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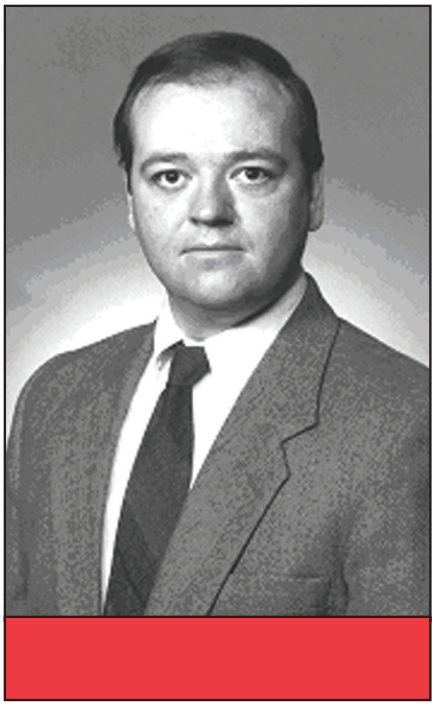
Success Story

DR. NELSON FORSTER RECEIVES AIR FORCE SCIENCE AND ENGINEERING AWARD FOR MANUFACTURING TECHNOLOGY



The Air Force recently awarded Dr. Nelson Forster, a Propulsion Directorate scientist, the Air Force Science and Engineering Award for Manufacturing Technology. Dr. Forster's team developed a process to manufacture bearing cages from carbon-carbon materials for use in advanced turbine engines, air vehicles, and missiles.

These bearing cages enable turbine engine operation far beyond current operational capabilities. Manufacturers can use this innovative process to make components for demonstrator engines for the Integrated High Performance Turbine Engine Technology (IHPTET) program, engines for unmanned air vehicles, and high-speed missile cruise missile engines.

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Accomplishment

Dr. Forster applied his internationally recognized expertise in mechanical systems design to invent a process to develop high-temperature bearing cages. This innovative process uses a carbon matrix tube reinforced with carbon fiber in a fabric woven in a multi-directional arrangement. After processing, the resulting material provides low density, high-thermal conductivity, low friction, and exhibits essentially no wear.

Bearings with this cage material generate substantially less heat and demonstrate a much lower operating temperature than bearings with traditional metal or polymer cages. This material is available at low cost—only 10% of the total bearing cost.

Background

The IHPTET program is a national program coordinating the efforts of the Air Force, Army, Navy, the National Aeronautics and Space Administration, and the major US turbine engine manufacturers. The overall goal of this effort is to double the propulsion capability of turbine engines relative to the baseline technologies in operation in 1987.

Existing turbine engine bearing cages use either metal or polymer-based materials. Such bearings will seize due to thermal run-a-way at temperatures higher than 550°C—the temperatures required for Mach 3 turbine engines. Other polymeric materials, such as phenolic cages, will melt, char, or burn during these required conditions.

To date, carbon-carbon is the only material to withstand these conditions and provide the required bearing performance. Testing of these bearing cages also indicates they offer ten times the improvement in bearing life for fuel-cooled bearings and show promise in applications to high-speed control moment gyros for military satellites. Directorate engineers plan to test carbon-carbon bearing cages in the XTL-16 and XTC-67 IHPTET demonstrator engines in 2004.

Propulsion
Awards and Recognition

Additional information

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