Call for FY 2024 DoD Frontier Project Proposals

Introduction

Purpose: The Department of Defense (DoD) High Performance Computing Modernization Program (HPCMP) established DoD Frontier Projects to enable research, development, test and evaluation (RDT&E), and acquisition engineering outcomes that would not be achievable using typically available HPCMP resources.

Overview: Please carefully review the requirements for proposals to ensure that all requirements are met in any submitted proposal. Frontier Projects will continue to pursue outcomes aligned with DoD mission priorities and be supported by multi-year commitments of exceptional amounts of high-performance computing (HPC) computational resources.

In FY 2022, the HCPMP made two significant changes to the Frontier Program.

1. **The HPCMP started executing two types of Frontier Projects: Foundational Research and Engineering Frontier Projects and Applied Acquisition and Sustainment Frontier Projects.**
2. **The HPCMP implemented a more rigorous review of progress. Projects that are not making adequate progress on initially stated goals may be either reduced in size or terminated.** Additional details are below.

Foundational Research and Engineering Frontier Projects follow the guidelines that have been in place since the program started in FY 2014. However, they primarily focus on science and technology (budget activities 6.1, 6.2, and early 6.3). These projects cannot easily be achievable using typically available HPCMP resources, and they are expected to use 100s of millions of core-hours per year and/or 100s of thousands of GPU-hours per year over a 2-to 4-year period.

Applied Acquisition and Sustainment Frontier Projects address DoD design, development, and test and evaluation projects; they focus on programs of record, test and evaluation, and quick response science and technology for urgent operational requirements. This type of project is generally more time-critical, has shorter execution timelines, and is expected to use 10s of millions of core-hours per year and/or thousands of GPU-hours per year over a 1-to-2-year period. As Frontier Projects these projects will benefit from a higher system priority that shortens timelines with enhanced throughput. There is also an option to start Applied Acquisition and Sustainment Frontier Projects outside the proposal cycle. The procedures for this are posted on the Resource Management website. New Applied Acquisition and Sustainment Frontier Project proposals should be submitted in response to this annual call until this call for proposals expires.

Eligibility: All Frontier Projects must be sponsored by a DoD government scientist/engineer and must use HPCMP resources to enhance mission impact and capability. Principal investigators for Frontier Projects may be scientists or engineers from government, industry, or academia. If the principal investigator is a DoD government scientist/engineer, there is no need to name a separate DoD sponsor.

Relation to Existing Frontier Projects: The HPCMP seeks projects with high DoD mission impact and strong scientific merit. New Frontier Projects should not be duplicative of existing Frontier Projects.

We continue previous years' interest in receiving proposals from key focus areas that have been identified as being of high interest within DoD: (1) hypersonic systems; (2) autonomous systems/artificial intelligence; (3) future vertical lift; (4) electromagnetic development and design, (5) directed-energy systems; and (6) microelectronics. Finally, we continue to be interested in proposals that will be able to leverage the program's investment in shared TS-SCI resources and the new HPCMP systems with significant GPU capabilities.

Of the sixteen active Frontier Projects, four projects will complete in FY 2023. The twelve projects that will continue to be active in FY 2024 with their corresponding primary computational technology areas (CTAs) are

1. High-Fidelity Modeling and Simulation to Support Army Aviation Acquisition Programs, Andrew Wissink, Army Aviation Development Directorate, AMRDEC (CFD)
2. Terminal Ballistics to Advance Army Modernization Priorities, Robert Doney, Army Research Laboratory (CSM)
3. Whole Atmosphere NEPTUNE, P. Alex Reinecke, Naval Research Laboratory (CWO)
4. Multi-fidelity Design Optimization of Rotating Detonation Engines, Matthew Harvazinski, Air Force Research Laboratory (CFD)
5. HPC Enabled, Digital Transformation for Laser Weapon Systems Development, John Tam, Air Force Research Laboratory (CFD)
6. Large-scale Integrated Simulations of Transient Aerothermodynamics in Gas Turbine Engines, Luis Bravo and Russell Powers, Army Research Laboratory and Naval Air Warfare Center (CFD)

7. Identifying Ultra-high-temperature Ceramics in Multi-Component Chemical Space for Hypersonic Technologies, Stefano Curtarolo, Office of Naval Research (CCM)
8. Data-driven Framework for Turbulence Modeling Using a Prolate Spheroid, Dory Lummer, Naval Surface Warfare Center (CFD)
9. Direct Numerical Simulations of Laminar-Turbulent Transition for High-speed Boundary Layers All the Way to Turbulence, Hermann Fasel, Air Force Office of Scientific Research (CFD)
10. Modeling and Simulation for Air/Ship Integration (A/SI) Program Support, Susan Polsky, Naval Air Warfare Center (CFD)
11. Enhanced Warfighting Capabilities of Joint Service F-35s by Incorporating Computational Fluid Dynamics into the F-35 Program Office Acquisition Process, Jae Lee, Naval Air Warfare Center (CFD)
12. Applied Computational Aerodynamics for B-52 Commercial Engine Replacement Program (CERP), Andrew Lofthouse, Air Force Life Cycle Management Center (CFD)

The four projects that will complete in FY 2023 are

1. Earth System Prediction Capability, Joe Metzger, Naval Research Laboratory (CWO)
2. High-Fidelity Physics-Based Simulation of Kinetic and Directed Energy Weapons Integration Strategies for Future Air Dominance Platforms, Scott Sherer, Air Force Research Laboratory – Air Vehicles (CFD)
3. Direct Numerical Simulations of Turbulence at Hypervelocity Flight Conditions, Neal Bitter, Office of Naval Research (CFD)
4. M&S for Ground Test and Evaluation, Jason Klepper, Arnold Engineering and Development Center (CFD)

A summary of all twelve projects that will continue into FY 2024 is included in Attachment 1.

Awards: Foundational Research and Engineering Frontier Projects may be proposed for up to a four-year duration. Applied Acquisition and Sustainment Frontier Projects may be proposed up to a two-year duration; however, we expect many of these projects will be shorter than two years. Exceptional amounts of HPC computational resources will be provided to each project without regard to any quota based on the proposing Services/Agencies. Support is available from HPCMP assets such as the DoD Supercomputing Resource Centers (DSRCs), User Productivity Enhancement and Training (PET), and the Data Analysis and Assessment Center (DAAC).

Project Review: Frontier Projects will be reviewed twice a year by the High Performance Computing Modernization Program Office (HPCMPO). In addition, written quarterly progress reports are required for quarters that do not contain the Annual Project Review or On-Site Visit. The overarching goals of all reviews are to assure projects are on track, delivering mission-relevant impact, and to resolve issues that projects are having with HPCMP systems and resources.

a. **Annual Project Review.** This review will be a formal project review meeting with HPCMP leadership and a technical review panel. As part of this review, HPCMP leadership and the technical review panel will make a progress assessment of each project. Projects that are not making adequate progress on initially stated goals may be either reduced in size or terminated. The intent is for this to be an in-person meeting with the option to conduct reviews at the Secret collateral level. Project Leaders are expected to attend all project reviews. If travel restrictions are in place, the meeting will be held virtually, and content will be adjusted to meet applicable security rules.
b. **On-site Visit.** Resource Management leads a small a group that includes Associate Director for Centers representation that visits each project for an in-depth review (normally 2.5 to 4 hours in duration). The primary focus of this review is to discuss significant detail on the technical aspects of the project. Another significant focus is to identify and resolve issues with HPCMP systems, software, and resources.

Submission: All Frontier proposals must be submitted through the appropriate Service/Agency High Performance Computing Advisory Panel (HPCAP) principal to the HPCMPO. All proposals must be at the unclassified level. If an exception is needed for a classified submittal, please contact Michael Ausserer at michael.ausserer@us.af.mil or 937-272-0525. Proposals must be received by the HPCMPO by 24 April 2023; however, HPCAP principals have established earlier internal deadlines. The HPCAP points-of-contact and dates for submission of proposals to the Services/Agencies are as follows:

- Air Force: Mr. Bryon Foster (Bryon.Foster@us.af.mil) and Mr. William Quigley (William.Quigley.5@us.af.mil). Submit proposals by 20 March 2023.
- Army: Ms. Jamie Stack (jamie.k.infantolino.civ@army.mil) and Mr. Eldred Lopez (Eldred.I.Lopez.ctr@mail.mil). Submit proposals by 31 March 2023.
- Navy: Ms. Kathy Hollyer (kathy.hollyer.ctr@navy.mil). Submit proposals by 3 April 2023.
- DTRA: Mr. Brian Leppert (brian.p.leppert.civ@mail.mil) and Jason Jordan (jason.e.jordan16.ctr@mail.mil) Submit proposals by 3 April 2023.
- DARPA: Dr. Nick Lemberos (nick.lemberos@darpa.mil). Submit proposals by 20 March 2023.
- MDA: Mr. Jose Rivera (jose.rivera.ctr@mda.mil). Submit proposals by 3 April 2023.

Evaluation: Selection will be based on the following two elements:

1. **DoD and warfighter mission impact**

2. **Technical excellence.** A technical review panel will be convened by the HPCMPO. This panel will evaluate proposals using the following criteria:
   a. Technical merit: Based on the project's goals, solution approach, management approach, and technical quality, what is the value of the computational work to the technical communities to which the project applies?
   b. Computational merit: How efficiently can the proposed project take advantage of the high-performance computing capabilities requested? Is the proposed computational approach robust and is the software (existing and/or proposed) highly scalable to achieve the desired outcomes?
   c. Potential for progress: Based on the team's qualifications and previous work, does the team have the potential to complete the proposed work?

Selection: The HPCMP Director will select the FY 2024 Frontier Projects. Awards will be announced in early August 2023. Selected projects will be provided Frontier allocations starting 1 October 2023.

Questions: Contact Mr. Michael Ausserer, HPCMP Associate Director for Resource Management, at michael.ausserer@us.af.mil or 937-272-0525.

Proposal Contents

Frontier Project proposals are limited to 15 pages (single-spaced, standard 12-point font, one- inch margins); it is not necessary that the proposal be 15 pages, provided the required information in each category can be presented in fewer pages. It must be a single Word document, except for the curricula vitae, which must be a separate document. If a Word documents cannot be submitted, please contact your Service/Agency and the HPCMPO (frontier@hpc.mil) for suitable alternative formats. The cover page, resource request sheets, and any curricula vitae do not count against the 15-page limit. **Proposals must contain the following sections – ordered and numbered as indicated. It is essential that all sections contain the required information in the detail requested.** Suggested lengths for each section are provided.

Cover Page: (Length: 1 page maximum, does not count against the 15 page limit; see Attachment 2)

Project Title: Provide the title of the project.

Project Type: Specify Foundational Research and Engineering or Applied Acquisition and Sustainment.

Requirements Project Number(s): Provide the project number(s) (as reflected in the HPCMP requirements database) representing the project requirements on which the

Frontier Project proposal is based. A proposal cannot be considered unless its resource requirements are reflected in the HPCMP requirements database. Please contact Logan Ale at require@hpc.mil for further details.

Duration: Specify the expected duration of the project, in years (maximum of four years for Foundational Research and Engineering and two years for Applied Acquisition and Sustainment).

CTA: List the primary and associated CTAs that best fit this project.

Estimated Resources by Year: Summarize the total estimated computational requirement on the Project Resource Request sheets by year, in millions of core-hours for traditional CPU requirements and thousands of GPU-hours for GPU requirements (see Attachment 3).

Government Sponsor: Provide the Government sponsor's name and contact information if the principal investigator is not a DoD government scientist/engineer.

Principal Investigator: Provide the Frontier Project's principal investigator's name and contact information. Only one person should be listed, and that person will be the lead for interactions with the HPCMP during the project.

Key Collaborators: Provide a list of organizations or personnel planned to participate in the project.

Impact: Summarize the expected impact of the project to DoD, the warfighter, and the technical community.

Technical Goals and Approach: Summarize the technical objectives of the project and the planned computational approach.

Major Applications Software: List major applications software that will be used.

Technical & Computational Challenges: Summarize anticipated challenges for the project and the planned computational approach.

Technical Proposal

It is essential that each required section be included in the proposal narrative with all details as directed in the following instructions:

Introduction: Introduce the project in broad terms. Include a general discussion of ongoing related work in both your organization and the scientific, technology, and/or testing community.
(Length: approximately ½ to 1 page)

DoD Impact: Clearly state the DoD mission impact of the project and any current and future programs of record it will support. State the advantage to be gained by utilizing HPC capability. (Length: approximately ½ to 1 page)

Technical Approach: Clearly state the technical goals of the project and discuss the science, technology, and/or engineering activities that are required to meet these goals. Provide a detailed plan for achieving these goals. Discuss technical challenges that will likely be encountered during the course of the project and how they will be overcome. (Length: approximately 3-6 pages)

Schedule and Anticipated Accomplishments: State clearly the duration of the project and provide a schedule in tabular form with estimated milestones and anticipated accomplishments for each year. **This is a key component of the proposal because it will be used to measure progress in the annual project review.** (Length: approximately ½ to 1 page)

Computational Approach: Describe the computational methodology and algorithms, and estimate the size of the problem with as many supporting details as possible. Discuss the relationship between early year developments and later year accomplishments. Discuss applicable software efficiency on scalable systems by stating the performance as a function of the degree of parallelism. Show evidence that the software provides sufficient foundation to scale to the problem size needed to achieve the goals of the project and/or discuss software developments that will be required as a part of the project. Scalability information, including a graph of application performance for a typical test case versus the number of cores and/or GPUs, should be included. **It is also particularly important that application codes are either fully developed or ready for use by each proposed project, or specific plans to reach that state of readiness are detailed in the proposal.** Discuss optimal computational architectures relative to available HPCMP resources. Discuss the computational challenges that will likely be encountered during the project, how they will be overcome, and how this project will add to the computational state-of-the-art in this technical area. **Detailed justification must be provided for the level of computational resources required.** (Length: approximately 2-4 pages)

Progress to Date: Discuss preparatory work in the proposed technical area in this section. Elaborate on any HPC resources previously used by this project and/or efforts leading up to this proposed project. Discuss what work remains and how a Frontier Project can facilitate achieving the proposed work. (Length: approximately ½ to 2 pages)

Key Personnel: Identify the key personnel who will work on this project and summarize the background and qualifications of each participant, including each participant's projected level of effort. Provide an estimate of the size of the group that will perform this work, including an estimate of the percentage of time each team member will contribute to the project. Also include a discussion of possible incorporation of HPCMP team members into the project team. (Length: approximately 1-2 pages)

Required Computational Resources and Justification: Outline the computational resources required to accomplish this project in terms of total core-hours and/or GPU-hours on HPCMP systems for all years of the project. **Provide requirements based on specific, current HPCMP systems for FY 2024 and FY 2025.** These early year requirements must be definitive and reasonably accurate. **For the out-years, an estimate of the required number of core-hours and/or GPU-hours can either be stated on current HPCMP systems or on a generic system architecture expected to be available. A list of current HPCMP systems is available at https://centers.hpc.mil**. Justification for the required level of computational resources can be provided by documenting known run times on the same or similar architectures as proposed for the project and scaling those to address the project's goals. Include a discussion of any specialized memory, storage, networking, and/or software requirements. (Length: approximately 1-3 pages)

Computational Summary Sheet: Provide estimates of computational resources required to accomplish the proposed project. A completed DoD Frontier Project Resource Request (see Attachment 3; not part of 15-page limit) for each year of the proposed project is required. The form is divided into three sections:

- Section I: Specify the applicable year and enter the principal investigator information.
- Section II: There are two tables in Section II. The first table facilitates outlining suites of systems at various locations that can address the project's requirements. Proposals may present multiple scenarios (combinations of platforms and locations). The second table, which contains computational processor, memory, and data archive storage requirements, must be completed once for each year of the project.

- Section III: Enter the computational project titles and project numbers (as reflected in the HPCMP requirements database) associated with the project. Please contact Logan Ale at require@hpc.mil if you need assistance with this.

Curricula Vitae: Provide a *curriculum vita* (including a list of relevant publications) for each of the key personnel. (**in a separate document**; not part of 15-page limit)

Attachment 1
Summary of Existing Frontier Projects

High-Fidelity Modeling and Simulation to Support Army Aviation Acquisition Programs (Andrew Wissink, Army Aviation Development Directorate, AMRDEC)

The goal of this project is to integrate the CREATE-AV Helios and Kestrel high-fidelity modeling and simulation tools into Future Vertical Lift acquisitions of interest to Army Aviation to demonstrate the impact of these tools for the acquisition of major defense systems by reducing cost, development time, and risk. The project performs high-fidelity multi-disciplinary computational modeling and simulation for the Future Attack and Reconnaissance Aircraft (FARA), Future Long Range Attack Aircraft (FLRAA), and Future Unmanned Air Systems (FUAS) acquisition programs in Future Vertical Lift (FVL), to characterize performance, loads, vibration, noise, and safety to inform decision teams. Frontier resources enable high quality computational analysis of these configurations with a high-resolution digital model before the expensive manufacturing and flight test phase of the acquisition. Because FUAS has a longer-term development cycle (scheduled DoD insertion FY27), the project initially focuses on newly envisioned applications of the current Gray Eagle UAS configuration presently used by the Army.

Terminal Ballistics to Advance Army Modernization Priorities (Robert Doney, Army Research Laboratory)

The goal of this project is to advance survivability and lethality capabilities in support of Army modernization priorities. A variety of codes are being used to perform continuum and mesoscale simulations to optimize armor and lethal mechanisms as well as evaluate and mature new protection concepts. Atomistic, microscale, and mesoscale simulations are being used to capture microstructural effects on energetic materials for improved prediction of detonative response as well as material discovery. This work is critical to advancing DoD capability in three of the U.S. Army's six Modernization Priorities: Long Range Precision Fires, Next Generation Combat Vehicle, and Soldier Lethality.

Whole Atmosphere NEPTUNE (P. Alex Reinecke, Naval Research Laboratory)

The major goal of this project is to use the NEPTUNE deep atmospheric model to develop and validate a high-resolution global numerical weather prediction system to support IOC and replace the existing Navy global NWP system. In addition, the project is developing and testing a unique, whole atmosphere forecasting capability, extending from the Earth's surface to 500 km height with the goal of predicting thermospheric disturbances at unprecedented spatial and temporal scales. The work supports existing ONR, NRL, and DARPA projects by performing numerical experiments with NEPTUNE of the whole atmosphere. Hindcasts for 30 to 60 day periods at increasing horizontal resolution are being done to validate new physical parameterizations, data assimilation techniques, and ensemble predictions in NEPTUNE. The project is designed to support the U.S. Navy's capabilities to characterize the current and future state of the battlespace environment in order to ensure battlespace dominance in the 21st century.

Multi-fidelity Design Optimization of Rotating Detonation Engines (Matthew Harvazinski, Air Force Research Laboratory)

The goal of this project is to deliver improved rotating detonation engine (RDE) operability limits and performance through multi-fidelity design optimization using simulations with various CFD applications. These simulations are being used for two specific areas of design optimization. Injector optimization will yield injectors that promote mixing and yield a higher percentage of combustion in detonation over deflagration. Nozzle optimization will result in better-conditioned flow with higher thrust. The overall effort will enable four 6.3 RDE programs: liquid fuel ram RDE for Mach 3 internal carriage air to ground munitions, solid fuel ram RDE for air to air munitions, RDEs for turbine engine augmentation (afterburner), and RDE Freejet test program.

HPC Enabled, Digital Transformation for Laser Weapon Systems Development (John Tam, Air Force Research Laboratory)

The goal of this project is to utilize HPC to enable high physical fidelity End-to-End Model (EtEM) simulation to buy-down technical risks in laser weapon systems (LWS) technology development. Specifically, the project will focus on weapon lethality, digitally connect LWS solutions across TRLs, accelerate the transition process, and reduce costs. The EtEM package is being used to model air-based laser weapon system scenarios including source modeling, beam control, adaptive optics, aero-optics, atmospheric propagation, scene generation, and damage modeling and lethality. Individual high-fidelity models for laser sources and turbulence are providing data used by EtEM. The overall result will provide significant technological advantage for space domain awareness, improve laser weapon system transition efforts by simulating solution strategies for technical risks to system performance, and connect those solutions to weapon lethality in the context of engagement simulation.

Large-scale Integrated Simulations of Transient Aerothermodynamics in Gas Turbine Engines (Luis Bravo, Army Research Laboratory; and Russell Powers, Naval Air Warfare Center)

The goal of this project is to advance the state-of-the-art in Digital Engineering tools by developing a massively parallel LES design framework for integrated simulations of unsteady engine analysis. The project plans to demonstrate applicability by conducting multi-component analyses of OEM engines at a sweep of design and off-design conditions. The thrust areas to be investigated are 1) onset of transients and performance in unsteady inlet and compressor integrated models, 2) onset of combustor dynamics using jet fuel chemistry and high temperature strongly coupled turbine fluid structure interactions, and 3) advancing industry standard integrated simulations in gasturbine engine extreme environments. The project will culminate with a sweep of integrated simulations of the PWAPU engine (62T-46C12) operating at off-design conditions and demonstration of improved performance. Rigorous uncertainty quantification and machine learning will be key for real-time and accurate engine design tools. Success of this project will lead to engines with increased performance, efficiency, and reliability at a much lower development cost in shorter timelines; incorporate these tools into a high-fidelity Digital Twin engine model that will enable real time engine health awareness and reduced lifecycle cost; and mitigate particle ingestion that will increase engine service life and mission readiness for operations in austere environments.

Identifying Ultra-high-temperature Ceramics in Multi-component Chemical Space for Hypersonic Technologies (Stefano Curtarolo, Duke University, sponsored by the Office of Naval Research)

The goal of this project is to identify multi-component disordered entropic reciprocal ultra-high-temperature ceramics (ER-UHTCs) that form high-entropy single phases with high-hardness values, train machine-learned interatomic potentials for multi-component ceramics and develop a materials similarity search tool to provide collections of materials with similar properties. The Automatic FLOW Framework for Materials Discovery (AFLOW) is being used to simulate materials and calculate their properties with density functional theory. Structural, electronic, thermodynamic, and thermo-mechanical properties are automatically analyzed, and descriptors are used to identify compositions that are likely to form disordered materials with high hardness. An active machine learning workflow is being implemented with a training feedback loop to refine the search space towards compositions with superior-hardness. Promising candidates will be experimentally synthesized, and the corresponding Vickers hardness will be measured. The project will lead to suitable high-temperature and high-pressure materials to withstand the extreme-environment conditions for DoD applications, such as reusable hypersonic vehicles, inside rocket engines, and friction stir welding.

Data-driven Framework for Turbulence Modeling Using a Prolate Spheroid (Dory Lummer, Naval Surface Warfare Center)

The technical goal of this project is to use the ONR HiPro prolate spheroid test data to validate Large Eddy Simulation (LES) CFD predictions. This will lead to the ability to predict submarine maneuvers at low speeds and high angles of attack. Currently, this is an area with a dearth of information and CFD validation in the transitional flow regime that can also have vortical, separated, and cross flow features. These features are difficult to accurately resolve with current models and can end up limiting vehicle operations. The LES CFD simulations will be used to generate a high-quality flow field database. The high-quality flow field database will then be used to train a new RANS CFD turbulence model using data-driven approaches. The improved RANS turbulence models can then close the gap in submarine maneuver modeling capabilities.

Direct Numerical Simulations of Laminar-Turbulent Transition for High-speed Boundary Layers All the Way to Turbulence (Hermann Fasel, sponsored by the Air Force Office of Scientific Research)

The primary goal of this project is to understand the influence of Mach number and Reynolds number on the nonlinear transition processes and turbulent flow for hypersonic regimes. This will assist in bridging the gap between ground-based wind tunnel experiments and flight tests and determine how ground-based data can be extrapolated to flight. The goal will be addressed by employing Direct Numerical Simulations (DNS) for various wind tunnel and free-flight conditions from the laminar boundary layer all the way to fully developed turbulent flow. Insights into the fundamental physics for the nonlinear stages of hypersonic boundary-layer transition and breakdown to turbulence is of critical importance for mitigating detrimental effects caused by the increased heat transfer and skin-friction drag during the transition process and for turbulent flow, such as the planned development of novel flow control strategies for preventing or mitigating these detrimental effects.

Modeling and Simulation for Air/Ship Integration (A/SI) Program Support (Susan Polsky, Naval Air Warfare Center)

The goal of this project is to expand integrated CFD flight simulation capabilities developed during the previous Frontier Project to enable modeling of a full launch and recovery envelope (LRE) at-sea test evolution. This project will move beyond the development stage of the previous Frontier into the application stage focusing on direct program test and evaluation support. This will be accomplished by using the “CASTLE/Kestrel” application software which was developed and tested for V-22 Osprey applications during the previous Frontier project. The tool will be refined and standardized to enable simulation of full approach and landing scenarios commensurate with live dynamic interface testing. Methods to post-process computational results to discern flight envelope limits will be created as part of a follow-on to the ONR Dynamic Interface Virtual Environment (DIVE) Program. Employing methods developed by DIVE for the V-22/LPD ship combinations, reduced order aerodynamic coupling models will be developed for additional ships/aircraft and will be integrated into virtual simulations as part of the M&S LRE development process to capture pilot workload elements contributing to LRE limits. The overall impact will be to decrease cost and improve operational capability through application of CFD modeling and simulation to the LRE development process.

Enhanced Warfighting Capabilities of Joint Service F-35s by Incorporating Computational Fluid Dynamics into the F-35 Program Office Acquisition Process (Jae Lee, Naval Air Warfare Center)

The goal of this project is to establish a more efficient CFD-based engineering method for weapons bay acoustics and trajectory analysis of stores suitable for store certification from the F-35 weapons bay. Recently, NAVAIR utilized the Kestrel CFD code to evaluate weapons bay acoustics, due to poor matching of wind tunnel predictions to flight testing. Similarly, due to store integration timeline constraints, several high fidelity CFD modeling techniques were utilized to simulate store trajectories. While the prior work was extremely successful, utilizing all of these simulation features is extremely computationally expensive and prohibitive for completing weapons integration work in the long term. The KESTREL flow solver will be utilized to understand the most significant contributors to store separation sensitivities through a model build-up approach (adding engine inflow, running comparisons to simplified and complex weapons bay geometry, etc.). Investigators will then compare results utilizing GBU-38 models and algorithm settings in comparison to flight test data to provide the necessary balance between accuracy and efficiency. The aerodynamic interactions between various aircraft parameters and the weapons bay flow field are often highly coupled to several parameters and requires careful attention and experience for proper separation predictions. This project will provide an accurate and computationally efficient store certification process for F-35 weapons bay separation utilizing this CFD methodology.

Applied Computational Aerodynamics for B-52 Commercial Engine Replacement Program (CERP) (Andrew Lofthouse, Air Force Life Cycle Management Center)

The overall goal of this project is to investigate air vehicle configurations of interest to US Air Force acquisition programs, specifically to develop a full aerodynamic model (including control surfaces and high-lift devices) for the new B-52 engine configuration for the B-52 Commercial Engine Replacement Program. The computational model will then be used to determine the effect of the new engine nacelles on maximum lift during take-off and landing, and to investigate differences in stability and control characteristics of the aircraft. The impact of the new engine nacelles on maximum lift, which affects take-off distance, is of particular concern to the program. The ultimate impact of this project is to demonstrate that flight test requirements can be reduced through the use of physics-based modeling and simulation.

Attachment 2
FY 2024 DoD Frontier Project Proposal Cover Page

FY2024 DoD FRONTIER PROJECT PROPOSAL COVER PAGE

Project Background		
Project Title:		
Project Type: either "Foundational Research and Engineering" or "Applied Acquisition and Sustainment"		
Requirements Project Number(s):	CTA(s):	Project Duration (in years):
Estimated Core-hours and/or GPU-hours by year: FY24- FY25- FY26- FY27-		
Government Sponsor		
Name:	E-mail Address:	
Organization:	Phone Number:	
Principal Investigator (may be the same as Government Sponsor)		
Name:	E-mail Address:	
Organization:	Phone Number:	
Key Collaborators		
Names & roles:		
Impact (Specify the impact of the project's outcomes to DoD, the warfighter, and the technical community)		
Technical Goals		
Technical Approach		
Major Applications Software (e.g., ANSYS CFD)		
Technical & Computational Challenges		
Cover material limited to one page – row heights may be adjusted to suit		

Attachment 3

DoD Frontier Project Resource Request

Submit a complete copy of the information in attachment 3 for each year.

DoD Frontier Project Resource Request

Section I: General Information

Project Number and Title: ______ Project Year: _______

Principal Investigator:

Name:_______ Service/Agency:____ Organization:_
Address, City, State, and Zip Code: ______________________________________

____
E-mail Address: ____
Phone: ____

Section II: Overall Project Resource Requirements

Platform(s)	**Location (DSRC)**		**CPU Resources (core-hours) GPU Resources (GPU-hours)**	
	First Choice	**Second Choice**	**Request**	**Minimum Acceptable**

Platform(s)	**Typical Number of Processors**	**Maximum Number of Processors**	**Typical Job Memory (GB)**	**Maximum Job Memory (GB)**	**Total Data Archive Storage Requirements (TB)**

Total Expected Working Storage Requirements (in TB):______________________________

Annual Expected Archival Storage Requirements (per year in TB):_____________________

Section III: Requirements Project Information

HPCMP Requirements Database Information:

Project Title from HPCMP Requirements Database:________________________________

Project Number from HPCMP Requirement Database: ________________________________