NASA TECHNOLOGY TRANSFER

Commercial Applications of Aerospace Technology

Fastrac Engine

The National Aeronautics and Space Administration (NASA) at Marshall Space Flight Center (MSFC) seeks qualified companies to further develop and commercialize the Fastrac turbopump rocket engine. The Fastrac engine can be built for less than $1 million using commercially available off-the-shelf (COTS) components and simplified manufacturing techniques. Fastrac provides 60,000 pounds of thrust and has many potential launch system applications. Having been tested successfully, the engine will propel NASA's X-34 flight demonstrator vehicle.

The NASA Fastrac Engine reflects NASA's new philosophy of "better, faster, cheaper."

Market Possibilities

According to the Federal Aviation Administration report *1998 LEO Commercial Market Projections*, approximately 400 to 500 launches are anticipated through the year 2010. MSFC's Fastrac engine could provide an alternative launch vehicle. Because Fastrac may provide a less expensive launch platform, market size may increase. The Fastrac engine can be used as a reusable launch vehicle thrust system for the 150 to 200 lower weight launches. Further developments will enable Fastrac to be used as an upper stage engine or scaled to accommodate larger size payloads.

Benefits - Low Cost of Manufacture

- Reduced complexity of engine design:
  - Simple cycle: liquid oxygen rocket propellant, gas generator
  - Simple control system: open loop sequencer
  - Simplified geometry: easy to machine
  - Fewer parts than previous American-made rockets.
- Use of commercially available off-the-shelf components technology.
- Use of low-cost, high-performance materials.

The Technology

NASA's goal is to develop a launch infrastructure that reduces the cost-to-orbit of a pound of payload from the current $10,000 to $1,000. This goal has helped define the major attributes of a new generation of low-cost rocket engine technologies that are key components of the new MSFC Fastrac engine. The Fastrac engine is being designed to cost approximately $1 million, about one-fifth the cost of other engines of similar size and performance. The Fastrac engine provides 60,000 pounds of thrust and has many potential launch system applications.

Technology Opportunity

The Fastrac engine uses a gas generator cycle to drive the turbine. A mixture of liquid oxygen and kerosene fuels the engine, which has significantly fewer parts than previous American-made rocket engines. The Fastrac engine is 7 feet long and 4 feet wide, and it weighs less than 2,000 pounds. Among the innovative elements of the Fastrac engine are a new low-cost combustion chamber and a low-cost injector.

Combustion Chamber

The combustion chamber features an ablative cooling layer that decomposes as it absorbs the heat of combustion. The chamber is integrated with the main nozzle assembly into a unitized structure made of state-of-the-art ablative and refractory materials. High-performance silica phenolic tape makes up the ablative liner, which is overwrapped with graphite epoxy to form the complete chamber/nozzle assembly. The ablative behavior of the liner is used to both cool and insulate the metal nozzle shell by resin boil-off and char layer formation. The ablative layer can be replaced after each flight of the engine's expected 7-launch life.

Injector

The new innovative injector design comprises only three parts: an injector core, a liquid oxygen dome closeout, and a faceplate. The geometry of each part is designed to be relatively easy to machine. The novel geometry of the injector core eliminates the need for fuel delivery manifolds largely due to the combination of a large monolithic faceplate with unique fuel channel patterns in the core. This three-part assembly configuration greatly reduces the complexity of the overall injector and virtually eliminates the need for fuel downcomer holes.

Commercial Opportunities with NASA

Patent applications have been filed for three elements of the engine technology: (1) the rocket nozzle and combustion chamber structure, (2) the fuel injector, and (3) the combination of the combustion chamber/nozzle with the injector to form the thrust chamber assembly. Commercial opportunities exist through licensing and cooperative development opportunities with NASA.

Contact:

Peter Liao
NASA Technology Applications Team
Research Triangle Institute
Phone: (919) 541-6124
Fax: (919) 541-6221
E-mail (preferred): pliao@rti.org

Danny Davis
Project Manager
NASA Marshall Space Flight Center
Phone: (256) 544-3145
Fax: (256) 544-3214
E-mail: danny.davis@msfc.nasa.gov

FS-2000-10-188-MSFC