National Aeronautics and Space Administration



Transformative Aeronautics Concepts Program (TACP)

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NASA Aeronautics Flight Accelerator (AFA) Industry Day – Program Capabilities Overview
Ohio Aerospace Institute, Cleveland, OH

Transformative Aeronautics Concepts Program (TACP) Overview

TACP cultivates revolutionary concepts and early-stage test capabilities for aviation transformation.

1) TACP Contributions to the Aeronautics Mission
2) TACP Innovation Ecosystem
3) TACP Capabilities
4) Transformational Tools and Technologies Project
5) University Innovation Project
6) Revolutionary Engineering Methods
7) TACP Industry Collaboration

TACP Contributes Uniquely

The mission of NASA aeronautics is to drive aviation leadership through the development of transformative technologies.

Four transformation areas to achieve this mission:



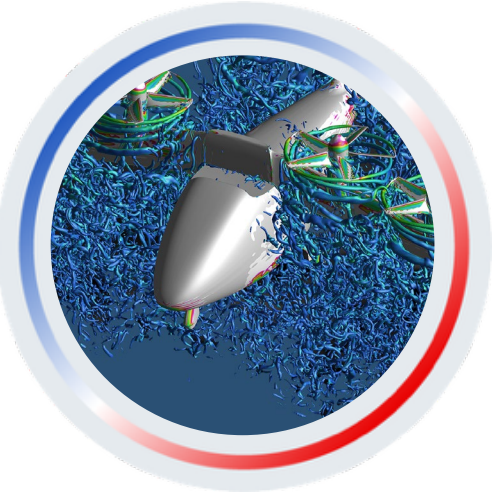
Pioneer High-Speed Flight



Automate Airspace and Safety Management Capabilities



Transform Airframes and Propulsion



Revolutionize Engineering Methods

TACP explores disruptive concepts before they enter mainstream development.

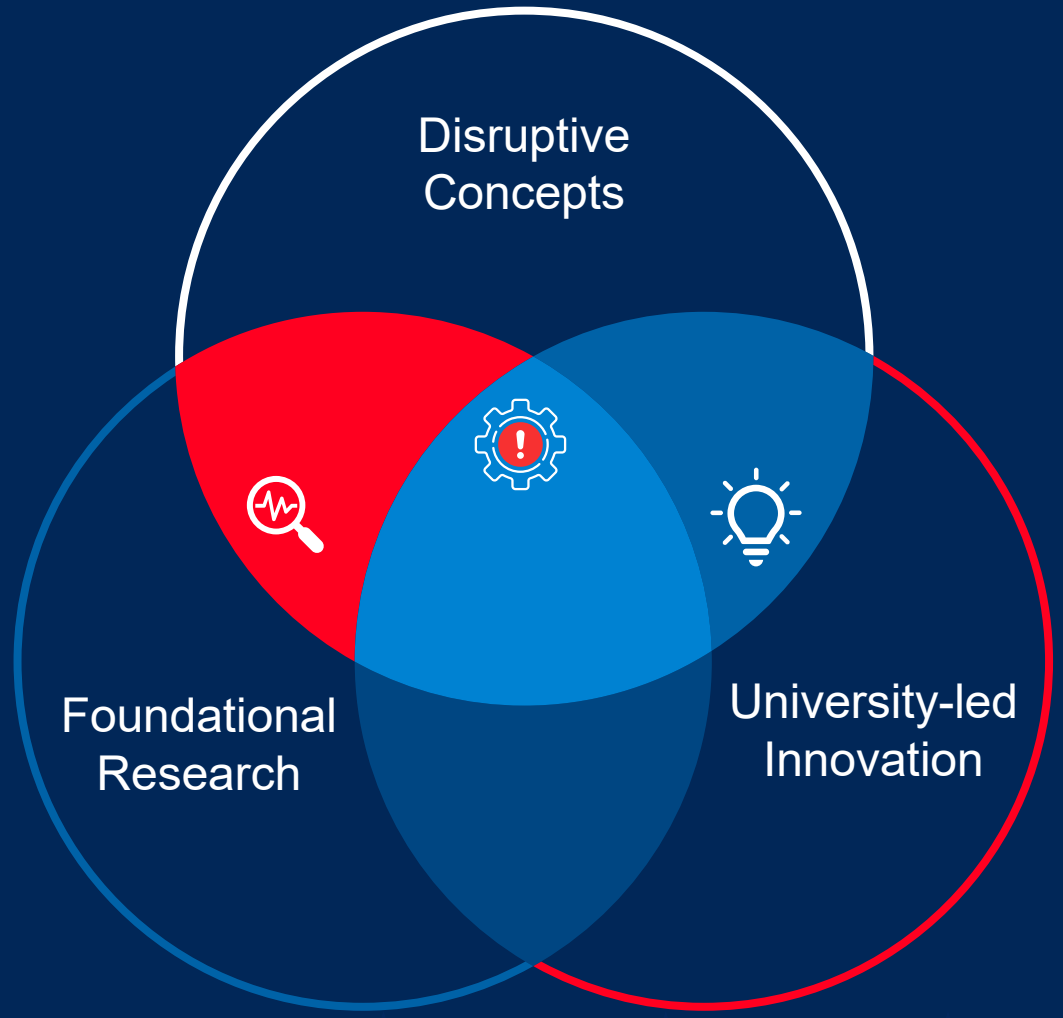
TACP reduces risk for future aviation technologies through rapid, iterative testing.

TACP enables innovation by allowing failures, learning from them, and accelerating turnover.

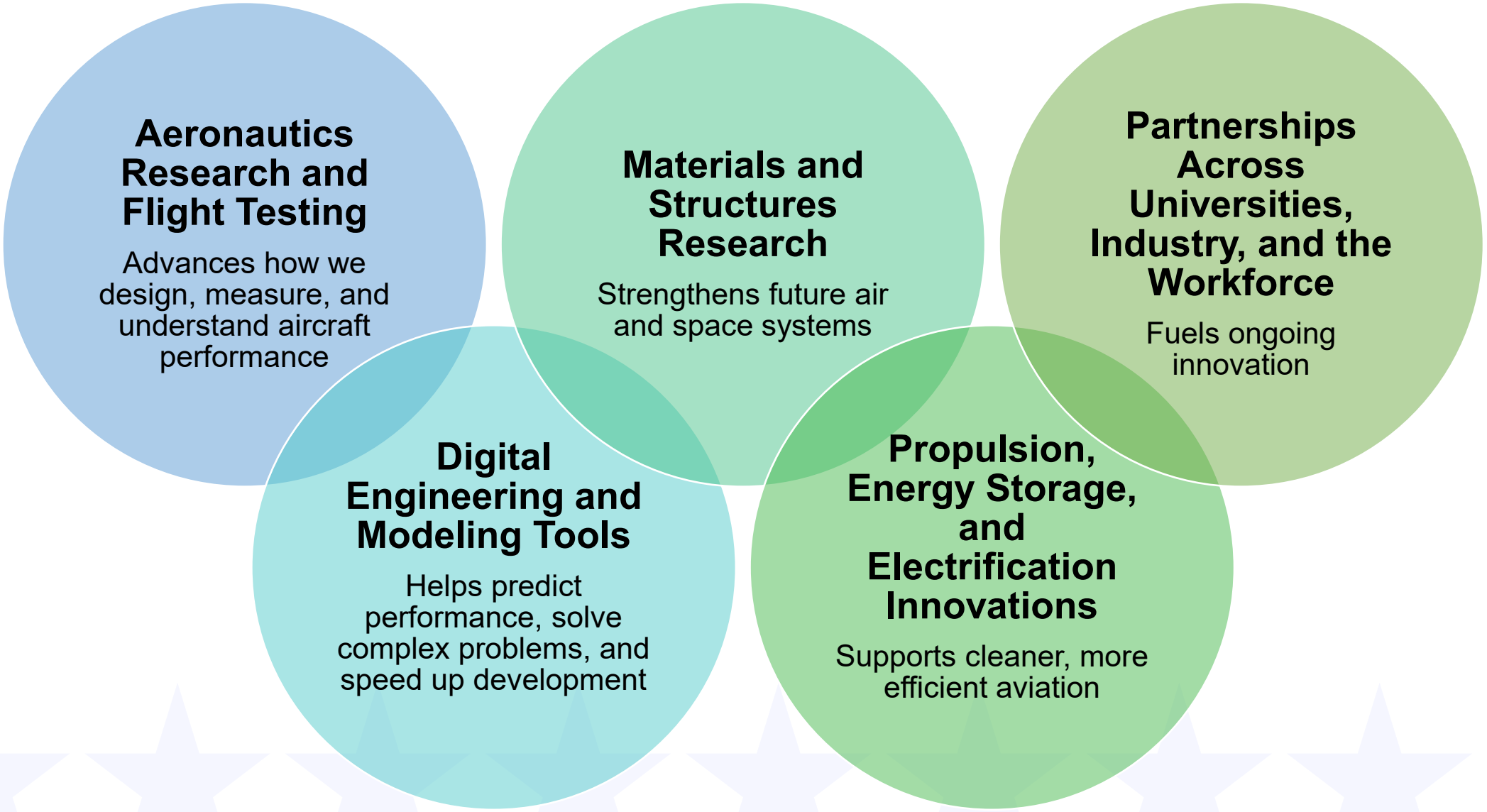
Innovation Ecosystem: Leadership in the Aviation Community

TACP is a dynamic ecosystem where disruptive concepts, foundational research, and university-led innovation converge.

TACP ignites innovation by building a dynamic, collaborative ecosystem that secures our leadership at the forefront of global aviation, powered by breakthroughs in aerospace engineering methodologies and tools.



The Capabilities Powering TACP's Innovation



Transformational Tools and Technologies (TTT) Project

Integrating innovative methods and world-class computational, experimental, and flight capabilities to transform aerospace engineering and discover the future of flight

What TTT Does

- Advances cutting-edge, early-stage research
- Develops high-impact methods and technologies
- Integrates computations, experiments, and flight
- Encourages bold curiosity and rapid innovation

Why This Matters

- Revolutionizes the future of aviation and space
- Discovers groundbreaking ideas and technologies
- Strengthens U.S. leadership in aerospace
- Sustains critical core capabilities for the Nation

Computational / Experimental Fusion	Advanced Materials & Structures	Alternative Propulsion Architectures	Innovative Concepts	Fundamental Flight Research
Advancing complex aerospace systems through integrated capabilities and rigorous physics-driven methods	Developing complex, new materials and methods to advance materials discovery	Exploring next-generation hybrid propulsion technologies to enable new types of aircraft	Identifying emerging, high-impact research that positions NASA to shape the future of aerospace	Strategically integrating flight testing to advance emerging aviation concepts

Delivering Solutions Vital to Mission Needs in Aviation and Space

University Innovation (UI) Project

The UI project supports educating the next generation of aeronautical innovators by providing opportunities for university-led teams to conduct research into transformative technology that supports NASA's research goals.

University Leadership Initiative (ULI)

- Enables **multidisciplinary university-led research** advancing next-generation aerospace concepts and technologies.
- Supports collaborative, large-scale teams across academia and industry.
- Emphasizes workforce development, transformative research pathways, and transition of innovative solutions to the broad aerospace community.

University Student Research Challenge (USRC)

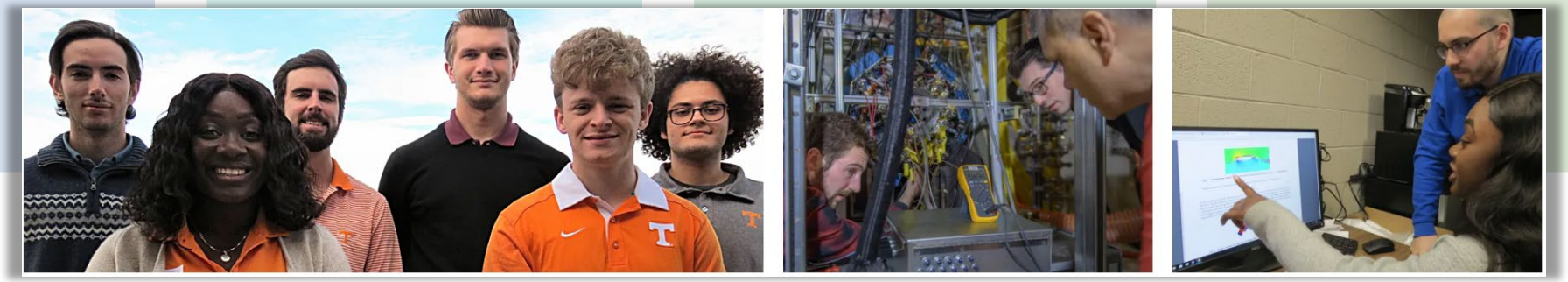
- Provides funding for **student-led aerospace research projects** that advance innovative ideas aligned with NASA mission needs.
- Emphasizes hands-on learning, small-team innovation, crowdfunding engagement, and development of future aerospace.

Gateways to Blue Skies (G2BS)

- Engages **undergraduate teams to explore future aviation challenges** and propose innovative solutions aligned with NASA's mission needs.
- Emphasizes early-career research experience, multidisciplinary problem solving, and concept development through analysis, systems thinking, and technical communication.

Future Aviation Maintenance

- Advances **next-generation maintenance technologies and practices** to improve aircraft safety, reliability, and operational efficiency.
- Includes work in predictive maintenance, digital inspection methods, automation, advanced diagnostics, and integration of data-driven tools to support future aviation systems.



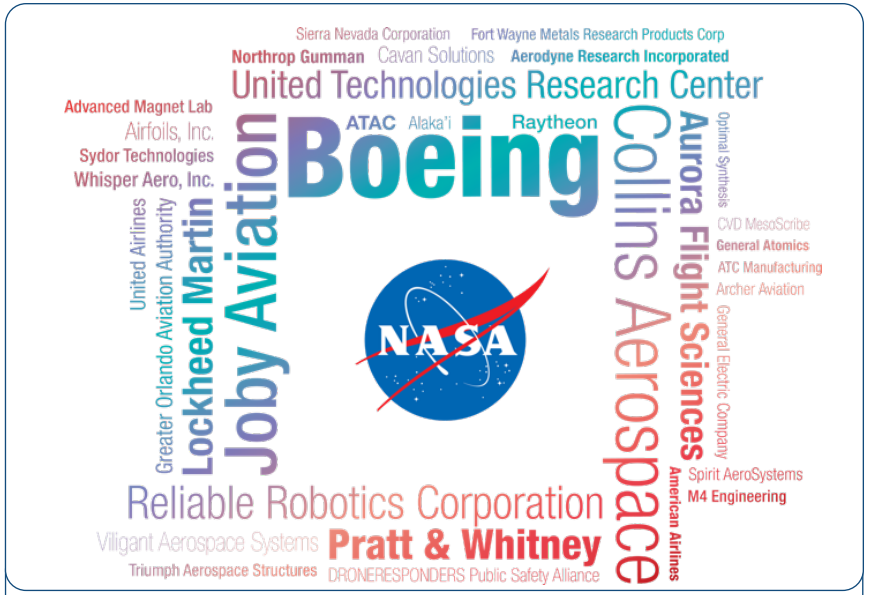
University Innovation (UI) Value and Impact

UI Project Investment



- Students work on aviation problems
- Industry guidance
- Discoveries made
- New aero technologies created

U.S. Leadership in Aviation



- Aero-trained workforce hired
- Access to cutting edge research
- New technologies transitioned

Over $220M in awards across a diverse portfolio of investments

73 awards to 124 universities

More than 1,100 students. Over 50% of faculty principal investigators are first time NASA awardees

Industry partners say, "ULI plays a key role in supporting low- to mid-TRL technology development"

Graduating students are joining Boeing, GE Aerospace, Joby, Exponent, Sentient Science, Northrup Grumman, Bell Helicopter, Exxon Mobil, Oakridge National Labs, Tesla, GM, NASA, …

NASA-funded academic research fuels innovation, talent, and tech transfer to U.S. industry.

Revolutionary Engineering Methods (REM)
Defining Opportunities



Global competition, workforce and resource constraints, and rapidly evolving technologies demand a step-change in engineering methods—not just new tools.

NASA is defining opportunities to accelerate U.S. innovation by modernizing how aerospace systems are engineered, including:

- Linking high-end computational analysis with NASA's unique ground and flight test assets
- Leveraging AI alongside physics expertise and high-quality datasets
- Developing next-generation design and analysis capabilities for significantly more complex, multi-disciplinary problems

Investing in engineering methods benefits both NASA and the aerospace community, leading to **shortened design cycles, reduced development cost, improved performance, and strengthened industry competitiveness.**

How TACP Collaborates with Industry

Joint early-stage concept exploration

Access to ground and small-flight test capabilities

Co-designed experiments with NASA researchers

Rapid feasibility studies

AFA provides an on-ramp for collaboration and technology maturation

For more information, participants are encouraged to contact members of the TACP team to explore concept-development partnerships.

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https://www.nasa.gov/directorates/armd/tacp/

