Welcome to the February 2023 Frontier Training Workshop

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Office of Science User Facilities

28 world-leading facilities serving over 33,000 researchers annually

- supercomputers,
- high intensity x-ray, neutron, and electron sources,
- nanoscience facilities,
- genomic sequencing facilities,
- particle accelerators,
- fusion/plasma physics facilities, and
- atmospheric monitoring capabilities.

- Open access; allocation determined through peer review of proposals
- Free for non-proprietary work published in the open literature
- Full cost recovery for proprietary work

http://science.energy.gov/user-facilities/user-facilities-at-a-glance/
Mission: Providing world-class computational and data resources and specialized services for the most computationally intensive global challenges

Vision: Deliver transforming discoveries in energy technologies, materials, biology, environment, health, etc.

| Petascale | 2015 | Jaguar Cray XT5 2.3 PF | AMD CPU | 7 MW | 2009
|-----------|------|-----------------------|---------|------|------
|          |      | Titan Cray XK6 27 PF  | NVIDIA GPU, AMD CPU | 9 MW | 2012
|          |      | Summit IBM 200 PF     | 6 NVIDIA GPUs, 2 Power CPUs | 13 MW | 2018
|          |      | Frontier HPE-Cray EX  | >1,500 PF, 4 AMD GPUs, 1 AMD CPU | 29 MW | 2022

Frontier
HPE-Cray EX
>1,500 PF
4 AMD GPUs, 1 AMD CPU
29 MW
The OLCF averages about 1,500 unique users who are located around the world.

OLCF users come from academia, industry, and govt institutions.

Users are attached to projects which run up to 3 years in duration. We average about 250 research projects per year.

OLCF resources are allocated through three highly competitive allocation programs requiring peer reviewed proposals.
Three primary user programs for access to LCF
Distribution of allocable hours

- 60% INCITE
- Up to 30% ALCC
  ASCR Leadership Computing Challenge
- 10% Director’s Discretionary

https://olcf.ornl.gov
OAK RIDGE NATIONAL LABORATORY'S FRONTIER SUPERCOMPUTER

TOP500

1.1 exaflops of performance on the TOP500 List.

GREEN500

62.04 gigaflops/watt power efficiency on a single cabinet.

HPL-MxP

7.9 exaflops on the HPL-MxP (formerly HPL-AI) benchmark.

- 74 HPE Cray EX cabinets
- 9,408 AMD EPYC CPUs, 37,632 AMD GPUs
- 700 petabytes of storage capacity, peak write speeds of 5 terabytes per second using Cray Clusterstor Storage System
- 90 miles of HPE Slingshot networking cables

Sources: May 30, 2022, and November 14, 2022, Top500 releases
What does it take to build a leadership class computer?

- Time
- Many talented people
- A little excavation and demolition
- Great partners
Is Exascale Feasible?

Several studies examine the feasibility of an exascale computer. A goal of 20MW power consumption is set.

ECP

ECP continues maturation of key technologies through Development of software and applications begins.

Build Contract Awarded

A contract to build Frontier is awarded to Cray. A contract to prototype and test key technologies is also awarded to Cray.

Frontier Installation

Hardware to build Frontier begins arriving at ORNL in July.

DOE Invests in key technologies

Technologies required for exascale are incubated and matured through FastForward and DesignForward.

Construction begins at OLCF

Construction of 40-megawatt datacenter begins.

“Go” for system build

ORNL and HPE reach a “Go Decision” for system build.

Frontier Entering User Operations in 2023
Many Talented and Hardworking People

- Broad support from DOE HQ and Site Office
- 150 experts from 6 labs met in late 2018 to review technical proposals for Frontier
- 1,000 ECP staff
- 90 OLCF staff
- 20+ application/software teams through ECP
- Over 200 electrical and mechanical workers
- Over 300 HPE and AMD engineers
- And more
A Little Demolition
– 30 offices, 8 laboratories, and a 20,000 s.f. data center
Became the space for 40 MW of cooling
2.5 miles of new power lines installed
The old Titan data center becomes the new Frontier data center

August 2019

October 2021
Great partners

– A pandemic, the supply chain, and tremendous complexity...oh my!
Next Steps

• We are in the final stages of the Orion file system deployment

• Once Orion is ready to be deployed, we will conduct a short final system test and checkout and then begin those projects in the User Programs with allocations in the pipeline including:
  – INCITE Teams
  – ECP Application and Software Teams
  – Early Science Teams
  – Small number of 2022-2023 ALCC Teams

• ALCC 2023-2024 are in the proposal pipeline now with an expected start date of July 1, 2023

• Our expectation is that we will start taking Director’s Discretionary proposals for Frontier in March, 2023

• We will be communicating a Summit decommissioning schedule shortly and plan to remove Summit from user operations near the end of this CY.
Thank You