

# *FastForward*

Presented to:

## ADVANCED SCIENTIFIC COMPUTING ADVISORY COMMITTEE

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# FastForward



FastForward is a story about two DOE offices investing in the US HPC computing industry to benefit DOE missions, primarily, and secondarily to benefit the nation's economic competitiveness

# FastForward in a nutshell

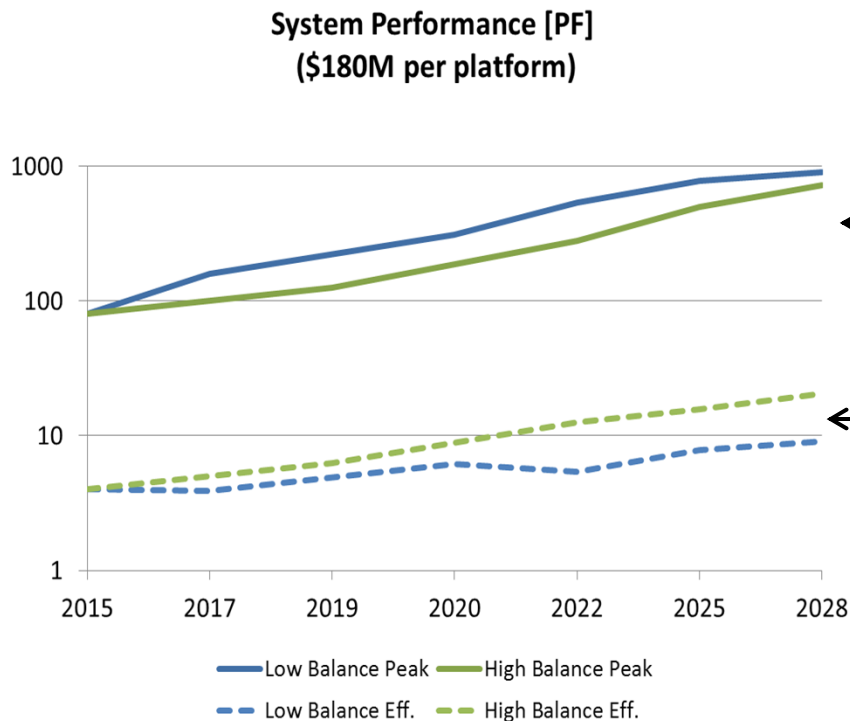
<b>Who</b>	2 DOE Orgs (Science/NNSA) 7 National Labs 5 (now 4) US companies
<b>What</b>	Fund \$62.5M of R&D for processors, memory, and storage technologies for a broad market
<b>When</b>	February 2012 to June 30, 2014
<b>Why</b>	Influence critical HPC technologies
<b>Results</b>	Contracts were awarded by June 29, 2012
<b>Next step</b>	Set up DOE/FF awardee 2-year collaborations

**Why?**

# How will we fare if we do not invest in technology for the future? Poorly.....

We may have to buy 9x to 10x computing HW to get 2x to 3x performance

- Many DOE missions demand higher fidelity multi-physics simulations and more capable HPC systems
- However ..... trends in computing HW lead to degraded performance and far higher energy costs

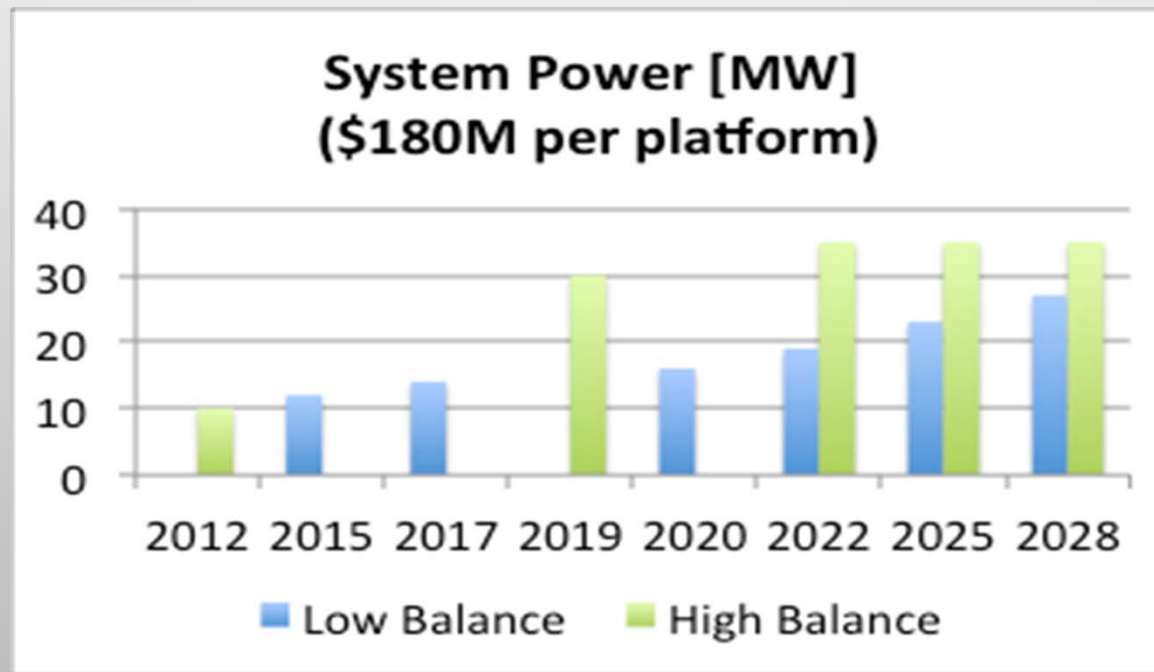


Peak performance = what we buy  
9x to 10x more hardware

Effective performance = what we get is  
2x to 3x app performance

Ratio of memory bandwidth & capacity to computing is shrinking

# Operating costs are expected to increase by 2x to 3x due to system power



An \$150M electric bill for a system that costs \$180M!

**What?**

# FastForward is an offensive maneuver to tackle the problem early

- **High-value R&D promising to:**
  - increase performance of DOE simulations
  - decrease energy usage
  - benefit the broad market
  - be available in large-scale DOE systems in 5 to 10 years

## FastForward Awardees

Vendor	Value	Scope
AMD Advanced Research LLC	\$12,600,000	Processor/Memory R&D
IBM Corporation	\$10,476,714	Memory R&D
Intel Federal LLC	\$18,963,437	Processor/Memory R&D
Nvidia Corp.	\$12,398,893	Processor R&D
Whamcloud Inc. (Now Intel Federal LLC)	\$7,996,053	Storage and I/O R&D
Total Subcontract Value	\$62,435,097	

# What makes us think this approach will work?

Why would companies care about serving to the HPC market ?

The HPC market is a leading market indicator

Why would companies bother with small awards (<\$20M) ?

R&D funding is an extremely important and scarce resource

Why would we expect the technology to be made available to buy?

This is a problem that needs to be worked

We've learned from past DOE efforts

# This approach has been demonstrated to be successful

<b>Systems Technologies</b>  Cray, IBM, Sun, and Corning	<b>Commodity Technologies</b>  Interconnects File systems Scalable rendering	<b>Pathforward</b> 1998-2005 NNSA/ASC
<b>BlueGene (IBM)</b>  Decade long collaboration	<b>RedStorm (Cray) and RoadRunner (IBM)</b>  Multi-year collaborations	<b>Advanced Technology Systems</b> NNSA/ASC

## Lesson Learned

*Investments needed in R&D for tech. & systems*

*investments in commodity tech. pay back over a long time*

*Long term collaborations have greatest potential for impact*

# Next steps

Investing in technologies is not enough - considering funding system R&D

Considering options to increase the likelihood the R&D will be available in systems that we can buy in 5 to 10 years

Curiosity's Heat Shield Separating



Black Hole Caught in a Stellar Homicide



# A great collaboration can do amazing things

- We had a great team!
- FastForward R&D has great potential – high quality proposals
- Now forming the co-design teams

## FastForward Evaluation and Selection Team

DOE	Bill Harrod	Thuc Hoang		
ANL	Ray Bair	Andrew Chien	Rob Ross	Ray Bair
LANL	Scott Pakin	Mike Lang	Aaron Torres	Gary Grider
LBNL	Nick Wright	Chuck McParland	Jason Hick	John Shalf
LLNL	Matt Leininger	Allan Snavely	Robin Goldstone	Terri Quinn
LLNL Procurement	Gary Ward	Brandt Esser	Julie Moffet	Len Haynes
ORNL	Barney Maccabe	Al Geist	Barney Maccabe	
PNNL	Darren Kerbyson	Andres Marquez	Evan Felix	Adolfy Hoisie
SNL	Doug Doerfler	Dave Resnick	Lee Ward	Sudip Dosanjh

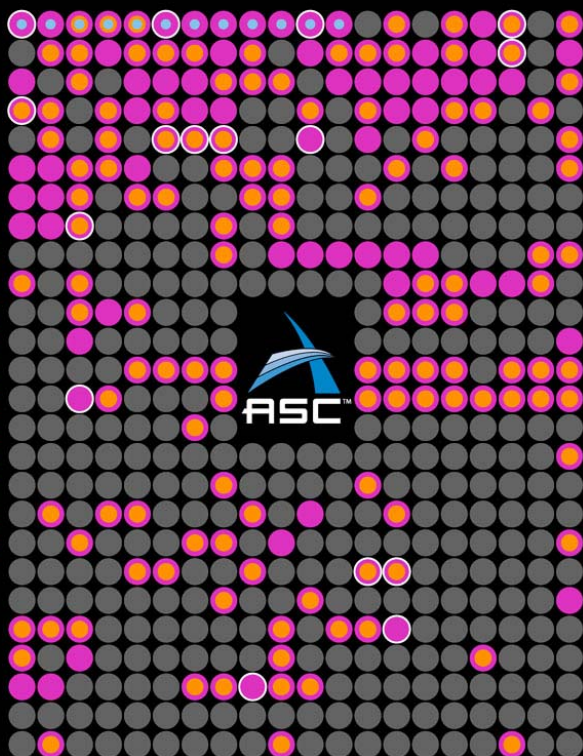


1ST 12 OF THE WORLD'S TOP 500

supercomputers—directly benefiting from ASC-funded architectures

38% OF THE WORLD'S TOP 500

supercomputers have benefited heavily from ASC investments



25% OF THE WORLD'S TOP 500

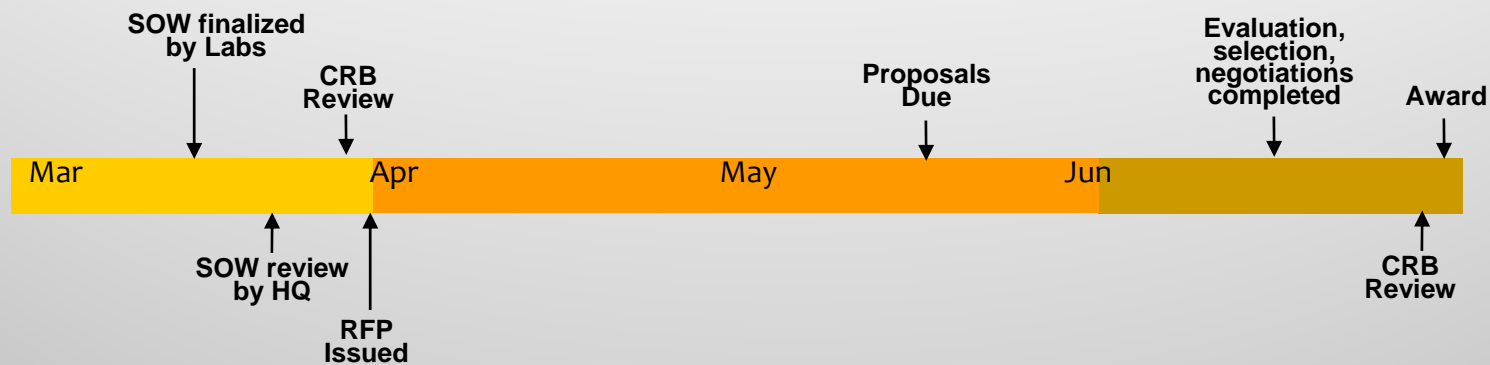
architectures are supported heavily by the ASC Inflight and PathForward project

ADVANCED  
SIMULATION &  
COMPUTING

INFLUENCING THE TECHNOLOGY OF CHOICE  
IN HIGH-PERFORMANCE COMPUTING

LNL-POST-000000

# Timeline



## Dates:

SOW finalized by Labs – 3/16

SOW review by HQ – 3/23

CRB – 3/28

RFP Issued – 3/30

Proposals Due – 5/15

Evaluation, selection, and negotiations completed – 6/15

CRB – 6/27

Award – 6/29