ORS Responsive Manufacturing Spacecraft

Next Generation Factory
Small Space Work Cell

Advanced Manufacturing & Assembly
A new approach was taken by Raytheon Missile Systems to invest in an autonomous manufacturing and assembly workstation to demonstrate autonomous manufacturing of low volume, high-value assets and autonomous test capability that is agnostic to the product that utilizes that capability. This methodology was recognized by ORS as a potential application for the low-volume, high-value concept. ORS consequently began an effort to build a 6U CubeSat designed specifically for advanced manufacturing methods.

Next Generation Factory includes these capabilities:
- Fusion Test Line accessed by robot to complete environmental test
- Small Space Work Cell includes learning/kitting area, advanced assembly workstation, and small space agnostic test cell for functional test
- Modular architecture for product and production line
- Covered under 'Continuous Custody' cameras

ORS Responsive Manufacturing
Spacecraft
Small Satellite Design for Responsive Manufacturing

The ORS Responsive Manufacturing Spacecraft is an operationally relevant 6U CubeSat designed to demonstrate autonomous manufacturing of low volume, high-value assets and autonomous digital techniques to provide mission assurance.

The spacecraft includes the following key features:
- 6U CubeSat is compatible with a Planetary Systems Corporation (PSC) Canisterized Satellite Dispenser (CSD)
- Simple and reliable deployed solar arrays
- SMA solar array release mechanisms
- High-accuracy pointing control (<0.02°) from the star tracker and reaction wheels
- Unified 5-band radio with Type 1 encryption
- Two switchable 12V unregulated power buses
- Dual lower-cost commercial-based processors provide high reliability by using a processor management board to autonomously analyze and repair failure of the primary processor should it occur and activate the backup processor if necessary
- 4 Gbytes mission memory
- Use of Ethernet for high-speed data transfer and controller area network (CAN) data buses for low-speed data transfer
- MOSA software to improve reusability and flexibility
- Reuse of 85% of the Modular Space Vehicle (MSV) flight software (as measured from reused single lines of code-SLOC)
- Payload volume >4000 cm³
- Up to 40W peak payload power

Payload Accommodations
for the ORS Responsive Manufacturing Spacecraft

The ORS Responsive Manufacturing SV provides over 4U of payload volume with flexible mechanical, electrical, and software capabilities:

Mechanical:
- 4642 cm³ available payload volume (~10.2 x 6.7 x 23.9 cm)
- 4 kg payload mass allocation
- 2 cm bolt pattern on baseplate for payload mounting

Electrical:
- Up to 40W peak and 10W average power
- 48VDC power supply (60VDC total for payload suite)
- Space Plug-and-Play Architecture (SPPA) controller area network (CAN) interface (CAN 2.0A-B)
- Ethernet interface (10 Mbps)
- 802.15.4 low rate (150Kbps)
- In addition, the payload suite has:
  - 8 analog input channels
  - 8 analog output channels

Software:
- XMM-based STEPS payload interface "Shiner"
- Full payload access in bus terminology needed for payload operations
- Payload integration does not require changes to existing flight software codebase

Mission Capabilities:
- High accuracy pointing control (<0.02°) from star tracker and reaction wheels
- Store rate: 180 degrees in 64 seconds (includes settling time)
- Guidance pointing modes:
  - Radar
  - Inertial
- Ground point track
- Unified 5-band radio with Type 1 encryption
- TM/Raw memory for 4 Gbytes for storage of payload data