

IT'S A CLEAN MACHINE

Cleaner running, environmentally friendly auto engines and gas turbines, as well as improved fuel efficiency—that is a nice sounding combination.

Since its founding in 1986, Precision Combustion, Inc. (PCI), New Haven, Connecticut, has focused on development and commercialization of its proprietary, clean, and efficient combustion and air pollution control technologies. The company reports it has invested in excess of \$10 million in research and development contracts obtained from government and industrial customers in the development of its products.

Small Business Innovation Research (SBIR) monies from Lewis Research Center were awarded in 1986 and 1990 to PCI. The research proved the viability of efficient, cost-effective catalytic reduction of gas turbine nitrogen oxide emissions along with fuel efficiency.

PCI's commercialization efforts are focused on two major product lines, a catalytic combustor for gas turbines and a catalytic converter for automotive applications.

The use of catalysts inside the combustion chamber allows leaner combustion which reduces the formation of nitrogen oxides while preserving the efficiency of advanced combustion turbine designs. Gas turbine catalytic combustion technology offers emission reductions and cost savings compared to more established low

emission technologies such as lean premixed combustion and selective catalytic reduction in meeting gas turbine emissions regulations.

Early Lewis Research Center interest in PCI's abilities has paid off handsomely. The company has developed an Advanced Technology Catalytic Combustor (ATCC), and the Microlith, an automotive catalytic converter. "These technologies would not have been commercially feasible without the support of the NASA SBIR program," says PCI president, Kevin Burns. "The follow-on commercial support that was built directly on this early research has enabled the company to grow substantially," Burns adds.

"Our catalysts inside the combustion chamber allow leaner combustion, avoiding formation of nitrogen oxides while preserving the efficiency of advanced combustion turbine designs," observes PCI chief scientist, William Pfefferle, the inventor of the original catalytic combustor for gas turbines. "We are integrating advanced catalytic technology with new combustor designs. Ground power generation customers are going to like this technology because it combines clean emissions with efficient high firing temperatures along with stability, operability, and reliability," Pfefferle concludes.

The combustor technology has potential application for aircraft turbine engines, both for military and commercial markets. In November 1996, a long-term business agreement to develop, manufacture, and sell new catalytic combustor products for Westinghouse Power Generation machines was announced. In a step toward broader industrial commercialization of catalytic combustor technology, PCI was awarded a \$750,000 contract from the U.S. Department of Energy. The work is geared to enable gas turbine manufacturers to meet new and stricter environmental regulations.



The development of the Microlith automotive catalytic converter (left) for ultra-low exhaust application turbine engines was advanced by a Lewis Research Center Small Business Innovation converter Research contract. Also developed were the stand-alone converter (right) and cartridge (foreground).

NASA's SBIR program has also supported another important catalytic product under development at PCI. In 1994, Marshall Space Flight Center began an SBIR program developing PCI's ultra-compact catalytic converter for spacecraft life support. The company has been concurrently developing this technology as a compact, lightweight, and high efficiency catalytic converter for automobiles. Prototypes are in test with major U.S. auto manufacturers. Recent testing of the converter has demonstrated emissions reduction that exceeds the new ultra-low emission vehicle standards of the day. The Environmental Protection Agency (EPA) is providing PCI ongoing commercialization support for its converter. PCI has been selected as one of only five small

businesses included in an EPA effort, the Environmental Technologies Initiative Program. PCI is currently exploring strategic alliances for scaling up production and developing a pilot manufacturing plant.

PCI anticipates its current growth and financing efforts will enable it to become a highly value-added, fully-integrated manufacturing company, providing core catalytic components and products for a range of clean combustion market opportunities. Other products in the development pipeline include a durable catalytic grow plug for diesel and gas turbine engines, and hybrid electric vehicle and fuel cell components, which provide a long-term stream of proprietary technology products fueling future company growth.



Dr. Paul Menacherry, a PCI research and development engineer, is working with a custom-built test rig used to simulate automotive exhaust gas.