

Dr. Dale E. Van Zante

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EDUCATION

PhD, Iowa State University, 1997
Dissertation: *Study of a Rotor Wake Recovery Mechanism in a High-Speed Axial Compressor Stage*

MS Mechanical Engineering, Iowa State University, 1992
Thesis: *Comparison of Slow and Fast-Response Instrument Flowfield Measurements Downstream of a Transonic Axial-Flow Compressor*

BS Mechanical Engineering, Iowa State University, 1990

EXPERIENCE

9/2022 – present
Project Manager (PM)
NASA Advanced Air Transport Technology Project (AATT)

2/2020 – 9/2022
Chief Technologist for Propulsion
NASA Advanced Air Transport Technology Project (AATT)

10/2019 – 2/2020
Acoustics/Propulsion Advisor
Office of Environment and Energy (AEE)
Federal Aviation Administration (FAA), Washington, DC

National Aeronautics and Space Administration



ULTRA-EFFICIENT AIRLINERS

Subsonic Transport Tech Development at NASA
Advanced Technology for Civil Aviation Workshop, University of Toronto Institute for Aerospace Studies

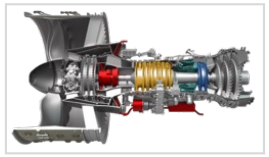
Dale Van Zante, dale.e.vanzante@nasa.gov
Manager, Advanced Air Transport Technology (AATT) Project
May 30, 2025

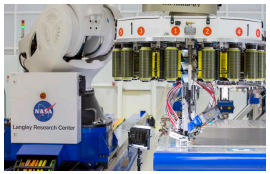
Ultra-Efficient Airliners: SFNP Integrated Technology Development



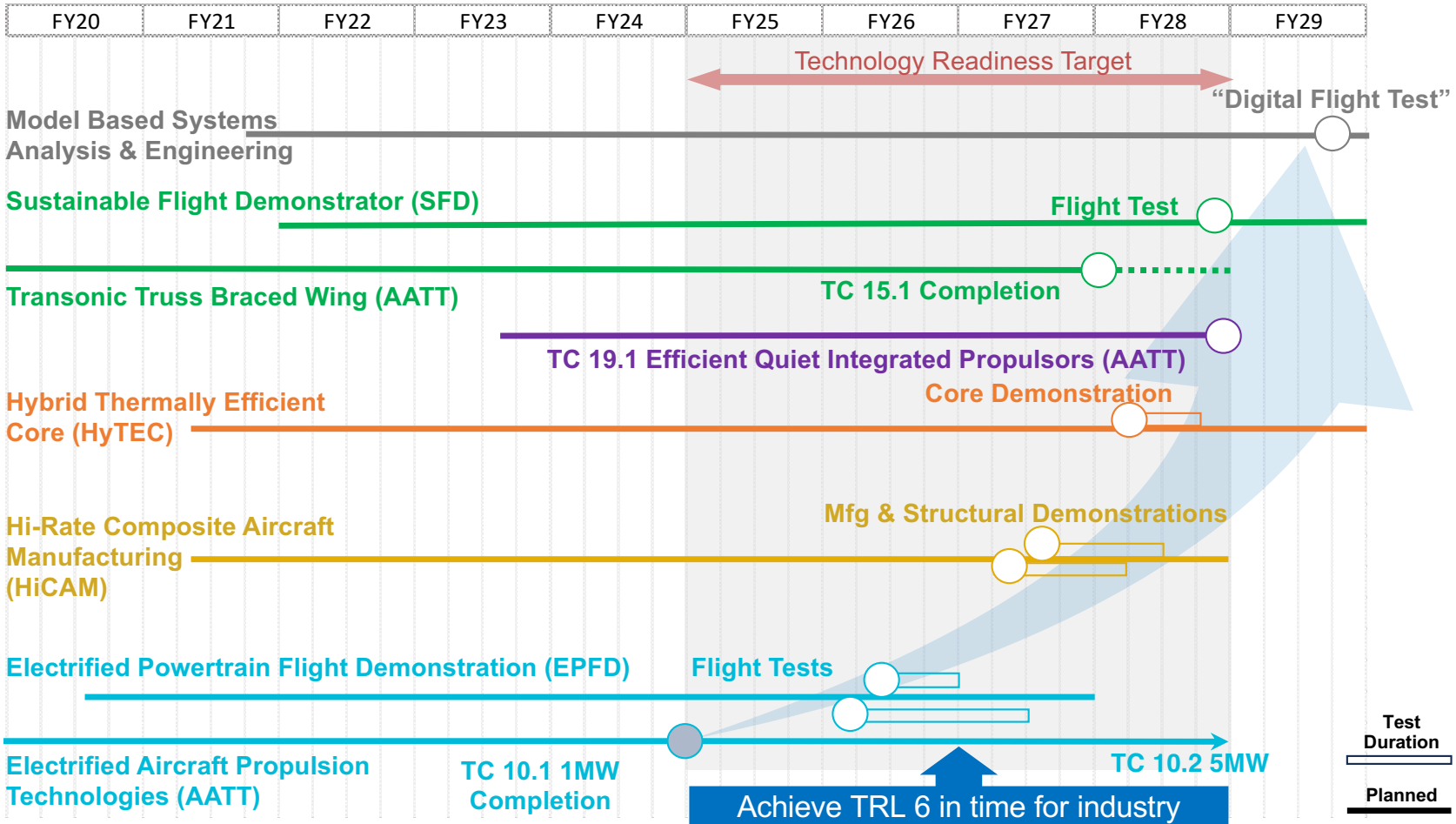


Image credit: CFM International









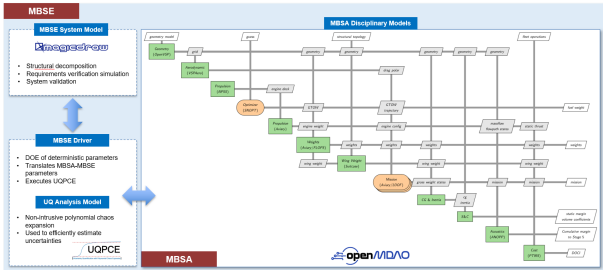
Progress: Integrated Technology Development



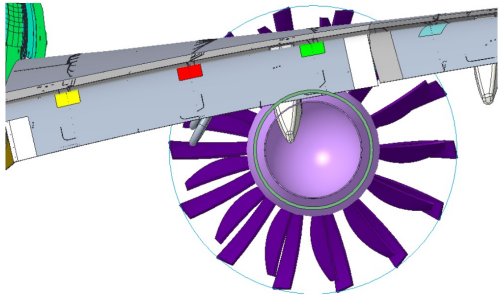
Wright Electric
2+MW motor



“Edge of the envelope”
risk reduction for TTBW



Model Based System Analysis
& Engineering (MBSA&E)



Open fan and wing integration
studies upcoming

AATT is enabling the flight demonstrators and reducing risk for future configurations.

Progress: NASA and Boeing ecoDemonstrator Test SAF Impact on Contrails

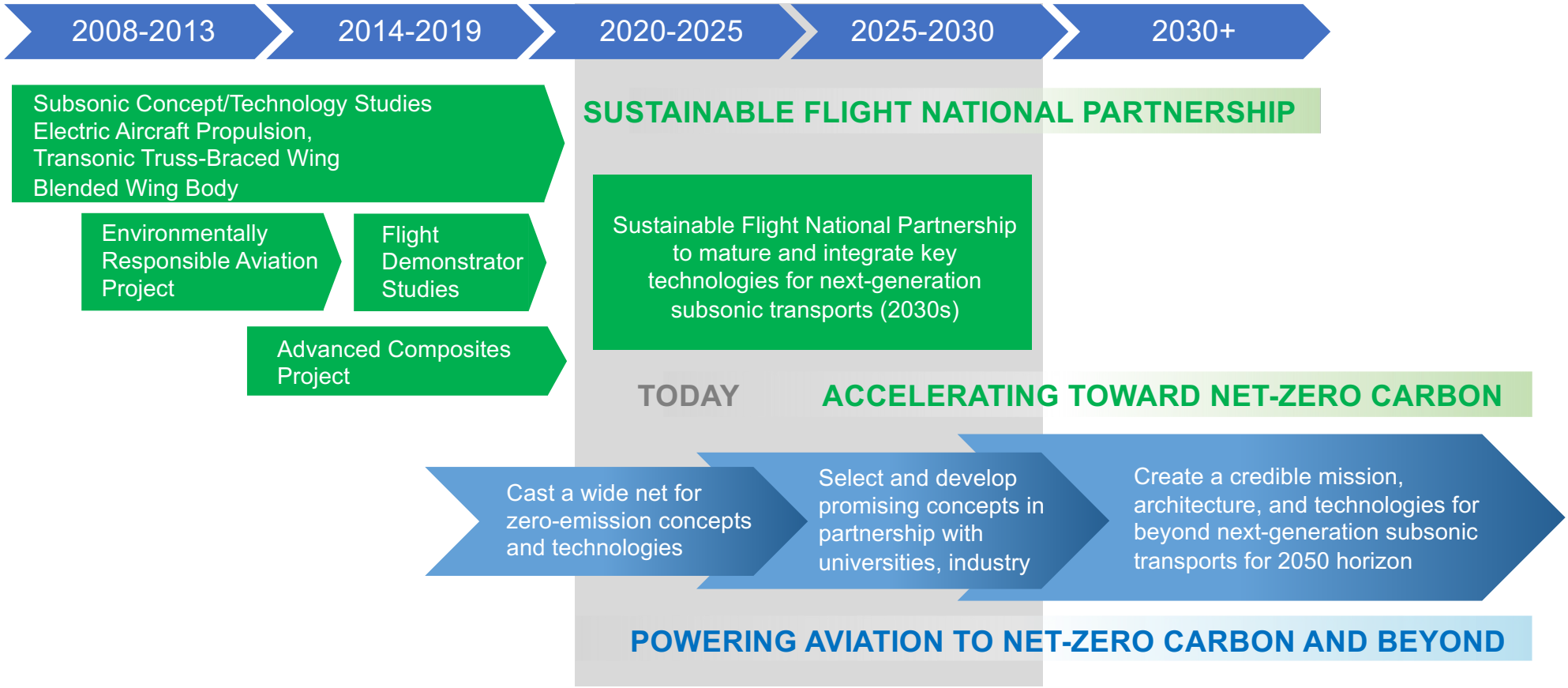
Successful flight test in October 2023 with Boeing 737MAX burning both Jet-A and burning 100% SAF in advanced GE lean-burn aircraft engine combustors





Future contrails research necessary for U.S. competitiveness.

NASA Sustainable Aviation Strategy



Investment in innovation today paves the way to a net-zero carbon and beyond aviation future.

AACES 2050 NRA Awards

Aurora FLIGHT SCIENCES
A Boeing Company

PRATT & WHITNEY
DEPENDABLE ENGINES

ELECTRA.AERO

jetzero

Georgia Tech
Aerospace Systems
Design Laboratory

Team of industry and academic partners

Key Findings from ARMD Strategy Assessment Studies

Considered information from multiple sources… and still collecting more

- ARMD strategy studies; Gov/Industry Workshops; Internal Studies; AACES; OGA/Industry Engagement

Key themes emerging:

- Likelihood of multiple fuels availability
- Heightened opportunities around vehicle integration
- Leveraging Computational Materials and Structures
- Increased need to consider market dynamics and implications beyond the vehicle

Presented at:
ARTR Meeting,
Washington, D.C.,
July 19, 2024

Initial assessment identified multiple research and technology opportunities:

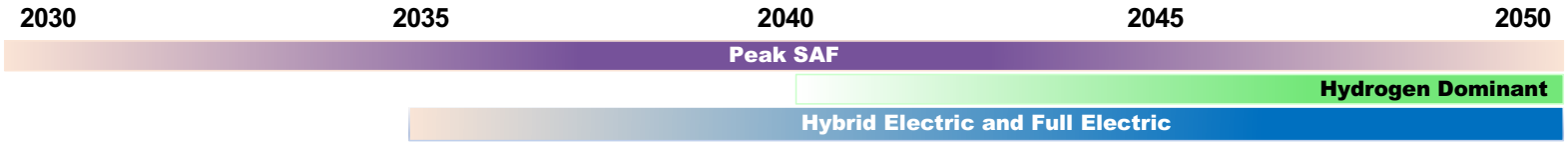
- Power and Energy: Superconducting EAP; High-Perf Heat Exchange and TMS; Advanced Cycles
- Aircraft Integration Technologies: Distributed Propulsors; Cryo Fuels; Advanced CFD and MDAO for PAI
- Materials and Structures: Computational Materials; Cryo Tanks and Integrated Structures; Next Gen Manufacturing – Qual/Cert for Additive Manufacturing, and Digital Engineering

Critical gaps requiring further study:

- Integrated cryogenic fuels strategy and vision concepts, high-power EAP vision concepts, multi-domain, sector-level systems assessment capability, strategy development within computational materials and structures sub-domain

The time is now for ensuring the future ARMD portfolio reflects complexity of achieving sustainability. Balanced investment in light of significant uncertainty beyond SFNP is critical to making impact.

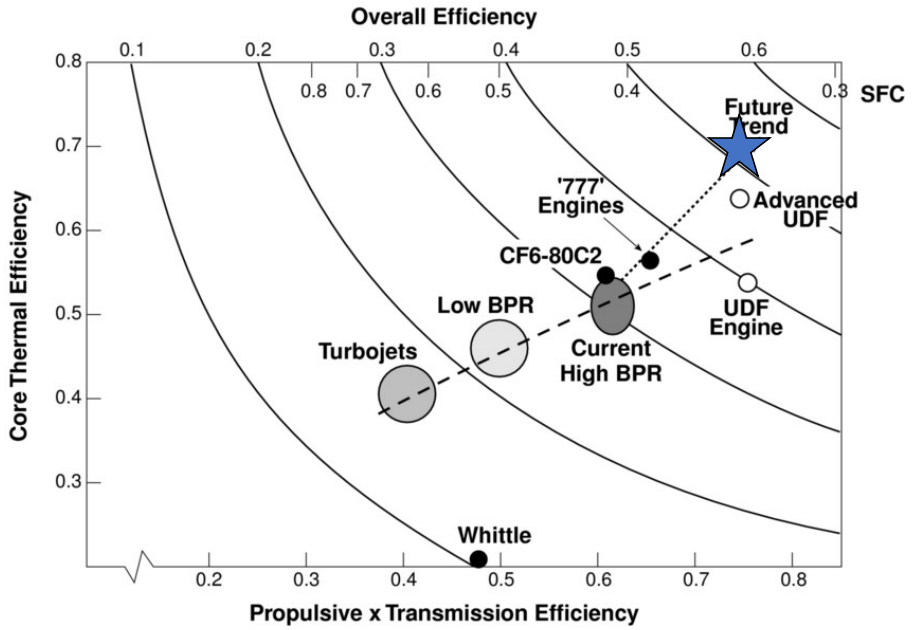
AATT Looking Forward



Recommended cross-cutting research themes:

1. Propulsion Thermal Efficiency: need to de-couple T3 and P3 to reach higher OPR, and,
2. Propulsive efficiency: high efficiency, podded propulsors are available now, but…
3. The integration of highly efficient propulsion systems with high efficiency airframes is the next largest area of uncertainty. And what about distributed (electric) propulsion?





https://web.mit.edu/16.unified/www/FALL/thermodynamics/notes/fig3EtaTrends_web.jpg

The need for a highly-integrated, technology collector and demonstrator is growing.

Power and Energy

Superconducting EAP; High-Perf Heat Exchange and TMS; Advanced Cycles

Now

SFNP focus (Jet-A and SAF)
Evolutionary → Revolutionary



Image credit: Pratt & Whitney



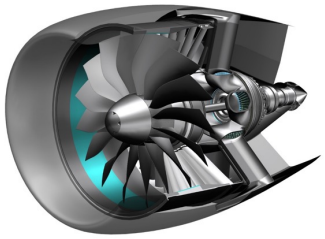
Image credit: CFM International

CAPABILITIES:

- Turbomachinery aero + noise
- Small cores
- Hot fuels and 100kW class TMS
- MW class EAP systems
- Propulsion Airframe Integration

Mid-century and beyond

Energy source change?
Transformational



HySIITE engine

Image Credit: Pratt & Whitney



Image Credit: Georgia Institute of Technology

CAPABILITIES:

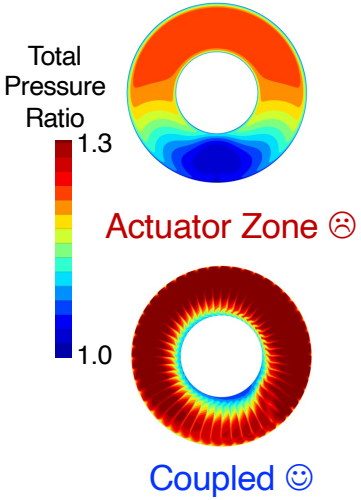
- Turbomachinery aero + noise
- Very, very small cores
- Cryo fuels and MW class TMS
- Multi-MW class EAP systems
- Distributed Propulsion

Propulsion Airframe Integration

Blending the propulsion and airframe capabilities (and PT and AT resources)

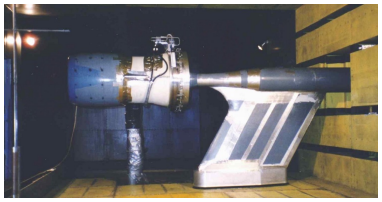
Now

Capability development for highly coupled systems
New test techniques required



Actuator Zone ☹

Coupled ☺



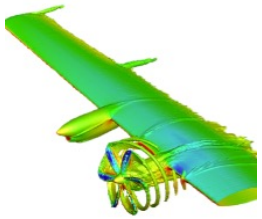
ADP fan in crosswind



High-fidelity simulations of open fan/wing integration for sustainable aviation

Mid-century and beyond

Transformational configurations
Is highly distributed a good thing?





PAI
Near term

PAI
Far term?

Near term, NASA adds value to our stakeholders with integrated distortion tolerant propulsor work.
Far term, NASA can evaluate benefits and reduce risk for revolutionary to transformational configurations.

Summary

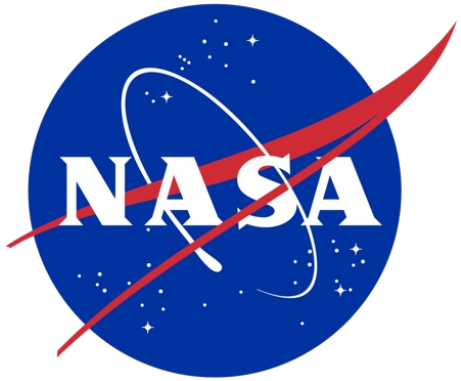
"It is difficult to make predictions, especially about the future."

– attributed to Yogi Berra

"Business physics" is driving changes in the research landscape

- Slowdown in the push for hydrogen aircraft
- SAF production capacity is slow to develop
- The new 2030s aircraft is pushing towards 2040

NASA is pursuing tech maturation activities for cleaner, quieter and more efficient aircraft for the 2030s and beyond.


NASA

Abstract:
This presentation is an overview of Subsonic Transport Tech Development at NASA for the Advanced Technology for Civil Aviation Workshop at the University of Toronto Institute for Aerospace Studies. The review includes both technology development for the proposed new 2030s single-aisle aircraft as well as 2040+ aircraft configurations.