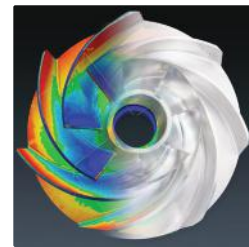
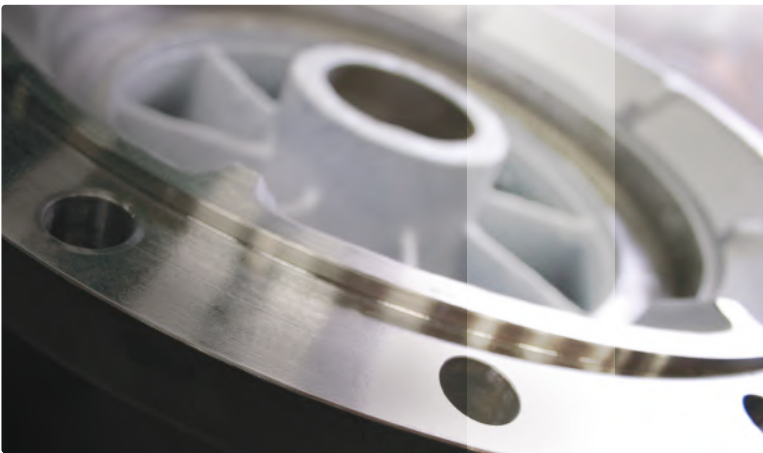
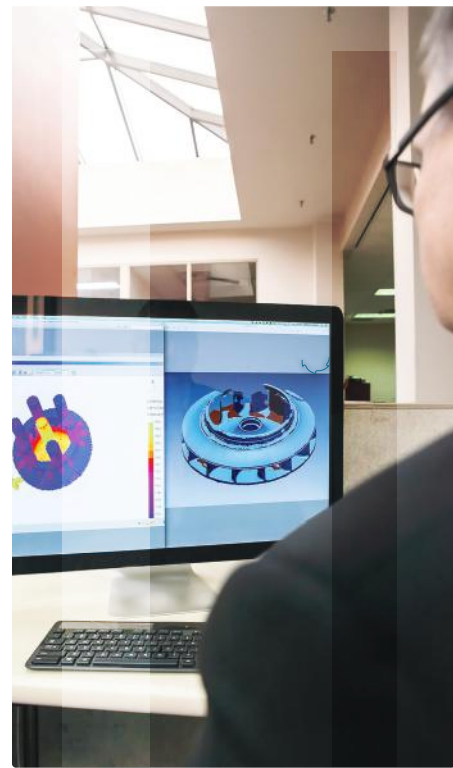




Engineered Parts Solutions





We Are Pump Experts

Engineering expertise is the foundation of our business. Our engineers and technical staff have extensive experience in the pump industry with a broad spectrum of pumping equipment. This diverse engineering experience combined with use of the latest manufacturing and design technologies along with our knowledge base of proven successes over more than 50 years of providing aftermarket services allows us to not only repair the pump but to improve it.

Our mission is to work hand in hand with our valued customers to optimize the performance and reliability of their pumping systems by evaluating and understanding root causes of pump degradation or failure and by providing unbiased engineering analysis, quality workmanship, and responsive field service for improved plant operation.



Worldwide Service Centers

24/7 Emergency Services

Engineered Pump Repairs

Certified Performance Testing

Wireless Condition Monitoring

Engineering Services

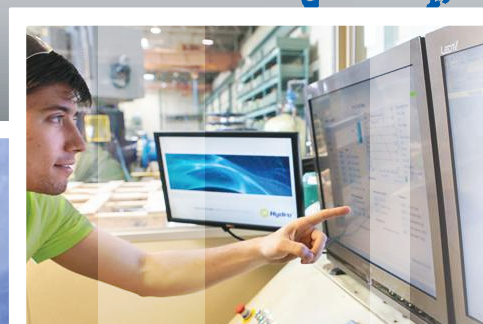
Critical Parts Solutions

Customer Training

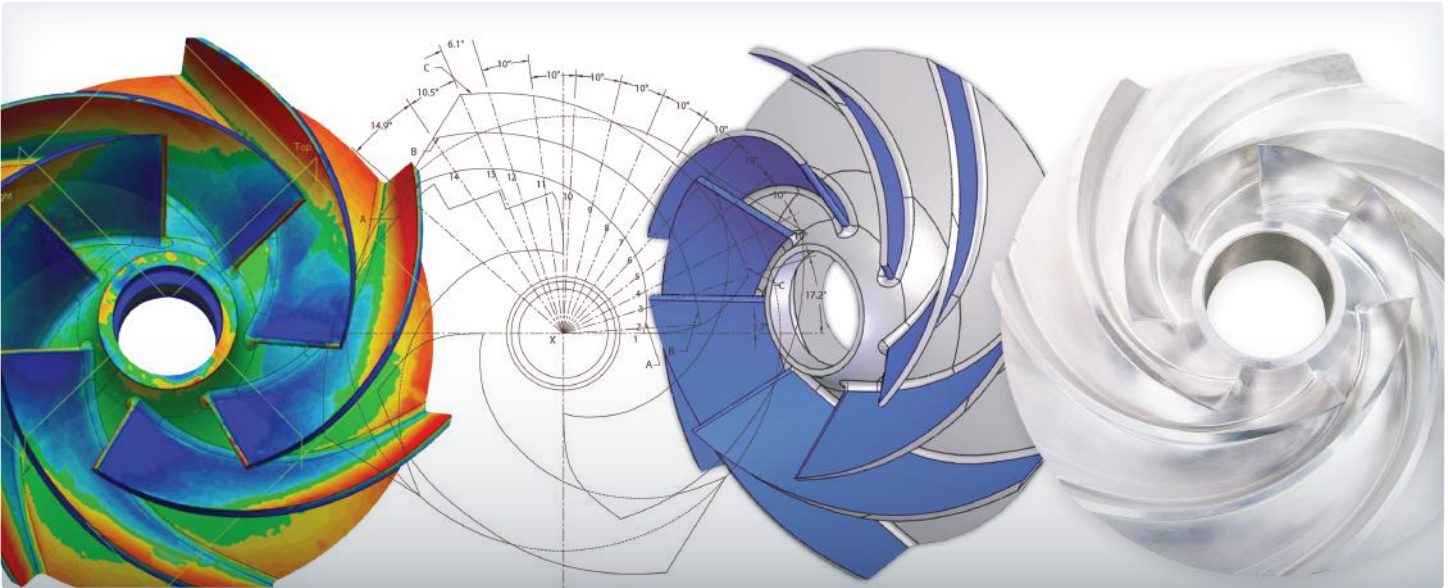
State-of-the-Art Technology

In-depth Knowledge of Major Brands

Field Service Support for Installation & Start-up



Hydro provides engineering expertise and essential support to pump users around the world for better performance and longer life.



Engineering Makes All The Difference

Engineering expertise is the foundation of our business.

Hydro's engineers and technical staff have extensive experience in the pump industry and with a broad spectrum of pumping equipment. By understanding the unique characteristics of the customer's application and applying their hydraulic, mechanical and materials knowledge, Hydro's engineers can make recommendations for restoring parts to achieve optimal pump performance and longer life.

An engineering review is a key element of our quality manufacturing process. Technical specifications are typically developed for parts via Hydro's proven reverse engineering practices.

Reverse engineering is quite different from "replicating". We are not interested in just replicating the existing component as it is, but also in evaluating the failure modes and defining the critical characteristics required to minimize the possibility of failure in the newly manufactured piece.

While accuracy, thoroughness and technology are important elements of reverse engineering, it is Hydro's pump-specific engineering knowledge, understanding and experience that distinguish and define our process.

Hydro's process for providing difficult-to-source cast parts, such as impellers, diffusers, discharge head casings, bowls and suction bells, may include:

- **Laser scanning and reverse engineering**
- **Solid modeling**
- **Hydraulic and metallurgical upgrades**
- **Solidification simulation**
- **Patternless casting / Precision sand mold printing**
- **Casting metals that you specify**
- **Testing to verify pump performance when required**

To achieve the best result for our customers, expert engineering is supported by the latest technology and proven process control procedures.

Manufacturing Excellence

Applying Technology to Enhance Parts Quality

Reverse Engineering

Hydro has the capability to collect component data using a portable Coordinate Measuring Machine (CMM) with 7-axis articulation and equipped with both contact and non-contact (laser) probes. A fully dimensioned solid 3D model is created using the data collected.

Engineering Review and Analysis

Hydro's engineers can utilize state-of-the-art CAD, computational fluid dynamics (CFD), and finite element analysis (FEA) software to evaluate the measured and required properties of the part to determine if there are up-upgrades that can be made to reduce wear and improve reliability. Once the critical design characteristics are verified, the 3D model is finalized.

Designing the Casting & Mold Package

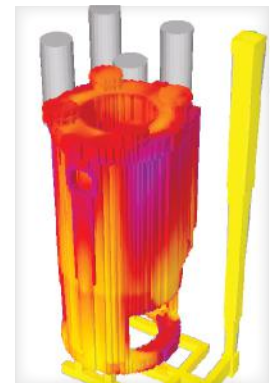
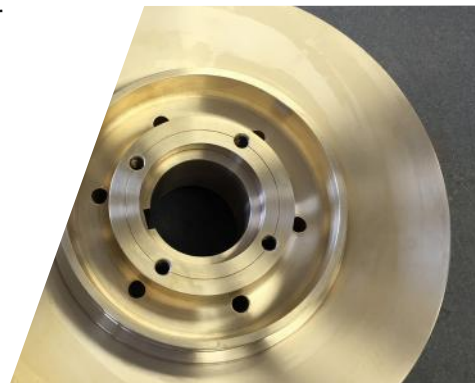
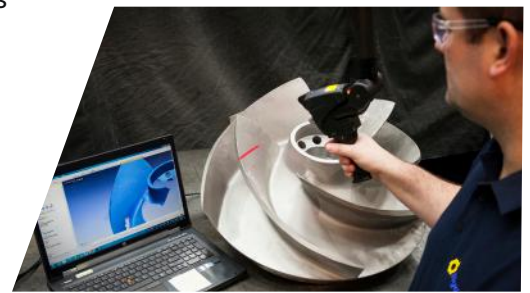
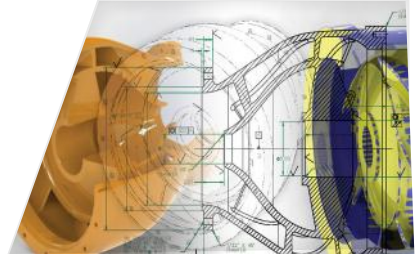
A casting model and drawing is created with allowance for machining stock and a solidification analysis is performed on the casting model, which enables Hydro's engineers to design an optimal mold package. The mold package can be created via computer-aided machining and/or 3D sand printing.

Manufacturing the Casting

To manufacture the casting, the sand-printed mold package is assembled and prepared for the pouring of the metal. After being poured, broken out of the mold and cleaned, the cast part is dimensionally inspected and measured by Hydro's engineers. A 3D model of the cast part may be created and compared to the original 3D model. This comparison of 3D models can be performed to validate the quality of the casting before it is released for machining.

Final Machining and Thorough Inspection

After the cast part is approved by Hydro's engineers, a final machine drawing is produced and approved for complete machining of the casting into the final component. Machining, drilling, surface finish and dressing is performed followed by a final inspection by Hydro's Quality Assurance team.



Hydro's engineering experience, use of the latest design technologies, and quality manufacturing processes enable us to support emergency parts requirements and provide component repeatability with a high degree of accuracy.

Meeting Stringent Quality Standards in The Nuclear Industry

Custom building a unique pump can provide an innovative solution to a pump problem. Hydro, Inc., recently had the opportunity to design and build such a pump for one of our customers. This challenging case represents an opportunity to tackle a persistent performance issue by using new technologies to engineer, design and manufacture a new pump custom-tailored for a particular application in an aggressive time frame.

Overview of problem: A nuclear plant had 10 identical pumps installed in its service-water systems. Formidable

power-supply and cooling-media constraints, design issues, and poor-quality manufacturing by the OEM caused numerous operational problems.

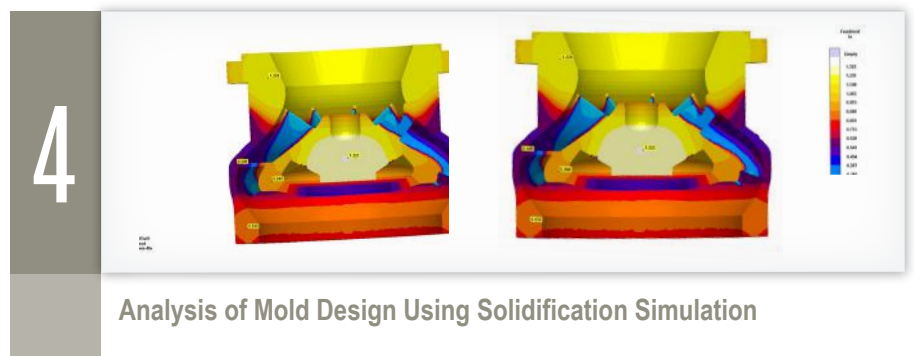
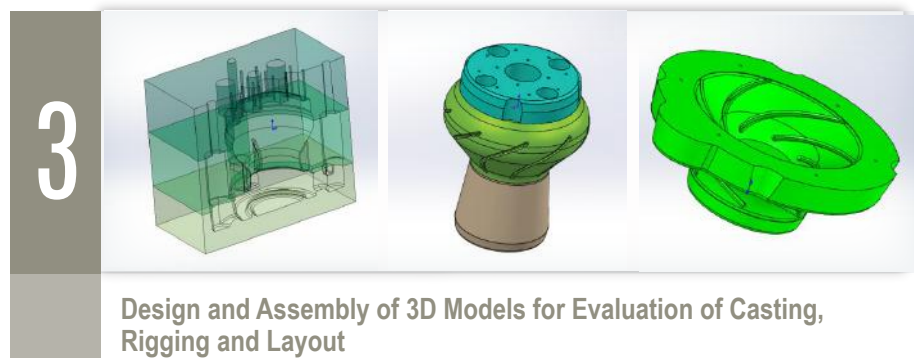
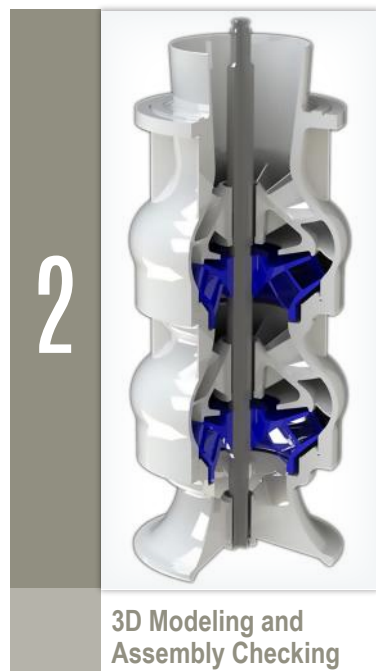
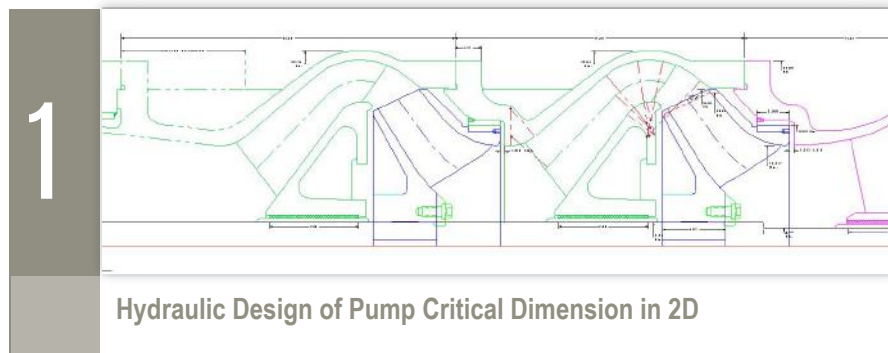
The motor was overloading on a regular basis due to inefficiency of the existing pumps. The plant was having a hard time juggling a HP limit—the existing driver had to be used thus limiting maximum allowable BHP.

Further complicating the issue, highly corrosive, full-strength seawater from the estuary area of a blackwater river served as the cooling media. Because

of this brackish, tannic water, the bowl assembly experienced high pitting and crevice corrosion beyond repair.

The decision to build a custom-designed pump: Between August 2009 and October 2014, Hydro had been contracted five times to complete repairs on these pumps. During the course of these repairs, analysis of data from testing results performed following each repair, Hydro came to a number of conclusions that led to the recommendation to consider custom-designing a pump for this specific application.

A key factor that led to recommending a custom built pump came from test results performed following each repair. Additional evaluation and assessments of performance testing results revealed other problems that greatly affected performance and reliability.



5



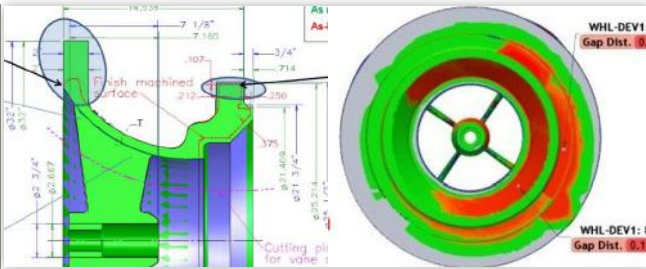
Manufacture 3D Printed Sand Mold & Cores and Assembly of Molds

6



Melting and Pouring of Castings

7



Validation of Cast Part Through Comparison with Original Drawing and Model

8



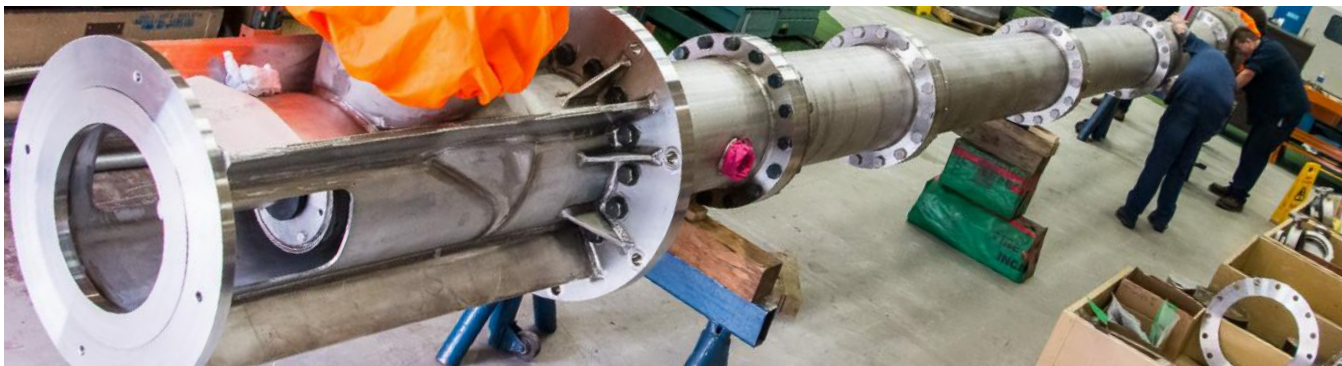
Performance Testing

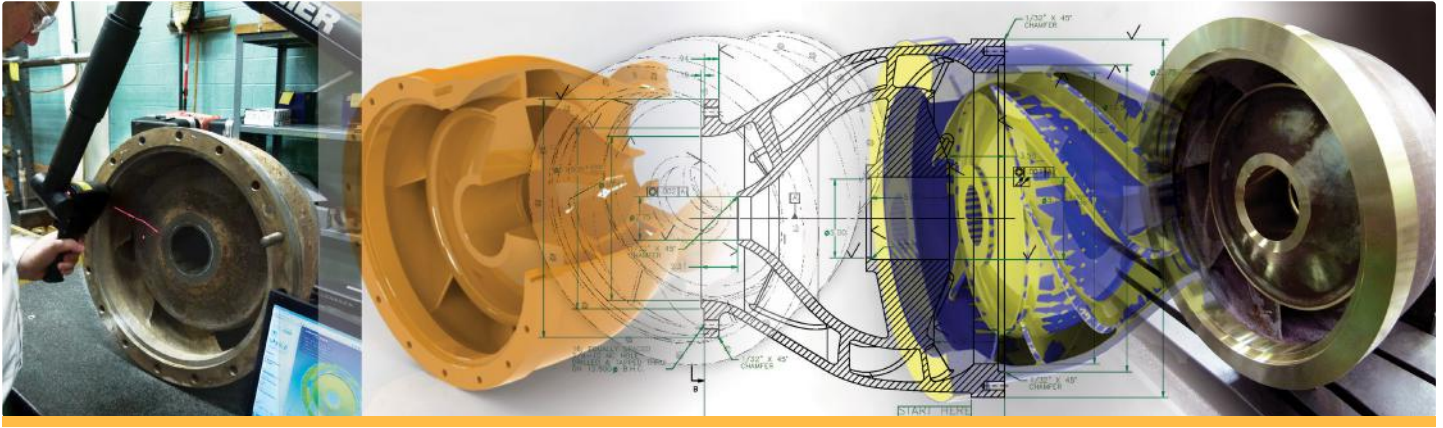
Reliability, Greater Efficiency, and Peace of Mind

After thorough analysis, Hydro was able to design a pump that addressed all of the existing problems. Hydraulic-design modifications were engineered to meet stringent duty requirements with high efficiency. Wear-ring geometry was optimized. High-quality casting processes ensure dimensional accuracy that was modeled and then implemented. High-quality surface finishes were specified and the assembly processes optimized.

Among the technologies applied in this innovative solution were 3-D printed sand molds and cast-flow simulation software. Employing these new technologies reduced the overall cost of the finished product and improved the delivery window. Significantly, the plant will realize the benefits from improved efficiency year after year. Among the technologies applied in this innovative solution were 3-D printed sand molds and cast-flow

simulation software. Employing these new technologies reduced the overall cost of the finished product and improved the delivery window. Significantly, the plant will realize the benefits from improved efficiency year after year.





When you require a cast part and are facing a long lead time, Hydro can meet your needs in a reduced time frame. We're on it.



800-223-7867 | hydroinc.com

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AUSTRALIA | CANADA | CURAÇAO | ENGLAND | FRANCE | INDIA | KOREA | OMAN | UNITED ARAB EMIRATES | VIETNAM

