform Small Electric Aircraft Propulsion Standards and Certification

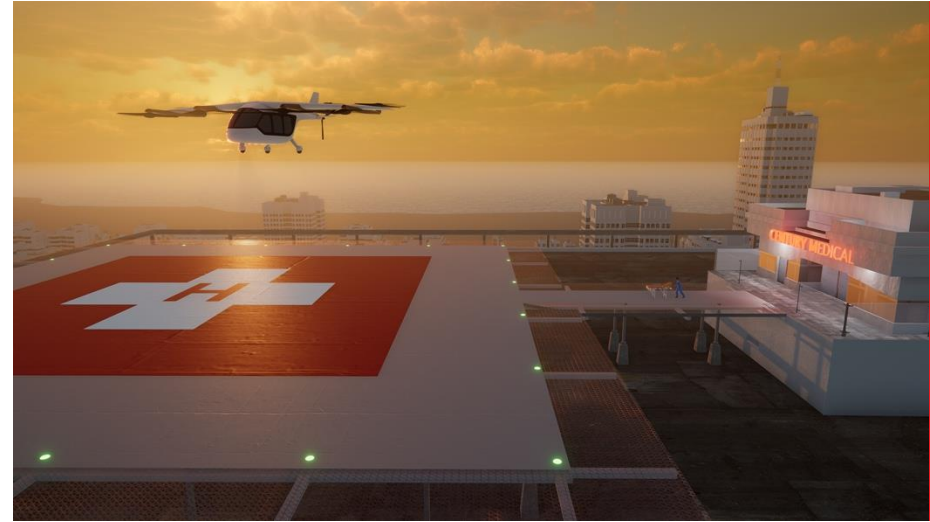
Advanced Air Mobility Missions are Emerging



CARGO
TRANSPORT



PUBLIC GOOD

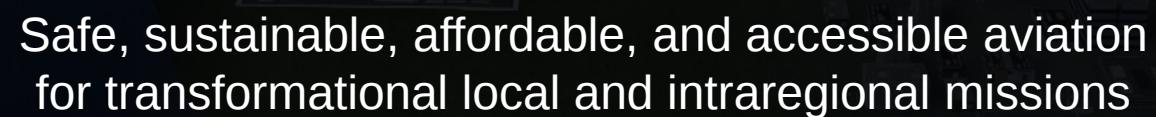


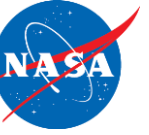
CONSUMER/
ENTERPRISE
GOODS AND
SERVICES



PASSENGER
TRANSPORT







Future Airspace and Safety: *Sky for All*



~ 2040: Planning to Achieve a Sky for All

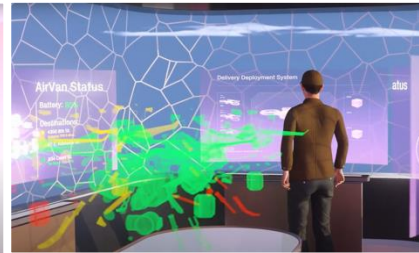
Imagining tomorrow's aviation system today, leveraging FAA Info-centric NAS



Operator Optimization



Ubiquitous and Resilient Operations



Sustainable Solutions



Seamless Skies



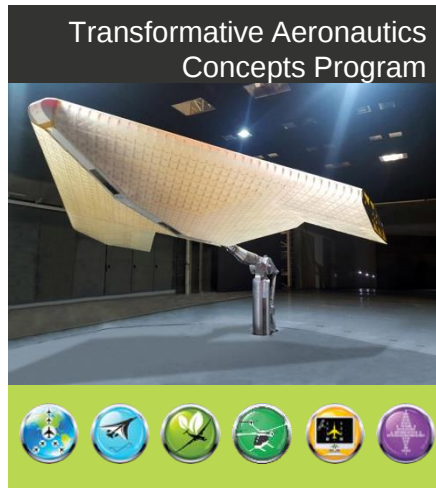
Learning-Based Systems and Communities

- NASA-led effort to gather inputs from the aerospace community and FAA
- Co-developed vision of a mid-21st century shared airspace that is agile, scalable, optimizable, increasingly diverse, and equitable
- Evolution from trajectory-based operations to collaborative and highly automated operations
- Sky for All results will inform ARMD research and development portfolio and collaboration with FAA

SKY^{for}ALL

Advanced Concepts for Emergency Response Operations

NASA Opportunity to Address a National Crisis



NASA Research, Development, and Technology Transition Project

To advance our nation's ability to predict and manage wildfires and other national disasters and mitigate their impacts

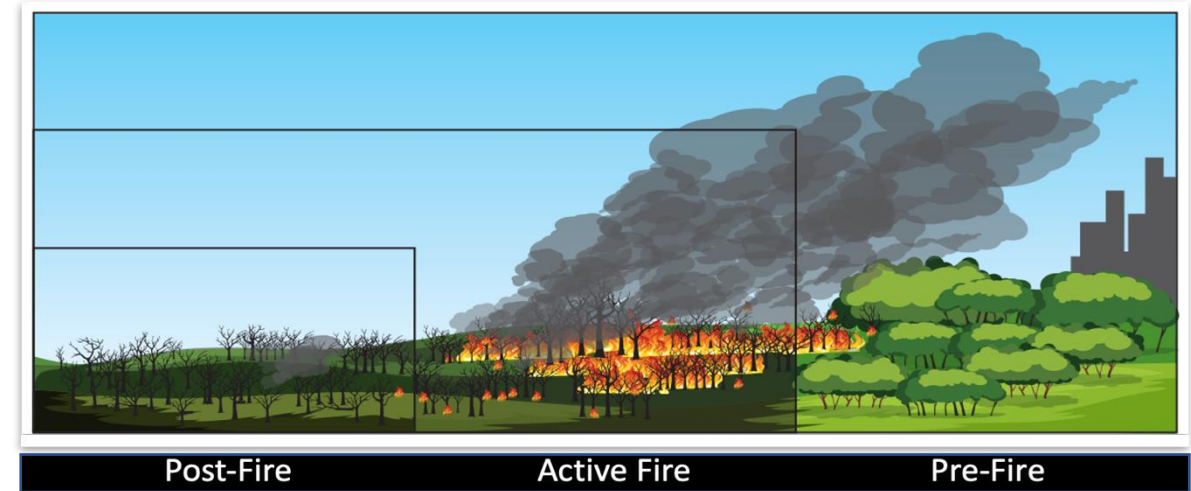


Objectives

- Focusing on wildfire use case, develop and demonstrate evolving NASA technologies to reduce fire risk, improve monitoring and response to wildfires while mitigating impacts to enhance safety and prevent economic loss.

Approach

- In coordination with wildfire community, lead development of advanced airspace operations and sensing technologies, safety methods, communications and aircraft capabilities for persistent suppression operations
- Leverage and expand current R&D related to air traffic/uncrewed traffic operations, drones, and safety methods to coordinate remote sensing aircraft
- Fuse satellite/airborne observations with models to support fire research and management
- Establish Public-Private-Philanthropic Partnerships to test and implement prototype capabilities and support transition/adoption by stakeholders



The technology developed in this program will be applicable to other disasters and climate driven events, e.g., floods and hurricanes



Achieving Zero-Emissions Aviation

Net-Zero Aviation Emissions Innovation



Foster radical aviation technology advancement – new energy sources, aircraft architectures – necessary for large aircraft with extremely low or zero emissions

Low TRL concepts can be further conceptualized, researched, developed, ground and flight-tested and advanced for late 2030s / early 2040s

Recent University Leadership Initiative awards included teams working on net-zero emissions topics

Research currently underway at low Technology Readiness Levels (TRL)



NASA Distributed Propulsion Concept

- Turbo-Electric with superconducting electric drivetrain
- Over 70% reduction in energy use

University of Illinois, Urbana-Champaign (NASA ULI) All-electric Concept

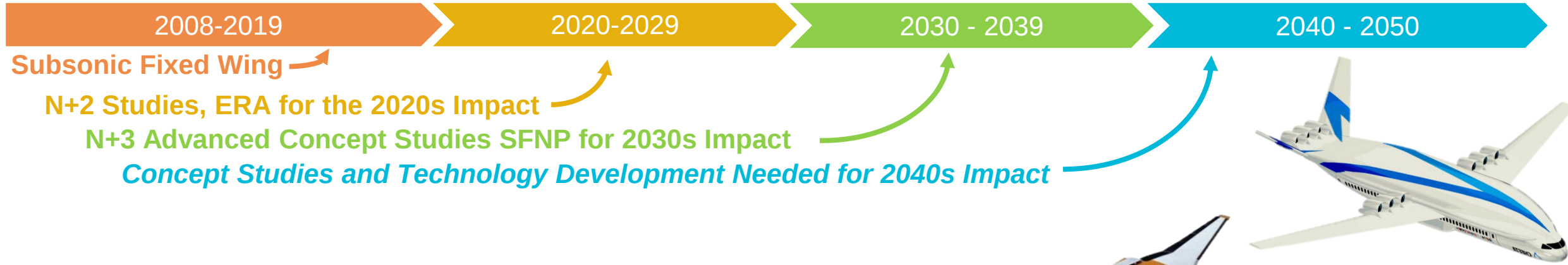
- Hydrogen fuel cell, superconducting electric drivetrain
- Zero carbon emissions



Long-Term Transport Technology and Innovation

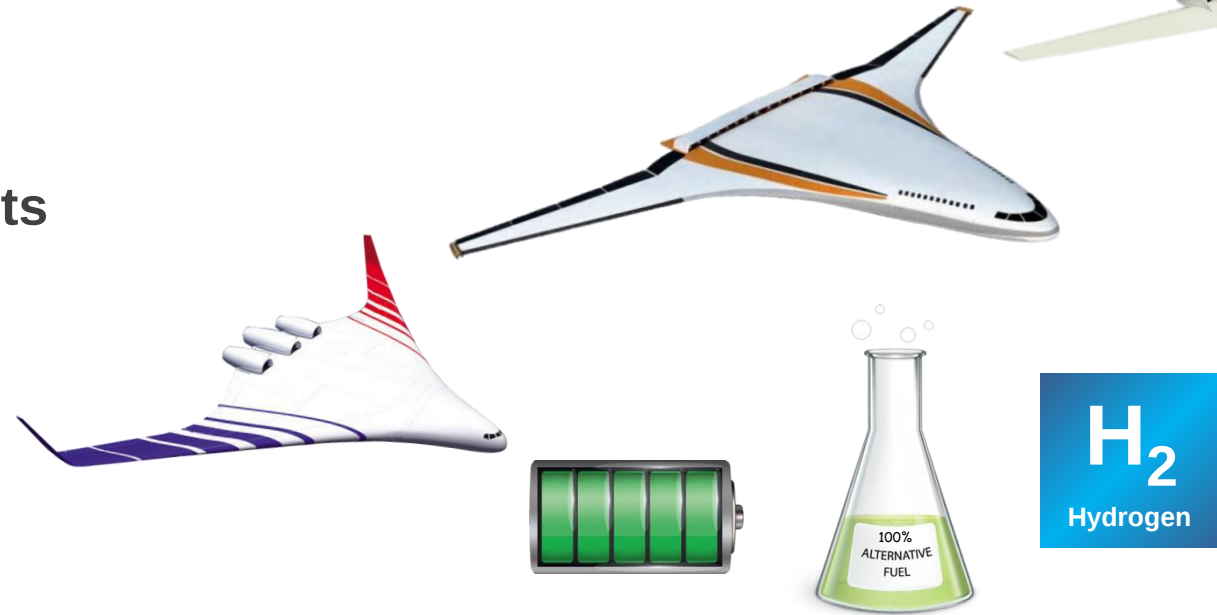


Generational studies to inform future technology investments



Opportunities to Define Future Aviation Systems and Concepts

- Advanced Concept Studies for 2040+ EIS
- Net-Zero Emissions Concepts
- Promising Technologies and Architectures
- Support Aviation Community with NASA-unique Contributions



Path Forward



Current

- The ARMD Portfolio is in alignment with Stakeholder needs and provides a compelling vision with positive impact.
- ARMD supports a robust Sustainable Flight National Partnership to enable highly efficient next-generation aircraft and ensure U.S. leadership in aviation
 - Demonstrate the first-ever high-power hybrid electric propulsion for large transport aircraft
 - Accelerate development of a full-scale sustainable flight demonstrator X-plane to validate integrated systems and their benefits
 - Advance small turbine cores that will increase engine thermal efficiency and reduce fuel burn
 - Improve the rate of composite manufacturing by 4 to 6 times faster than current production rates
 - Develop technologies needed to increase use of sustainable aviation fuels
 - Develop a robust model-based systems analysis and engineering framework at the aircraft system level
 - Develop the next evolution of air traffic management to safely increase operational efficiency which reduces fuel burn and emissions

Next

- ARMD recommends the ARTR expand its scope to look at the larger sustainability landscape for opportunities to enable a sustainable future.