



DoD High Performance Computing

**Supercomputing Resources Available to
DoD Research, Development, and Test & Evaluation Programs/Projects**



**Kelly Dalton, Technical Director
AFRL DoD Supercomputing Resource Center**

Outline

- **Use of Supercomputing within Research, Development, Test & Evaluation missions**
- **DoD supercomputing resources available**
 - No charge for computation time
 - Available for use by government, contractors, and academia on DoD contract
- **Efforts to support “above secret” requirements**

Goal: Increase awareness of DoD supercomputing capabilities available to support programs/projects

Supercomputing (High Performance Computing)

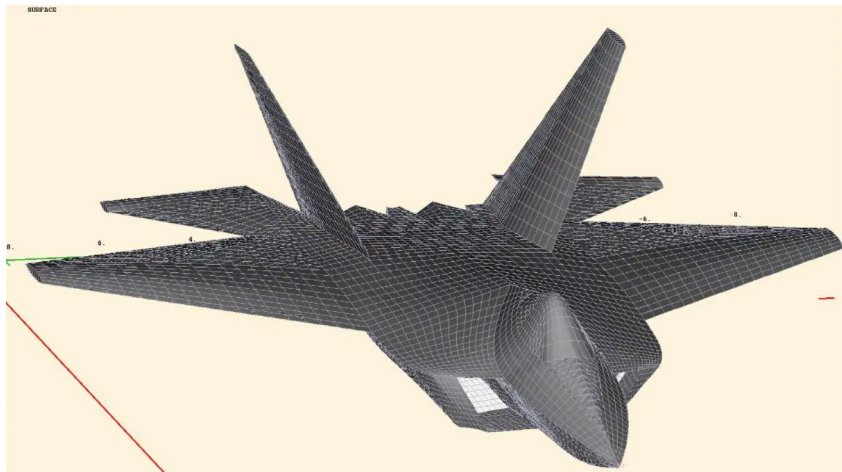
- Enables problem solving and data analysis that is impossible, too time-consuming or costly with standard computers
- Relies on specialized hardware to orchestrate high-speed, parallel computation at maximum performance



Use of Supercomputing:

Solving Complex Problems via High Speed Parallel Processing

Large problems divided into smaller problems, then solved at the same time in parallel.



Examples: Computational Fluid Dynamics (CFD) &
Finite Element Analysis

Example: HPC Accelerating Heavy-Lift Launch Capability for DoD

Since 2016, SpaceX has used the HPC allocations to investigate flow phenomena and supplement the knowledge of the aerodynamics of its space launch vehicles and associated hardware.

In 2019, HPCMP allocated **17 M core hours to SpaceX** through the Department of the Air Force enabling:

- **Reducing risk** through direct simulation of vehicle aerodynamics vice extrapolation
- Provided detailed launch geometry **analyses otherwise unobtainable in time available.**

| Vehicle Configuration | DoD – Air Force Mission Relevance | Additional CFD Cases Analyzed | CPU-Hours | Equivalent Time Saving (Months) |
|-----------------------|-----------------------------------|-------------------------------|------------|---------------------------------|
| Falcon 9 Block 5 | GPS III, L-85, L-87 | 180 | 5,000,000 | 5.8 |
| Falcon Heavy Block 5 | STP-2, AFSPC-44, AFSPC-52 | 225 | 12,000,000 | 13.9 |



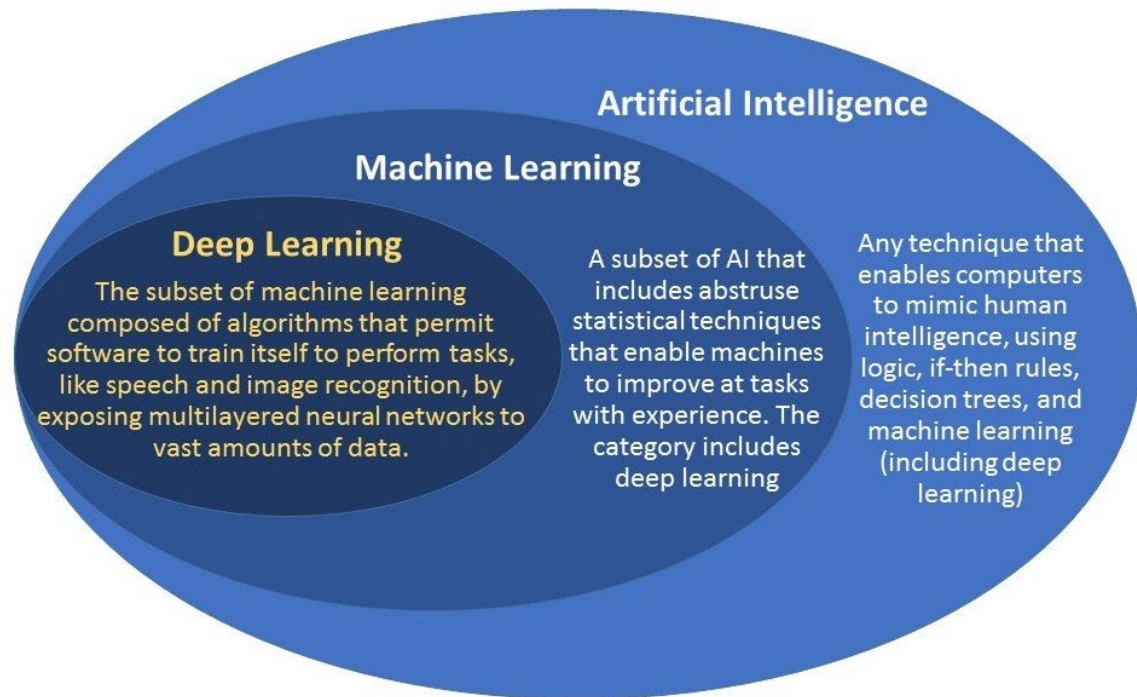
Falcon Heavy Launch

“The DoD, Air Force, and SpaceX partnerships on the HPC systems will continue to be vital to our continued success of delivering the necessary aerodynamic analyses required for a reliable launch vehicle for the Air Force”

- Benjamin Bettis, Manager, Aerodynamics Engineering, SpaceX

Use of High Performance Computing: *Artificial Intelligence, Machine Learning (ML), and Deep Learning*

- GPU Intensive
- Growing Demand
- Evolving Software
- Evolving Hardware

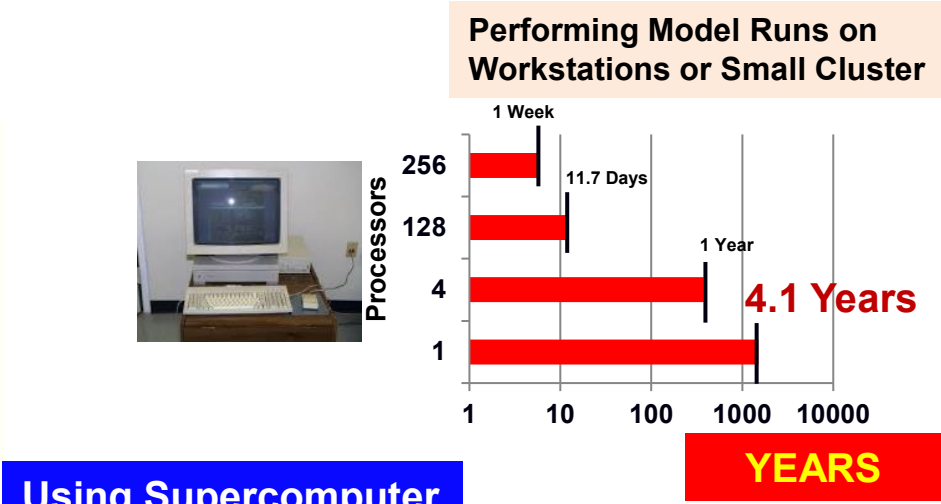


Source: <https://www.ibm.com/blogs/systems/ai-machine-learning-and-deep-learning-whats-the-difference/>

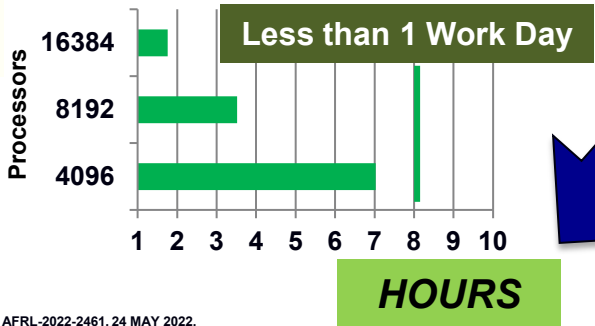
Use of Supercomputing: Solve Problems at Higher Fidelity in Less time

Example: ACAT I Program Milestone Decision Operational Effectiveness Study to Support Down select

- 2 Future aircraft design concepts
 - 4 Flight Profiles (Low, Med, High, Standoff)
 - 5 Weapon Configurations
 - 3 Environments (Forest, Desert, Mountainous)
 - 2 Times of Day (Day, Night)
 - 10 Weather conditions
 - 5 Electronic Jamming states
 - 2 Target Conditions (Moving, Stationary)
 - 3 Target Types (Early Warning RADAR site, missile launcher, RADAR van)
-
- $2 \times 4 \times 5 \times 3 \times 2 \times 10 \times 5 \times 2 \times 3 = 72,000$ cases
- Assume a single model run takes 30 minutes on 1 processor



Using Supercomputer



MUSTANG Supercomputer:
56,448 processors



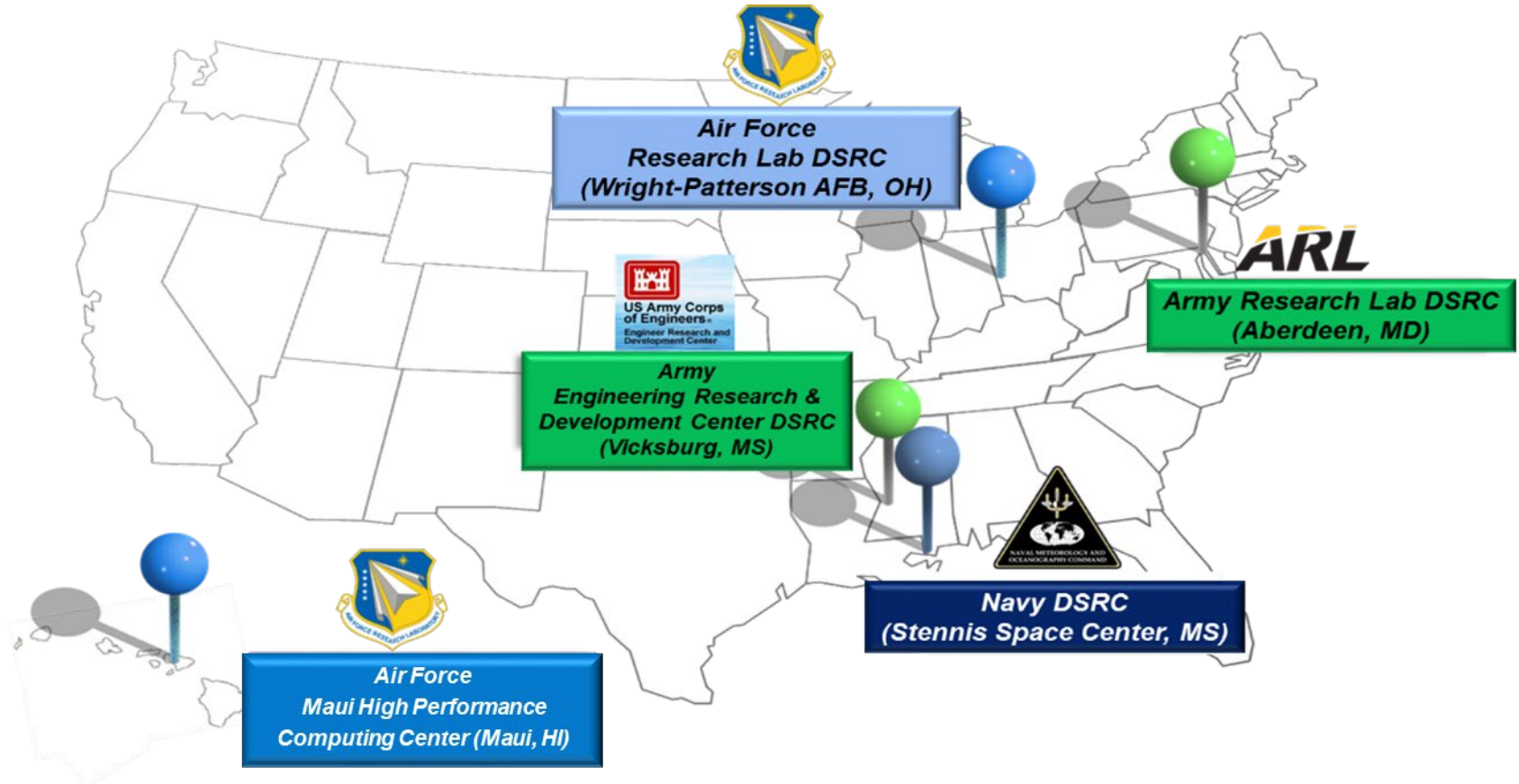
DoD High Performance Computing Modernization Program

- The DoD High Performance Computing Modernization Program (HPCMP) initiated in 1993 in response to Congressional direction
- The Mandate - advance the supercomputing capability for the DoD, provide a national research network, provide software and computational science expertise and support to better enable DoD RDT&E activities
- DoD program administered by Engineering Research & Development Center (Vicksburg, MS) on behalf of Army ASLT
 - Joint Service execution
 - Substantial “in kind” funding from services



**DoD HPC Modernization Program Supports
Air Force, Army, Navy, and DoD Agencies**

DoD Supercomputing Resource Centers (DSRCs)



Available DoD HPCMP Supercomputing Resources

| Center | Name | System Type | Compute Cores | GPU | Phi | Peak Performance TFLOPS |
|--------|----------------|--------------|------------------|--------------|-----------|-------------------------|
| AFRL | Mustang | HPE SGI 8600 | 56,448 | 24 | | 5,004 |
| | Voodoo | HPE SGI 8600 | 13,824 | | | 1,194 |
| | Spectre/Shadow | HPE SGI 8600 | 13,824 | | | 1,194 |
| | Warhawk | HPE Cray XE | 139,776 | 104 | | 5,100 |
| | Blackbird | HPE Cray XE | 45,312 | 26 | | 1,600 |
| ARL | Centennial | SGI ICE XA | 73,920 | 32 | | 2,648 |
| | Hellfire | SGI ICE XA | 33,088 | 32 | | 1,210 |
| | Scout | IBM | 6,080 | 646 | | 6,000 |
| | Betty | Cray CS500 | 102,400 | 292 | | |
| | Jean | Liquid | 57,696 | 280 | | 6,900 |
| | Kay | Liquid | 48,480 | 76 | | 3,400 |
| ERDC | Onyx | Cray XC40/50 | 214,568 | 32 | 32 | 7,736 |
| | Freeman | Cray CS500 | 80,320 | 16 | | |
| | Wheat | Liquid | 86,784 | 531 | | 17,000 |
| MHPCC | Hokulea | IBM Power 8+ | 640 | 128 | | 693 |
| | Wai | SGI UV300 | 576 | | | 22 |
| | Kai | SGI UV300 | 576 | | | 22 |
| Navy | Gaffney | HPE SGI 8600 | 35,328 | 16 | | 3,137 |
| | Koehr | HPE SGI 8600 | 35,328 | 16 | | 3,137 |
| | Durham | HPE SGI 8600 | 7,104 | | | 635 |
| | Narwhal | HPE Cray XE | 290,304 | 112 | | 12,800 |
| | | | 1,342,376 | 2,363 | 32 | 79,432 |



Compute time is allocated:

- Air Force 30%
- Navy 30%
- Army 30%
- Agencies 10%

• No charge for computational hours on the supercomputers!

AFRL Warhawk

- HPE Cray XE
- 139,776 Compute cores
- 5.1 petaFLOPS
- 1092 Compute Nodes
 - 4 Large Memory Nodes
 - 40 Dual Machine Learning Nodes
 - 24 Visualization Nodes
 - 1024 Standard Nodes
- 8 Login Nodes - 4 Data Transfer Nodes
- 2.3 GHz AMD EPYC 7H12 Processor
 - 64 cores/CPU
- 104 NVIDIA Volta V100 GPGPUs
- Cray Slingshot Interconnect (200 Gb/s)
- 561 TB of Memory
- 24.84 PB of Storage



Future System

AFRL Raider (Fall 2022)

- **Awarded to Penguin Computing**
- **189,440 Compute Cores 6.11 PetaFLOPS**
- **354 Compute Nodes**
 - 8 Large Memory Nodes
 - 32 Quad Machine Learning Nodes
 - 24 Visualization Nodes
 - 64 High Core Performance Compute Nodes
 - 1400 Standard Nodes
- **10 Login Nodes**
- **2 Data Transfer Nodes**
- **2.0-3.6 GHz AMD ‘Milan’ 7713 Processor**
 - 64 cores/CPU
- **152 NVIDIA Ampere A100 GPGPUs**
- **InfiniBand HDR-200 Dragonfly**
- **414 TB of Memory, 20 PB Storage**



45'(540") scale to 1:25 = 21.6

Defense Research and Engineering Network (DREN)

- **Robust, high-capacity, low-latency network**
- **Connects DoD Supercomputing Resource Centers and user sites**
- **Supports the DoD Research, Development, and Test & Evaluation missions**
- **DREN IV provides 1 Gbps to 400 Gbps service to DoD sites**
- **Supports Multicast, IPv6, and IPv4**
- **Complies with all DoD Security Regulations and provides secure transport for data between Service Delivery Points (SDPs) at each connected location**
- **Secret-level network overlay (SDREN)**



Computational Research and Engineering Acquisition Tools and Environments (CREATE)



CREATE-AV

KESTREL

Air Vehicle (AV) Design Tools

CREATE-SHIPS

Ship Design Tools

CREATE-RF

Radio Frequency (RF)
Antenna Design and

CREATE-GV

Ground Vehicle Design Tools

CREATE-MG

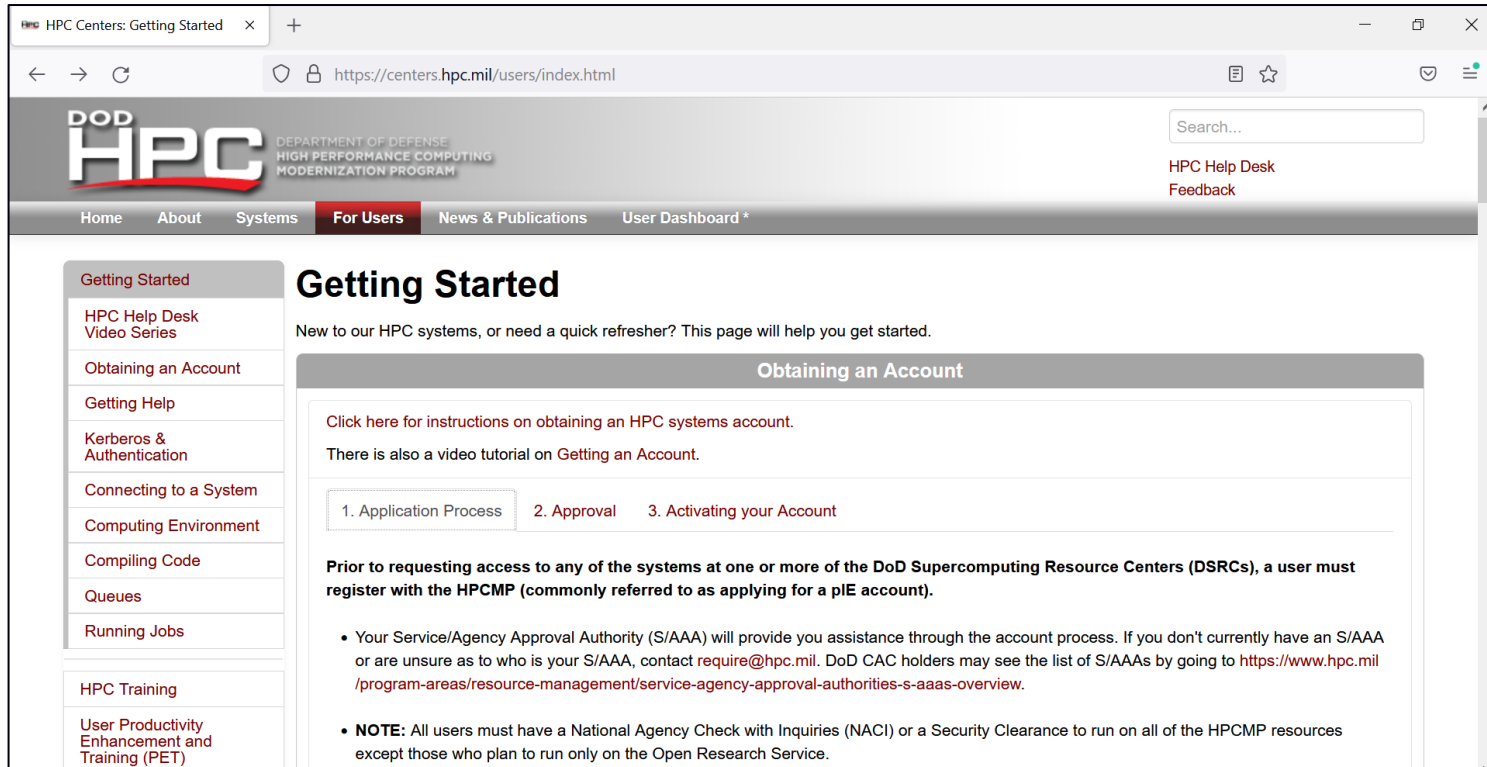
Meshing and Geometry (MG)
Support

- **Aircraft (AV) Design Tools:** Fixed-wing aircraft, rotorcraft, conceptual design, trade-space exploration and operational testing and transition
- **Ship Design Tools:** Shock/damage, hydrodynamics, early-stage design & trade-space exploration, and operational testing and transition
- **Radio Frequency (RF) Antenna Design and Integration Tools:** Conceptual design and detailed analysis tools relevant to virtually all DOD platforms
- **Ground Vehicles (GV) Tools:** End-to-end mobility solver, provide rapid, physics-based data for design and trade-space analysis
- **Meshing and Geometry (MG) Support:** CAD-neutral digital representations/product models of weapons systems & platforms and terrain/environments

Who can use DoD Supercomputers?

- All users must have a National Agency Check with Inquiries (NACI) or a Security Clearance
- DoD RDT&E entities and support contractors can use DoD HPC systems
- No Charge to Using Organizations for Computation Time

How to Obtain an Account



The screenshot shows a web browser window with the URL <https://centers.hpc.mil/users/index.html>. The page header includes the DOD HPC logo and navigation links: Home, About, Systems, For Users (selected), News & Publications, and User Dashboard. A search bar and links for HPC Help Desk and Feedback are also present.

Getting Started

New to our HPC systems, or need a quick refresher? This page will help you get started.

Obtaining an Account

Click here for instructions on obtaining an HPC systems account.
There is also a video tutorial on Getting an Account.

1. Application Process 2. Approval 3. Activating your Account

Prior to requesting access to any of the systems at one or more of the DoD Supercomputing Resource Centers (DSRCs), a user must register with the HPCMP (commonly referred to as applying for a piE account).

- Your Service/Agency Approval Authority (S/AAA) will provide you assistance through the account process. If you don't currently have an S/AAA or are unsure as to who is your S/AAA, contact require@hpc.mil. DoD CAC holders may see the list of S/AAs by going to <https://www.hpc.mil/program-areas/resource-management/service-agency-approval-authorities-s-aas-overview>.
- NOTE:** All users must have a National Agency Check with Inquiries (NACI) or a Security Clearance to run on all of the HPCMP resources except those who plan to run only on the Open Research Service.

<https://centers.hpc.mil>

Want to try it out before doing the formal account process?

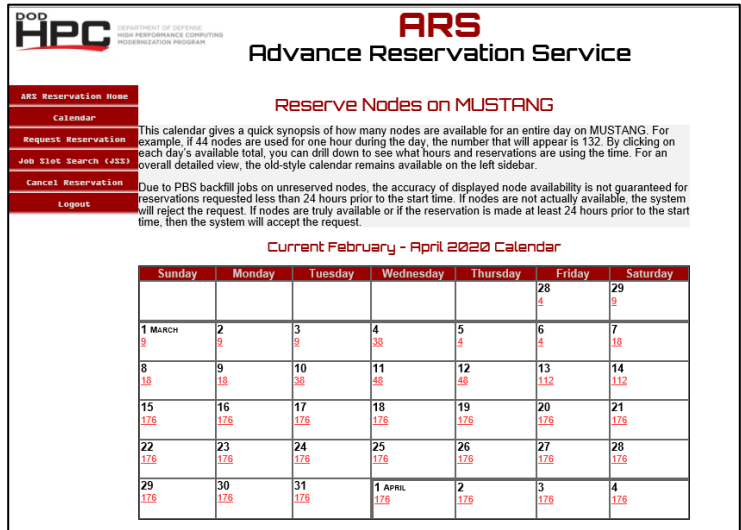
- **“Micro-user” accounts now possible to try out the systems**
 - Streamlined process (i.e. less paperwork)
 - Must graduate to “formal” project if work continues
 - Good way to get started if you are new at supercomputing

Running Jobs: Priority Service Provided to Users

- Allocation process
 - Processing hours dedicated to DoD High Priority and Urgent Projects

- Advance Reservation Service (ARS)
 - State-of-the-art job scheduling/queuing system
 - HPCMP customers guaranteed, quick access to portions of allocated systems for dedicated use

- Dedicated Support Partitions (DSPs)
 - Processing nodes specifically reserved for large computational efforts
 - Projects that cannot be addressed with advance reservation service
 - Long-term reoccurring work (30–360 days)
 - Developmental testing



ARS
Advance Reservation Service

Reserve Nodes on MUSTANG

This calendar gives a quick synopsis of how many nodes are available for an entire day on MUSTANG. For example, if 44 nodes are used for one hour during the day, the number that will appear is 132. By clicking on each day's available total, you can drill down to see what hours and reservations are using the time. For an overall detailed view, the old-style calendar remains available on the left sidebar.

Due to PBS backfill jobs on unreserved nodes, the accuracy of displayed node availability is not guaranteed for reservations requested less than 24 hours prior to the start time. If nodes are not actually available, the system will reject the request. If nodes are truly available or if the reservation is made at least 24 hours prior to the start time, then the system will accept the request.

Current February - April 2020 Calendar

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|-----------------|-----------|-----------|-------------------|-----------|-----------|-----------|
| | | | | | 28 4 | 29 9 |
| 1 MARCH 3 | 2 8 | 3 9 | 4 33 | 5 4 | 6 4 | 7 18 |
| 8 18 | 9 18 | 10 38 | 11 43 | 12 48 | 13 112 | 14 112 |
| 15 176 | 16 176 | 17 176 | 18 176 | 19 176 | 20 176 | 21 176 |
| 22 176 | 23 176 | 24 176 | 25 176 | 26 176 | 27 176 | 28 176 |
| 29 176 | 30 176 | 31 176 | 1 APRIL 176 | 2 176 | 3 176 | 4 176 |

<https://reservation.hpc.mil/reserve/>

DoD Supercomputing Resources Available for “Above Secret” Programs/Projects

U.S. Technological Advantage Being Challenged



Tech / Policy

China plans multibillion-dollar investment to knock US from top spot in fastest supercomputer ranking

- China and the US dominate when it comes to the world's fastest supercomputers, owning 45.4 per cent and 21.8 per cent of the top systems globally respectively

The Washington Post

Business

The quantum revolution is coming, and Chinese scientists are at the forefront

China's drive to dominate a field with big economic and military applications outpaces some U.S. strides

TECHNOLOGY

US and China race to faster supercomputers amid simmering trade war

ercomputer labs to the latest

abc NEWS VIDEO LIVE SHOWS 2020 ELECTIONS

WASHINGTON -- The United States is blacklisting five Chinese organizations involved in supercomputing with military-related applications, citing national security as justification for denying its Asian geopolitical rival access to critical U.S. technology.

THE WALL STREET JOURNAL

How a Big U.S. Chip Maker Gave China the 'Keys to the Kingdom'



HOME / NEWS / HPC

Top500: US keeps top spot, but China dominates supercomputing

The New York Times

China Extends Lead as Most Prolific Supercomputer Maker

Mon, Mar 09, 2020

Newsweek

U.S. World Business Tech & Science Culture Newsgeek Sports Health The Debate

TECH & SCIENCE

RUSSIA PLANNING TO BUILD POWERFUL NEW SUPERCOMPUTERS AFTER SEEING ITS TECHNOLOGY LAG BEHIND U.S. AND CHINA

BY JASON MURDOCK ON 2/11/20 AT 9:39 AM EST

BEIJING, CHINA, UNITED STATES, WORLD

PLA's J-20 fighters use stolen US tech

abc NEWS VIDEO LIVE SHOWS 2020 ELECTIONS CORONAVIRUS

China stealing foreign military technology in race to become world power: Report

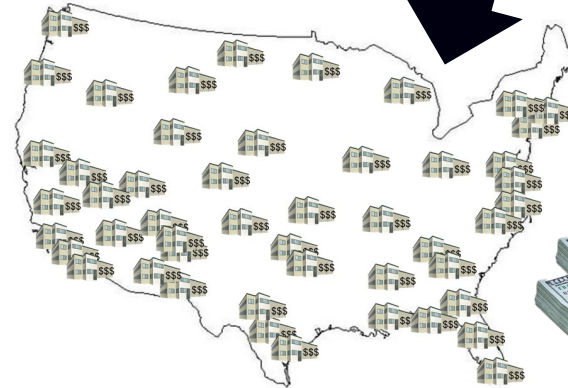
China is building up its military by investing in modernization and influence.

How Programs Currently Obtain Supercomputing Support (Why DoD Leadership is Interested in this Effort)

- Find a government or contractor site with ample power & cooling
 - *If it doesn't exist, build it*
 - *If it doesn't have enough power and cooling, add enough (hopefully)*
- Design a computer that project can afford (not what you really want)
- Procure the computer after a lengthy acquisition process
- Hire security staff to get the facility accredited and to operate site
- Hire an IA staff to get the system accredited
- Hire system administrators (or misuse engineers)
- Maintain the facility
- Maintain/update/patch software
- Maintain/update hardware
- Maintain accreditation
- Perform the project (finally)
- Pay for tech refresh (if you can) or mothball the site
- Dispose of system when program/project ends (???)

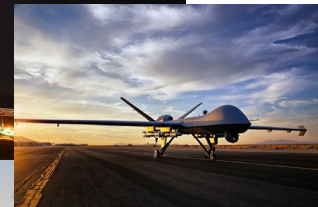
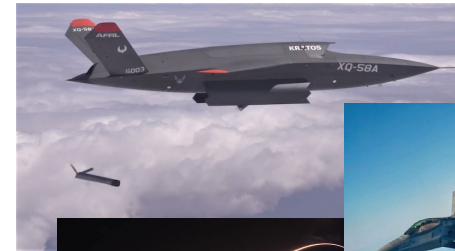


**This process repeated for a multitude of programs
In every Service and
DoD Agencies**

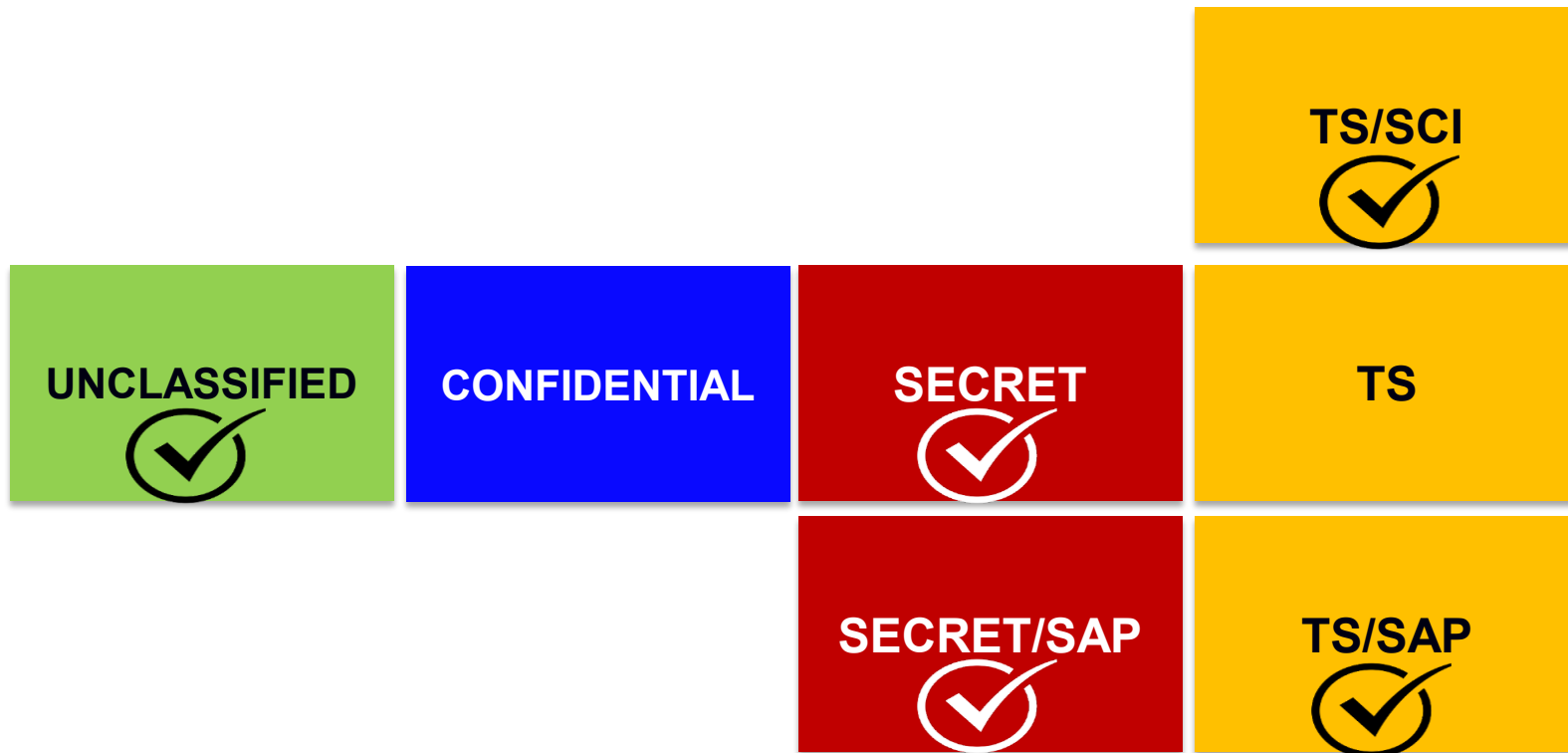


Objective: DoD Supercomputing for “Above Secret”

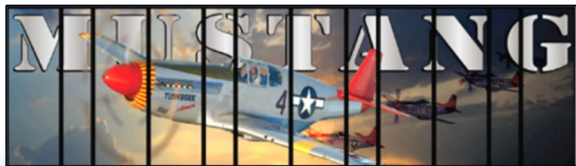
- Sustain technical advantage for the U.S. military and DoD agencies
- Address critical, underserved RDT&E requirements
- Provide better support to acquisition
- Build agile & efficient means to leverage powerful computational resources
 - Establish “Warm” capability
 - Facility and System accreditation done
 - System administration provided
 - Built in technical refresh
 - Ability to leverage large scale parallel computing
 - Can reduce costs and redundant efforts across DoD



Scope of DoD HPCMP Resources



Expanded Support for DoD RDT&E



“Mustang”

- **56,448 compute cores**
- **4.87 PetaFLOPS**
- **1128 Standard Compute Nodes**
 - + 24 large memory nodes
 - + 24 visualization nodes
- **8 E-Racks, 6 Cool/CDU, 11 D-Racks**
- **2.7 GHz Intel Xeon 8168 “Skylake”**
- **24 cores/CPU**
- **244 terabytes of memory**
- **9.281 petabytes of storage**



“Voodoo”

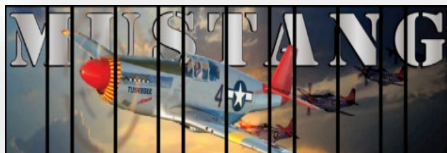
- **13,824 compute cores**
- **1.194 PetaFLOPS**
- **284 Standard Compute Nodes**
- **4 large memory nodes**
- **2 E-Rack, 2 Cool/CDU, 3 D-Racks**
- **2.7 GHz Intel Xeon 8168 “Skylake”**
- **24 cores/CPU**
- **58 terabytes of memory**
- **1.584 petabytes of storage**



“Shadow” & “Spectre”

- **6,912 compute cores (each)**
- **0.59 PetaFLOPS**
- **140 Standard Compute Nodes**
- **4 large memory nodes**
- **1 E-Rack, 2 Cool/CDU, 2 D-Racks**
- **2.7 GHz Intel Xeon 8168 “Skylake”**
- **24 cores/CPU**
- **29.9 terabytes of memory;**
- **1.046 petabytes of storage**

Expanded Support Now Available



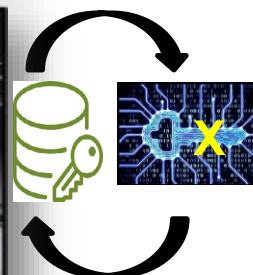
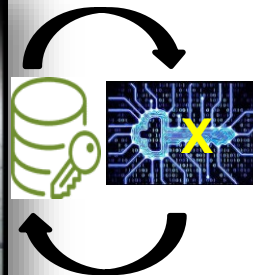
56,448 core
"Mustang"

Shared
24/7



13,824 core
"Voodoo"

Shared
24/7



6,912 core
"Spectre"

One Program/Project
on System



6,912 core
"Shadow"

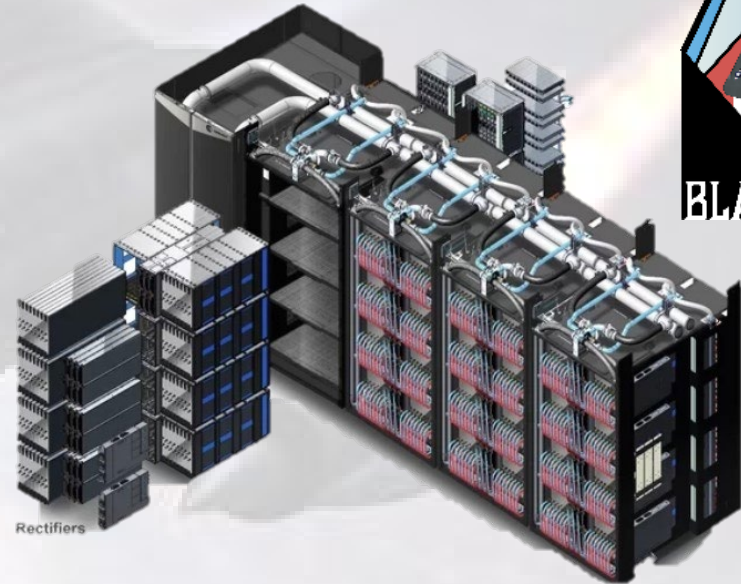
One Program/Project
on System



DoD HPC System “Blackbird”

(Technical Insertion 2019)

- Cray Shasta
- 45,312 Compute Cores 1.6 PetaFLOPS
- 354 Compute Nodes
 - 2 Large Memory Nodes
 - 10 Dual Machine Learning Nodes
 - 6 Visualization Nodes
 - 336 Standard Nodes
- 4 Login Nodes
- 2 Data Transfer Nodes
- 2.3 GHz AMD EPYC 7H12 Processor
 - 64 cores/CPU
- 26 NVIDIA Volta V100 GPGPUs
- Cray Slingshot Interconnect (200 Gb/s)
- 184 TB of Memory
- 7.2 PB of FIPS 140-2 Storage



Strategy for “Above Secret” Supercomputing

- **For DoD to exploit large-scale systems, we must have ability to share a supercomputer across programs/projects**
 - Traditional periods processing approach inefficient and impractical
 - Enables high utilization
- **Must support timely technical refresh and accreditation**
 - U.S. technological advantage at risk
- **AFRL DSRC pursuing technical solution to securely isolate projects/programs and users on shared supercomputing system**
 - Collaboration with AF Test Community and DoD SAP CIO office
 - Support from vendors and other domain experts

The New York Times

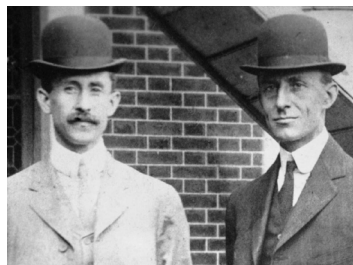
FLYING MACHINES WHICH DO NOT FLY.

The ridiculous fiasco which attended the attempt at aerial navigation in the Langley flying machine was not unexpected, unless possibly by the distinguished Secretary of the Smithsonian Institution, who devised it, and his assistants. Prof. MANLY, who undertook the

October 9, 1903:

“The flying machine which might really fly might be evolved ... in 1 to 10 million years.”

- New York Times



December 17, 1903:

“Success 4 flights Thursday morning all against twenty one mile wind. Started from level with engine power alone. Average speed through air thirty one miles. Longest 57 seconds.”

- Orville Wright, Telegram to Father

Assistance and Training

DoD HPC Help Desk



<https://centers.hpc.mil>

Help: help@helpdesk.hpc.mil

Toll Free: 877-222-2039

Local: 937-255-0679

Manager: manager@helpdesk.hpc.mil


Hours: 8:00 AM – 8:00 PM ET

HPC Help Desk Video Series

Welcome to the HPC Help Desk Video Series. This series answers some of the most common questions asked by our users, helping them make the most of their HPC accounts. Topics covered include the following:

| Title | Captions | Job Aid | Length |
|--|--------------------------------------|---------------------------|--------|
| Getting an Account | Show with Captions | Job Aid | 14:40 |
| Getting Help: the HPC Help Desk | Show with Captions | Job Aid | 13:46 |
| Introduction to Baseline Configuration | Show with Captions | Job Aid | 4:39 |
| Introduction to HPCMP SCAMPI | Show with Captions | Job Aid | 8:15 |
| Introduction to Modules | Show with Captions | Job Aid | 12:38 |
| Introduction to FBS | Show with Captions | Job Aid | 14:36 |
| Using Lustre | Show with Captions | Job Aid | 10:34 |
| Using SLB | Show with Captions | Job Aid | 10:53 |
| Using a YubiKey | Show with Captions | Job Aid | 08:54 |
| Installing Kerberos for Linux * | Show with Captions * | Job Aid * | 10:16 |
| Installing Kerberos for Mac * | Show with Captions * | Job Aid * | 12:40 |
| Installing Kerberos for Windows * | Show with Captions * | Job Aid * | 11:12 |
| Logging into an HPC System * | Show with Captions * | Job Aid * | 05:16 |
| Using FileZilla * | Show with Captions * | Job Aid * | 12:39 |
| Getting Started with the HPCMP GitLab Service on Mac and Linux * | Show with Captions * | Job Aid * | 13:26 |
| Getting Started with the HPCMP GitLab Service on Windows * | Show with Captions * | Job Aid * | 19:10 |

* login required



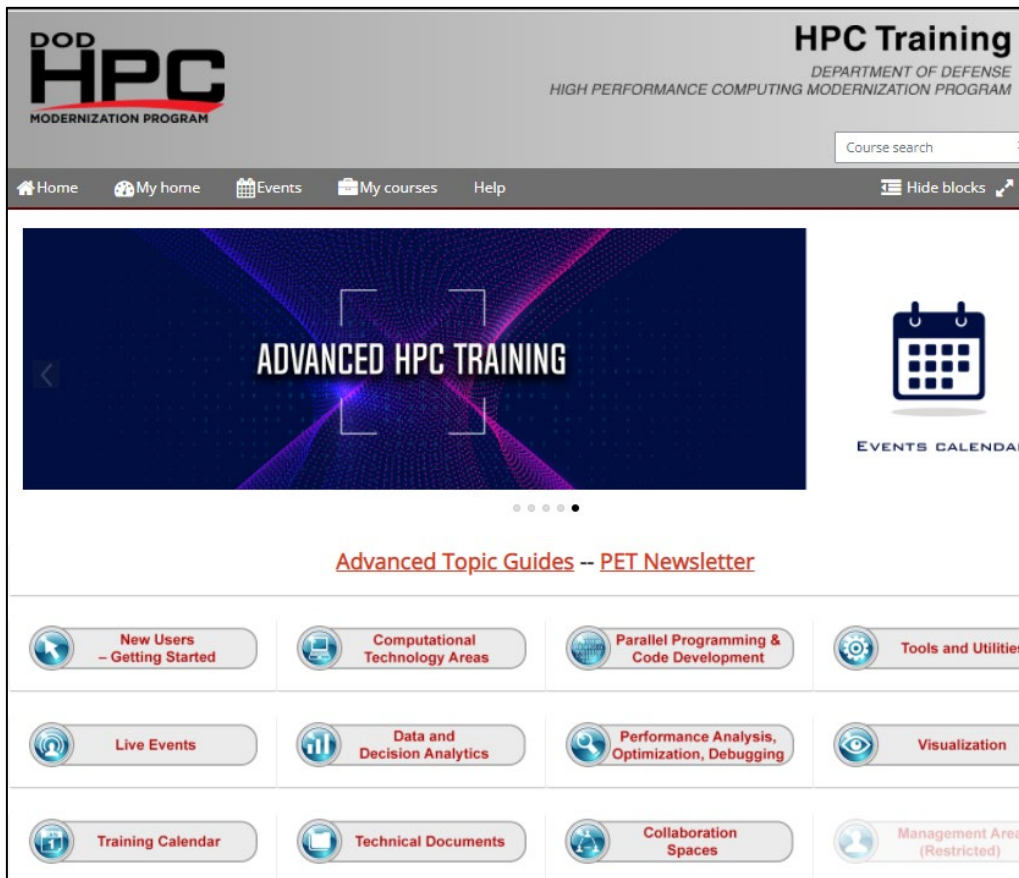
[HPC Help Desk](#)
[Feedback](#)

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[Systems](#)
[For Users](#)
[News & Publications](#)
[User Dashboard *](#)

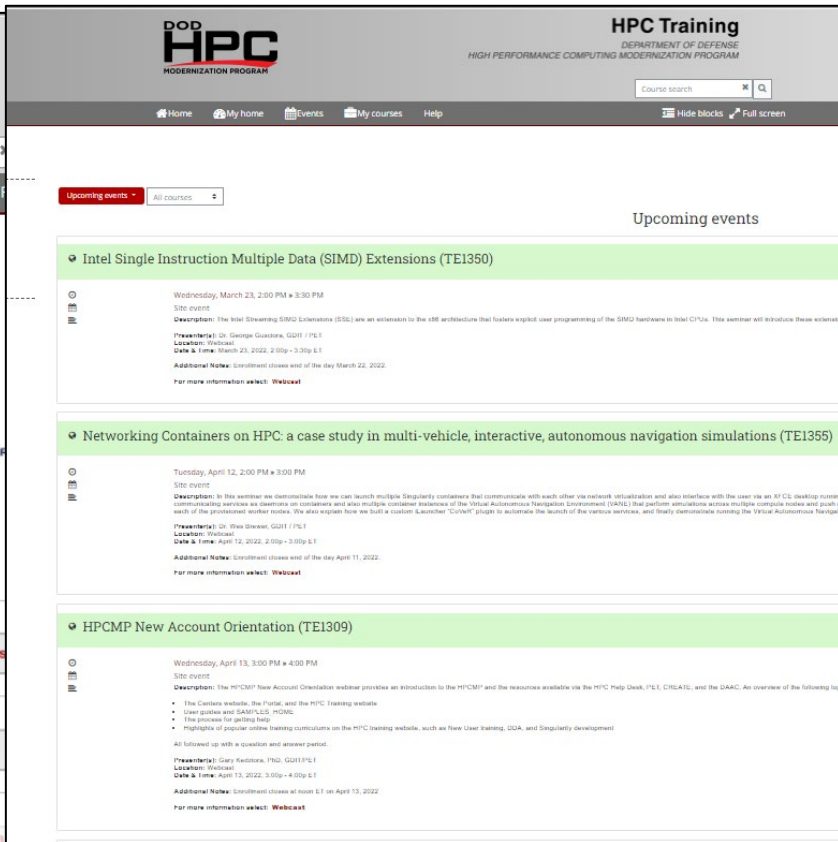
HPC Help Desk

| | |
|--|---|
| When to Contact the HPC Help Desk | Users should contact the HPC Help Desk when assistance is needed for unclassified problems, issues, or questions. |
| Hours of Operation | 8:00 a.m. - 8:00 p.m. Eastern, Monday - Friday (excluding Federal holidays). |
| HPC Centers Home Page | https://centers.hpc.mil/ |
| Help Desk Video Tutorial | Getting Help: the HPC Help Desk |
| Phone Number | 1-877-222-2039 or (937) 255-0679 |
| Help E-mail | help@helpdesk.hpc.mil |
| Accounts E-mail | accounts@helpdesk.hpc.mil |
| HPC Help Desk Manager E-mail | manager@helpdesk.hpc.mil |
| After Hours | Calls, e-mails and tickets received after normal operating hours will be addressed the following business day. |
| Mailing Address | DoD HPCMP HPC Help Desk AFRL/RCM 2435 Fifth Street Wright-Patterson Air Force Base, OH - 45433-7802 |
| Ticket Requests | Active users may submit tickets from the Active User Help Ticket. Inactive users may submit tickets using the Inactive User Help Ticket. |

Supercomputing Training <https://training.hpc.mil>



The screenshot shows the main page of the HPC Training website. At the top left is the DOD HPC Modernization Program logo. To the right, it says "HPC Training DEPARTMENT OF DEFENSE HIGH PERFORMANCE COMPUTING MODERNIZATION PROGRAM". Below this is a "Course search" input field. A navigation bar contains links for Home, My home, Events, My courses, and Help, along with "Hide blocks" and "Full screen" options. The main content area features a large banner for "ADVANCED HPC TRAINING" with a calendar icon and "EVENTS CALENDAR" text. Below the banner is a link for "Advanced Topic Guides -- PET Newsletter". At the bottom, there is a grid of 12 buttons for various topics: New Users - Getting Started, Computational Technology Areas, Parallel Programming & Code Development, Tools and Utilities, Live Events, Data and Decision Analytics, Performance Analysis, Optimization, Debugging, Visualization, Training Calendar, Technical Documents, Collaboration Spaces, and Management Area (Restricted).



The screenshot shows the "Upcoming events" page on the HPC Training website. It features a search bar at the top right and a "Upcoming events" dropdown menu. The page lists three events:

- Intel Single Instruction Multiple Data (SIMD) Extensions (TE1350)**
Site event
Wednesday, March 23, 2:00 PM - 3:30 PM
Description: The Intel Streaming SIMD Extension (SSSE3) are an extension to the SSE architecture that fosters exploit user programming of the SIMD hardware in Intel CPUs. This seminar will introduce these extensions.
Presenter(s): Dr. George Guadara, GD11 / PE1
Location: Virtual
Date & Time: March 23, 2022, 2:00p - 3:30p E.T.
Additional Note: Enrollment closes end of the day March 22, 2022.
For more information select: Webcast
- Networking Containers on HPC: a case study in multi-vehicle, interactive, autonomous navigation simulations (TE1355)**
Site event
Tuesday, April 12, 2:00 PM - 3:00 PM
Description: In this seminar we demonstrate how we can launch multiple Singularity containers that communicate with each other via network visualization and also interface with the user via an X11 GUI desktop running communicating services as daemons on containers and also multiple container instances of the Virtual Autonomous Navigation Environment (VANE) that perform simulations across multiple compute nodes and push the results of the simulation to other nodes. We also explore how we built a custom Kubernetes "Operator" plugin to automate the health of the various services, and finally demonstrate running the Virtual Autonomous Navigation.
Presenter(s): Dr. Wm Steiner, GD11 / PE1
Location: Virtual
Date & Time: April 12, 2022, 2:00p - 3:00p E.T.
Additional Note: Enrollment closes end of the day April 11, 2022.
For more information select: Webcast
- HPCMP New Account Orientation (TE1309)**
Site event
Wednesday, April 13, 3:00 PM - 4:00 PM
Description: The HPCMP New Account Orientation webinar provides an introduction to the HPCMP and the resources available via the HPC Help Desk, PEs, CREATS, and the SRAC. An overview of the following topics:
 - The Centers website, the Portal, and the HPC Training website
 - User guides and SAMPLES, HPCDS
 - The process for getting help
 - Highlights of popular online training curriculum on the HPC training website, such as New User training, Q&A, and Singularity developmentAll followed up with a question and answer period.
Presenter(s): Gary Radwin, PhD, GD11/PE1
Location: Virtual
Date & Time: April 13, 2022, 3:00p - 4:00p E.T.
Additional Note: Enrollment closes at noon E.T. on April 13, 2022.
For more information select: Webcast

Advanced User Support

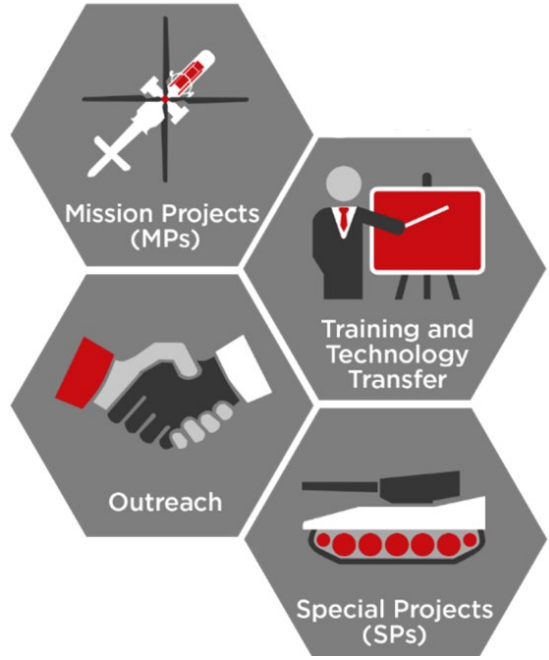
PhD level assistance is provided through the Productivity Enhancement and Training Element of the DoD HPC Program

Mission Projects

DoD HPCMP PhD support staff funded by DoD HPCMP to work with users to solve mission-critical problems of interest across the DoD

Outreach

Increase awareness of DoD Supercomputing Resources and support available to the DoD RDT&E community



PET

USER PRODUCTIVITY
ENHANCEMENT AND TRAINING

Training

Provide recurring live and recorded training for new and advanced supercomputing users as well as training/reference material

Special Projects

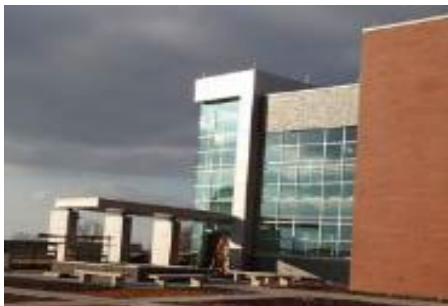
DoD HPCMP PhD support staff funded by user's organization to help the user's organization solve unique mission-critical problems

Additional Resources

AFRL DSRC Dual Mission

AFRL DoD Supercomputing Resource Center (AFRL DSRC)

- Hosting of DoD HPCMP Funded Supercomputers
- Data Storage
- DREN (Defense Research & Engineering Network)
- Software Licenses
- Customer Assistance
- DoD Funded Operations



DOD HPC
MODERNIZATION PROGRAM

AFRL Supercomputing Resource Division (AFRL/RCM)

- Hosting of other AF, AFRL & DoD HPC or Specialized Systems
- ICD 705 Compliant Floor Space
- HPC Expertise
- DAF, AFRL, and Project Funding



Dedicated HPC Project Investments (DHPIs)

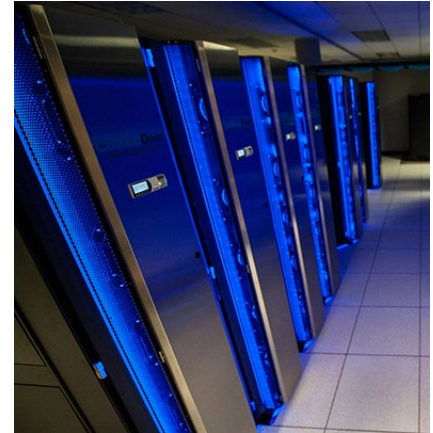
- DoD HPCMP accepts annual proposals to fund small-scale laboratory or test center on-site HPC systems to support unique 2-4 year mission critical projects

Examples:

- Project's classification and availability requirements that cannot be met using existing DoD HPCMP resources
- Have requirements that must consider real-time performance, Hardware-in-the-loop
- Need HPC-at-the-Edge and deployable HPC
- Includes embedded implementations
- Require a unique application of an emerging technology

Evaluation Criteria:

- Project is a priority for Service/Agency and/or all DoD
- Receiving site is capable of hosting an HPC system
- Receiving organization willing to pay for site preparation
- Receiving organization will pay for operation and maintenance
- Good Return-on-Investment expected



Critical Dates:

Call for Partnering & Collaborations: 20 April 2022

Proposal submission: 30 June 2022 COB

Service/Agency ranking provided to DHPI panel chair: 8 July 2022

Anticipated award announcement: July 2022

Systems must be hosted at one of the DoD Supercomputing Resource Centers

Reutilization of Decommissioned Systems

- DoD HPC systems being decommissioned are often offered for reuse
- Organizations requesting decommissioned HPC systems must support RDT&E conducted by the program offices, laboratories, centers and educational institutions of the Army, Navy, Air Force, Marine Corps or other DoD agencies
- Call for proposals often in May/June timeframe with systems typically available for transfer in the fall
- Call for proposals announced at: <https://www.hpc.mil>



Frontier Projects

- **Purpose:** Enable exploration of high-value DoD RDT&E activities that otherwise would be challenged using typically available HPCMP resources
- **Two Types of Frontier Projects:**
 - **Foundational Research and Engineering Projects**
 - Focus on science and technology activities (6.1, 6.2, and early 6.3)
 - Expected to use 100s of millions of core-hours per year, and/or 10s of thousands of GPGPU node-hours per year over a 2-4 year period.
 - **Applied Acquisition and Sustainment Projects**
 - Emphasis on DoD design, development, and test and evaluation projects supporting programs of record and quick-response science and technology for urgent operational requirements.
 - Expected to use 10s of millions of core-hours per year, and/or thousands of GPGPU node-hours over a 1-2 year period.
- ***Annual Call from HPCMPO in May timeframe***

https://www.hpc.mil/images/hpcdocs/newsroom/call_for_proposal/FY-2022_Frontier_Call_for_Proposals.pdf

DoD HPCMP User Group Meeting



- **September 13-16, 2022**
- **Hosted by AFRL DoD Supercomputing Resource Center**
- **Location: Dayton, Ohio (University of Dayton Research Institute)
Plus Virtual Option**
- **Registration/Call for Presentations now open**

<https://ugm.hpc.mil>

Summary: DoD HPC Modernization Program Provides Invaluable HPC Resources to Scientists & Engineers

- DoD government and contractors can access all DoD HPC systems
 - **No cost to using organization for compute time on systems**
- Connectivity to DSRCs, labs, academia, and test activities via a capable wide-area network – the Defense Research and Engineering Network (DREN)
- Access to expert help with accounts, coding, domain expertise, and training
 - DoD HPC Helpdesk assistance
 - Readily available training
 - Advanced user support
- DoD HPC Modernization Program supports “above secret” supercomputing

Questions?



*Air Force Research Laboratory
DoD Supercomputing Resource Center (DSRC)
AFRL/RCM
Wright-Patterson AFB, OH 45433*