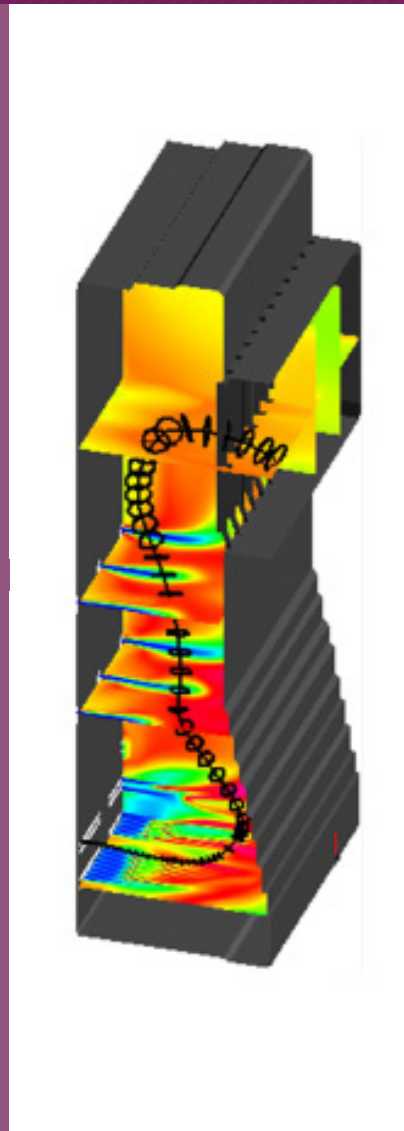
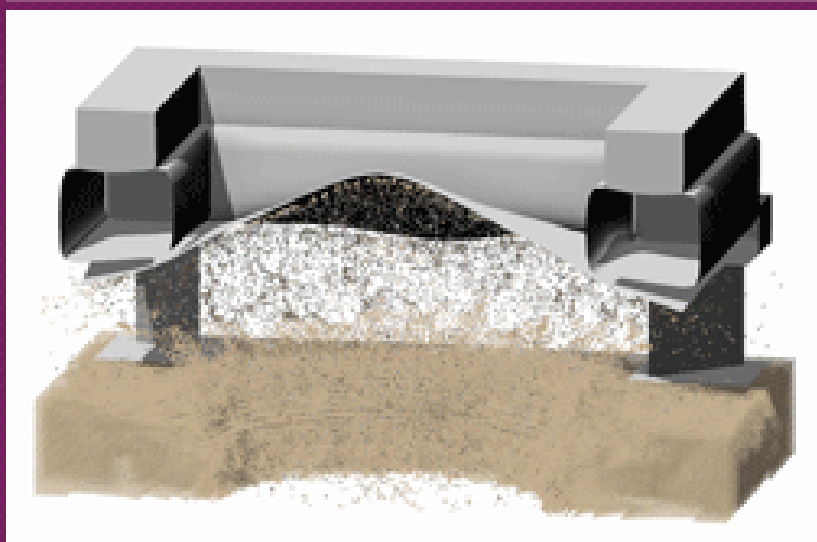




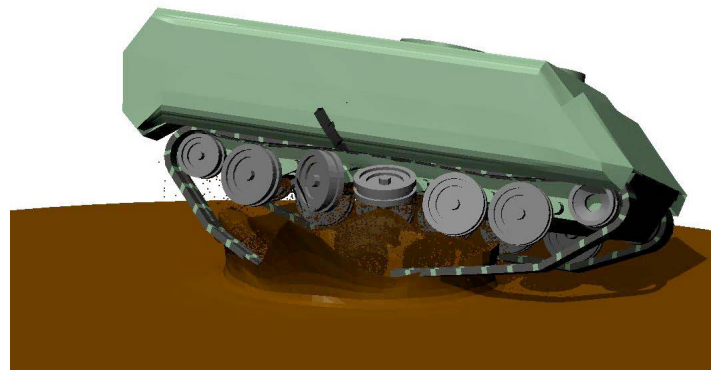
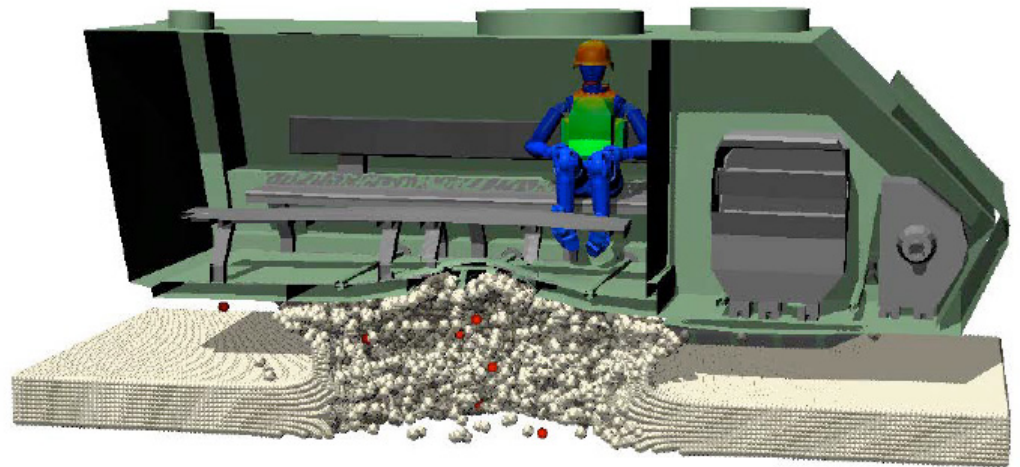
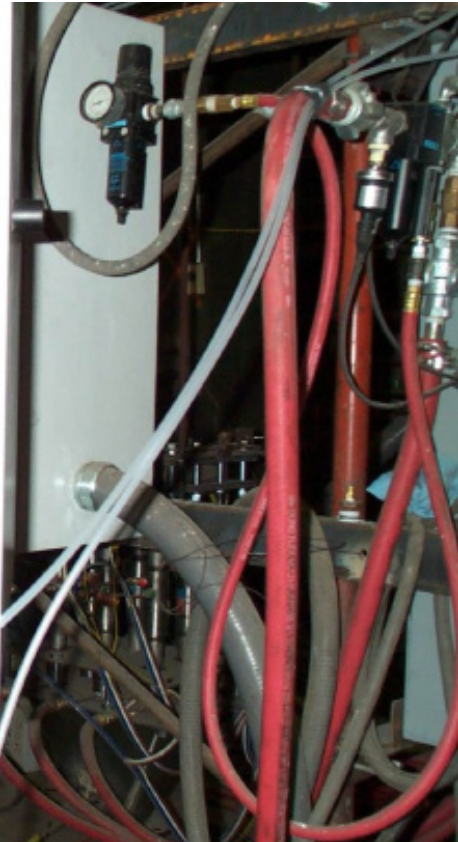
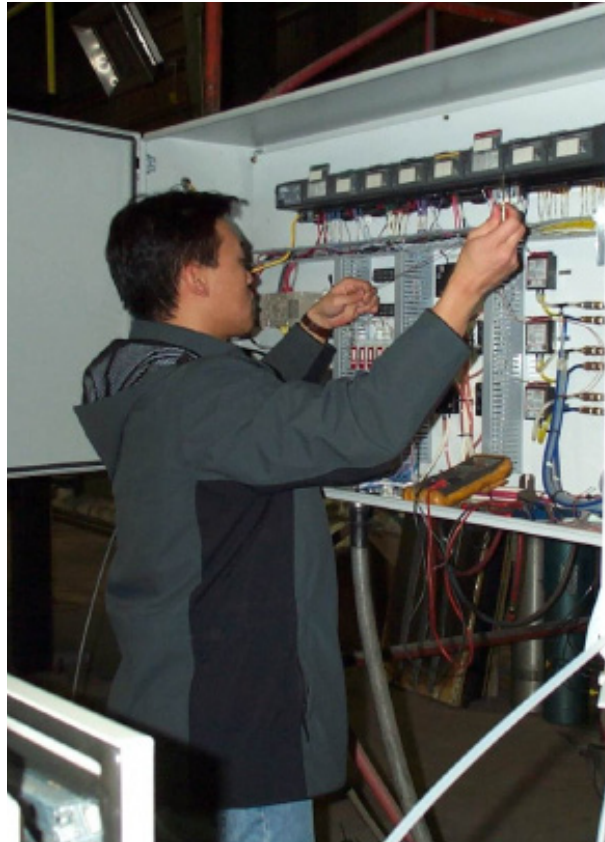
REACTION ENGINEERING INTERNATIONAL reaction-eng.com

Committed Individuals Solving Challenging Problems



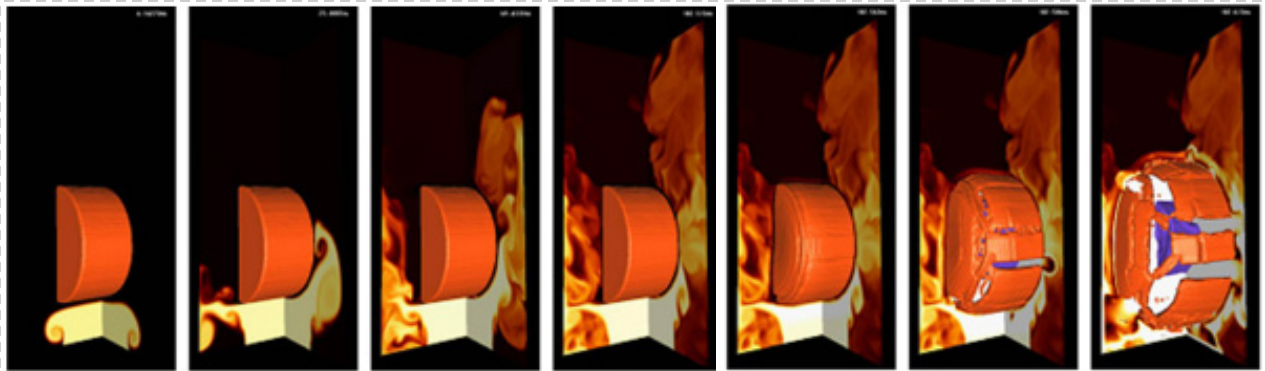
Reaction Engineering

International's mission is to clearly establish and maintain an internationally recognized and respected reputation as a leading R&D organization in the defense and energy sectors by providing the very finest team of responsive professionals with the highest caliber of problem solving capabilities in the world.



Capabilities

- ▶ Advanced Explosives and Energetics Modeling
- ▶ Fluid-Structure Interaction - Explosive Effects on Vehicles and Structures
- ▶ Combustion System Design and Performance Analysis
- ▶ CFD and Process Simulations for Industrial Applications
- ▶ Customized Software
 - Simplified unit-specific CFD tools, advanced process simulation software
 - Special purpose combustion chemistry tools and chemical kinetic software
 - Blast event and afterburn simulation tools
- ▶ Specialized Equipment
 - Development and evaluation of equipment and instrumentation concepts
- ▶ Proof-of-Concept Testing



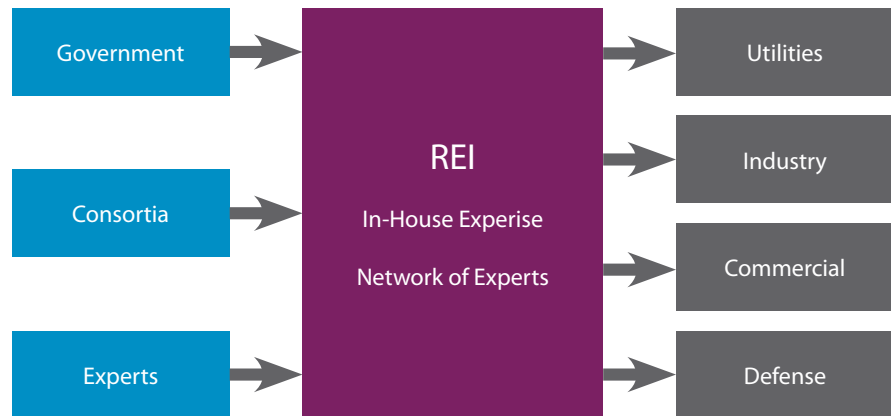
Strengths

- ▶ Modeling and Analysis Expertise
 - Explosives and Energetics
 - Combustion, Fuel Conversion & Pollutant Emissions
 - Fire simulation, Blast events simulation
 - Unique, Proprietary Modeling Capabilities & Tools
- ▶ Ability to develop and apply advanced chemistry to CFD and process modeling tools
- ▶ Ability to develop chemistry models for unique fuels
- ▶ Ability to merge diverse models to create a simulation tool to solve practical problems
 - “Qualified” Modelers
- ▶ Understand physics, chemistry, mathematics, software
- ▶ Industrial perspective
- ▶ People
 - Technical Staff: experienced, team-oriented, specialists
- ▶ Most with advanced (MS, PhD) from top universities
- ▶ Deeply versed in fundamental science and numerical solvers
 - Network of Consultants
 - Customer Oriented

Services

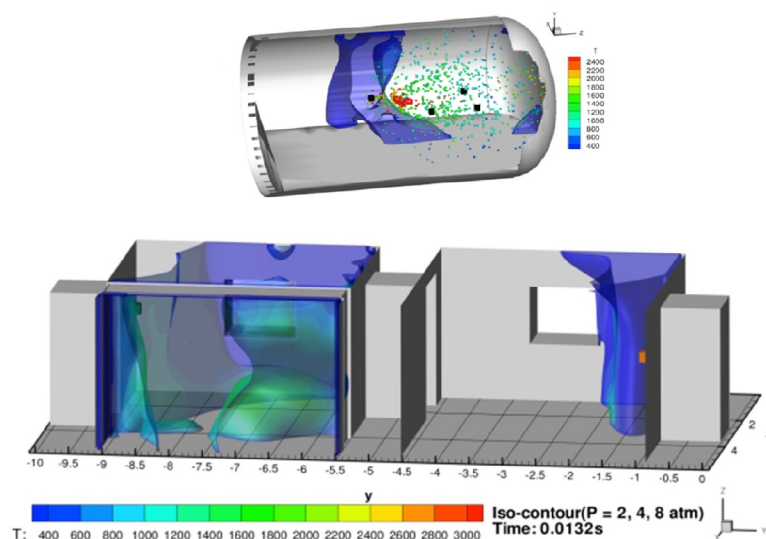
- ▶ Problem solving to address specific questions
- ▶ R+D on contract or consulting basis to assist in technology development
- ▶ Independent evaluation / third party assessment / Expert Witness

Role



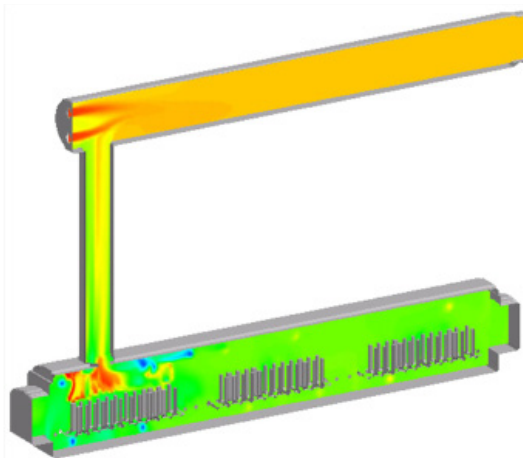
Example Projects

Blast Event and Afterburn Effects Simulation Tools – Through funding from the Army and Marine Corp, REI has developed blast event simulation tools that allow for de-coupled simulation, or fully coupled simulation if desired, of the blast wave from an explosive device, its interaction with the surrounding medium (e.g., soil) and the vehicle structure. REI and a university partner are currently working on a Navy funded project to develop computational modeling of non-ideal munitions containing metal and hydrocarbon fuels to better understand and predict the ignition of compressible multiphase flows.



Cyclone Barrel & Cyclone Furnace NO_x Predictions – Through funding from the Electric Power Research Institute (EPRI) and guidance from power generation industry professionals, REI developed a detailed combustion model to predict performance and pollutant emissions (NO_x, SO_x) from coal fired cyclone barrels and cyclone-fired furnaces used for electric power generation. The successful program produced new technologies and guidelines for furnace operation that significantly reduces emissions without expensive equipment upgrades, resulting in substantial cost savings to plant owners and rate payers.

Chemical Weapons Incinerator Models – Through funding from the Army Research Office, REI teamed with leading combustion experts from academia, national laboratories and industry to develop computational models to predict the performance and emissions for incinerators used to destroy the US chemical weapons stockpile. A university partner used computational chemistry methods to develop the chemical kinetics to describe the destruction of chemical warfare agent under incinerator conditions. REI developed the combustion models of the incinerator units. In August, 2004 REI was awarded a U.S. Army Phase II SBIR Quality Award 2004 for this project. REI has performed twenty follow-on projects based on the developed modeling technology.

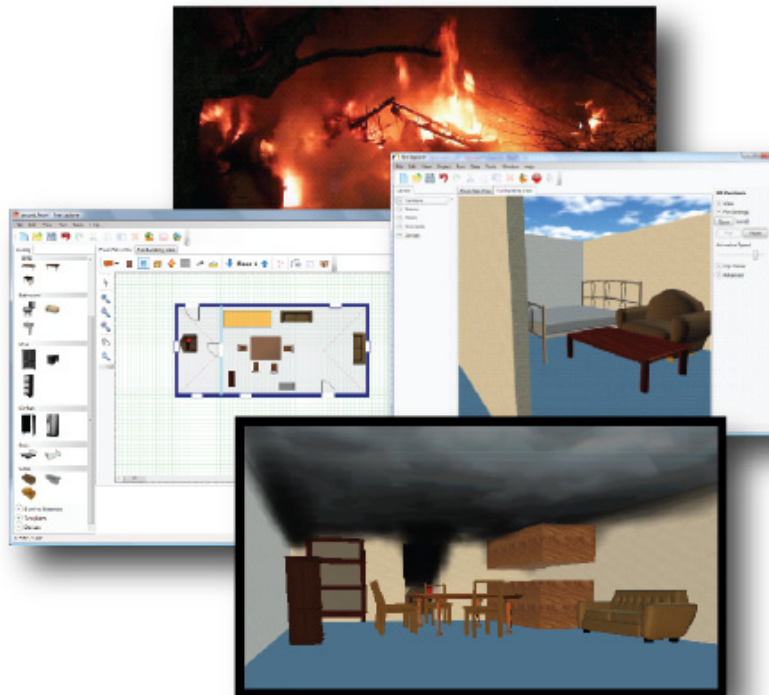


JP-8 Combustion Chemistry Models for SCRAMJETS – Through funding from the Air Force Research Laboratory at Wright Patterson Air Force Base, REI has developed combustion chemistry models for JP-8 under SCRAMJET conditions. REI teamed with university partners to develop the chemical kinetic model for JP-8 combustion using computational chemistry methods and model validation experiments. REI teamed with industry consultants and commercial CFD software providers to provide the Air Force with the JP-8 combustion models incorporated into their preferred CFD modeling tools.

JP-10 Combustion Chemistry Model – Through funding from the Naval Warfare Division (NAVAIR), REI is developing a combustion chemistry model for JP-10, a high energy density fuel used in cruise missiles and being considered for other applications. The chemical kinetic model was developed by a university partner using computational chemistry model. Validation data for the model is being generated by a second university partner.

Fire Simulation Tool – Through funding from the Air Force, REI has developed the FireExplorer® fire simulation tool. FireExplorer® offers a full suite of tools for

performing fire simulation studies. A user can quickly draw a floor plan of interest, place furniture and other objects within the building and configure fire sources. Simulations can be run on local or distributed computers and the user is able to see the results directly in an interactive 3D graphics window as the simulation proceeds. The tool allows fire professionals to quickly and easily understand fire behavior, review building fire scenarios, and plan responses to firefighting events.



Pyrolysis Furnace Modeling – Through funding from the NSF and industrial collaborators, REI developed a new software tool, ADAPT, for modeling combustion and pollutant emissions in pyrolysis furnaces. New low-NO_x burner technologies contemplated for reducing emissions in these furnaces required significant improvements in advanced mesh refinement, numerical methods, and chemical kinetic sub-models. Successful development of this tool has resulted in an exclusive modeling agreement with a major pyrolysis furnace OEM to model all new pyrolysis furnaces and furnace retrofits. The success of this collaboration has further led to a large process model development task for the OEM.

Furnace Design Tool – Through funding from an industrial partner, REI developed a software tools for use by their chemical process furnace designers.



Company Profile

Reaction Engineering International (REI) was founded in 1990 on the premise that a company composed of full-time professionals that encouraged part-time participation by specialized consultants could most easily apply cutting edge technology to defense and energy-related problems. Our staff consists of fourteen full time professionals (twelve with advanced degrees in engineering or science), two part-time academics and three part-time professionals. We have a compact organization with minimal bureaucracy. Excluding our office manager, all personnel are technical with managers holding joint management/technical positions. We have Defense Contract Audit Agency (DCAA) authorized rates.

Customer Base

Industry:

- ▶ Predominantly large industrial companies, many Fortune 500 level.
- ▶ Selected List: American Electric Power, Ameren, ConocoPhillips, DTE Energy, Monsanto, Praxair, Solvay, Shaw-Stone&Webster.

Government:

- ▶ DoD - Air Force, Army, DTRA, Marine Corp, Navy
- ▶ DOE - NETL, NSF and NASA
- ▶ Prime contractors - SAIC, URS

International

- ▶ Clyde Bergemann (No/So America), Doosan Heavy Industries (Korea), Korea Electric Power Company Research Institute (Korea), LG Caltex (Korea), LP Amina (PRC)

Strategic Alliances

- ▶ Clyde Bergemann – recovery boilers
- ▶ Detroit Stoker Company – solid fuel fired stokers
- ▶ Praxair – oxygen enhanced combustion
- ▶ Shaw-Stone&Webster- ethylene cracking furnaces for petro-chemical industry

Contact

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