Unclassified

Leveraging University Expertise to Accelerate Hypersonics Technology Development

Office of the Under Secretary of Defense for Research and Engineering
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Discussion Outline

- Key Tenets for Advancing Hypersonic Technology Development
- Introduction to the Joint Hypersonics Transition Office (JHTO)
- JHTO University Engagement Activities
  - Grants
  - University Consortium of Applied Hypersonics
- Next Steps in JHTO University Engagement

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Key Tenets for Advancing Hypersonic Technology

- S&T Investments tied to identified DoD need
  - Finite resources – facilities, people, dollars
  - Accelerates to meet the threat
  - But still allow for discovery
- Coordination and collaboration
  - Reduce redundancy
  - Reduce waste and inefficiencies
  - Identify opportunities
  - Eliminate stove-pipes
- Tap into non-traditional performers or partners
  - Universities
  - Foreign allies
- Balanced healthy workforce

Joint Hypersonics Transition Office

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Joint Hypersonics Transition Office (JHTO)

Our Mission: Accelerate hypersonics technology development to enable the systems the warfighter needs through an integrated S&T strategy, allied and university engagement, and collaboration

Primary Efforts: JHTO's hypersonic S&T strategy and roadmaps highlights the critical technologies to enable their maturation and transition to future operational capabilities for the warfighter. JHTO created and oversees the University Consortium for Applied Hypersonics which provides foundational and applied hypersonic research, development, and workforce support

- **University Consortium for Applied Hypersonics** – Over 100 universities and 500 individual researchers along with affiliated industry government laboratories provides foundational and applied hypersonic research and the workforce necessary to support programs
- **International Hypersonic Efforts** – Leads the departments efforts to engage allied partners in hypersonic efforts to cooperatively further hypersonic development projects
- **Hypersonic S&T investments** – JHTO funds targeted S&T projects to mature critical technologies applicable to numerous warfighting capability development efforts

Examples of JHTO efforts and products:

HyFly2 Propulsion System

- Air-breathing hypersonic scramjet engine developmental effort in support of Navy and Air Force hypersonic cruise missile developmental efforts and SCIFIRE..

Hypersonic S&T Strategy and Roadmap

- Identifies critical technologies necessary to enable the capabilities called for in National Hypersonic Strategy.
- Roadmaps outline the efforts to mature critical technologies to the level where they can be transitioned to warfighting capability

Technology Transition Plans

- The JHTO Systems Engineering Field Activity at NSWC Crane works with Service and DoD Agency hypersonic system development efforts to develop technology transition plans to facilitate the use of DoD funded technology maturation efforts

NAVSEA WARFARE CENTERS CRANE

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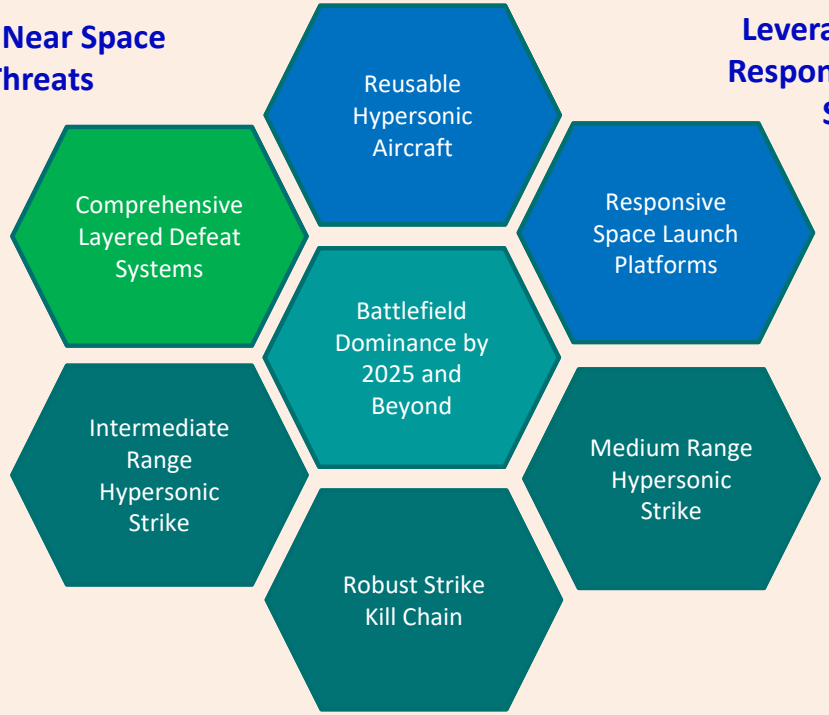
National Hypersonics Strategy & JHTO's Role

Overarching Capability Pillar Elements

Defeat Adversary Near Space Hypersonic Threats

Leverage Near Space for Responsive ISR/Strike and Space Access



Defeat Time Critical And Heavily Defended Land and Sea Targets From Survivable Standoff Range

JHTO's Key Enabling Role

Provide leadership across the Department for successful development and transition of S&T into warfighter capabilities for both offense and defense.

S&T Development & Transition is Essential for Battlefield Dominance in 2025 and Beyond

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University Initiatives

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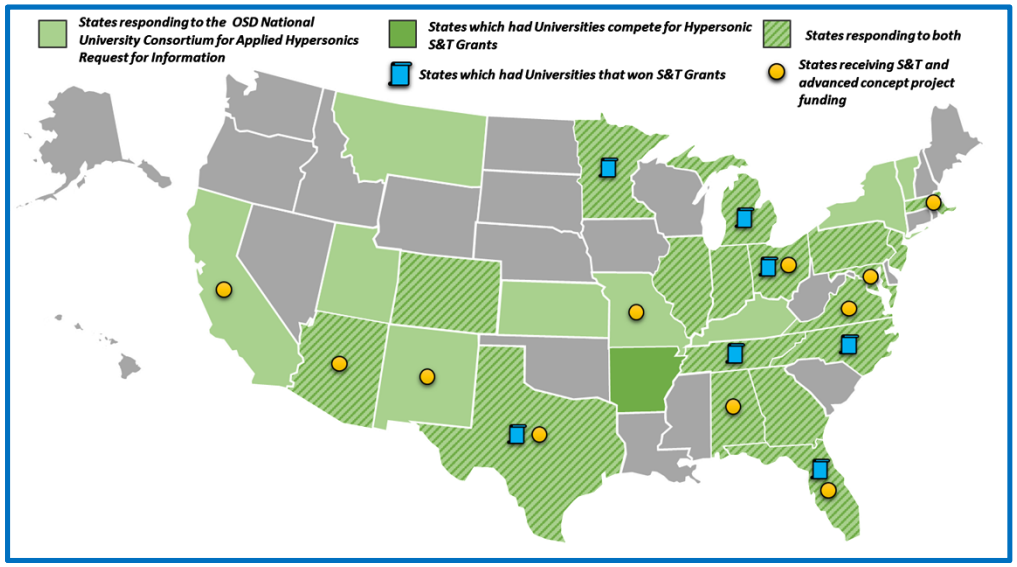
University Grants: Awarded $4M across 8 topic areas

- ★ **UNIVERSITY OF DAYTON:** *Design swap for improved interlaminar shear and survivability*
- ★ **TEXAS A&M:** *Interferometric vision and optomechanical accelerometer sensing for navigation, guidance, and adaptive control of hypersonic vehicle platforms*
- **THE UNIVERSITY OF TEXAS AT AUSTIN:** *Physics-Based Design Tool for Dual-mode Scramjet Isolators*
- ★ **UNIVERSITY OF MINNESOTA:** *Simulation methods for the rapid prediction of hypersonic environments*
- **NC STATE:** *Investigations of self-starting stream-traced inlets at off-design conditions*
- ★ **UNIVERSITY OF FLORIDA:** *Modeling of high-speed multiphase blast effects*
- **UNIVERSITY OF MICHIGAN:** *Multiscale Modeling and Experiments to Understand Performance of Liquid-fueled Rotating Detonation Rocket Engines*
- ★ **THE UNIVERSITY OF TENNESSEE SPACE INSTITUTE:** *Curricula Development for a Robust Hypersonic Workforce*



★ Applicable to Defenses Against Hypersonic Weapons (DAHW)

Lays the groundwork for the Consortium

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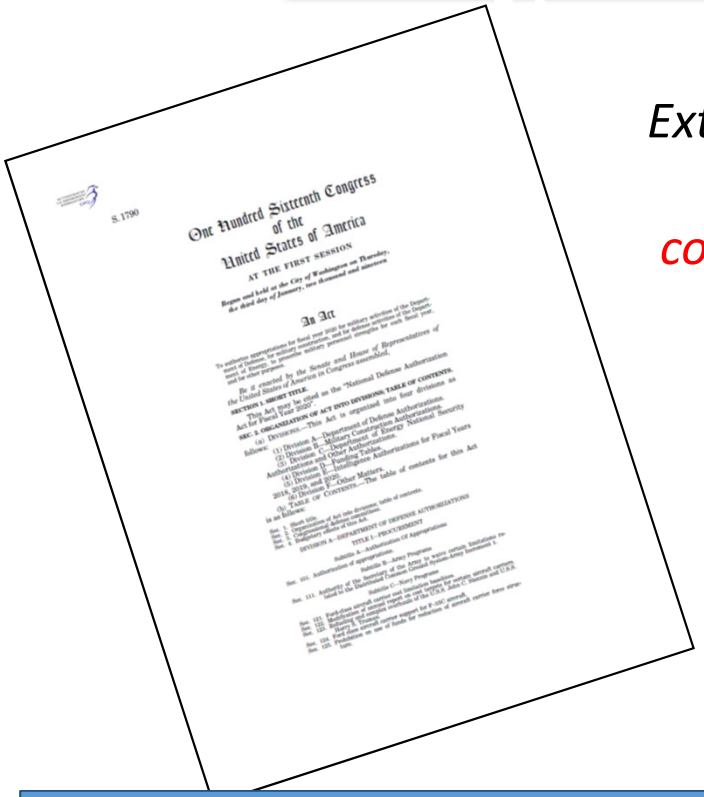
University Consortium for Advanced Hypersonics (UCAH)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One Hundred Sixteenth Congress
of the
United States of America
AT THE FIRST SESSION

An Act

FY20 NDAA

Extends the activities of the Joint Hypersonics Transition Office and authorizes the establishment of a new university consortium focused on hypersonic research and development

- **JHTO vision**
  - Focused on applied hypersonics – Applied Research (6.2) and Advanced Technology Development (6.3)
  - Classified and ITAR work encouraged
  - Aimed at transitioning technologies and growing workforce in critical areas
    - Current university research unbalanced→ Workforce gaps
  - Maintain and leverage existing university expertise and grow by expanding geographically and encouraging best and brightest to choose hypersonics
  - **Consortium available for service and defense agency use**

A Consortium for the ***Entire*** USG Hypersonic Enterprise Leveraging Academic Institutions to Solve Thorny S&T Problems and Build the Workforce We Need

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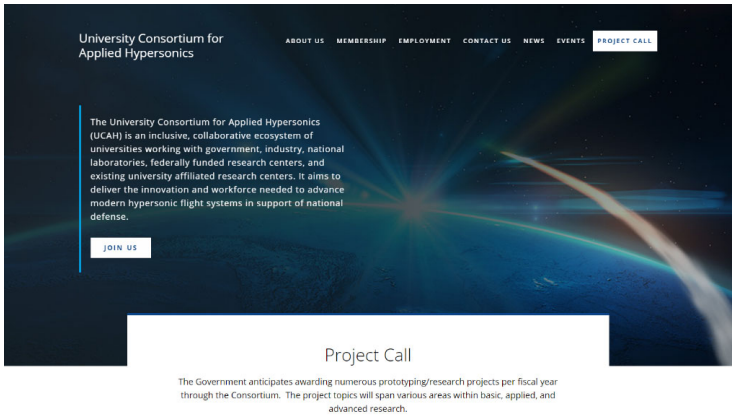
National Applied Hypersonics University Consortium

- **Closely tied to national needs and programs**
  - Topics and larger projects derived from DOD hypersonics S&T strategy and programs
  - Pull from our S&T IPTs for government SMEs
  - Supports the needs of the offensive strike and hypersonic defense communities

- **Six technology focus areas (in priority order):**
  1. High temperature materials and manufacturing
  2. Guidance, navigation, and control
  3. Air-breathing propulsion
  4. Environments and phenomenologies
  5. Applied aerodynamics and systems
  6. Lethality and energetics



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National Applied Hypersonics University Consortium

- **Funding several types of projects**
  - *Supporting:* Stand-alone projects
  - *Next Generation:* Technology push of new ideas
  - *Challenge:* Competing teams tackle multidisciplinary problem with government or industry transition partner and T&E community
- **Mechanism for two-way flow of information to maximize impact of university community**
  - Sharing of DoD needs and priorities
  - University community participates in roadmap development
- **Texas A&M Engineering Experiment Station (TEES) partnering with Georgia Tech and MIT awarded the consortium management contract in October**
  - Planning for $18 million/year spent on university research
  - Approximately 100 schools signaled intent to join from at least 26 states and two countries
  - Diverse governance board of national experts from:
    - Texas A&M
    - Georgia Institute of Technology
    - Massachusetts Institute of Technology (MIT)
    - University of Minnesota,
    - University of Illinois at Urbana-Champaign
    - University of Arizona
    - University of Tennessee Space Institute
    - Morgan State University
    - California Institute of Technology
    - Purdue
    - University of California-Los Angeles

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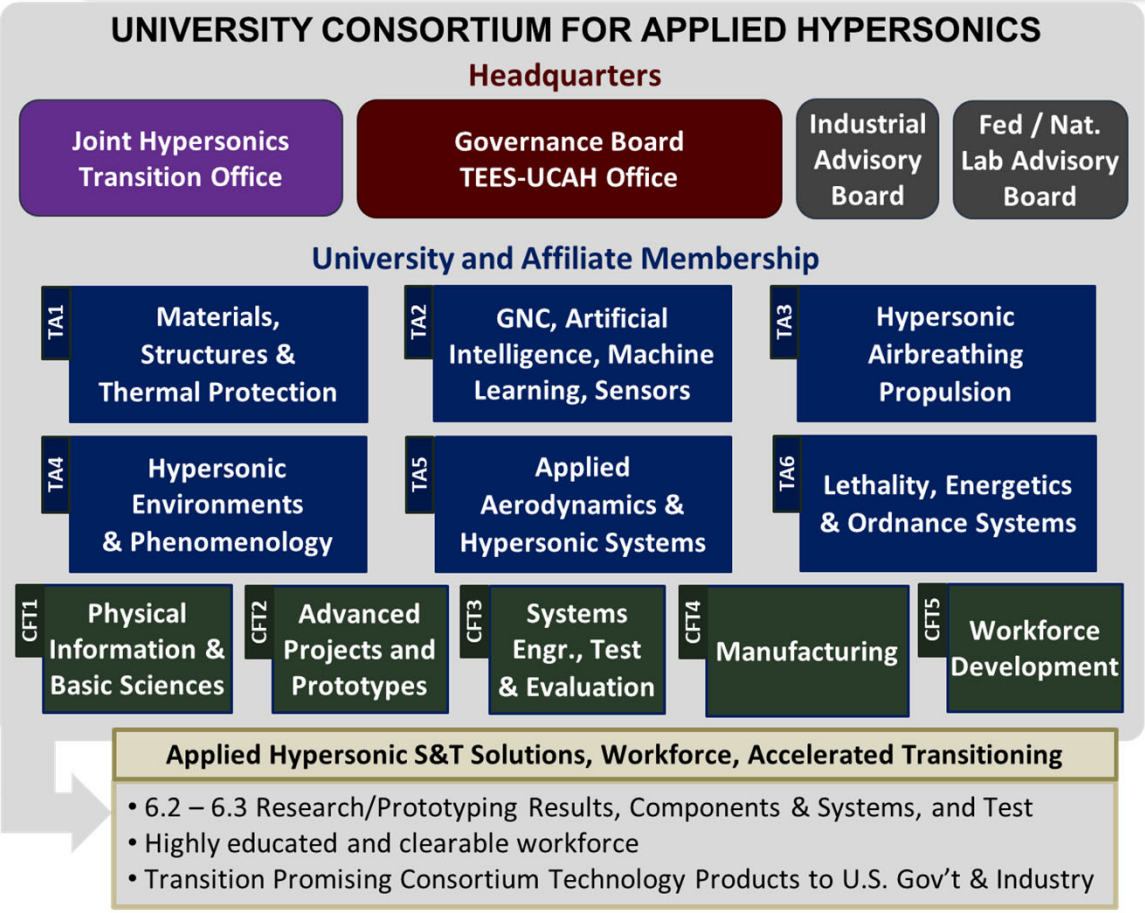
UCAH: Structured for Success



Consortium interest:

- 100+ universities
- 380 faculty
- 90+ industry or affiliate members from over 40 companies
- Seven National laboratories
- Four international schools (UK, AUS)

Leadership:

- JHTO, GB, and TEES
- GB, Technical Area and Cross Functional Leadership includes 19 universities

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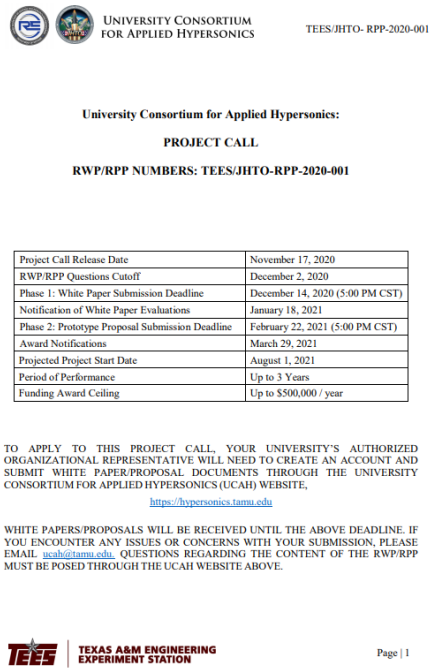
UCAH Project Call

- **Reviewing first batch of proposals**
  - Submission deadline for White Papers 14 December
  - Notification of White Paper evaluations 18 January
  - Proposals due 25 February
  - Award notifications 29 March
- **16 projects in 6 core areas; 1 Next generation call**
- **Relevant projects coordinated with MDA subject matter experts**
  - Participated in topic formulation
  - MDA subject matter experts participated in reviewing at least half the topics
    - Most topics written to include MDA relevant problems
  - UCAH provides contract vehicle for MDA and others to use to access sensitive, ITAR, and/or 6.2-6.4 university research
    - Offer tasks and funding directly to membership for MDA specific technology development



UNIVERSITY CONSORTIUM FOR APPLIED HYPERSONICS

TEES/JHTO- RPP-2020-001

University Consortium for Applied Hypersonics:

PROJECT CALL

RWP/RPP NUMBERS: TEES/JHTO-RPP-2020-001

Project Call Release Date	November 17, 2020
RWP/RPP Questions Cutoff	December 2, 2020
Phase 1: White Paper Submission Deadline	December 14, 2020 (5:00 PM CST)
Notification of White Paper Evaluations	January 18, 2021
Phase 2: Prototype Proposal Submission Deadline	February 22, 2021 (5:00 PM CST)
Award Notifications	March 29, 2021
Projected Project Start Date	August 1, 2021
Period of Performance	Up to 3 Years
Funding Award Ceiling	Up to $500,000 / year

TO APPLY TO THIS PROJECT CALL, YOUR UNIVERSITY'S AUTHORIZED ORGANIZATIONAL REPRESENTATIVE WILL NEED TO CREATE AN ACCOUNT AND SUBMIT WHITE PAPER/PROPOSAL DOCUMENTS THROUGH THE UNIVERSITY CONSORTIUM FOR APPLIED HYPERSONICS (UCAH) WEBSITE,

https://hypersonics.tamu.edu

WHITE PAPERS/PROPOSALS WILL BE RECEIVED UNTIL THE ABOVE DEADLINE. IF YOU ENCOUNTER ANY ISSUES OR CONCERNS WITH YOUR SUBMISSION, PLEASE EMAIL ucah@tamu.edu. QUESTIONS REGARDING THE CONTENT OF THE RWP/RPP MUST BE POSED THROUGH THE UCAH WEBSITE ABOVE.

TEES TEXAS A&M ENGINEERING EXPERIMENT STATION

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Project Call Highlights for DAHW Applications

Closing the kill chain

★ **- 3.** Seeker and Sensor Material Development for Hypersonic Vehicles

- **5.** Control Methodology for Changing Aerodynamic Structures

★ - **11.** Characterization, Modeling, and Validation of Divert and Attitude Jet Control for Hypersonic Vehicles

- **13.** Modeling, Simulation, and Testing of Separation Events

Expanding the target set and lethality

★ **- 9.** Directed Energy Radiation Interaction with Hypersonic Airflow

Agile and flexible development

-10. Improved Methods for Development of Aerodynamic Databases

- 14. Multi-Disciplinary Optimization

Affordable timely production in large quantities

1. Non-Destructive Testing for Hypersonics Materials Manufacturing

Projects tie to JHTO investment priorities and priority capability goals

★ *Strong emphasis on DAHW*

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JHTO University Engagement Next Steps

- Next project call in April
  - Finalizing and soliciting challenge problems
- Next industry day April 6
- Developing grand challenges to guide fundamental and university research
- TEES on-boarding member schools to the UCAH
- Distribution of memo to services and defense agencies on how to use the consortium to access university research for applied hypersonics
- Working with the JHTO Systems Engineering Field Activity at NSWC Crane to develop transition and maturation plans for JHTO-funded university S&T into prototyping programs

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Questions?

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Creating the Technologies of the Future Fight

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