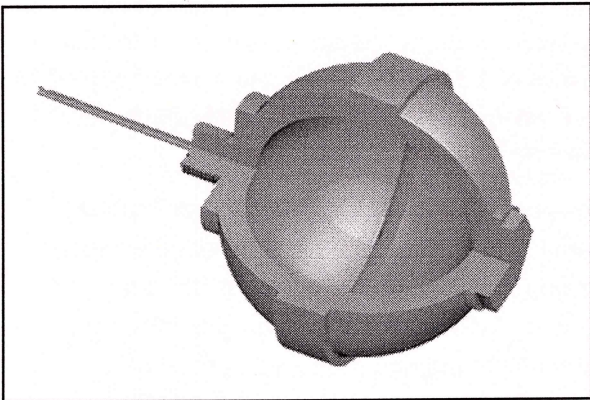


# Gas transfer systems

## Fact Sheet

A core competency at Sandia/California and a component of all modern nuclear weapons, gas transfer systems enable efficient thermonuclear weapons, boosting the yield of a fission reaction by facilitating fusion of hydrogen isotopes.



*High-pressure gas reservoir*

The systems must meet exacting requirements of two key customers. The Department of Defense specifies weapon performance, storage, use, and potential environments for the stockpile. The Department of Energy oversees nuclear weapon design, development, testing, and certification.

Meeting stringent design and performance requirements is aided by the high efficiencies achieved through boosting. Scientists and engineers work in teams to solve challenges posed by evolving needs of the enduring stockpile. These researchers have cradle-to-grave responsibility for gas transfer systems in

all California-designed weapons systems, from initial concept through production, maintenance, stockpile surveillance, and retirement.

### Thrust

To support the gas transfer components mission in the complex of weapons design and production facilities, Sandia/California occupies a unique role. Through agreements with Lawrence Livermore and Los Alamos national laboratories, Sandia/California designs gas transfer systems for California-designed weapons, while Los Alamos carries out gas transfer work for weapons systems designed in New Mexico. Los Alamos now handles all tritium research while Sandia/California focuses on prototyping, materials, modeling and manufacturing process development.



*High-pressure testing*

### Scope

Sandia/California's commitment and stockpile obligation encompass providing technical expertise for systems now in the stockpile as well as developing new, advanced designs.

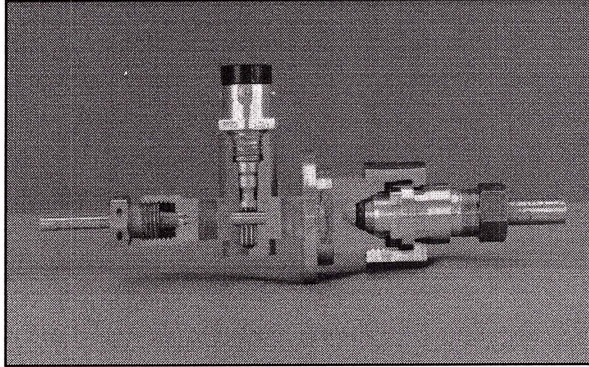


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*Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.*



## Gas transfer systems



*Explosively actuated valve cut-away*

This commitment has fostered these technical strengths:

- Engineering design
- Modeling and simulation
- Welding and joining
- Metallurgy (including understanding tritium effects in metals)
- Production and stockpile support
- Laboratory testing, including high-pressure and explosives testing

Gas transfer system responsibilities are met by drawing upon a suite of strengths in different disciplines, including physical modeling to predict material behavior, analytical modeling, material science research (particularly the study of gas embrittlement of metals), experienced design teams using advanced tools and capabilities, process integration and testing expertise.

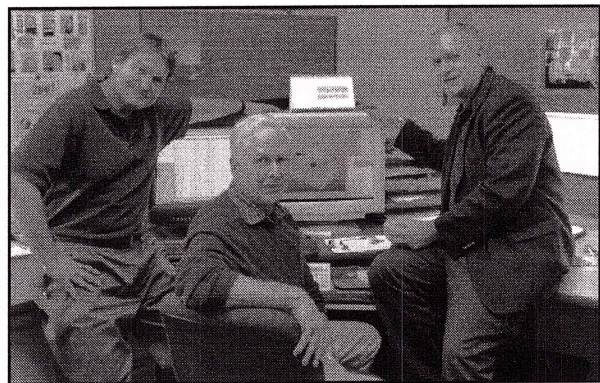
### Advances

Many manufacturing advances have been developed through gas transfer system research at Sandia. Forging of gas reservoir vessels, for

example, has been described as both a science and an art. The labs work with commercial plants to develop new processes for the high-pressure vessels that meet demanding specifications. Sandia's breakthroughs include predictive simulation and modeling of forging and of manufacturing processes such as press modeling and die design.

Small explosively actuated valves were also invented by Sandia to open or seal tubes, or direct gas flow, and are used in almost all weapon systems. Sandia has standardized a family of 12 highly reliable valve designs used in five weapons programs, and continues to develop new and improved versions.

Making advances from this vigorous technology base, site researchers have received weapons "awards of excellence" from the Department of Energy for their enhanced insights into manufacturing and production processes.



*Gas transfer system design and analysis*

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