

Power PROCESSOR

GECO brings
Supercomputer
to Mines



Through the leadership of Physics Professor Mark Lusk (left), Mines has designed and acquired a high performance computing (HPC) cluster that aims to be a national hub for computational inquiries aimed at the discovery of new ways to meet the world’s energy demands. Mines researchers have named the supercomputer “Ra,” after the ancient Egyptian sun god. “I think the name is appropriate because of the important role the sun plays in nearly every form of energy that we gather,” says Lusk.

The cluster is currently being assembled in the Center for Technology and Learning Media building on the Mines campus. Provided by Dell Inc., the cluster of 12 cabinets and 2,144 computer cores is designed to perform calculations at a rate unprecedented in the history of the college. Its estimated peak performance will be approximately 20 teraflops—fast enough to do more than 3,000 calculations every second for each and every one of the 6.6 billion people on the planet. This places the machine well within the top-100 fastest computers in the world.

The new facility, administered by the Golden Energy Computing Organization (GECO), is dedicated to advancing energy-related science. “Our aim is to make a positive, international impact on the discovery and development of new sources of energy,” says Lusk.

In order to achieve a balanced energy portfolio, GECO has four priority areas: disruptive scientific discoveries associated with renewable resources; improvements to existing methods of finding, characterizing and tapping existing resources; generation of quantitative assessments of the impact of energy policy on the environment; and the design of new energy-related materials.

Each of the priority areas is itself divided into two challenges. Photo-production of hydrogen and biomass energy conversion fall under the renewable energy priority. Hydrocarbon deposit characterization and hydrate nucleation and growth will be explored to help locate and develop existing resources. Research will be performed on carbon dioxide emissions and carbon sequestration to advance environmental stewardship. And finally, new energy-related materials including polymer batteries and ultracold designer materials for solid state systems will be investigated.

GECO is a collaborative project between researchers at Mines, the National Renewable Energy Laboratory (NREL) and the National Center for Atmospheric Research. “The investigations cross several disciplines and target technological payoffs with time scales from several months to several decades,” Lusk notes.

The GECO initiative will have four payoffs for the Mines community: raising the School’s international profile as a premier energy-focused research institution; facilitating the acquisition of large-scale funding; making Mines a leader in the effort to develop a Front Range HPC grid for both academic and industrial sectors; and providing the infrastructure and motivation for the creation of a significant HPC educational component.

The educational programs to be established with GECO include a five-year B.S./M.S. degree, wherein students complete an undergraduate degree in either Engineering Physics or Petroleum

Engineering and an M.S. degree in Mathematical & Computer Sciences focused on scientific computing. The Engineering Physics program is already in place.

Additionally, Mines will establish a new Ph.D. minor in HPC and will develop a focused HPC certificate program for members of the Front Range industrial community. Hands-on HPC systems administration training will be provided for both students and faculty members.

The organization has also established outreach programs for minority colleges and organizations. Salish Kootenai College, a four-year institution on the Flathead Indian Reservation in western Montana that offers a B.S. in information technology and computer engineering, will be the first to collaborate with Mines on educational programs in HPC and will benefit from hands-on learning opportunities.

A second outreach collaboration has been established between GECO and the Mines section of the Society of Women Engineers (SWE). A team of SWE members will be trained on the GECO cluster and will make presentations at local high schools to promote interest in careers in energy-related fields.

Funding to support the supercomputer has been provided by the Colorado School of Mines Foundation, NREL and the National Science Foundation.



Four Priority Areas, Eight Challenges

