Innovative Technology Transfer Partnerships

At John F. Kennedy Space Center

Instrumentation Systems Development

Orbiter Tire Pressure Monitor (TPM)

- **NASA's mission**
  - To understand and protect our home planet
  - To explore the universe and search for life
  - To inspire the next generation of explorers
    … as only NASA can
- **Technological innovation and collaboration**
  - Create a more secure world and improve quality of life
  - Enable capabilities

Orbiter Tire Pressure Monitor (TPM)

TECHNOLOGY TRANSFER PROGRAM

- **New Mission Statement**
  - Create partnerships with industry, academia, and other government agencies to develop and transfer technology in support of the NASA Enterprises.

- **New Goals**
  - Reduce NASA technology development life-cycle costs.
  - Transfer technology in support of the NASA mission.
  - Enhance NASA mission technology capabilities.

Orbiter Tire Pressure Monitor (TPM)

WHAT NASA OFFERS

- **Access**
  - Technologies (IP ownership)
  - Capabilities and other assets
  - Development and testing (reduced risk of failure)
- **Partnership**
  - Various vehicles: Space Act Agreements, SBIR, licenses, and more
  - NASA R&D contractors, universities, and other companies
- **Multifaceted teams to coordinate collaboration**

Orbiter Tire Pressure Monitor (TPM)

Innovative Technology Transfer Partnerships

- **What We Do**
  - **Spin-out:** Introduce NASA innovations into external sectors (business and industry, academia, other government)
  - **Spin-in:** Identify innovations in the external sector that facilitate NASA R&D (achieving our missions faster and more efficiently)

Orbiter Tire Pressure Monitor (TPM)

- **Focus of instrumentation systems development**
  - Transducer Development
  - Hazardous Gas Detection
  - Contamination Monitoring
  - Testing and Installation of KSC facility systems

- **Technologies**
  - Orbiter Tire/Strut Monitor
  - Airborne Volcanic Emissions Mass Spectrometer
  - Wireless External Tank Center of Alignment

Orbiter Tire Pressure Monitor (TPM)

■ Project requirements

- Requirements call for performing accurate pressurization and pressurization decay tests (leak tests) to tires and struts.
- Requirements call for identifying any leak paths during ground processing before the Orbiter is ready for flight.

■ Instrument requirements

- Pressure range from 14.7psia to 500 psia.
- Detecting 0.1-psi pressure changes at that pressure range.
- Accurate within a temperature range from 20°F to 120°F.
- Minimize the instrument high pressure volume, thus reducing the risk of personal injury to the operator.

Orbiter Tire Pressure Monitor (TPM)

Project approach

- Design utilizes:
  - Small, highly accurate pressure and temperature sensors;
  - Optimum mechanical interface between the tire/strut valve and the sensors;
  - Compact, hand-held electronics unit that provides rapid, reliable pressure/ temperature data display.
- Instrument sensing head attaches directly to the pressure supply/relief valve on the tire and/or the strut, with the electronics contained in a hand-held enclosure connected by means of a six (6) foot instrumentation cable.
  - Keep the operator at a reasonable distance from the tire or strut.
- Places instrument as close to the tire or strut measurement location.
  - Allows to make accurate measurements.
  - Minimizes the length of high-pressure lines or volumes.

Orbiter Tire Pressure Monitor (TPM)

Project approach

- The pressure measurement portion of the proposed system centers on a small, highly accurate pressure sensor capable of delivering pressure measurements repeatable to within 0.03 pounds per square inch absolute (PSIA).
- Temperature compensation and correction is required to maintain this tight tolerance through out the wide operating temperature range.
- The complete pressure sensor assembly, housed in a stainless steel enclosure, contains the pressure sensor, a temperature sensor and electronics for precision excitation to the pressure sensor and amplification of pressure and temperature measurements.
- The sensing unit housing, fittings and unit's orientation were designed to allow for easy installation and removal by technicians.

Orbiter Tire Pressure Monitor (TPM)

Project approach

- The hand-held device can be powered by 12-VAC or by 9-VDC batteries.
- Electronics provide supply voltage to the sensing unit electronics, as well as low pass filtering and analog-to-digital conversion of sensors measurements.
- The system includes smart software algorithms embedded in a micro-controller, utilizing complex conversion equations developed from pressure and temperature sensor calibration data.

National Aeronautics and Space Administration

John F. Kennedy Space Center

SPACEPORT ENGINEERING AND TECHNOLOGY

Orbiter Tire Pressure Monitor (TPM)

SPIN OUT OPPORTUNITY:

For further on licensing this technology from NASA please contact:

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