National Aeronautics and Space Administration

An Overview of NASA Sustainable Aviation

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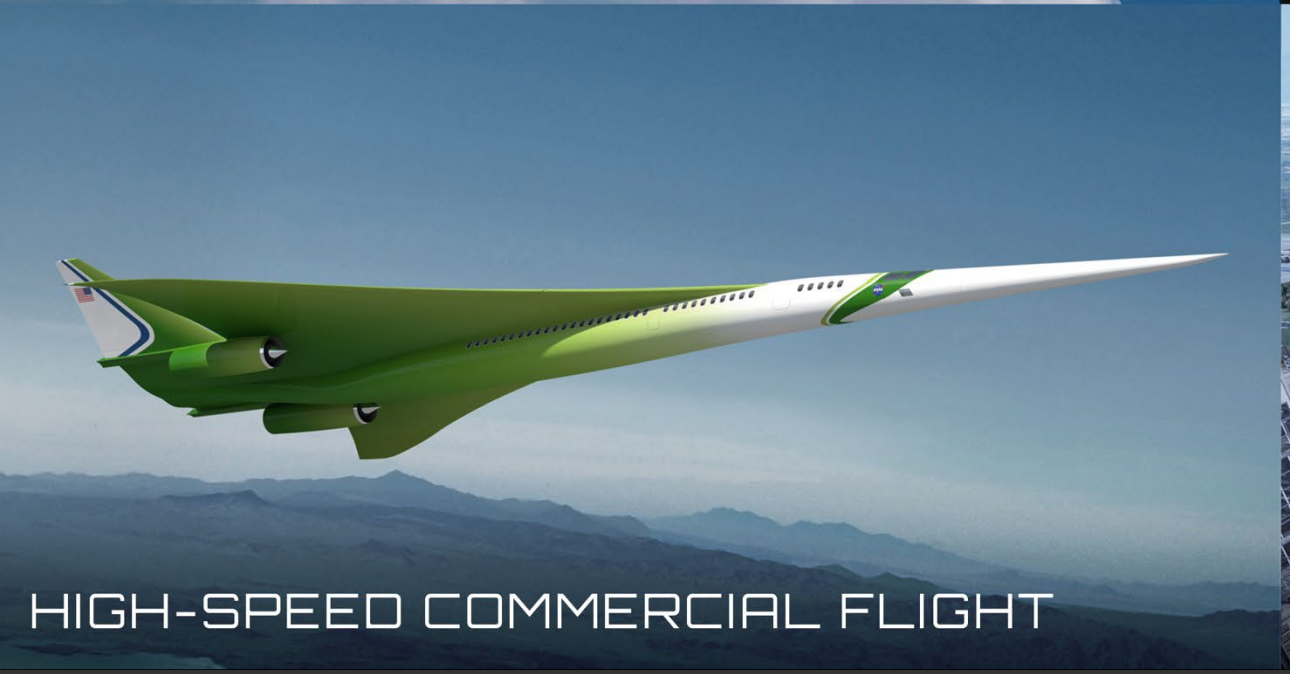


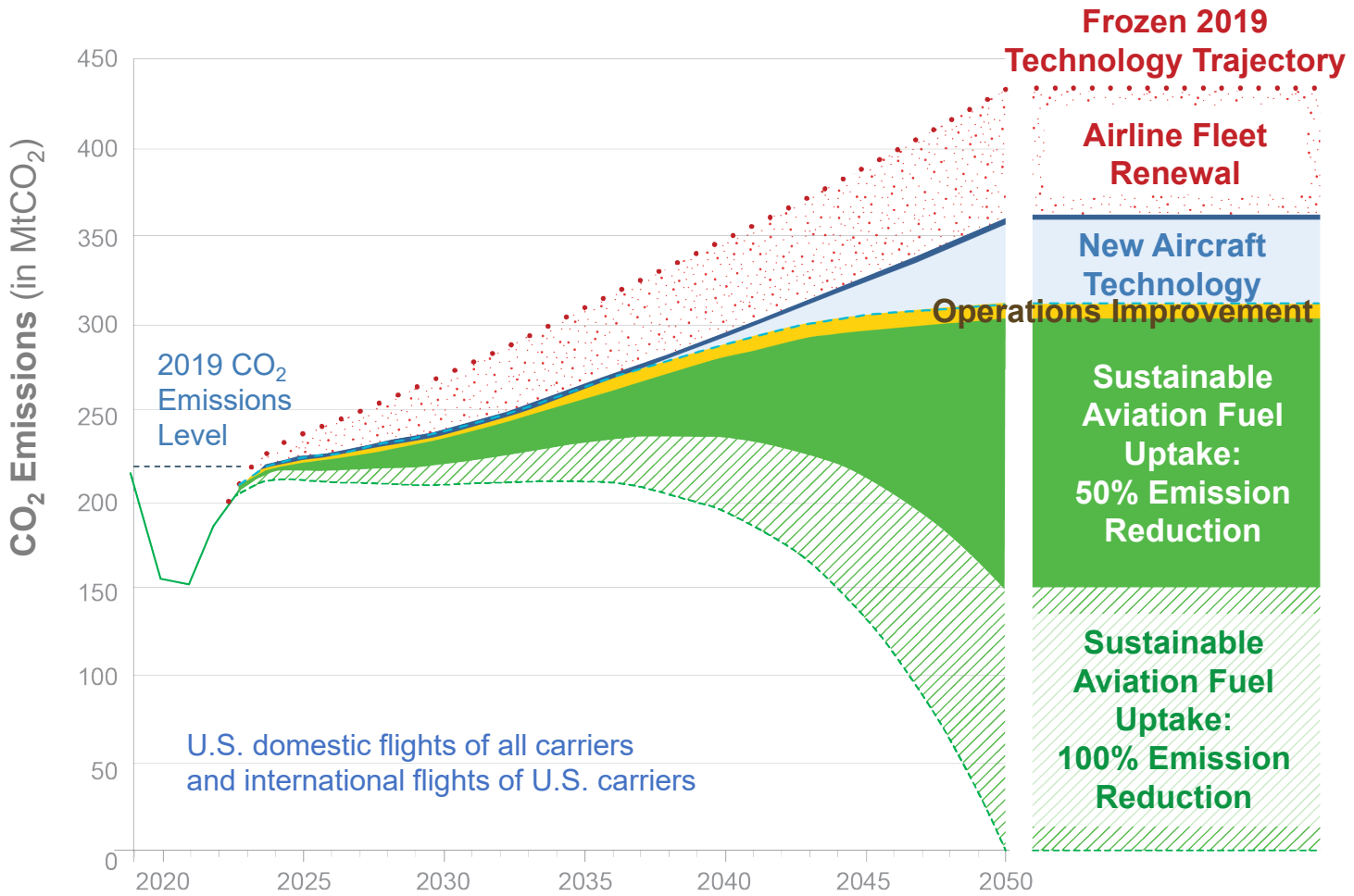
Four Transformations for Sustainability, Greater Mobility, and Economic Growth

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

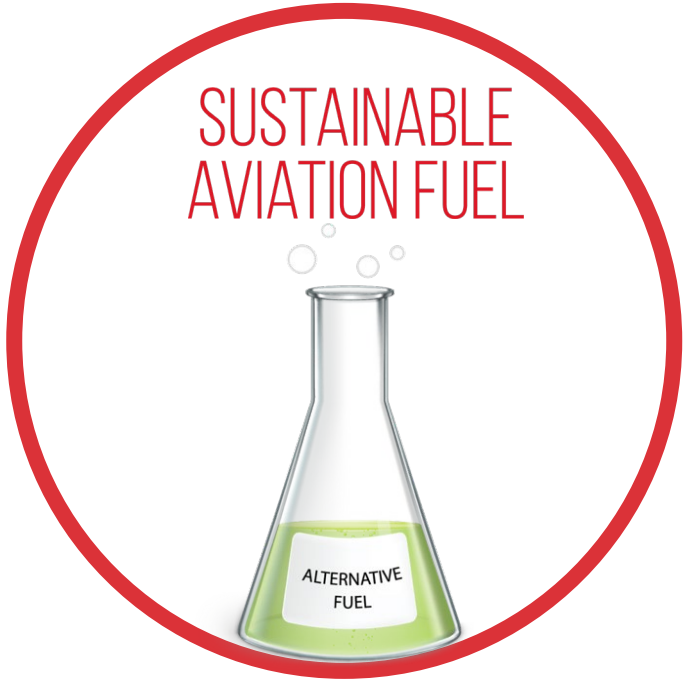


The U.S. is working with the global community to achieve net-zero greenhouse gas emissions by 2050 using a common basket of measures.

Aviation Pillars for a Sustainable Future

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

NASA = Primary Role



NASA = Supporting Role

NASA = Primary Role

Sustainable Flight National Partnership

Next-Generation Capability on the Path to Net-Zero Greenhouse Gas Emissions by 2050

Advance engine efficiency and emission reduction

Enable integrated trajectory optimization

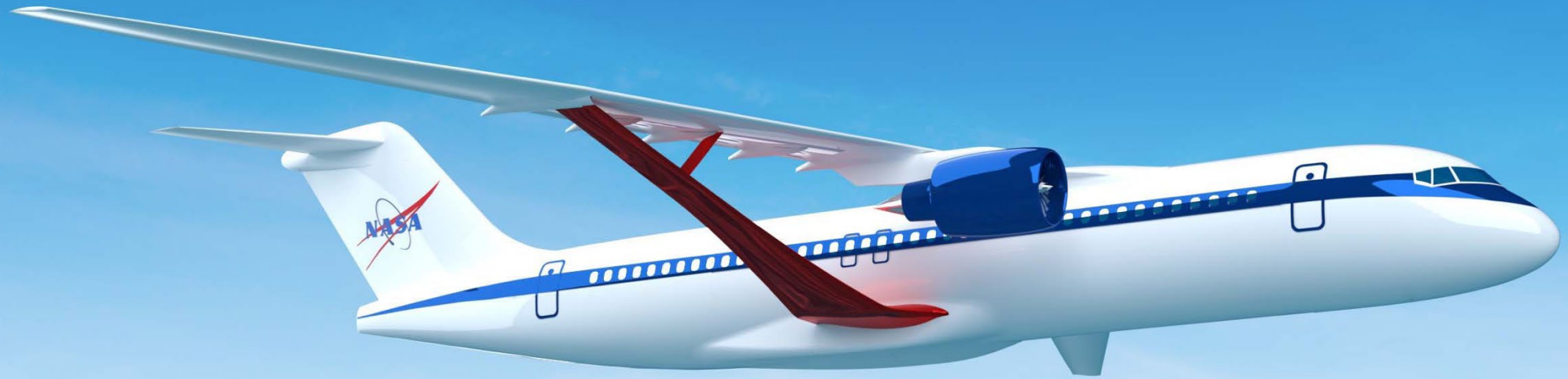
Advance airframe efficiency and manufacturing rate

Enable use of 100% sustainable aviation fuels

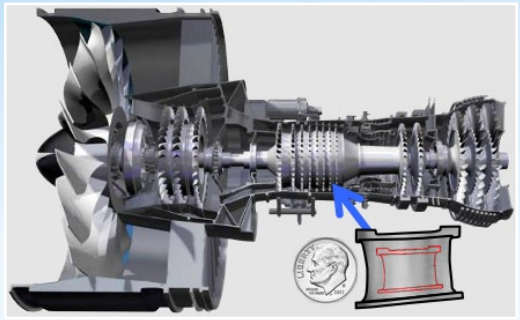
Achieve net-zero greenhouse emissions by 2050 through 25-30% energy efficiency improvements in next-generation transports, 100% sustainable aviation fuel, and optimal trajectories.

Subsonic Transport Technologies

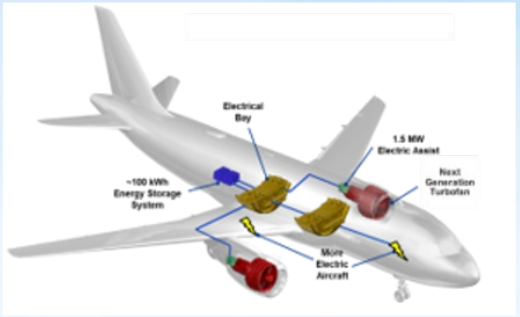
Ensure U.S. industry is the first to establish the new “S Curve” for the next 50 years of transports



Transonic Truss-Braced Wing
5-10% fuel burn benefit



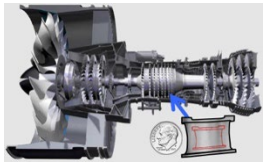
Small Core Gas Turbine
5-10% fuel burn benefit

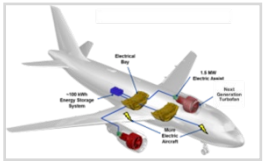


Electrified Aircraft Propulsion
~5% fuel burn and maintenance benefit

High-Rate Composite Manufacturing
4x-6x manufacturing rate increase

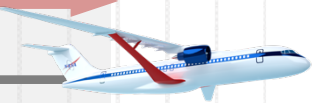
Subsonic Transports: Integrated Technology Development





FY20 | FY21 | FY22 | FY23 | FY24 | FY25 | FY26 | FY27 | FY28 | FY29

Technology Readiness Target



Model Based Systems Analysis & Engineering

Sustainable Flight Demonstrator (SFD)

Flight Test

AATT - Transonic Truss Braced Wing

TC Completion

Hi-Rate Composite Aircraft Manufacturing (HiCAM)

Mfg Demo & Structural Test

Hybrid Thermally Efficient Core (HyTEC)

Core Demonstration & Test

Electrified Powertrain Flight Demonstration (EPFD) Flight Tests

AATT - Electrified Aircraft Propulsion Integrated Ground Test

TC Completion

Achieve TRL 6 in time for industry product decision-making

Leverage the Asset – Future Spirals

Planned

Notional

Sustainable Aviation Fuels

Enable the use of 100% sustainable aviation fuels (SAF) and reduce climate impact

Scope

- Support adoption of high-blend ratio sustainable aviation jet fuels

Benefits

- Reduced aviation environmental impact
- Reduced uncertainty for climate impact of aviation-induced cloudiness
- Improved efficiency/emissions with drop-in synthetic and biofuels

Approach

- Characterize high-blend sustainable aviation jet fuel emissions on ground and in flight

Future SAF Research Plans in Development

NASA AACES 2050 Studies

Advanced Aircraft Concepts for Environmental Sustainability

2008-2019 | 2020-2029 | 2030 - 2039 | 2040 - 2050

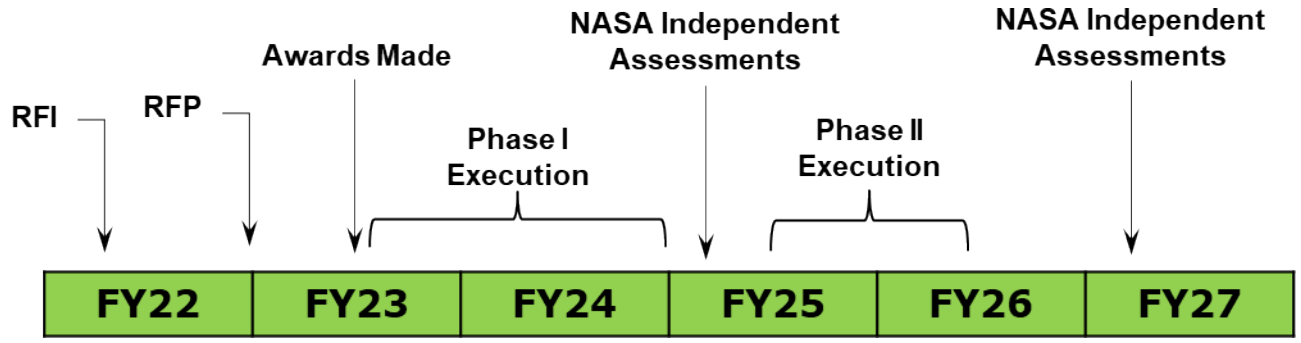
FY10-15 ERA N+2 for the 2020s Impact

FY09 N+3 Adv Concept Studies Target 2030-35 Impact

FY23 "N+4" AACES Studies - Explore 2020s, Demo 2030s, Impact 2040s

- *2040s Marketplace (payload/range/speed), 2050 Environmental Goals*
- *Alternative Energy Scenarios (LH2, LNG, Increased Electrification, 100% SAF)*
- *Advanced Airframes (clean energy compatible, shielding, adaptive, unconventional structures)*
- *Alternative propulsion (clean energy compatible, BLI, distributed propulsion, hybrid electric)*
- *Tools & Methods for Reduced Lifecycle Cost & Environmental Impact*

H_2 Hydrogen



RFI Released 5/19/22, RFP Fall 2022, Awards Early CY23


NASA