Application Brief: MSTI

Bridging the Gap Between Concept and Implementation! (sm)

Productivity

- MATRIX$_X$ Compliant
- High Fidelity Signals
- Real Time
- Graphical Operator Console
- Command Override

Advanced Technology

- PowerPC 604e
- 100BaseT Ethernet
- Scalable Architecture
- Multi-Model
- IRIG-B Synchronization

Support

- Validated Aerospace Model Library
- Time-Tagged Scripting Console
- Manual Telemetry Override / Trend

Miniature Sensor Technology Integration

The Miniature Sensor Technology Integration (MSTI) spacecraft program, sponsored by the Strategic Defense Initiative through Phillips Laboratory at Edwards Air Force Base, consisted of a series of three low-earth, sun synchronous orbital spacecraft designed for experimental observation missions using infrared sensors.

Each of the three spacecraft were designed, built, tested and launched in twelve to twenty-four months. This extremely short design, implementation and test cycle is in part due to a rapid prototyping software development tool set, including automatic flight code generation from engineering block diagrams. MSTI 1, 2 and 3 were successfully launched on November 21, 1992, May 8, 1994 and May 17, 1996, respectively. MSTI 3 had the most stringent attitude knowledge and control requirements of the series with better than 0.011º of attitude knowledge, 0.1º of attitude control.

The MSTI mission evaluated new payload technologies while also realizing a number of collateral achievements. MSTI was the first mission to fly generated code in space. Good design practices of the engineers produced a robust design that twice saved the satellite despite mission-jeopardizing hardware failures. The development tools enabled the program management to maintain design continuity from initial design simulation, to the more specific development of the flight software.

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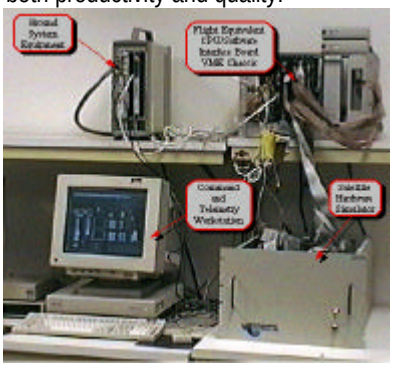
The same models were then used for interactive real-time computer testing, vehicle testing and to create a realistic telemetry simulator. Since each vehicle employed some design reuse, many of these models were validated by data obtained from a prior mission.

Processor in the Loop

MSTI's original design incorporated the satellite control algorithms, models of the satellite's instruments and actuators and models of the natural environment. After the design was complete, the control model was generated into flight code. The instrument and environmental models were automatically generated into interactive test software.

Known as "processor-in-the-loop," this technology is tightly integrated into the graphical code development tools so that substituting actual hardware signals into a real-time emulation is comparatively simple. This technology is one of the characteristics that distinguish the Octant service organization apart from other engineering organizations. The appropriate application of these tools simultaneously improves both productivity and quality.



Here the flight computer engineering model is executing generated code produced from the design simulation. The real-time emulator uses the instrument and environmental models to produce hardware signals identical to the flight machinery. The simulation originally ran on a workstation now is targeted to the flight computer and the real-time environmental simulator.