High Performance Multi-Spectral Observation and Real-Time Video Sighting Enabled by NEMO-HD

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Mission Overview

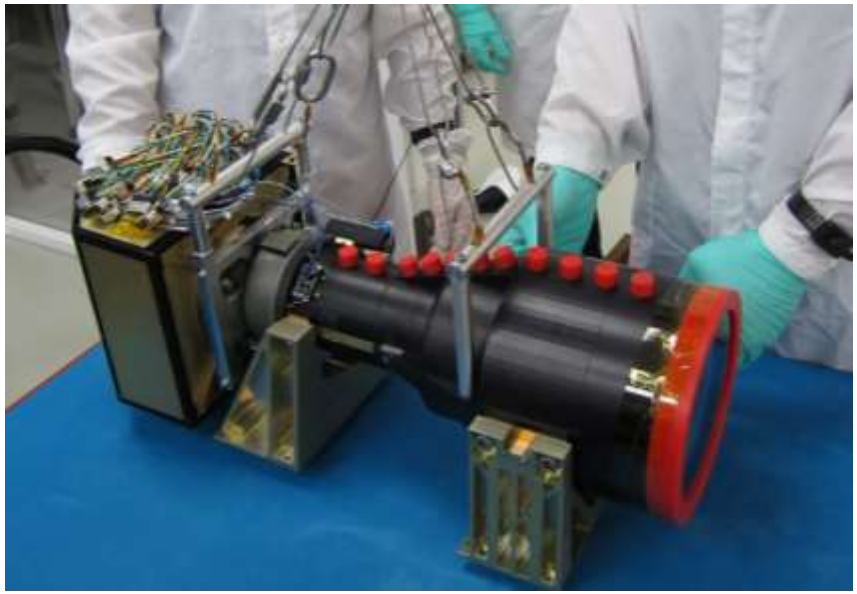
- Mission objectives:
  - Responsive multi-spectral imaging
  - Real-time control
- Organizations
  - Bus design and Payload by SFL
  - Experimental Technologies by SPACE-SI
    - Secondary X-band transmitter
    - Image Processing Pipeline
    - Real-time interactive ACS

Primary Payload

High-Resolution Imaging

- Fast 155 mm f/2.3 optics
- 300 lp/mm resolution at focal plate
- 5 Still image channels

Channel	Band (nm)	GSD	Swath
PAN	400 – 900	2.8 m	
Blue	420 – 520	5.6 m	
Green	535 – 607	5.6 m	10 km
Red	634 – 686	5.6 m	
Near-IR	750 – 960	5.6 m	



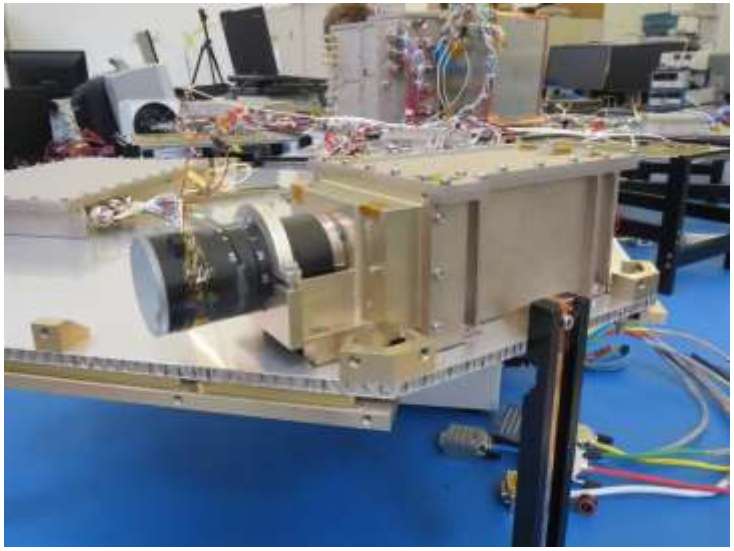
Video Channels

High-Resolution Video
- Same optics as the primary instrument

Low-Resolution Video
- Wide-angle context

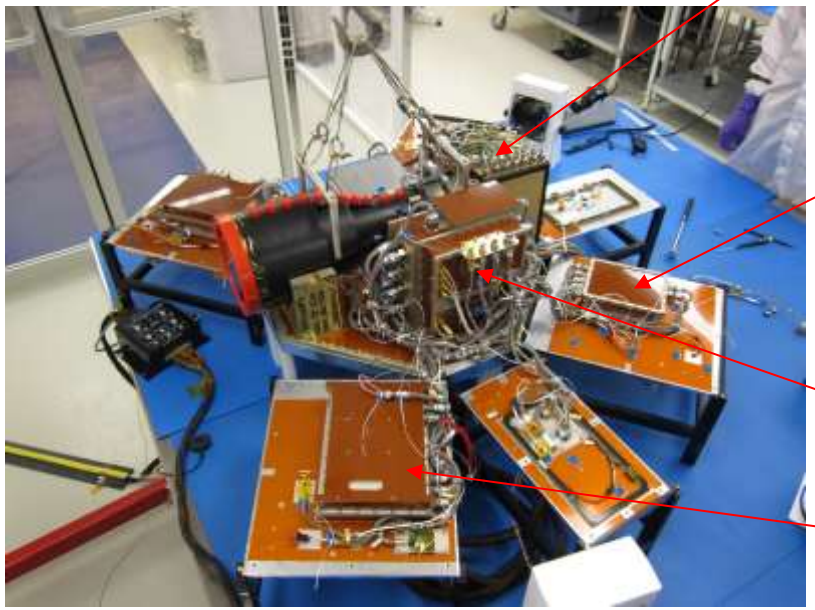
Capable of dual real-time or recorded video streams
- Resolution of 1920 x 1080 (full HD)
- H.264 encoding
- Up to 25 Mb/s per channel

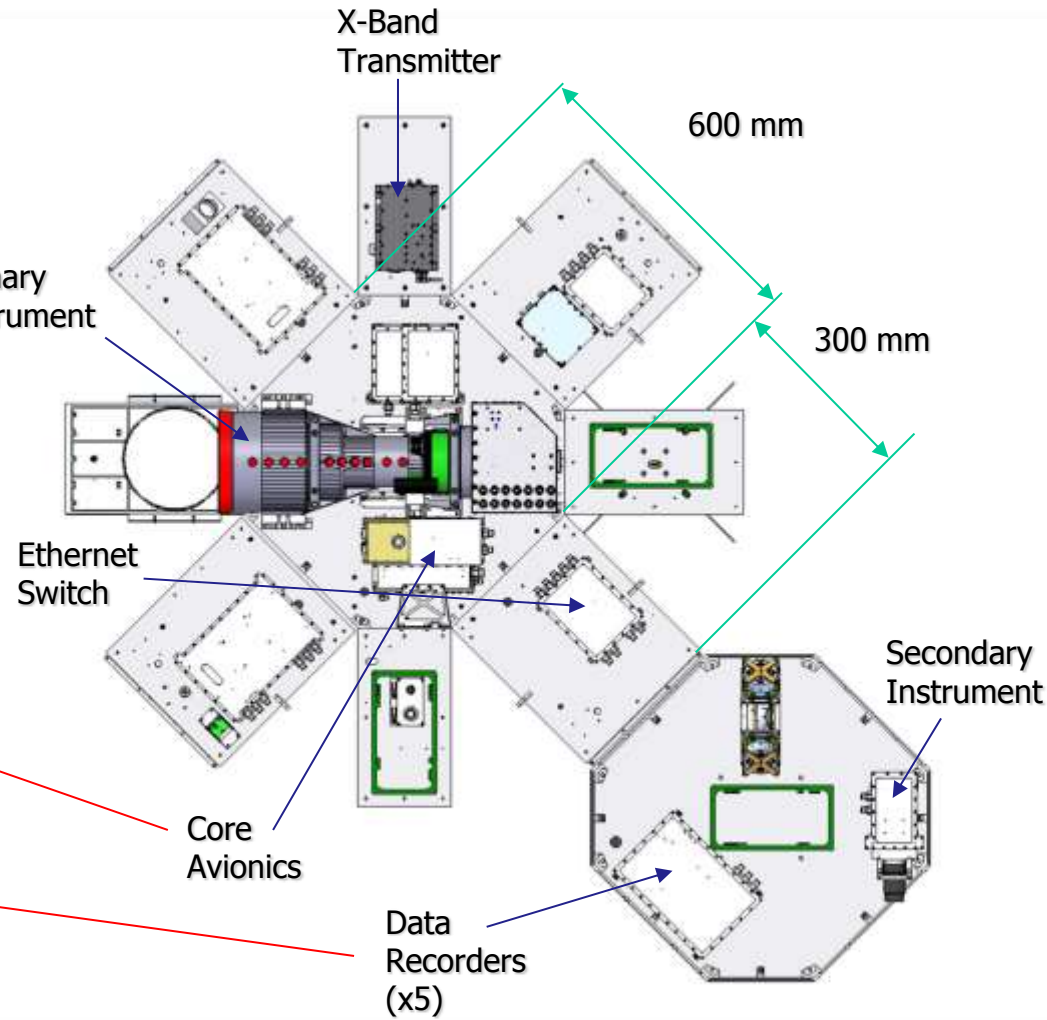
Channel	Band (nm)	GSD	Swath
Primary	RGB	2.8 m	5 km
Secondary	RGB	40 m	75 km



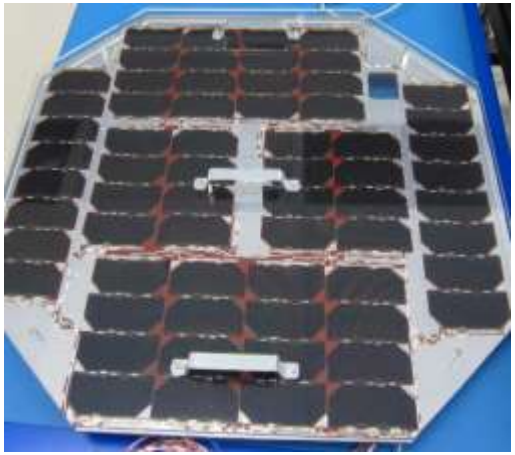
NEMO-HD Bus

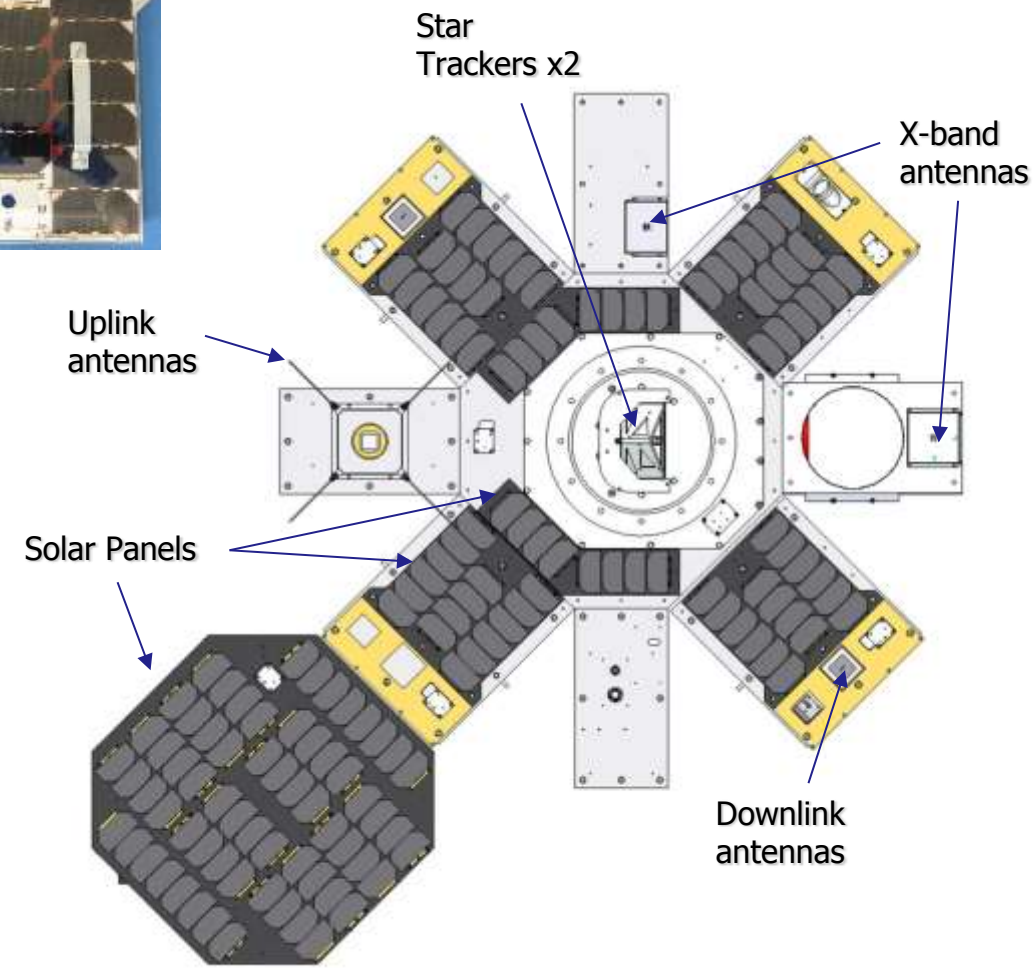
Mass	65 kg
Dimensions	600 x 600 x 300 mm



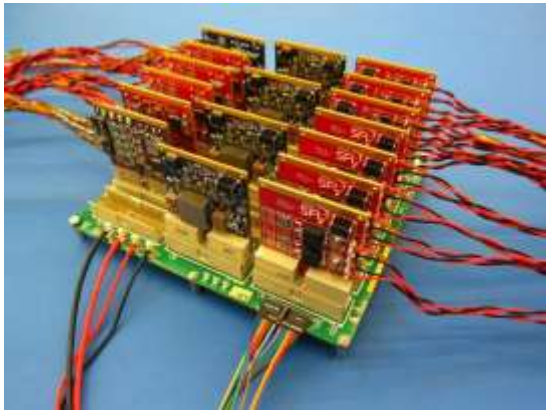


NEMO-HD Bus

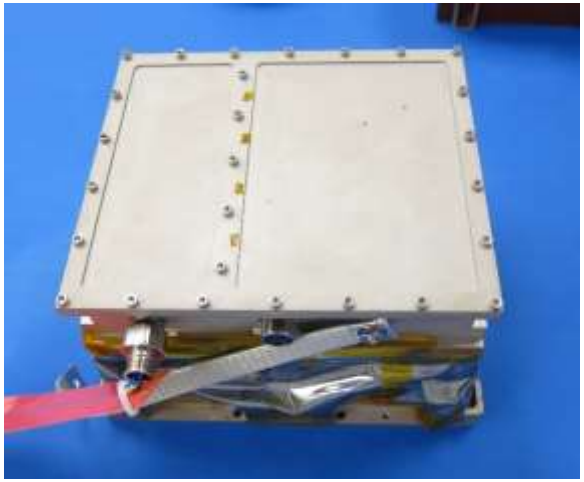


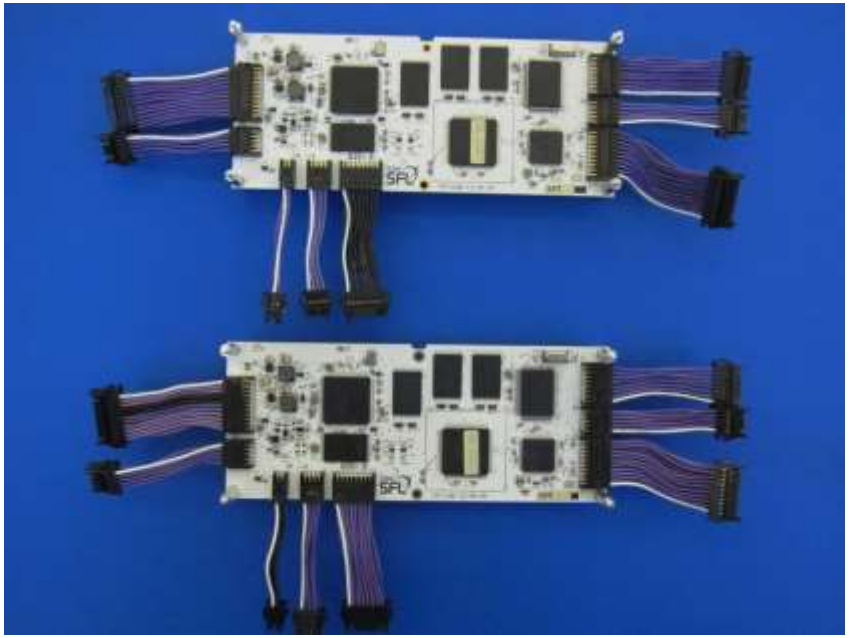

Star
Trackers x2
X-band
antennas
Uplink
antennas
Solar Panels
Downlink
antennas

NEMO-HD Power, C&DH

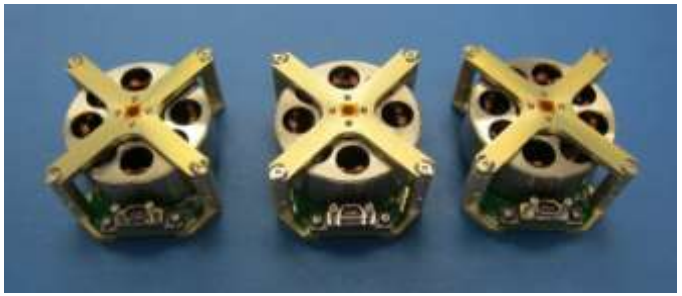


- Modular Power System
  - 5 W keep-alive
  - 215 W peak
  - 5.8 Ah battery
- Housekeeping and Attitude Computers
  - SFL flight heritage
  - some cross-strapping for redundancy





NEMO-HD ADCS

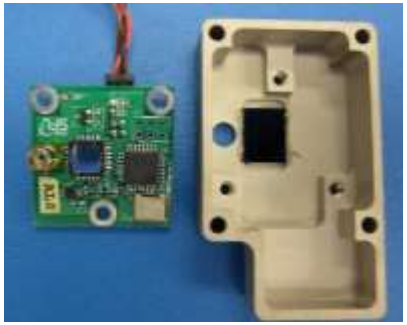


Reaction Wheels

GPS

Rate Sensors

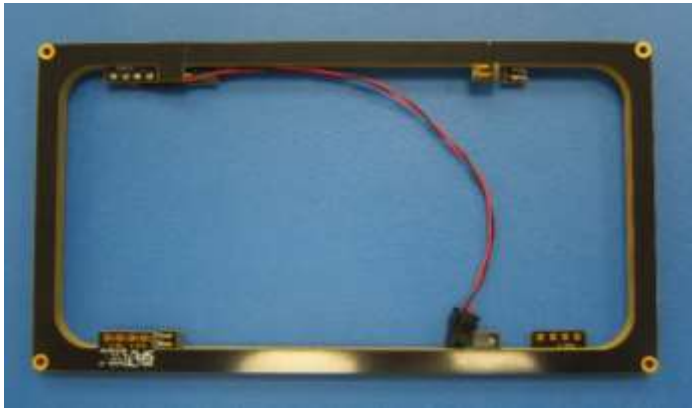
Magnetometer



Sun Sensors

Star Trackers

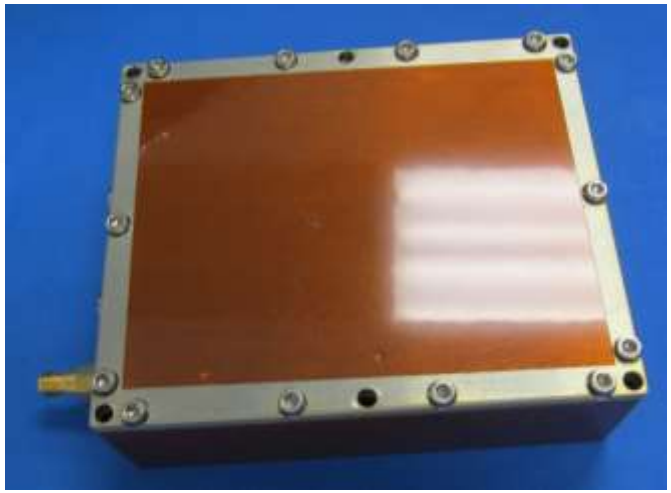
Magnetic Torquer



Determination	< 15″ 1-σ
Pointing	< 120″ 2-σ
Slew Rates	1.5°/s

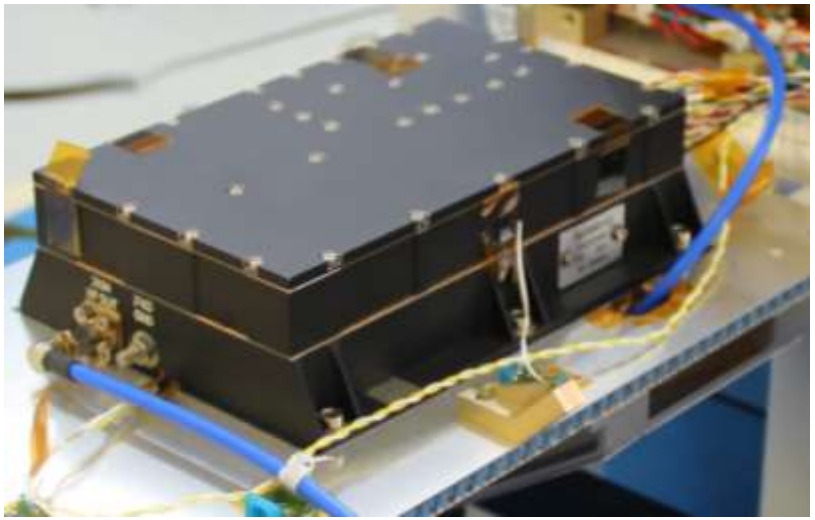
NEMO-HD T&C

S-Band Transmitter UHF Receiver



Space-SI X-Band

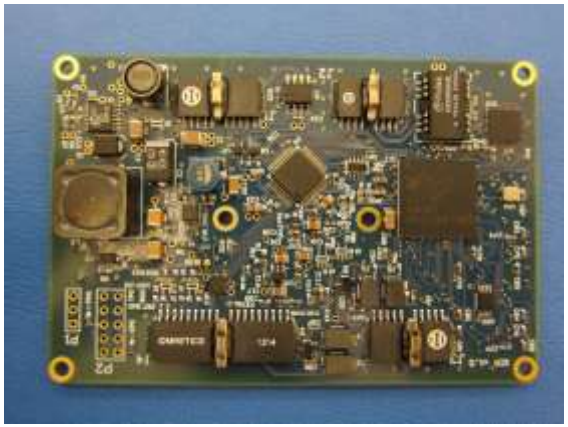
Primary X-Band



Uplink	UHF	4 kb/s
T&C downlink	S-Band	up to 1 Mb/s
Payload downlink	X-Band	50 Mb/s

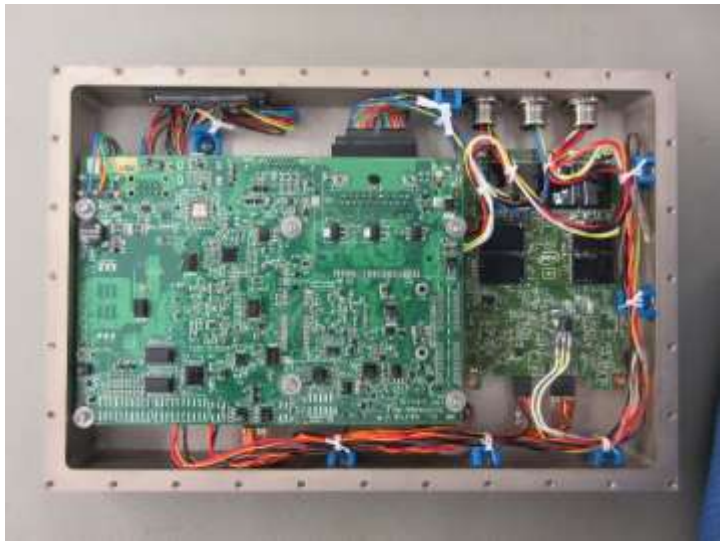
NEMO-HD Payload Electronics

Ethernet Switch



Ethernet-serial converter

Payload Recorder



Concept of Operations

Action	Real-time	Real-time (auto)	Time-tagged
Select channels	yes	yes	yes
View video	yes	yes	no
Record video	opt	opt	opt
ACS	user	target-based	commanded
Frame/swath Acquisition	on command	on command	timed

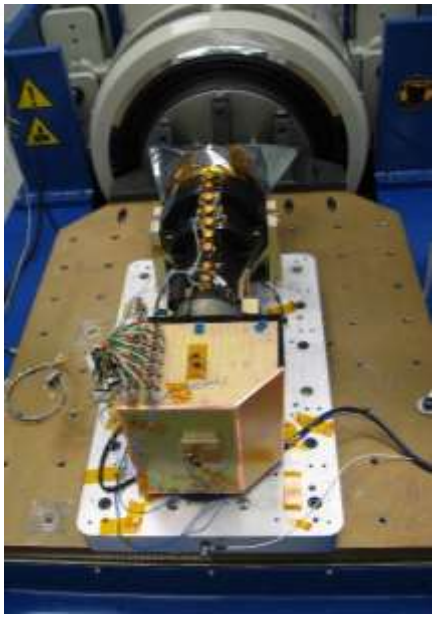
- Payload data can be downlinked at any point
- Automatic slew to sun point when idle

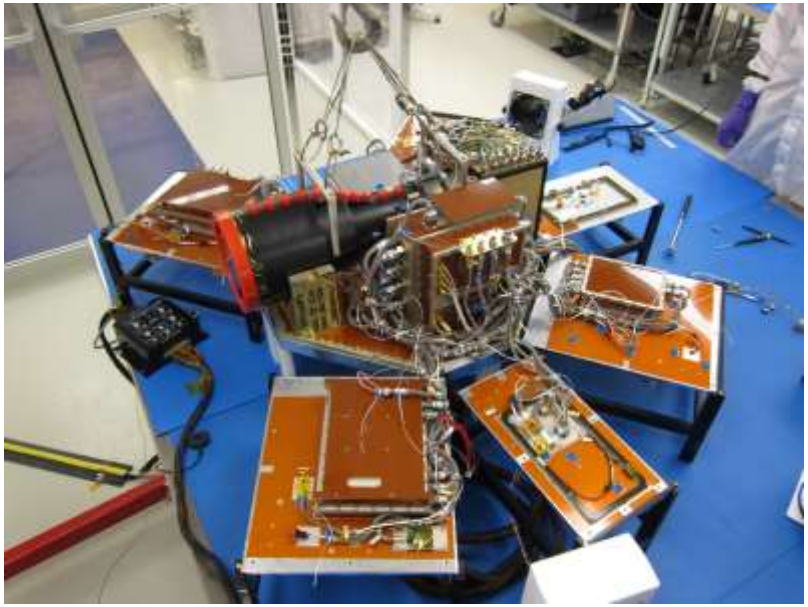
Flexible Earth Observation Platform

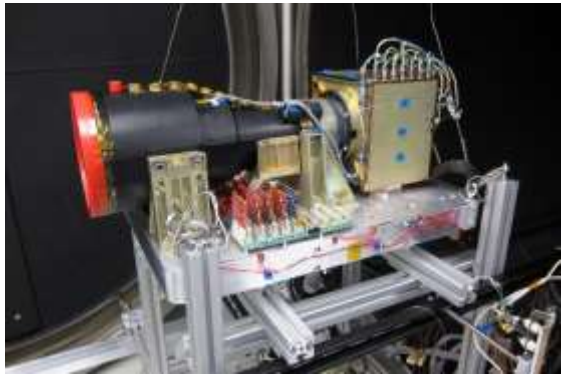
- NEMO-HD bus driven by payload size
- Heavy optics driven by
  - –channel count
  - –resolution
- Change instrument specs for a smaller spacecraft
- Flexible multi-channel architecture easy to adapt to other missions
- Power systems scales 2 W < Pmax < 1 kW

Current Status

- Payload environmental qualification complete
- Satellite assembled ready for integration







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