

# Argonne Leadership Computing Facility

Accelerating Discovery and Innovation

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[www.anl.gov](http://www.anl.gov)

# Supercomputing Resources

Our supercomputers are 10 to 100 times more powerful than systems typically used for scientific research.



# Computing Resources



**Mira IBM BG/Q**  
 49,152 nodes  
 786,432 cores  
 768 TiB RAM  
 Peak flop rate:  
 10 PF



**Theta Cray XC40**  
 4,392 nodes  
 281,088 cores  
 892 TiB RAM  
 Peak flop rate:  
 11.69 PF



## Theta

Features Intel processors and interconnect technology, a new memory architecture, and a Lustre-based parallel filesystem – all integrated by Cray's HPC software stack

**Iota Intel/Cray XC40**  
 44 nodes  
 2,816 cores  
 8.9 TiB RAM  
 Peak flop rate: 117 TF

**Firestone IBM Power8**  
 2 nodes + K80 GPU  
 20 cores  
 128 GB RAM  
*Hybrid CPU/GPU*

**Cooley Cray/NVIDIA**  
 126 nodes  
 1512 Intel Haswell CPU cores  
 126 NVIDIA Tesla K80 GPUs  
 48 TB RAM / 3 TB GPU

**Cetus IBM BG/Q**  
 4,096 nodes  
 65,536 cores  
 64 TiB RAM  
 Peak flop rate: 836 TF

### Storage Capability

#### Disk

- Mira: ~27 PB of GPFS file system capacity with performance of 240 GB/s on the largest file system (19PB).
- Theta: ~18 PB of GPFS/Lustre file system capacity; 9PB is GPFS and 9.2PB is Lustre.

#### Tape

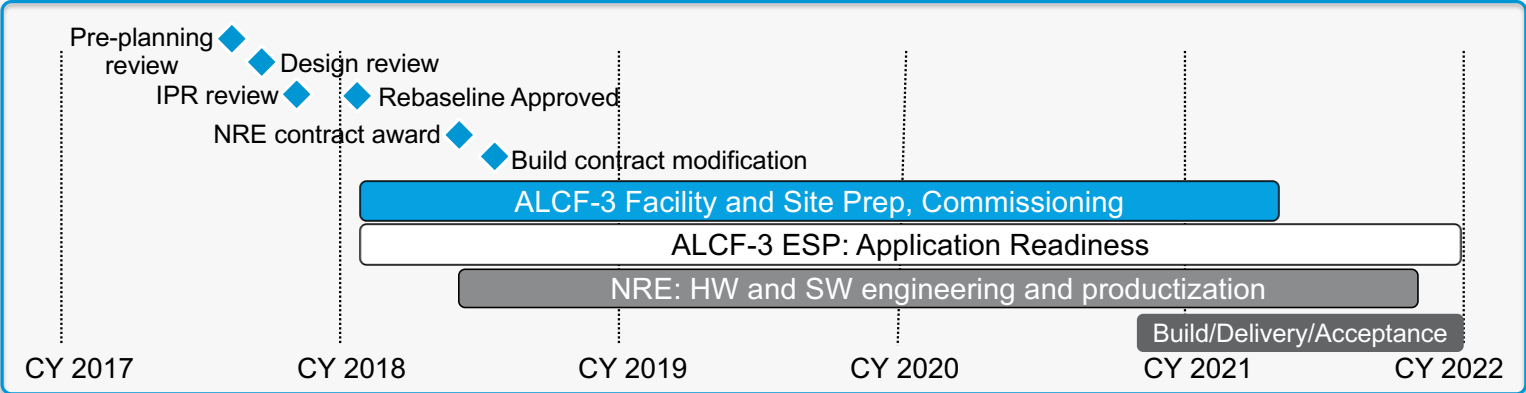
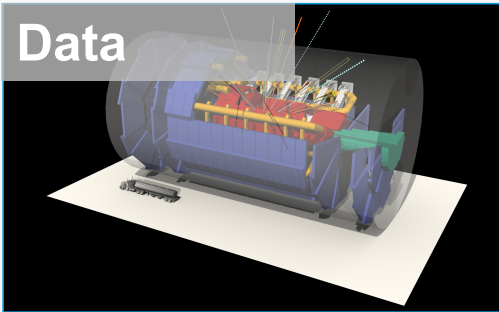
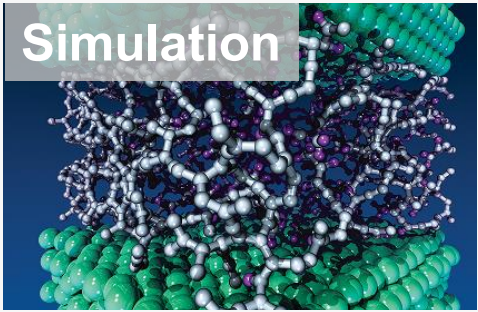
- The ALCF has three 10,000-slot libraries using LTO 6 tape technology. The LTO tape drives have built-in hardware compression for an effective capacity of 36-60 PB.

# Aurora : Nations First Exascale Supercomputer

Intel supercomputer to be delivered in 2021  
**Over 1000 PF**



Supporting the future of science



# How Do Researchers Gain Access to ALCF?

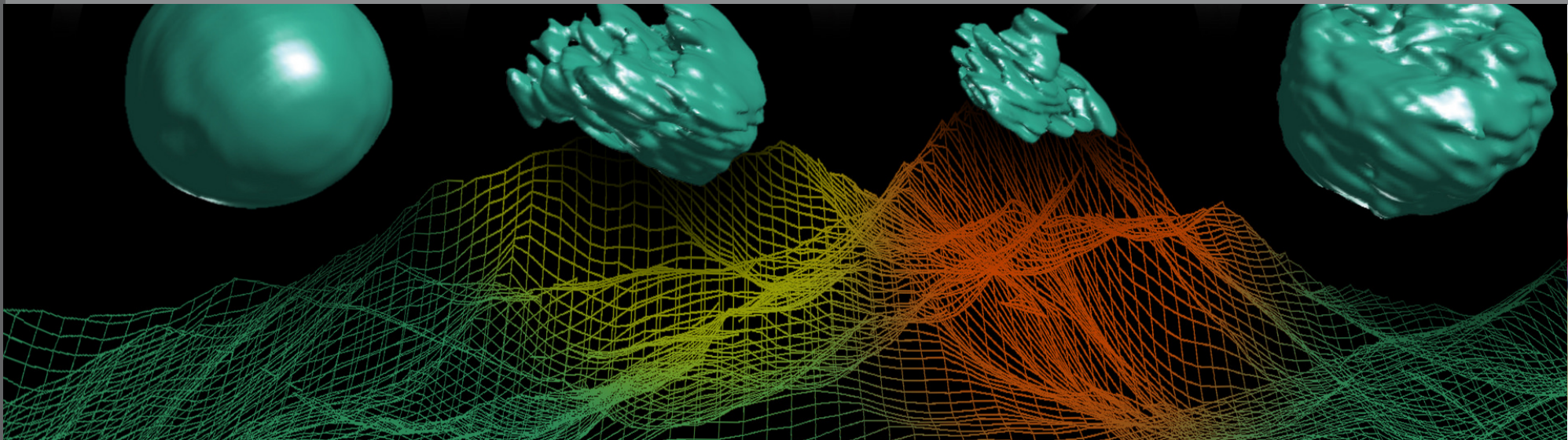
**We offer different pipelines based on your computational readiness. Apply to the allocation program that fits your needs.**

- Getting Started (DD)**
- Major Awards (INCITE, ALCC)**
- Targeted Projects (ADSP, ESP)**

# Getting Started (DD)

Our Director's Discretionary (DD) allocation program provides researchers with small awards of computing time to "get started" on our computing resources while pursuing real scientific goals.

The DD allocation program allows users to prep their code so that it can take advantage of our massively parallel systems.



# DD

## Director's Discretionary

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**Purpose:** A “first step” for projects working toward a major allocation

**Eligibility:** Available to all researchers in academia, industry, and other research institutions

**Review Process:** Projects must demonstrate a need for high-performance computing resources; reviewed by ALCF

**Award Size:** Low tens of thousands to the low millions of compute hours

**Award Duration:** 3-6 months, renewable

**Total percent of ALCF resources allocated:** 20%

### **Award Cycle**

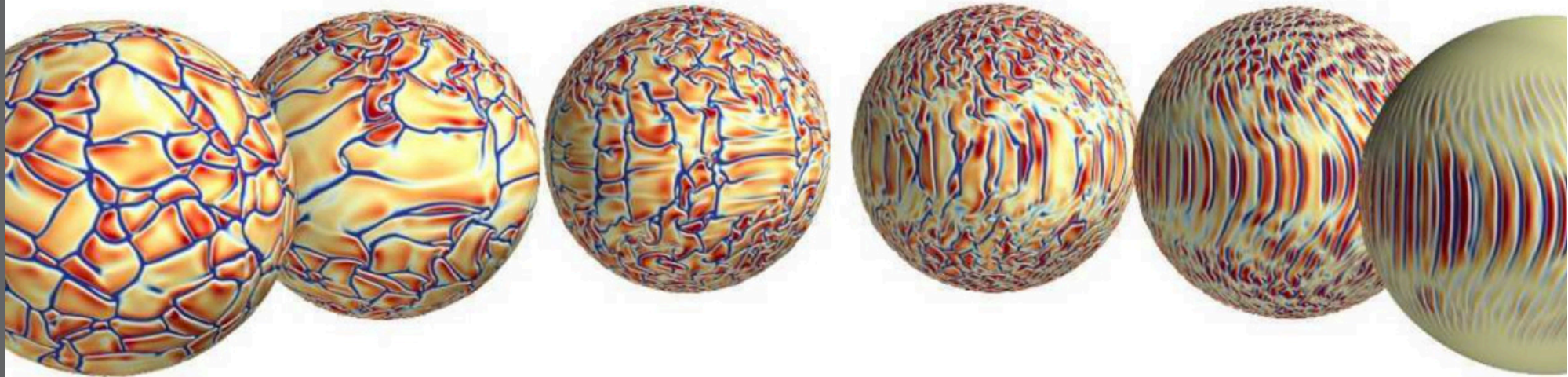
Ongoing (available year round)



## Major Awards (INCITE, ALCC)

Our major allocations provides users with computationally intensive, large-scale research projects time on our machines.

The programs conduct a two-part review of all proposals: a peer review by a panel of experts and a computational readiness review.



# INCITE

## Innovative & Novel Computational Impact on Theory and Experiment

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The DOE's INCITE program provides allocations to computationally intensive, large-scale research projects that aim to address "grand challenges" in science and engineering.

**Eligibility:** Available to researchers in academia, industry, and other research institutions

**Review process:** INCITE program conducts a two-part review of all proposals including a peer review by an international panel of experts, and a computational-readiness review

**Award size:** Low to high millions of core-hours

**Award duration:** 1-3 years, renewable

**Total percent of ALCF resources allocated:** 60%

### **Award Cycle**

January 1 to December 31

# What is INCITE?



## Innovative and Novel Computational Impact on Theory and Experiment

INCITE promotes transformational advances in science and technology through large allocations of computer time, supporting resources, and data storage at the Argonne and Oak Ridge Leadership Computing Facilities (LCFs) for computationally intensive, large-scale research projects.



# INCITE criteria

Access on a competitive, merit-reviewed basis\*

1	<b>Merit criterion</b>
	Research campaign with the potential for significant domain and/or community impact
2	<b>Computational leadership criterion</b>
	Computationally demanding runs that cannot be done anywhere else: capability, architectural needs
3	<b>Eligibility criterion</b>
	<ul style="list-style-type: none"><li>• Grant allocations regardless of funding source*</li><li>• Non-US-based researchers are welcome to apply</li></ul>

\*DOE High-End Computing Revitalization Act of 2004: Public Law 108-423

# Twofold review process

	New proposal assessment	Renewal assessment
1	<b>Peer review: INCITE panels</b> <ul style="list-style-type: none"> <li>• Scientific and/or technical merit</li> <li>• Appropriateness of proposal method, milestones given</li> <li>• Team qualifications</li> <li>• Reasonableness of requested resources</li> </ul>	<ul style="list-style-type: none"> <li>• Change in scope</li> <li>• Met milestones</li> <li>• On track to meet future milestones</li> <li>• Scientific and/or technical merit</li> </ul>
2	<b>Computational readiness review: LCF centers</b> <ul style="list-style-type: none"> <li>• Technical readiness</li> <li>• Appropriateness for requested resources</li> </ul>	<ul style="list-style-type: none"> <li>• Met technical/computational milestones</li> <li>• On track to meet future milestones</li> </ul>
	<b>Award Decisions</b> <ul style="list-style-type: none"> <li>• INCITE Awards Committee comprised of LCF directors, INCITE program manager, LCF directors of science, sr. management</li> </ul>	

# 2017 INCITE award statistics

- Request for Information helped attract new projects
- Call closed June 24<sup>th</sup>, 2016
- Total requests of more than **13 billion core-hours**
- Awards of 5.8 billion core-hours for CY 2017
- **55 projects awarded of which 17 are renewals**

## Acceptance rates

*45% of nonrenewal submittals and 85% of renewals*

## Contact information

Judith C. Hill, INCITE Manager  
[hilljc@DOEleadershipcomputing.org](mailto:hilljc@DOEleadershipcomputing.org)

## 2017 award statistics, by system

	Titan	Mira
Number of projects*	31	30
Average Project	72.6M	117.7M
Median Project	75M	100M
Total Awards (core-hrs in CY2016)	2.25B	3.53B

\* Total of 55 INCITE projects (many of the projects received time on both Mira and Titan)

## New proposals,\* new PI's

\*excluding renewal submittals

47% of the PI's had never before led an INCITE proposal

–85 new proposals, 40 led by new PI's

- 34% of non-renewal projects awarded time led by new PI's
  - 38 new projects awarded, 13 led by new PI's

INCITE actively engages with new research teams through outreach such as workshops, email distributions, and individual networking.



# ALCC

## ASCR Leadership Computing Challenge

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The DOE's ALCC program allocates resources to projects directly related to the DOE's energy mission, as well as national emergencies, and for broadening the community of researchers capable of using leadership computing resources.

**Eligibility:** Available to researchers in academia, industry, and other research institutions

**Review process:** DOE peer reviews all proposals for scientific/technical merit; appropriateness of approach; and adequacy of personnel and proposed resources

**Award size:** Low to high millions of core-hours

**Award duration:** 1 year

**Total percent of ALCF resources allocated:** 20%

### **Award Cycle**

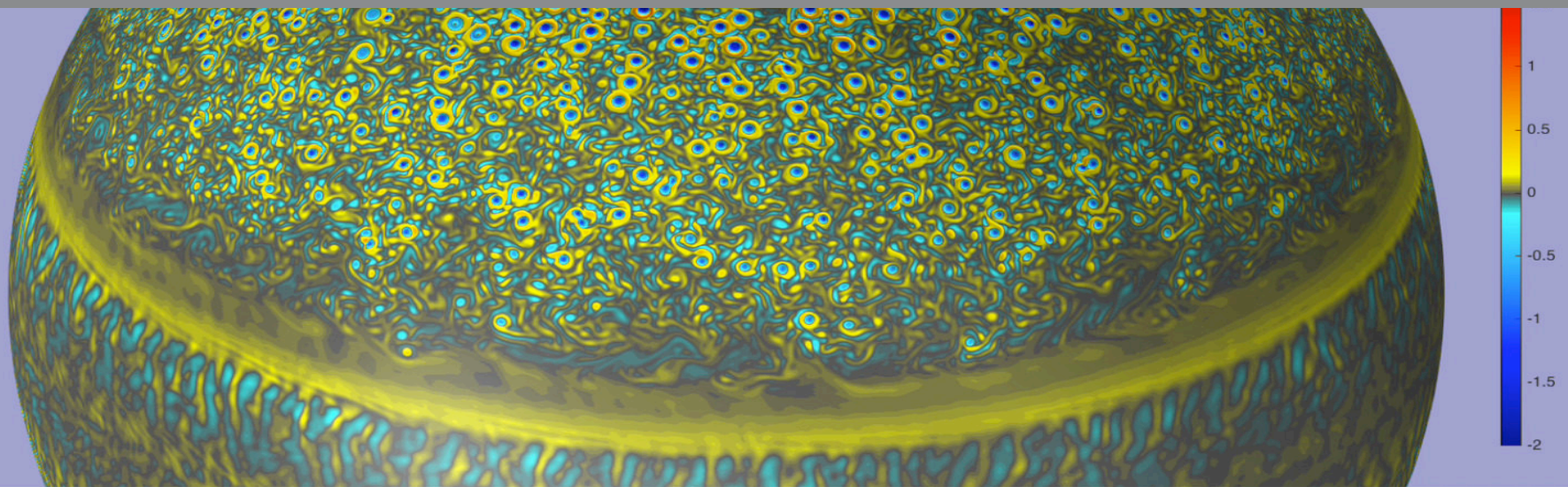
July 1 to June 30

LCF Allocation Programs	INCITE 60%	ALCC 20%	Director's Discretionary 20%
<b>Mission</b>	High-risk, high-payoff science that requires LCF-scale resources*	High-risk, high-payoff science aligned with DOE mission	Strategic LCF goals ECP
<b>Call</b>	1x/year – (Closes June) <i>2018 Call Open</i>	1x/year – Closes February	Rolling
<b>Duration</b>	1-3 years, yearly renewal	1 year	3m,6m,1 year
<b>Typical Size</b>	20-30 projects    1-3M node-hours	10-15 projects    0.5-2M node-hours	~100 of projects    <0.5M node-hours
<b>Total Hours</b>	~220M Mira, ~17.8M Theta	~6M node-hours Theta	~6M node-hours Theta
<b>Review Process</b>	Scientific Peer-Review    Computational Readiness	Scientific Peer-Review    Computational Readiness	Strategic impact and feasibility
<b>Managed By</b>	INCITE management committee (ALCF & OLCF)	DOE Office of Science	LCF management
<b>Readiness</b>	<b>High</b>	<b>Medium to High</b>	<b>Low to High</b>
<b>Availability</b>	Open to all scientific researchers and organizations <b>Capability &gt; 131,072 cores (16.7% of Mira)</b>		

# Targeted Projects (ADSP, ESP)

Our ADSP program is intended for projects hoping to gain insight into very large datasets produced by experimental, simulation, or observational methods.

Our ESP program is intended to help ready our next-generation supercomputers for production.



# ADSP

## ALCF Data Science Program

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Targeted at big data science problems, ADSP aims to explore and improve a variety of computational methods that will help enable data-driven discoveries across all scientific disciplines.

**Eligibility:** Available to researchers in academia, industry, and other research institutions

**Review process:** Applications undergo a review process to evaluate potential impact, data scale readiness, diversity of science domains and algorithms, and other criteria

**Award size:** Low to high millions of core-hours

**Award duration:** 2 years

### **Award Cycle**

October 1 to September 30

# ESP

## Early Science Program

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As part of the process of bringing a new supercomputer into production, the ALCF hosts the Early Science Program (ESP) to ensure its next-generation systems are ready to hit the ground running.

The intent of the ESP is to use the critical pre-production time period to prepare key applications for the architecture and scale of a new supercomputer, and to solidify libraries and infrastructure to pave the way for other production applications to run on the system.

In addition to fostering application readiness, the ESP allows researchers to pursue innovative computational science projects not possible on today's leadership-class supercomputers.

### **Award Cycle**

Determined by production timeline



**Thank You!**

**Learn more at: [alcf.anl.gov](http://alcf.anl.gov)**