# Lockheed Martin Awarded Patent For Solid Rocket Nozzle Throat Technology

PRNewswire
SUNNYVALE, Calif.

The U. S. Patent and Trademark Office (USPTO) has granted Lockheed Martin a patent for a new and innovative, near-zero erosion, net-molded ceramic rocket nozzle throat for solid rocket motors. The new ceramic material promises to improve solid rocket motor affordability and performance compared to the current state-of-the-art 4D carbon-carbon material.

In 1997, Lockheed Martin Space & Strategic Missiles, Sunnyvale, Calif. initiated an advanced materials technology development project to assess the feasibility of using ceramic materials in solid rocket motor nozzle throats as part of an ongoing company-funded Independent Research and Development (IRAD) program. The patent (Patent Number 6,510,694 B2) was issued on Jan. 28, 2003.

Propulsion design engineers with the Fleet Ballistic Missiles (FBM) program teamed with materials scientists from the company's Advanced Technology Center in Palo Alto, Calif. to develop and static test a ceramic as a low-erosion rocket nozzle throat material. FBM engineers are developing this high-temperature advanced ceramic material for potential use in future strategic missile-sized solid rocket motors, however, the new nozzle throat material also holds promise for other applications including tactical missiles and thrusters.

"This is a significant technology breakthrough," said Joe Zegarski, solid rocket motor advanced project lead at Lockheed Martin. "Other organizations all over the world have been trying to develop a zero-erosion throat since the early 1960's. Our invention will help Lockheed Martin provide its customers with more robust and cost effective missile systems in the future."

In a series of scale-up tests using throats specimens up to 2" in diameter and 300 lb rocket motors containing either Class 1.3 or Class 1.1 propellants, the Lockheed Martin ceramic demonstrated to have less than 0.1 mils/second erosion rate and outperformed (i.e., had less erosion than) 4D Carbon-Carbon by a factor of 20. The ceramic throat inserts were fabricated using a net- molding technique, that is expected to provide a greater than 50% reduction in fabrication cost and procurement lead-time compared to those of Carbon-Carbon.

Additional tests of the cost saving ceramic throat technology are planned for the future. The ATC recently fabricated the largest ceramic-lined nozzle throat insert to date, a 5.2-inch throat insert that will be tested with an 800-pound, Class 1.1 solid rocket motor.

In January 2003, Technology Review -- published by the Massachusetts Institute of Technology (MIT) -- for the third consecutive year ranked Lockheed Martin first in the aerospace industry for the technological strength and innovation of its patents. Last year, USPTO issued 199 patents to Lockheed Martin from a total of 500 patent applications submitted by Lockheed Martin engineers and scientists.

Space & Strategic Missiles is a part of Lockheed Martin Space Systems Company, headquartered in Denver, Colo., one of the major operating units of Lockheed Martin Corporation. Space Systems designs, develops, tests, manufactures and operates a variety of advanced technology systems for military, civil and commercial customers. Chief products include space launch and ground systems, remote sensing and communications satellites for commercial and government customers, advanced space observatories and interplanetary spacecraft, fleet ballistic missiles and missile defense systems.

Headquartered in Bethesda, Maryland, Lockheed Martin employs about 125,000 people worldwide and is a global enterprise principally engaged in the research, design, development, manufacture and integration of advanced technology systems, products, and services. The Corporation reported 2002 sales of $26.6 billion.

For more information about Lockheed Martin Space & Strategic Missiles, see our website at: http://lmms.external.lmco.com/

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