



# North Carolina State University Visit to INL

November 2019

*Changing the World's Energy Future*

Eric T Whiting



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**November 2019**

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Idaho Falls, Idaho 83415**

**<http://www.inl.gov>**

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# North Carolina State University

*Visit to INL*

*6-7 November 2019*

**Eric Whiting**

*Division Director*

*Advanced Scientific Computing*



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



# DOE Ecosystem – HPC systems



ORNL	#1
LLNL	#2
LANL/SNL	#7
LBNL/NERSC	#14
ANL	#24

\$100M-1B  
Acquisition Cost



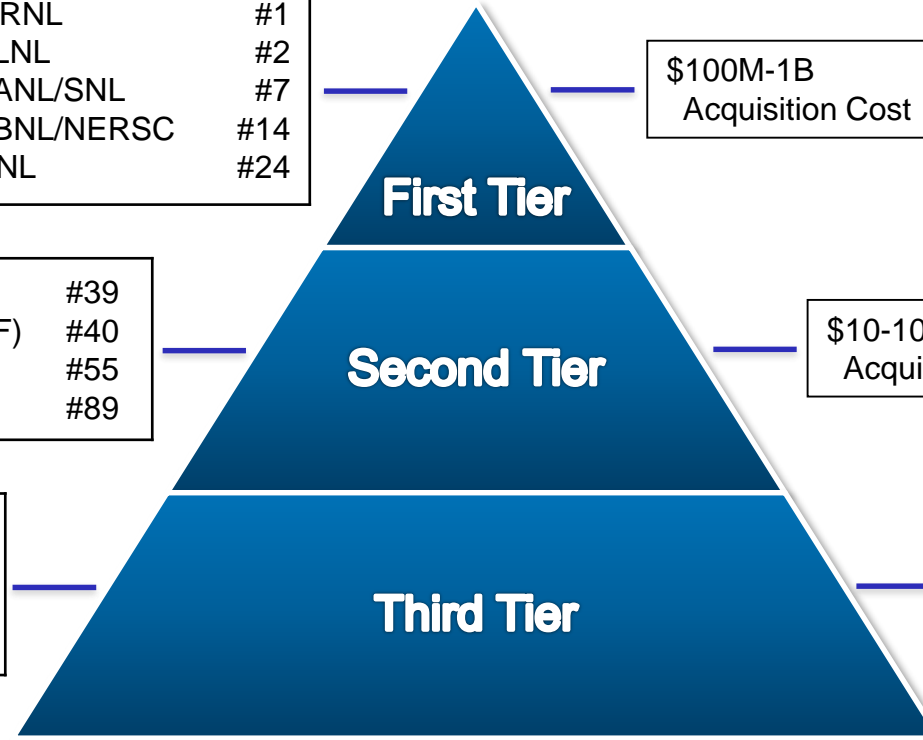
NREL	#39
NCAR (NSF)	#40
NETL	#55
PNNL	#89

\$10-100M  
Acquisition Cost



INL Falcon	#456
INL Lemhi	#500+
Bettis	#500+
Knolls	#500+

\$1-10M  
Acquisition Cost

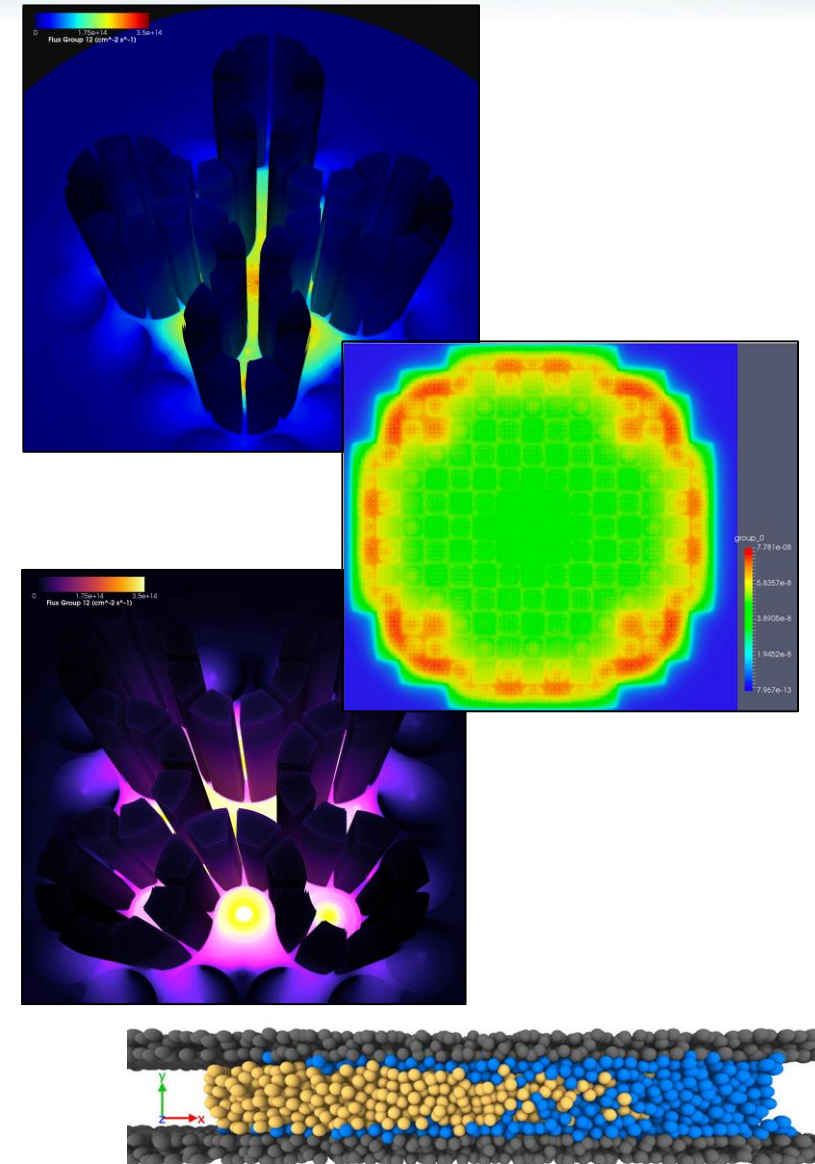
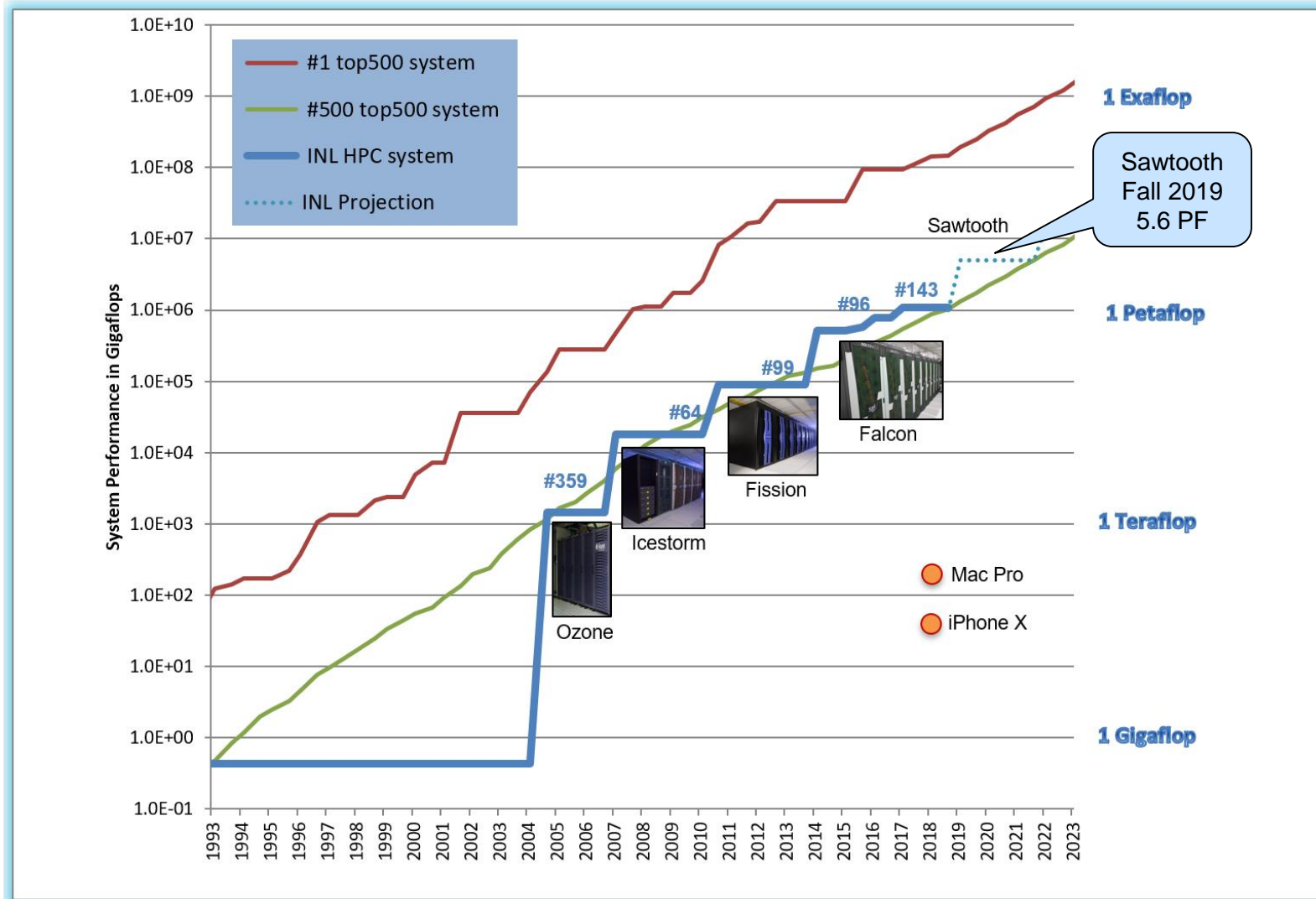


June 2019 Top500 Rankings

INL's next system 'Sawtooth' will move into the second tier (\$10M+) in order to meet program/mission needs



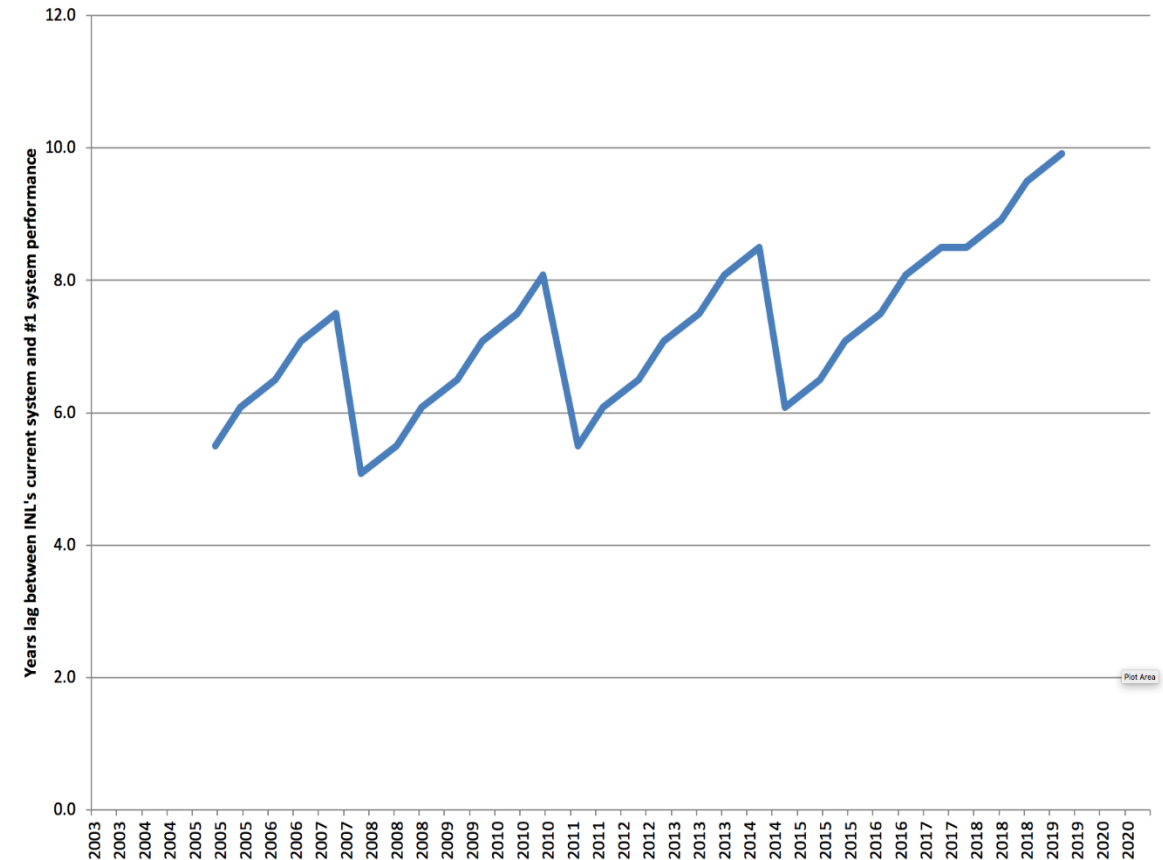
# INL HPC History



## Time Lag between INL HPC System and #1 TOP500 System

INL System	Year	Performance	Prior #1 System with Similar Performance
Ozone 8 racks, \$2.1M	June 2005	1.44 TF	June 1999 ASCI RED: Sandia (\$46M), 104 racks, 1MW, 2.12 TF
Icestorm 4 racks, \$2.4M	Nov 2007	17.78 TF	June 2002 Earth Simulator (\$556M), 320 racks, 6.4MW, 35.8TF
Fission 14 racks, \$3.5M	June 2011	91 TF	June 2005 BlueGene/L (~\$200M) LLNL, 104 racks, 136 TF
Falcon 14 racks \$9.9M	Nov 2014	511 TF (2014) 1,088 TF (2017 upgrade)	June 2008 Roadrunner LANL (\$100M), 296 racks 2.35MW, 1,026TF
Sawtooth (projection) ~40 racks ~\$20M	Nov 2019	5-10 PF (projection)	June 2011 K Computer (\$1.25B), RIKEN AICS, Japan, 671 racks, 10.0MW, 8,162TF

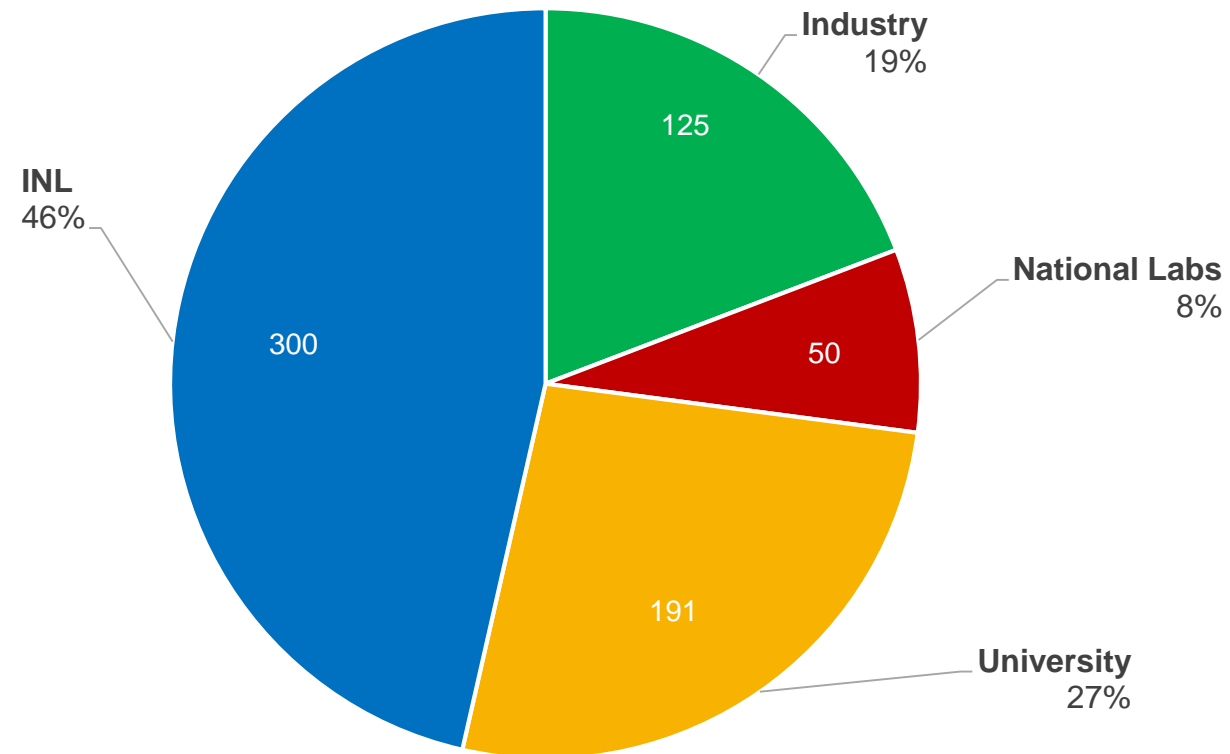
INL HPC Time lag from #1 system



By taking advantage of technology advances, INL is able to deploy systems that have equivalent #1 performance with a 5-8 year time delay, enabling a huge savings in cost, power, and space

# *HPC User Statistics*

**HPC Users**  
as of 8/1/2019



■ Industry ■ National Labs ■ University ■ INL



# Sawtooth Delivery

- **The new Sawtooth Supercomputer is scheduled to be delivered to the Collaborative Computing Center (C3) on 02 December 2019**
- **Sawtooth Overview:**
  - Four-year lease-to-own; approximately \$20M total cost
  - Approximately 100,000 compute cores with LINPACK performance of ~6 Petaflops/s (PF)
  - System will include GPU capabilities (0.56 PF)
  - Requirement for room-neutral water cooling
  - Installation in the new Collaborative Computing Center (C3)
- **Schedule:**
  - Dec 2019-Feb 2020: Installation/acceptance window
  - March 2020: System operational



## ***Engagement Opportunities – North Carolina State University and INL***

- Modeling and Simulation
  - MOOSE framework
  - M&S validation
- Computational capability
  - INL HPC accounts are available for university use with collaborative connections
- Visualization
- Data science
  - AI/ML – Seeking expertise in the context of applied sciences
  - Sensors and analytics

