Burst Containment: Aviation, Industrial, Medical and Military

Why Simulation? Optimization, Regulation or Design Insurance

Analysis: Nonlinear

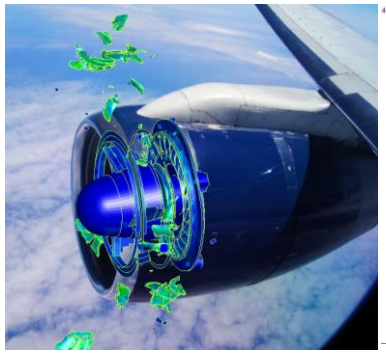
Objective: Provide accurate burst containment simulations for high-speed rotating equipment

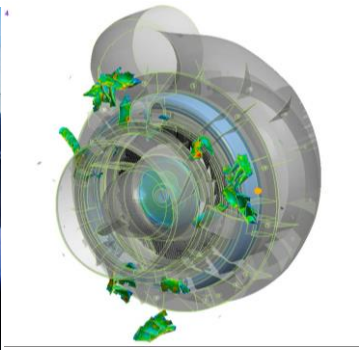
Burst containment testing is challenging and expensive since the test destroys pretty much everything and often times, one has no idea if containment or non-containment was marginal or not. The challenge with finite element analysis is determining if the result is a cartoon or a simulation. The engineering software cost for performing a transient, dynamic nonlinear simulation burst containment simulation is minimal but it still requires engineering experience to make it all work accurately. Our nonlinear FEA consultants have decades of validated experience.

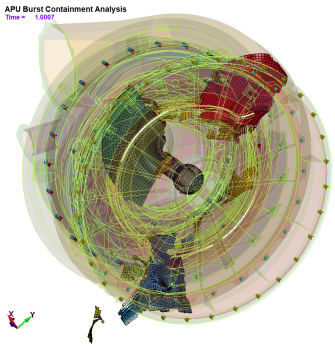
This short note covers our engineering consulting services work on burst containment within four major industries: aviation (auxiliary power units or APU's), Industrial (electrical power turbines), Medical (x-ray scanning machines) and Military (blast containment). We are pleased to state that our simulation work has been validated and has stood the test of time.

Burst Containment: Aviation, Industrial, Medical and Military

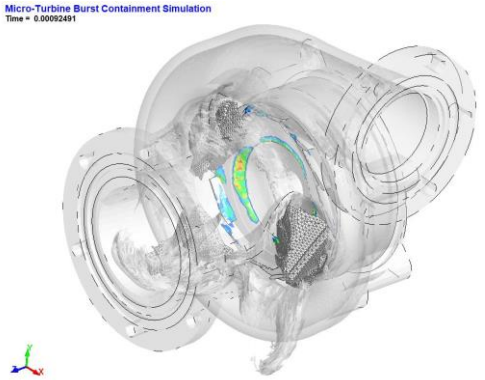
Aviation: Blade-Out, Auxiliary Power Units (APU)



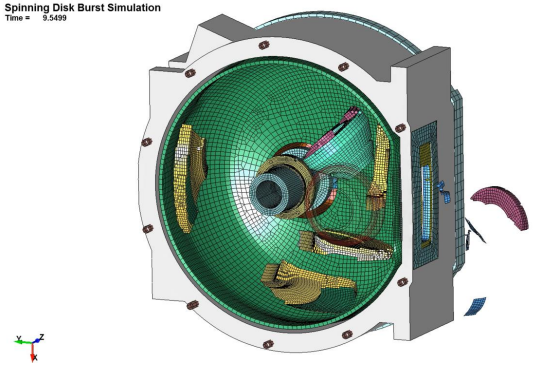




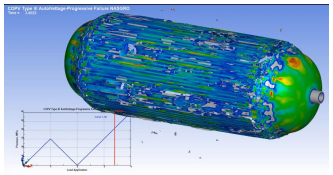
Industrial Turbines (Power Generation)

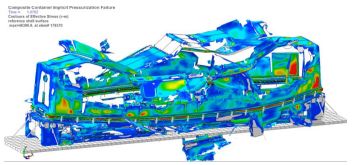


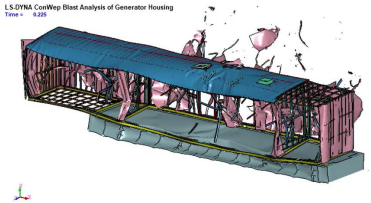
Medical Imaging – Rotating Anode Containment

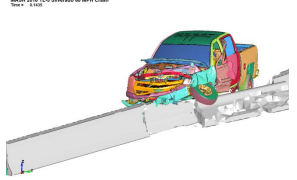


Diverse Nonlinear FEA Experience



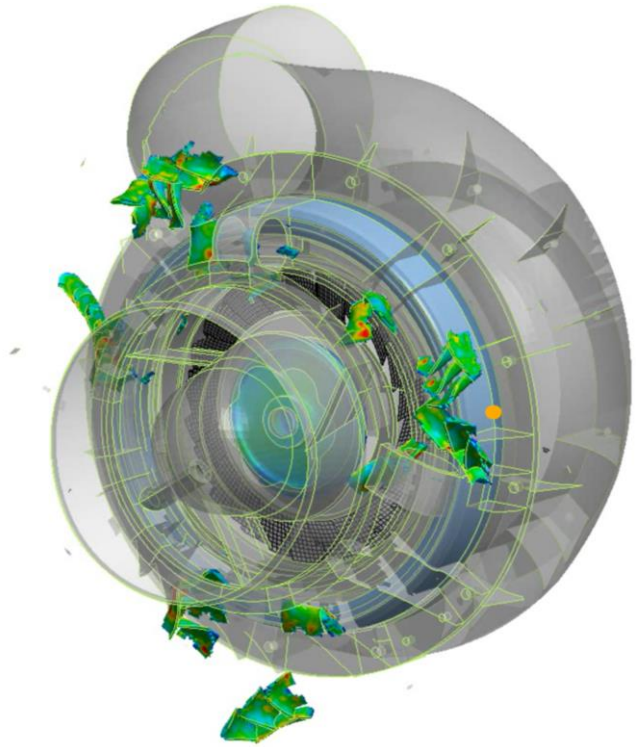


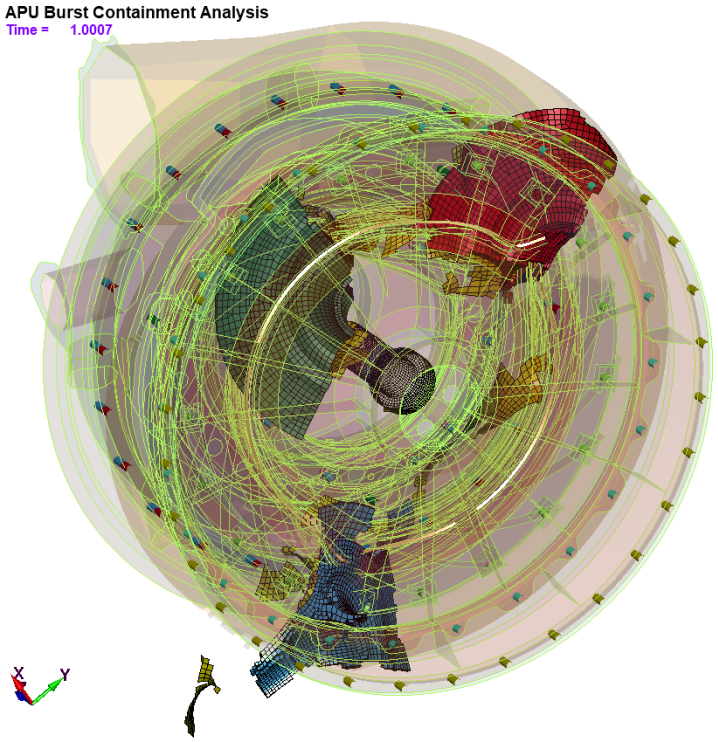




For those that are video inclined, this video link https://youtu.be/dnYavkeV5RU provides a quick overview of our burst simulation work by our team of FEA experts in transient, dynamic nonlinear FEA simulation.

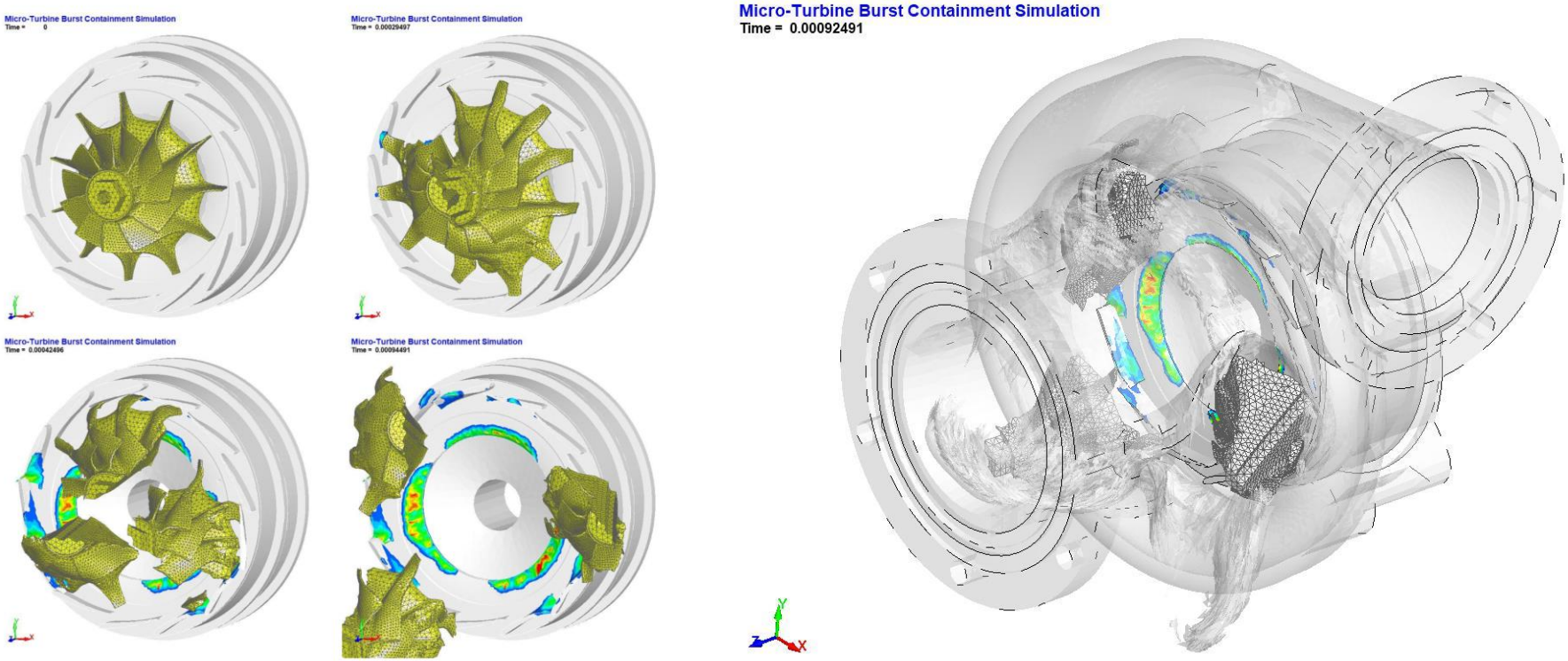
Burst Containment: Aviation – Blade-Out, Rotor Tri-Hub or Turbine Wheel





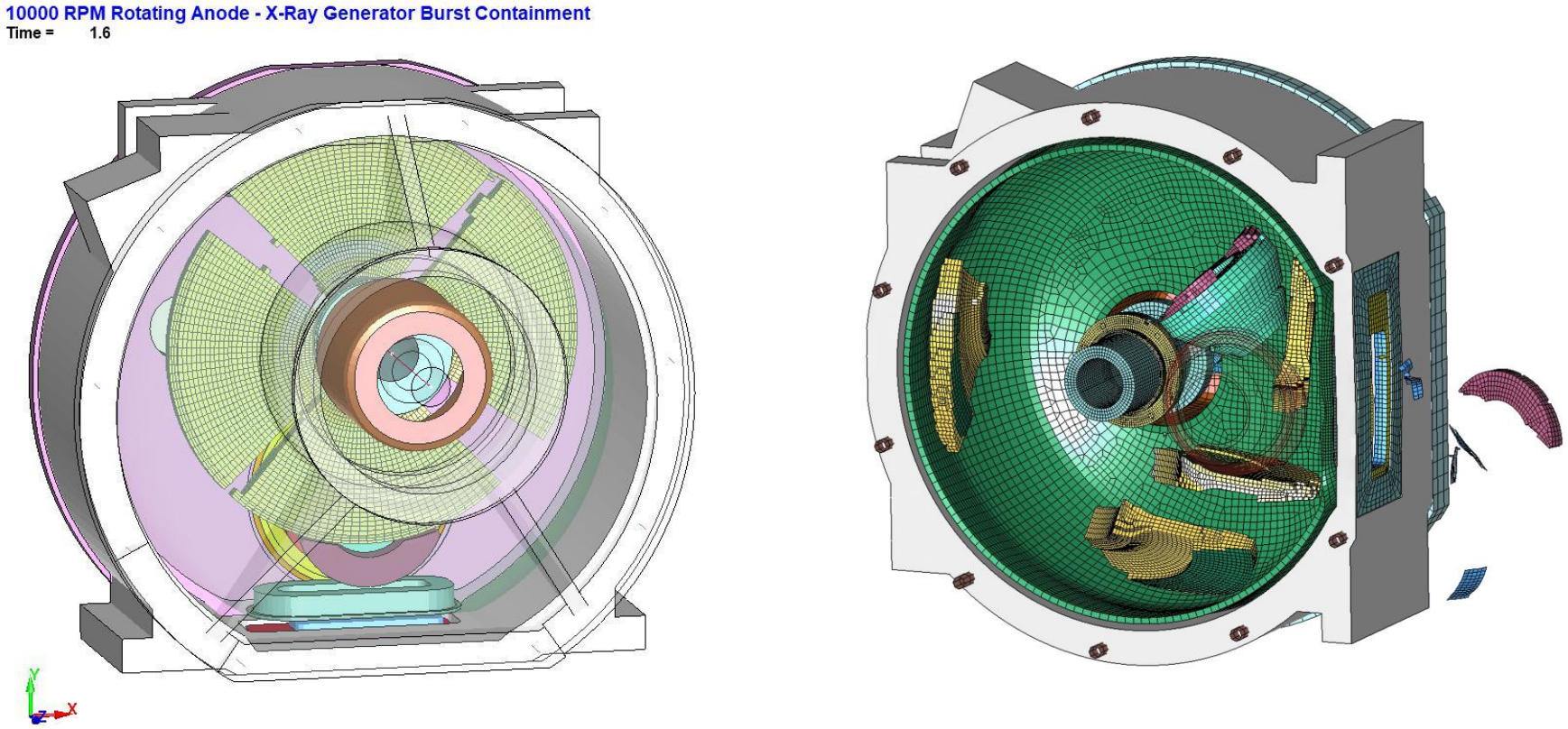
Burst containment of high-speed rotors (APU, Engine Starter Rotors, Turbine Blade Hubs) is an FAA/EASA certification requirement. Simulations provide a very efficient method for cost-to-weight optimization and design insurance that the system will pass the FAA/EASA requirement. Predictive Engineering's consulting engineers have direct experience with constructing burst containment simulations that have been validated in test and in service.

Burst Containment: Industrial – Turbine Wheel Power Generation (Tri-Hub Split)



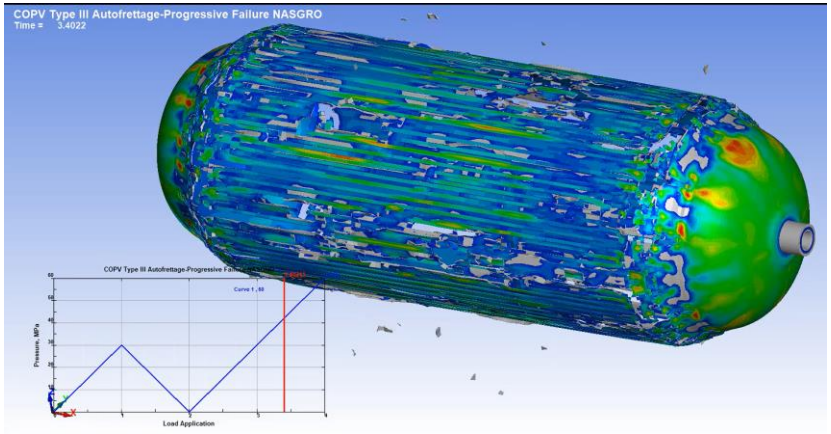
Turbochargers, gas turbines, impellers, diffusors, jet engines all create burst containment challenges. The conversion of gas energy to mechanical energy is a classic turbine wheel application. This gas fired turbine wheel system was investigated for its tri-hub burst containment robustness.

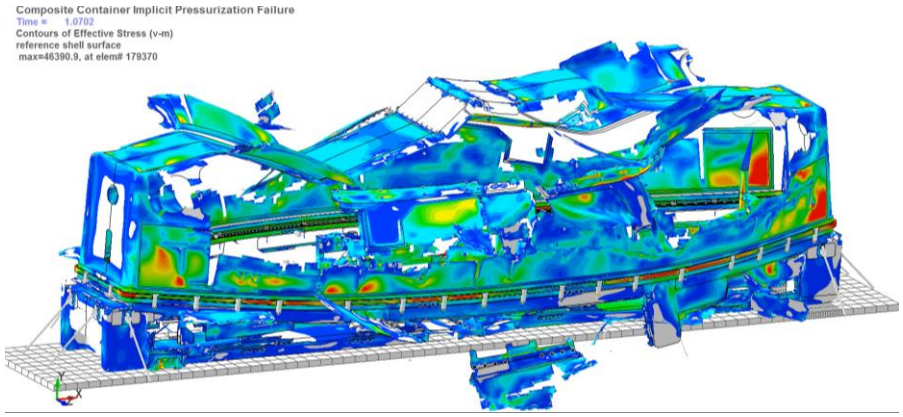
Burst Containment: Medical – X-Ray Generation via Rotating Tungsten Disk (CT)

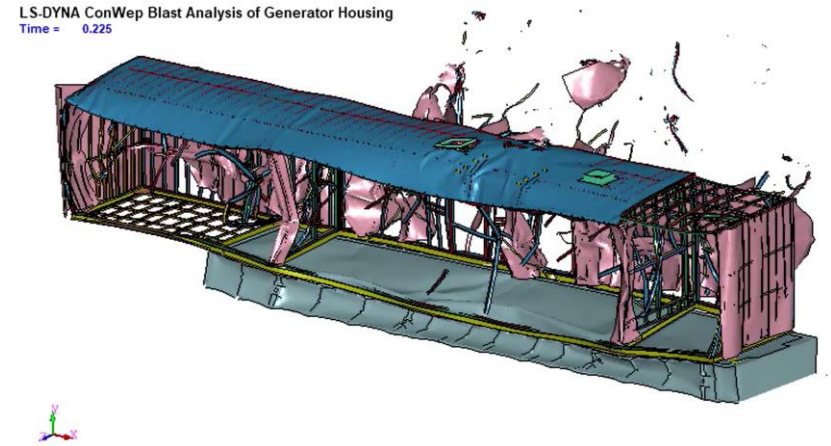


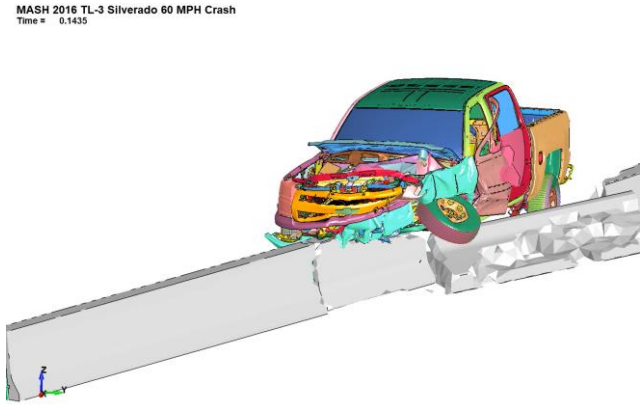
High-intensity X-Ray generation for medical CT imaging relay upon a rotating tungsten-coated anode. This anode typically rotates around 10,000 RPM. Over time, the anode disk embrittles and can burst. Simulation work replicated the burst behavior and additional optimization work arrived at a final design that provided full containment.

Burst Containment: Explosive-Failure Experience with Metals, Composites, Ceramics









Validated experience with composites, plastics, polymers and metals under explosive (ConWep) and Pressurized Burst Conditions. Material experts in ceramics, metals, engineered composites (polymeric and cement) – see Predictive Engineering Consulting Services for more stories.

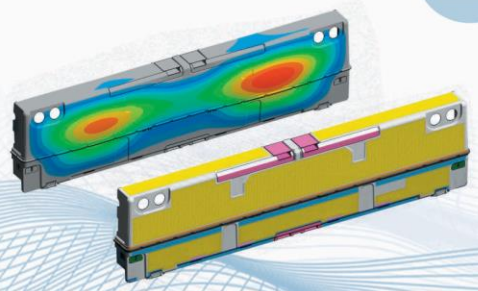
Predictive Engineering – The Advantage of Getting it Right the First Time

Finite Element Analysis
Predictive Engineering

Finite element analysis consulting services, software, training and technical support.

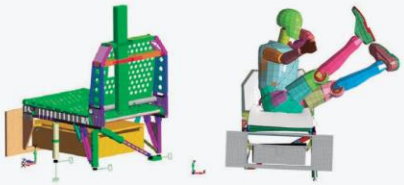
- Composites, Pressure Vessels, Vibration.
- **NASTRAN:** Linear Dynamics.
- **LS-DYNA:** Drop-test, Impact, Burst Analysis.
- **STAR-CCM+:** CFD Thermal/Flow Analysis.

+20 years experience

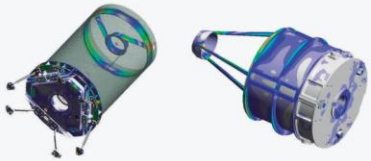


Project Examples

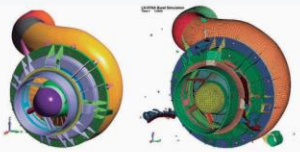
FAA 16G SLED TEST VERIFICATION



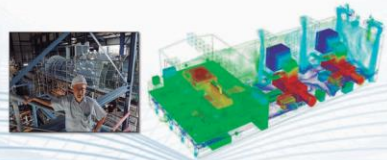
STRESS AND VIBRATION ANALYSIS OF SATELLITES



LS-DYNA TURBINE BURST SIMULATION



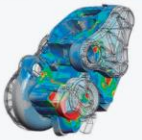
CFD STUDY ON CO-GENERATION POWER PLANT BUILDING



Our Services

FEA

Predictive Engineering brings to bear more than 20 years of finite element analysis FEA consulting experience in solving the most difficult mechanical engineering analysis challenges.
Our validated experience ranges from transmissions to submarines to satellites.



TRANSIENT NONLINEAR

At Predictive Engineering, we pride ourselves on the ability to idealize complex structures and systems into predictive numerical models. Our nonlinear, static and transient dynamic work has been validated against strain-gauges, drop and sled test results, accelerometers, crack growth and fracture and in extreme service environments.

ASME-BPVC

From seismic to buckling to cyclic service (fatigue), Predictive can assist in verifying the most challenging pressure vessel designs. Our hard-earned experience allows us to safely classify tanks and vessels as "fit-for-service" that would typically have required extensive redesign or re-work.

CFD

Our expertise in computational fluid dynamics (CFD) comes from hundreds of thermal-fluid projects in medical, aerospace, marine, HVAC (data centers), civil and automotive. This experience gives us the capability to quickly optimize and provide accurate digital prototypes.