SURREY

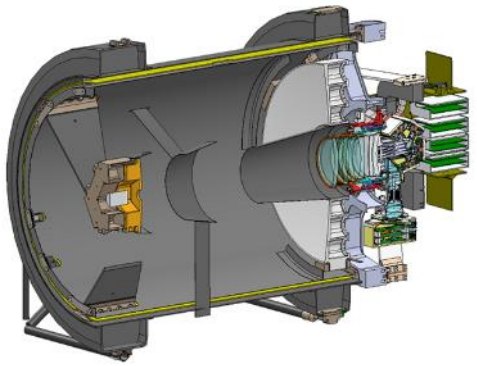
CHANGING THE ECONOMICS OF SPACE

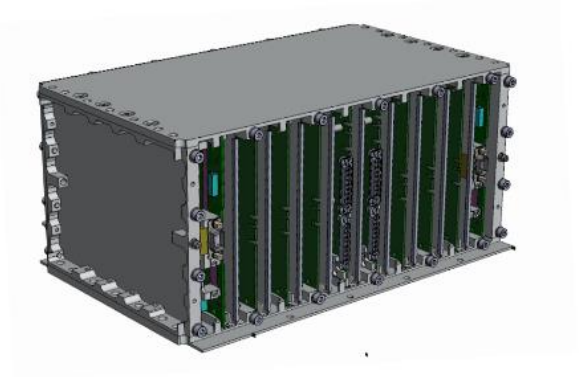
CEOI Low Cost EO Developments

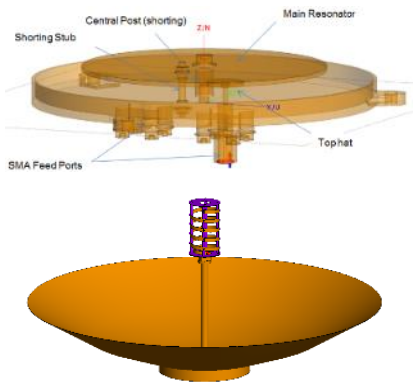
Introduction

Three key developments

- High Resolution Dual Mode Camera
  - Designed and developed for an external customer
  - Key developments funded by CEOI to secure contract
- Payload Data Handling Unit (PDHU) required for interfacing with the Optical and SAR payloads
  - Designed to accommodate up to 3Tbytes of storage
  - Payload data rates up to 10Gbits/s
- Inter-Satellite Link (ISL)
  - Enables a trailing satellite to receive data from a leading satellite so it can be rapidly re-tasked to avoid cloud cover

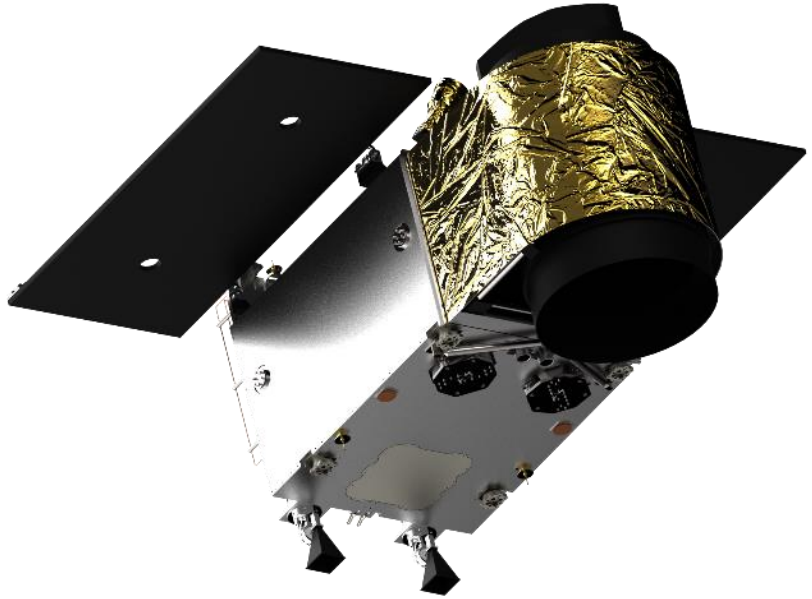


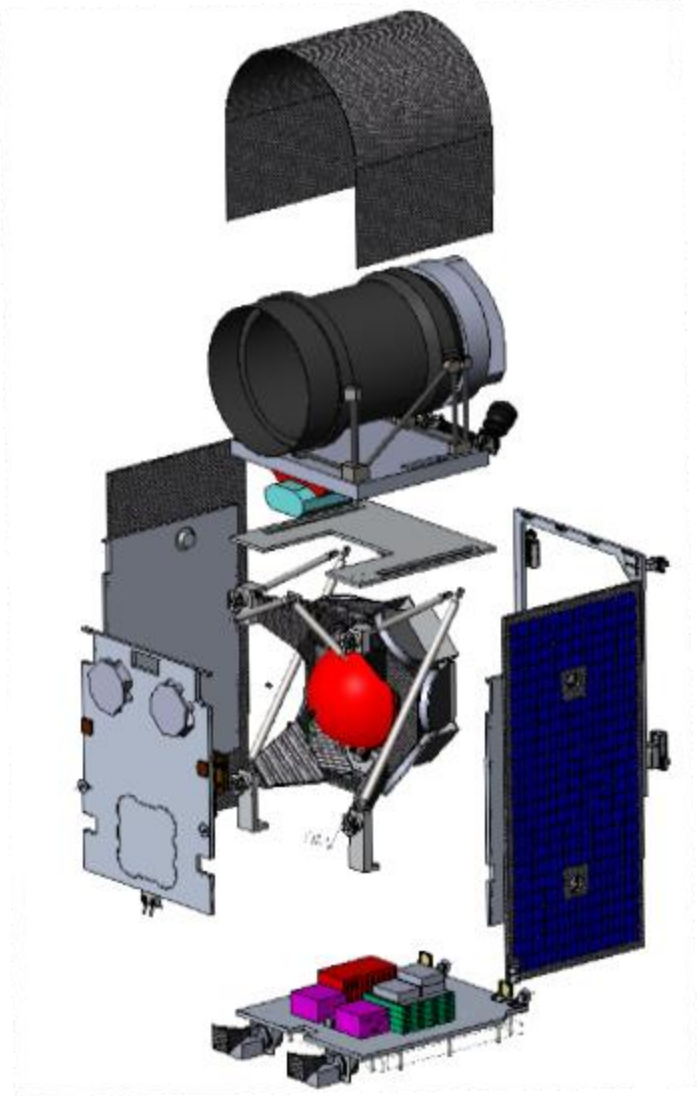




HRC-DM - Overview

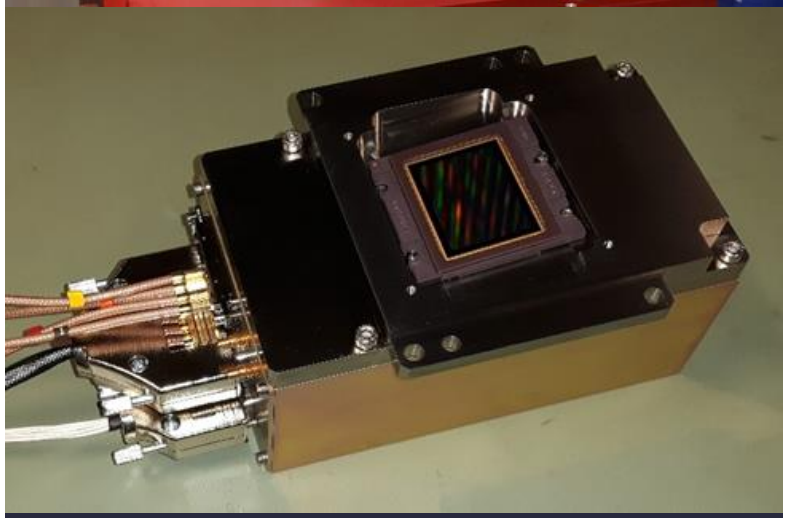
- Video Focal Plane Assembly
  - 0.5m high resolution PAN Optical still imagery and Ultra HD video with a swath of 2.5 x 1.9 km
- The Pushbroom Focal Plane Assembly
  - Channels light from the telescope to panchromatic and multi-spectral CCD and CMOS detectors
  - Provides 0.5m high resolution imagery with 12.5km swath





DM-HRC Technical Achievements

- Derisking of key developments
  - Primary mirror
  - Lens Assembly Engineering models
  - Electronic assembly Engineering models
  - Focus Mechanism Engineering models
- Development of high resolution payload design to CDR level

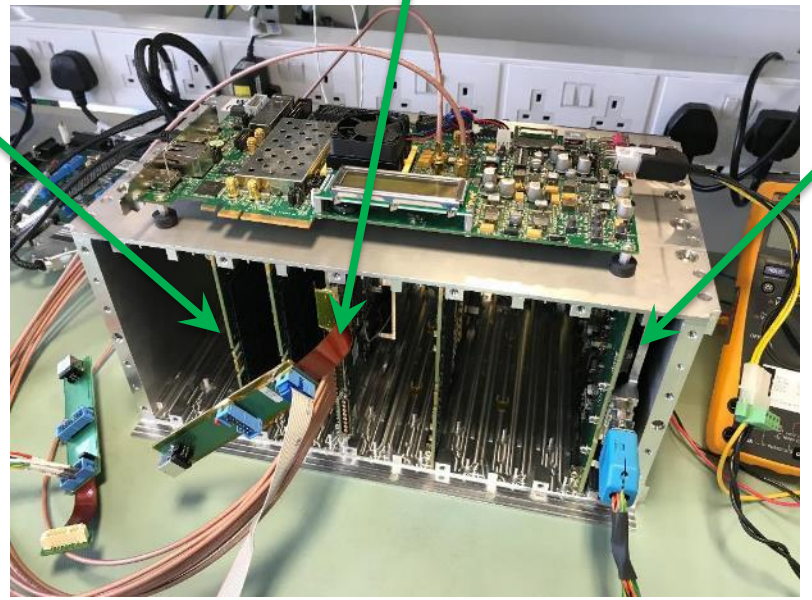


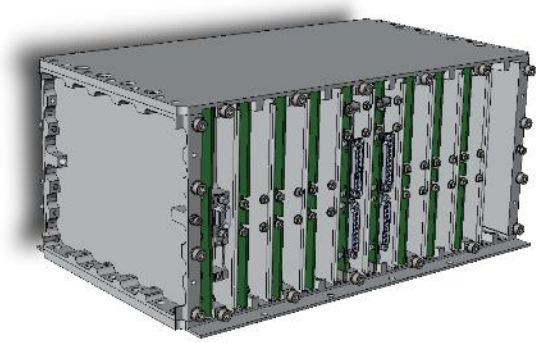
PDHU - Overview

512G Storage

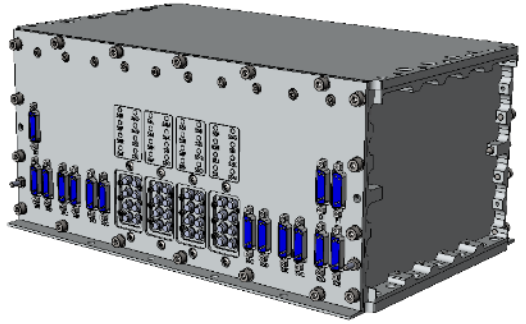
Payload Processing

Central Power Distribution





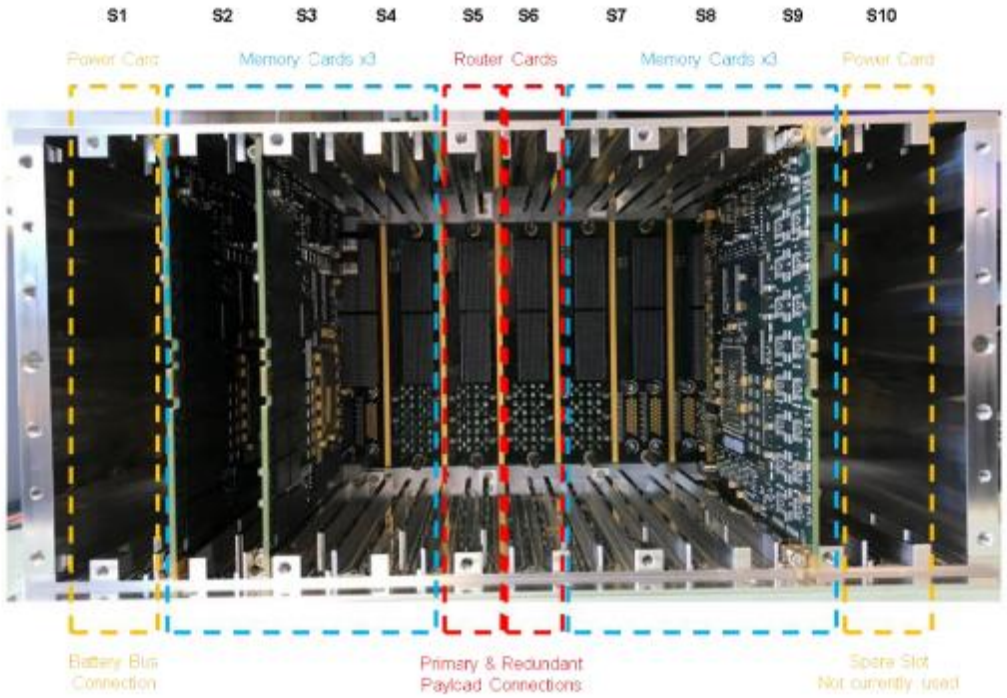
Card Frame - Front



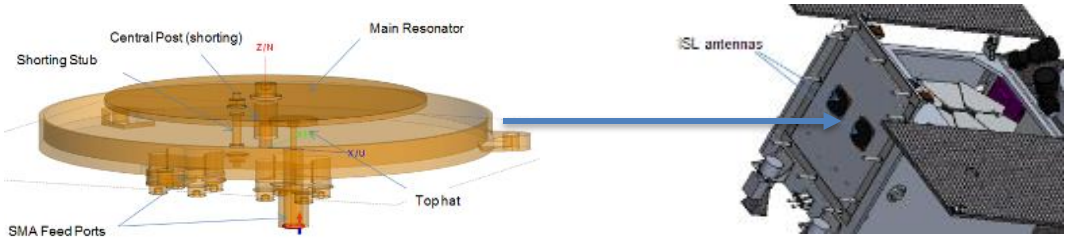
Card Frame - Rear

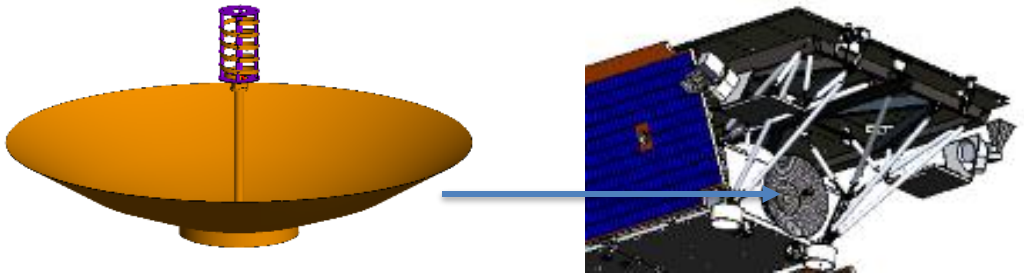
PDHU Technical Achievements

- Gigabit serial payload interfaces
- Switched serial backplane
- Card-frame
- Captured and Downloaded from a representative imager and SAR payload
- 2x EM setups including mechanics



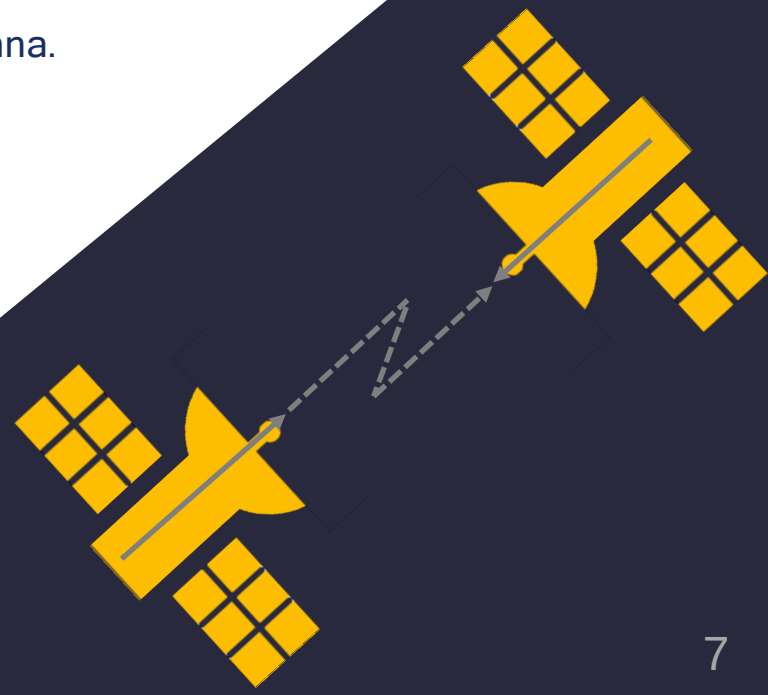
Inter-Satellite Link





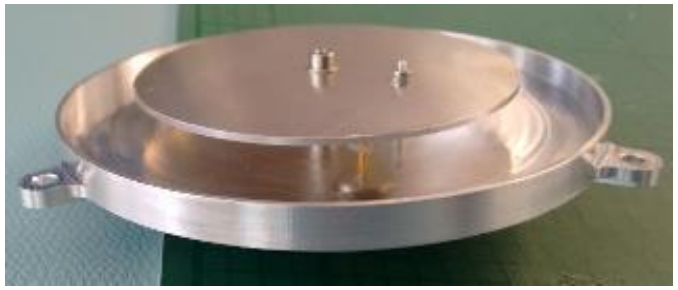
- Inter Satellite Link (ISL) enables a trailing satellite to receive data from a leading satellite so it can be rapidly re-tasked to avoid cloud cover
- ISL design is baselined around SSTL's TTC card
  - Flexible rate receiver
  - High and low rates on one card

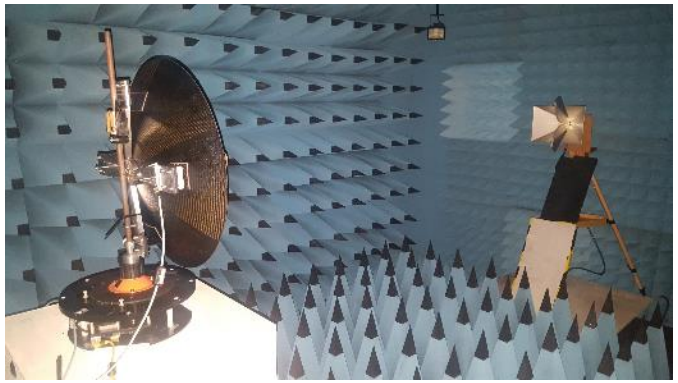
- Two different antenna solutions to satisfy the differing needs of the SAR and Optical craft under all off-pointing conditions
- All Metal Patch (AMP)
  - Low cost solution to providing medium gain levels over a reasonably broad beam width
- Back-Fire-Helix fed Dish
  - High gain, circularly polarised, S-Band antenna.

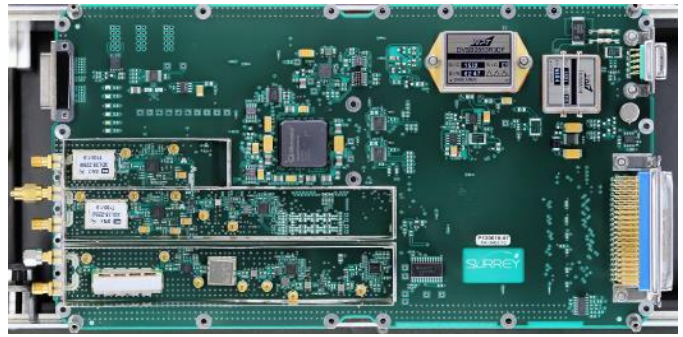


ISL Technical Achievements

- Design, manufacture & test of BFHFD and AMP antennas
  - All Metal Patch (AMP)
    - Quick and simple manufacturing supporting mass-production for large constellation missions
  - Back Fired Helix Fed Dish (BFHFD)
    - Carbon composite reflector antenna to minimise performance variation over the operational temperature range.
    - The back-fire nature of the feed antenna simplifies the overall design
- Design, manufacture and test of 691A TTC hardware solution
  - Additional functionality to improve performance and simplify manufacture
- Development and demonstration of coding wrapper & integration within VHDL for TTC/ISL hardware







Training and Knowledge Achieved

CEOI funding has directly supported the work undertaken allowing the business to train Graduate engineer developing home grown talent and growing the UK Space Industry workforce.

DM-HRC

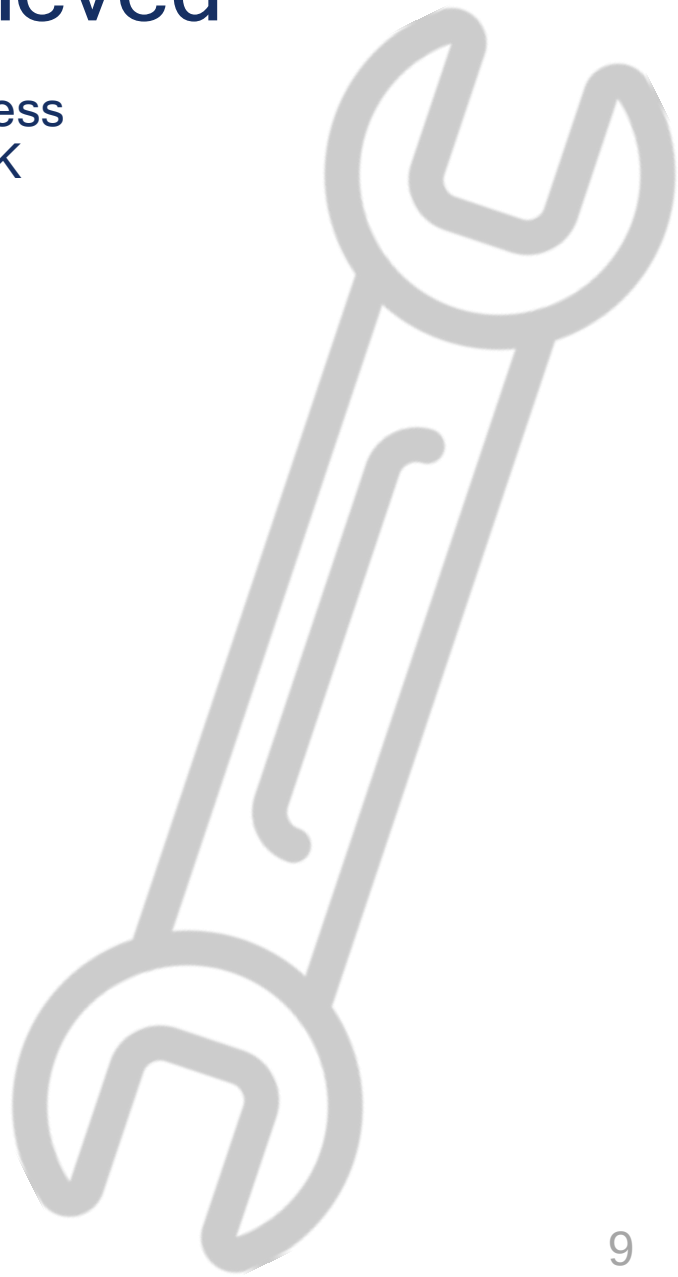
- Primary Mirror Breadboarding developing internal experience in achieving highly accurate mirror measurements

PDHU

- Understanding of newer Xilinx FPGA technology
- Understanding the gigabit serial technology, as this is extensively used throughout the PDHU architecture

ISL

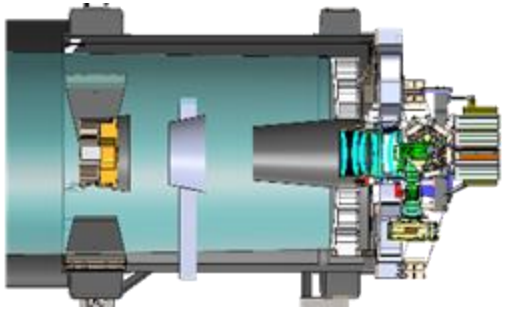
- First dish antenna design conducted by SSTL RF engineer
- First carbon fibre dish manufacture conducted by SSTL
- First implementation on SSTL Transmit/Receive hardware of a CCSDS compatible error correction scheme.



Position Achieved

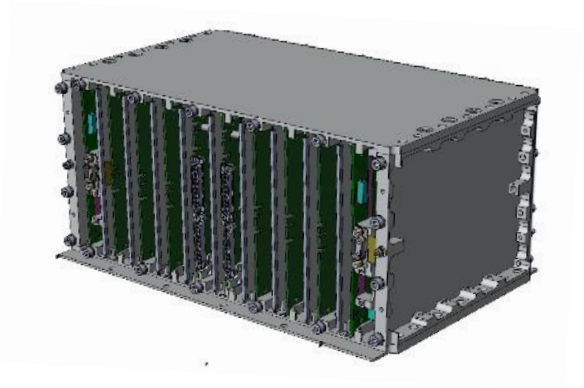
DM-HRC

- New offerings to a range of international customers.
- Derisked use of components in a number of future contracts
- New skills in the design and testing of large form mirrors



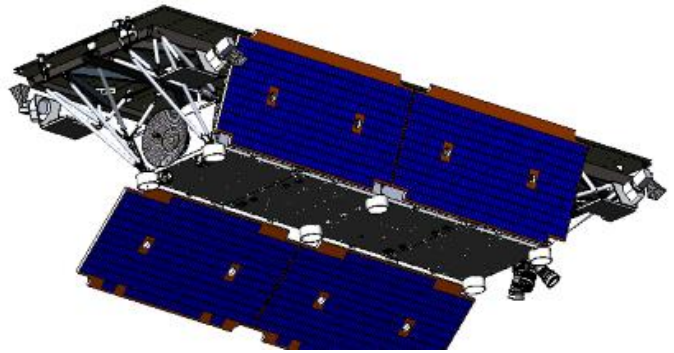
PDHU

- SSTL can now bid into higher capacity and higher performance missions
  - PDHU is currently baselined on 4 SSTL missions
- Scalable and modular data recorder which can adapt to mission requirements
- SSTL first 3Tbyte storage solution
- Control of the IP (hardware, software, and firmware) for evolving the PDHU product



ISL

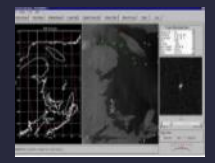
- Control of IP for
  - the next generation of TTC solution
  - ISL specific avionics modifications and associated gateware/software
  - two new antenna products
- AMP to improve TTC capability or enhance low Mbps payload data rate
- BFHFD has potential future MEO/GEO mission re-use



Benefits of the Project to SSTL

- TRL of SSTL low cost imager, data handling and ISL capabilities have been raised
  - Highly innovative Earth Observation sensors
  - Vastly increase the performance of SSTL's satellite platforms.
  - Customers are requiring faster data rates, high compression rates and longer acquisition periods
  - Support numerous payload configurations, and storage requirements
  - Novel technology to enable real time responses to the data


Environmental Monitoring


Maritime Security


High Resolution Mapping


Pollution Monitoring


3D Mapping


Intelligence and Security

Benefits to the UK Economy

- Commercial contracts generated as a result of the investment work
- UK investment producing a competitive advantage
  - "Made in the UK" and "owned in the UK"
  - Retention of IP for the whole DM-HRC imager, PDHU and ISL
- Securing a significant return on investment for UK industry
  - Preferential access to the downstream data
- Future work with International Partners
  - Collaborative work taking place with support of UK Government will encourage Partners to grow UK presence