imulation-driven design enables ACD to reinterpret the process of design, while offering our customers tested products with con"dence in design and evidence of performance. Unlike the past, when each design required a prototype for testing, simulation takes design to a whole other level. Simulation-driven design is de"ned as a design process where decisions related to the behavior and the performance of the design in all major phases of the process are signi"cantly supported by computer-based product modelling and simulationŽ.

ACD•s integrated state-of-the-art simulation tools and solutions help to explain performance trade-offs at an incredible level of detail. This enables us to analyze a variety of conditions up front, review results and "ne-tune the design prior to the full-scale prototyping and testing. Simulation-driven design gives us the ability to resolve potential issues before we put them in the design, thus preventing expensive "eld failures. The result is a better end product for our customers.

What are the benefits? Simulation provides several key benefits: Improving/increasing product quality, resulting in a reduced risk of failures and warranty issues; simultaneously improving the bottom line through reduced product and labor costs.

a) Timescales … ACD recognizes the power of building, testing and verifying their products using a virtual prototype rather than a physical prototype. This is more cost effective and offers lower risk, which in turn translates to reduced cycle times.

b) (fying 20[(tran(Evidence)-9 P)171.3erformance)… Custom7(werequifecevidence)10304 -2.3 TD .015 Tc .36

Aerodynamic Design Codes

As a provider of turbomachinery solutions, ACD•s competence lies in our skill and ability to design impellers customized to end user needs. The following aerodynamic sizing tools allow design and rapid analysis of the ˮow through the impellers.

€ Aerodynamic 1D Sizing Tools (•MeanlineŽ Analysis)

- Vista Tools in Ansys - Includes design software such as CCD (Centrifugal Compressor Design), CPD (Centrifugal Pump Design), RTD (Radial Turbine Design)
- Concepts NREC Compal

€ Blade Geometry Design

- Ansys BladeGen and BladeEditor
- Concepts NREC

€ Aerodynamic 2D Rapid •ThroughFlowŽ Analysis

- Concepts NREC Axcent

€ Turbomachinery Speciˮc Mesh Generation Tools

- Ansys TurboGrid
- Numeca AutoGrid5

€ 3D CFD (Computational Fluid Dynamics) Analysis Software

- Ansys CFX & Fluent
- Numeca Fine/Turbo

Structural Analysis Tools

€ Mechanical Analysis - Static Structural, Modal, Thermal
- Ansys Mechanical
- SolidWorks Simulation

€ Rotordynamics
- XLRotor - For simulation of rotor bearing system dynamics.

Testing

€ Experimental Modal Analysis (EMA) … To do full modal analysis on impellers and measure FEA-computed frequencies and mode shapes.

- Data Physics Dynamic Signal Analyzer (DSA)
- Vibrant Technology MeScope