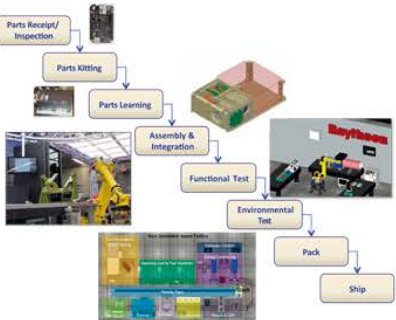


# Next Generation Factory Small Space Work Cell



## Advanced Manufacturing & Assembly

A new approach was taken by Raytheon Missile Systems to invest in an 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 consequentially 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 S-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 >4000cm<sup>3</sup>
- Up to 40W peak payload power

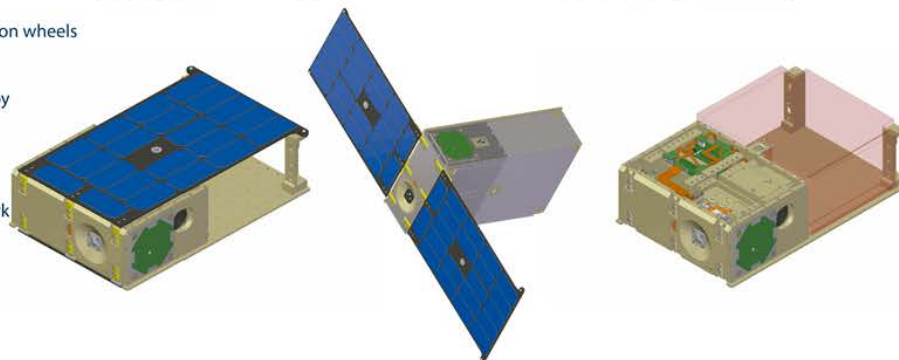


# ORS Responsive Manufacturing 6U Spacecraft

Flexible,  
Reusable,  
Government-Owned  
Design

### Incorporating

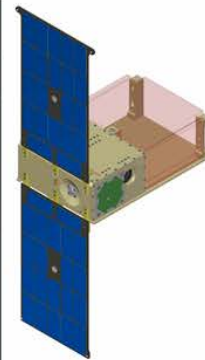
- Autonomous Manufacturing
- Modular Open System Architecture
- Open Standards



# 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 cm<sup>3</sup> available payload volume (~10.7x19.7x23.9 cm)
  - 6 kg payload mass allocation
  - 2 cm bolt pattern on baseplate for payload mounting
- Electrical:**
  - Each payload (up to 3) is provided:
    - Switched 12 V unregulated power
    - Up to 40 W peak power (max of 40 W total for payload suite)
    - Space Plug-and-play Architecture (SPA) controller area network (CAN) interface (CAN 2.0 A/B)
    - SPA Ethernet interface (10 Mbps)
    - 8x Discrete I/O (3.3V CMOS)
  - In addition, the payload suite has:
    - 8 analog input channels
- Software:**
  - XML-based xTEDS payload interface "driver"
  - Full payload access to bus telemetry needed for payload operation
  - 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
  - Slew rate: 180 degrees in 64 seconds (includes settling time)
  - Common pointing modes:
    - Nadir
    - Inertial
    - Ground point track
  - Unified S-band radio with Type 1 encryption
  - TMR flash memory for 4 Gbytes for storage of payload data



Designed Reference Missions:  
(Illustrates system capability)

Reference Mission	Payload On-time	Downlink Duration	Charge Mode
Scenario 1	20 W payload for 30 min in sunlight every other orbit	15 min following payload operation	In sunlight every other orbit
Scenario 2	20 W payload for 30 min in	15 min following payload operation	In sunlight every orbit
Scenario 3	5W payload continuous	15 min every orbit	Generation from NADIR pointing, 45° inclination.

# ORS Responsive Manufacturing Flight Software Modular Open System Architecture (MOSA)

