330+
teraflops
peak computing
performance

2.4
million
annual computer runs

87+
million
computing hours

370+
partner
institutions

1,173
clients
of faculty, staff and
student assistants

Ohio Supercomputer Center
An **OH·TECH** Consortium Member

www.osc.edu

OSC propels innovation, discovery and economic competitiveness

The Ohio Supercomputer Center (OSC), a member of the Ohio Department of Higher Education's Ohio Technology Consortium, provides supercomputing, cyberinfrastructure, research and educational resources to a state and national community, including academic research, industry and government.

- **Building Ohio's future.**
  Addressing the need for high-performance computing resources and expertise, the center strives to be a strategic force in propelling Ohio's economy and positioning the state as a competitive national forerunner in science and technology.

- **We empower researchers.**
  Recognizing HPC resources as an indispensable springboard for innovative breakthroughs, OSC empowers academic and industry researchers to achieve pioneering scientific discoveries in biosciences, advanced materials, energy and a host of emerging disciplines.

- **We partner with industry.**
  In addition to harnessing collaborative research opportunities across the nation and developing joint research proposals, OSC facilitates industrial processes with modeling and simulation tools for virtual product development, bringing leading-edge resources and advanced expertise to large and small enterprises.

- **We lead Ohio's knowledge economy.**
  OSC directs strategic research activities of vital interest to the State of Ohio, the nation and the world community. Our in-house research staff specialize in supercomputing, computational science, data management, biomedical applications and a host of emerging disciplines.

"TotalSim wouldn't exist without computational science, and without our access to OSC we could not price ourselves the way we do to our clients, and we could not be the business we are right now."
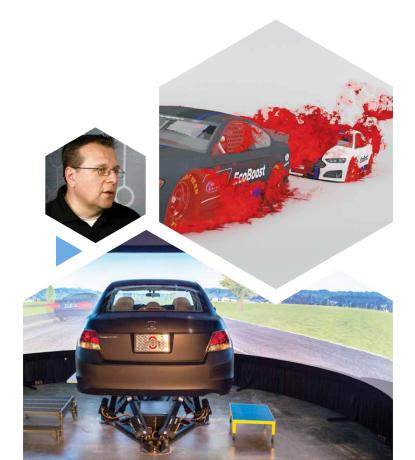
— *Ray Leto, President TotalSim USA*

(Right) The $1.3 million Ohio State University Driving Simulation Laboratory — a partnership between OSC, Honda R&D Americas, Inc., and Ohio State — will help researchers learn more about driver distraction and how to prevent it.

Providing tools for innovation

At the heart of the Ohio Supercomputer Center are our supercomputers, mass storage systems and software applications. *(see back page for system specs)*

- HP Intel® Xeon Phi® 'Ruby' Cluster supercomputer, with a total peak performance of 144 teraflops of computing power.

- HP Intel® Xeon® 'Oakley' Cluster supercomputer, with a total peak performance of 154 teraflops.

- IBM 1350 AMD® Opteron® 'Glenn' Cluster, with a total peak performance of 60 teraflops.

- Csuri Advanced GPU Environment, which leverages the unique computing properties of the Graphics Processing Unit to provide a robust visualization environment.

- Mass Storage Environment, containing more than 2 petabytes of disk storage for a single, centralized point of control.

- More than 30 software applications maintained by OSC and access to more than 70 different software packages. These include the leading software for computational fluid dynamics, structural mechanics, numeric computation and visualization. OSC also develops advanced software codes and novel computational methods with its research partners.

OSC: Key initiatives

Ohio's investment in OSC is energizing economic and workforce education efforts throughout the state.

Industrial ngagement

OSC helps industrial partners large and small access high performance technologies.

- Our industrial engagement effort, AweSim, creates manufacturing apps that provide easy access to simulation-driven design for small and mid-sized businesses. This public/private partnership builds on the success of Blue Collar Computing, our first industry program, and our leadership with the National Digital Engineering and Manufacturing Consortium (NDMEC), a recently concluded public/private partnership that provided Midwestern manufacturers with access to advanced modeling and simulation resources.

- Additionally, we actively support firms, such as Intel, P&G, TotalSim, AltaSim, Nimbis Services and Kinetic Vision, with their modeling and simulation needs.

- We create tools for staff with minimal programming knowledge to run specific tests. For example, the Weld Predictor, created with the Edison Welding Institute, provides virtual arc weld modeling and simulation.

- The Interface Lab provides expertise, advanced equipment and intuitive interfaces for integrating multi-sensory data into a single, coherent simulation.
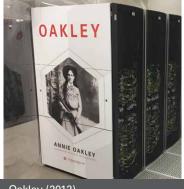
Workforce Education

OSC has earned an international reputation for exceptional training and education programs.

- Our instructors provide training to faculty and student researchers through scientific computing workshops, one-on-one classes and web-based portal training. We support numerous national partnerships and collaborative programs, such as supercomputer training sponsored by the National Science Foundation, Department of Defense and Great Lakes Consortium for Petascale Computation.

- We promote student interest in the Science, Technology, Engineering and Mathematics (STEM) fields through our Summer Institute for Ohio's brightest freshmen, sophomores and juniors, as well as Young Women's Summer Institute for middle-school girls. OSC also focuses on updating the skills of K–12 teachers, so they can apply technology, modeling and simulation, and project-based learning in their classrooms.

- Our Ralph Regula School of Computational Science coordinates computational science education—the use of computer modeling and simulation to solve complex business, technical and academic research problems. We offer programs for a baccalaureate minor, an associate degree concentration and workforce certification.

"It is vital that small- and medium-sized businesses have access to the powerful computational and storage resources that OSC provides. That computing power fuels the more precise and accurate models necessary to mimic the actual results of physical tests commonly used to innovate."

— *Tom Lange, Director Modeling & Simulation Corporate R&D Procter & Gamble Company*

(Right) Working in small peer teams, OSC Summer Institute students use supercomputers for practical applications such as solving complex science and engineering problems, conducting network forensics to catch hackers, studying the spread of the bird flu and designing computer games.

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High performance computing systems

	Ruby (2014)	Oakley (2012)	Glenn (Phase III, 2009)
Theoretical Peak Performance	96 TF +28.6 TF (GPU) +20 TF (Xeon Phi) ~144 TF	88.6 TF +65.5 TF (GPU) ~154 TF	34 TF +6 TF (GPU) ~40 TF
# of Nodes / Sockets / Cores	240 / 480 / 4800	692 / 1384 / 8304	426 / 856 / 3408
Cores per Node	20 cores/node	12 cores/node	8 cores/node
Local Disks Space per Node	~800 GB in /tmp	~800 GB in /tmp	~400 GB in /tmp
Compute CPU Specs	Intel Xeon E5-2670 v2 CPUs • 2.5 GHz • 10 cores per processor	Intel Xeon x5650 CPUs • 2.67 GHz • 6 cores per processor	AMD Opteron 2380 CPUs • 2.5 GHz • 4 cores per processor
Compute Server Specs	200 HP SL230 40 HP SL250 (for NVIDIA GPU/Intel Xeon Phi)	HP SL390 G7	IBM x3455
# / Kind of GPU/Accelerators	20 NVIDIA Tesla K40 • 1.43 TF Peak double-prison • 2880 CUDA cores • 12 GB memory 20 Xeon Phi 5110p • 1.011 TF Peak • 60 cores • 1.053 GHz • 8 GB memory	128 NVIDIA M2070 • 515 GF Peak Double Precision • 6 GB memory • 448 CUDA cores	18 NVIDIA Quadro Plex 2200 S4 • Each with Quadro FX 5800 GPUs • 240 CUDA Cores/GPU • 4 GB memory/GPU
# of GPU / Accelerator Nodes	40 total (20 of each type)	64 Nodes (2 GPUs/node)	36 Nodes (2 GPUs/node)
Total Memory	~16 TB	~33 TB	~10 TB
Memory per Node / per Core	64 GB / 3.2 GB	48 GB / 4 GB	24 GB / 3 GB
Interconnect	FDR/EN IB (56 Gbps)	QDR (40 Gbps)	DDR IB (20 Gbs)

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