Accelerating the Pulse of R&D for the “Heart of Industry”

ITT Industrial Process (IP) is a dynamic business expanding on a global scale. Headquartered in Seneca Falls, New York, IP offers a portfolio of world-leading brands in industrial pumps, valves and monitoring and control equipment, offshore water treatment systems, and plant optimization and efficiency systems, as well as aftermarket services and parts.

Goulds Pumps is among the most widely recognized and respected brands in the global pump industry, serving customers in the oil and gas, mining, power generation, chemical, pulp and paper, and general industrial markets.

Goulds Pumps has been manufacturing high quality pumps for industry for over 160 years, beginning with metal-banded wooden pumps in 1848, and the world’s first all-metal pump in 1849. It was acquired by ITT Corp. in 1997.

THE CHALLENGE

As the “Heart of Industry” since the Industrial Revolution, Goulds Pumps products remain essential components powering a range of industries. While existing designs keep the industry’s lifeblood flowing, new designs are needed to propel its future.

As Goulds Pumps’ customers advance into new materials, processes and markets, they will need more powerful, efficient, versatile,
resilient, and affordable pumps. With HPC\textsuperscript{NY}, Goulds Pumps invested in design research and development to realize now what for many will only be possible tomorrow.

The core of Goulds Pumps’ strength is its Industrial-age history coupled with Information-Age thinking. It has been using computer-aided design and computational fluid dynamics to create new pump designs and model their performance. However, the shift to massively parallel computer architectures in the middle of the last decade presented a dilemma to Goulds Pumps and other companies. The cutting-edge of fluid modeling was advancing at a remarkable pace, but the flow of those advances into off-the-shelf software, and thus into the company’s R&D process, slowed dramatically. It seemed the pulse of what was possible had quickened, but the pulse of what was practical had not.

NEW SOLUTIONS
Rensselaer Polytechnic Institute (RPI) was one of the first universities to recognize the extent to which the switch from faster processors to massively parallel computing would become a barrier to progress in computational modeling, and in the industrial application of those techniques.

With the foundation of the Center for Computational Innovations (CCI) in 2007 in partnership with IBM and New York State, Rensselaer backed its expertise in parallel computing with the resources necessary to aid companies such as Goulds Pumps. When hydraulic engineers at Goulds Pumps approached Rensselaer about accelerating their pump design process and increasing the accuracy of their simulations, RPI was able to respond with deep and broad expertise consulting, customized commercial software, and large-scale computational resources.

MODELING AND SIMULATION
Accurate predictions of how a pump will perform require a number of changes that necessitate increased computational power: finer details of fluid flow and turbulence must be resolved, particularly in areas such as the small gap between the rotating impeller and pump housing, and additional physics, such as those related to cavitation (bubble formation), must be modeled. Such changes can make the problem orders of magnitude larger, and completing a simulation quickly then requires software that can efficiently spread the computation over thousands of processors.

Bringing such complex techniques into routine use adds further challenges – preparing the model inputs and analyzing the results must be highly automated (or these steps will take longer than running the model!) and resources are needed to run not just one, but many models, to explore different design options.

RESULTS
With support through New York's High Performance Computing Consortium (HPC\textsuperscript{NY}) and CCI, Rensselaer computational scientists worked closely with Goulds Pumps' engineers to adopt more accurate methods and streamline its overall modeling process. Rensselaer introduced Goulds Pumps to Simmetrix (Clifton Park, NY), a leading provider of high-performance component software for simulation-based design. HPC\textsuperscript{NY} scientists customized Simmetrix’s software to help Goulds Pumps automate problem set-up across the entire ensemble of simulations to be executed.

This collaboration with RPI has turbocharged Goulds Pumps’ ability to bring innovation to the heart of industry. By leveraging high performance computing Goulds Pumps has gained a singular, strategic advantage, one that has already directly impacted their business, and one that will continue to reap benefits in terms of streamlined processes. Their new modeling capabilities helped bring the XHD Extra Heavy Duty Lined Slurry Pump to market, which won a 2012 Breakthrough Product award from Processing Magazine and took top honors at the Pump Industry Awards of the British Pump Manufacturer’s Association. With its new lease on future capabilities, Goulds Pump is investing in additional digital modeling as part of a $22M, 50+ job expansion of its production and R&D facilities now underway.

High performance computing is helping to quicken the pulse of innovation; yielding advances that will flow through Goulds Pumps’ products to the economy as a whole.

"Partnering with RPI and Simmetrix has been instrumental in advancing Goulds Pumps’ analysis abilities in the area of computational fluid dynamics. The largest impact is the reduction in the design cycle time, which allows optimization of the design of our product. As a result, ITT has this significant competitive edge in the pump industry." — Mark Hall, Senior Hydraulic Pump Engineer

**ABOUT HPC\textsuperscript{NY}**

Funded by ESD Division of Science, Technology & Innovation, HPC\textsuperscript{NY} is a partnership between NYSERNet, a private not-for-profit corporation created to foster science and education in New York, and three supercomputing centers: the Rensselaer Polytechnic Institute Center for Computational Innovations, Stony Brook University/Brookhaven National Laboratory’s New York Center for Computational Sciences, and the University at Buffalo’s Center for Computational Research.

HPC\textsuperscript{NY} provides businesses and research organizations with access to world-class advanced computing expertise through accelerating the engineering and development path of complex,
ground-breaking designs to reliable, accurate, innovative product and process performance that can provide a distinct competitive advantage.

ABOUT CCI

The Center for Computational Innovations (CCI) is one of the world's most powerful university-based supercomputer centers. Since opening in 2007, CCI has helped more than 850 researchers in academia and industry tackle scientific and engineering challenges across a wide spectrum of disciplines.

Key to this success has been the CCI’s ability to work with software from 3rd party vendors like ANSYS, and CD-adapco, as well as leverage research software tools and other “open source” software systems. These software systems are utilized by academic users and CCI partners Boeing, Corning, GNS, IBM, Kitware, P&G, and Simmetrix. The CCI provides over one petaflop of peak computational power from a massively parallel 81,920 core IBM Blue Gene Q supercomputer and an Intel Xeon cluster. Coupled to these systems is over one petabyte of high speed, low latency disk storage.

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