



# QB50: 2U CUBESAT PLATFORM

An Off-the-shelf 2U CubeSat platform  
tailored for QB50

## MAIN FEATURES

- High efficiency **power system** with significant heritage.
- High energy density **lithium polymer battery**.
- High efficiency, flight proven **solar panels**.
- **On board Computer (OBC)** options:
  - a) High-performance 32-bit ARM Cortex-M1 20MHz Processor based OBC, Actel ProAsic 3, 4xUART, 2xI2C, 1xSPI (1mpbps), 2GB storage.
  - b) Pumpkin CSK MB + PPM E1 (16 MIPS Microchip® PIC24FJ256GB210 w/4xUART, 3xSPI, 3xI2C, 1xUSB, etc.).
- **Attitude control** using magnetorquers, magnetometers and coarse sun sensors to achieve +/-5° pointing and sensing to +/-1°.
- **UHF/VHF Transceiver** and quad dipole **antenna** for communications.
- Proven Pumpkin 2U **structure** and internal mounting.
- **Platform emulator** to de-risk payload development with 32 Bit OBC option.
- Comprehensive User Manuals and support documentation.
- Affordable solution without compromising quality due to use of existing Clyde Space products.
- Compressed schedules due to use of off-the-shelf components in a configuration already proven by Clyde Space engineers.
- Other options:
  - a) Full **mission software** suite for control of your payload and the spacecraft.
  - b) High quality **ground-station** using proven components.

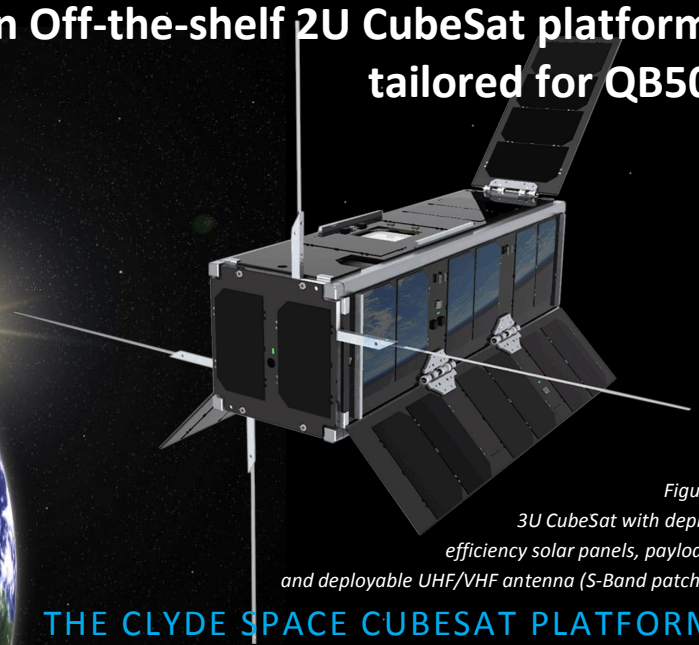


Figure: UKube-1  
3U CubeSat with deployable high efficiency solar panels, payload apertures and deployable UHF/VHF antenna (S-Band patch underside).

## THE CLYDE SPACE CUBESAT PLATFORM

Our QB50 platform ground-station based on the UKube-1 platform that Clyde Space is currently providing for the UK Space Agency. Our platform technology has undergone and passed a Critical Design Review by Astrium UK on behalf of the UK Space Agency and will be launched in Q4 2012. Furthermore, the ground segment option we propose is also part of the UKube-1 project.

UKube-1 is a 3U Cubesat and is designed to accommodate multiple payloads. To aid the development and integration of payloads, we have also developed a platform emulator, simulating the electrical, software and mechanical interfaces of the CubeSat platform, simplifying and accelerating spacecraft integration, de-risking the mission in general.

Our QB50 platform takes the key elements of UKube-1 and applies them to a 2U form factor.

## WHY USE CLYDE SPACE FOR QB50?

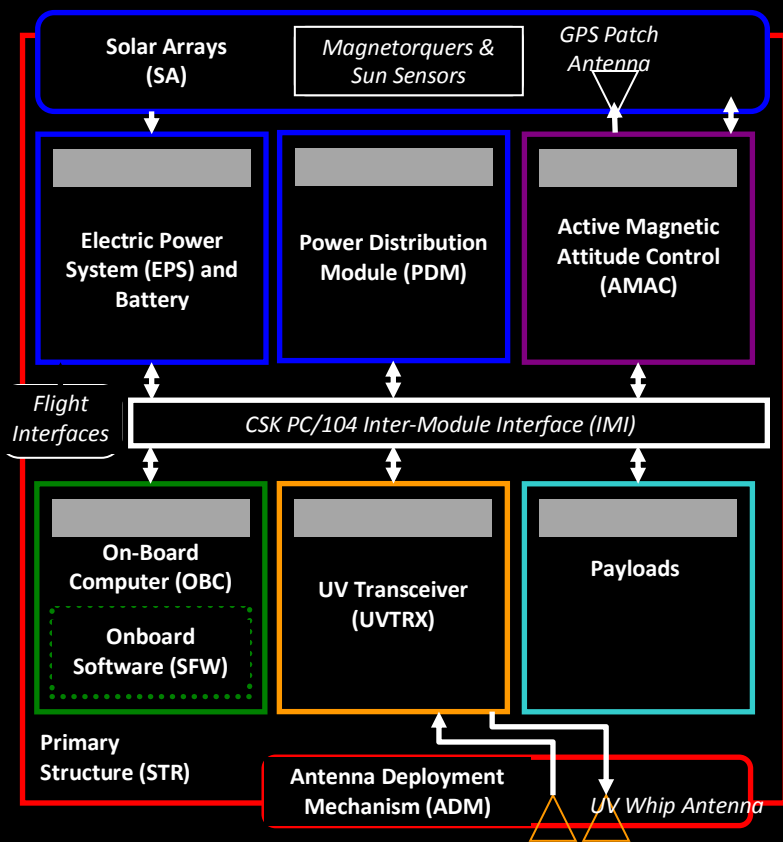
Clyde Space is a leading CubeSat provider and our hardware is used on at least 40% of all CubeSat missions, including the top missions in the USA such as SMDC-ONE, NASA Firefly and DICE. We are the only company to spin-out from the highly successful small satellite company, Surrey Satellite Technology Limited. Founded by a former technical lead at Surrey, Clyde Space has established itself as the market leading provider of CubeSat systems. As the provider of the UK Space Agency's first mission, UKube-1, Clyde Space's expertise now extends to complete spacecraft.



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**We have more experience in delivering successful small satellite missions than any other CubeSat vendor**

The figure below describes the proposed system architecture for the 2U CubeSat, indicating the subsystem classification within the spacecraft. This describes the functional architecture, based upon the CSK PC/104 board format and the additional interfaces required.



**SA:** Power generation uses off-the-shelf Clyde Space Solar Arrays with >28.3% Spectrolab Solar Cells. Two 5.2W, two 4.2W and two 2.1W solar panels are included. All Surface Mount Arrays incorporate Embedded MTQs and Coarse Sun Sensors.

**EPS:** Clyde Space off-the-shelf next generation EPS, with 3 maximum power point tracking battery charge regulators. 3.3 V @ 4 A, 5 V @ 4 A, 12V @ 1A and Battery V @ 4 A.

**BAT:** Off-the-shelf Clyde Space 20 Whr battery arranged 2S2P, with a nominal voltage of 7.9 V

**OBC:** Options: **32BIT:** Platform and payload operations, command, and data handling primarily utilising a flash-based Actel FPGA with softcore processor. 8 kB Shared Memory for telemetries and flags, and 2 x 1 GB Mass Memory. **16BIT:** 16 MIPS Microchip® PIC24FJ256GB210 with SD Card slot.

**SFW:** Onboard Software is only available for the 32BIT OBC. Developed by Clyde Space it also uses software modules from ESA spacecraft software specialist SciSys. The software modules are configured to provide an API, enabling you to develop and run software on-board the spacecraft without invalidating the core spacecraft software.

**UVTRX:** Primary transceiver capability for telecommand, telemetry, and redundant payload data, uses an ISIS off-the-shelf UV Transceiver, providing a UHF uplink and VHF downlink. The UV Transceiver interfaces to a UV Whip Antenna deployed from the Antenna Deployment Module

**AMAC:** Basic guidance, navigation and control functionality uses a Clyde Space developed Active Magnetic Attitude Control system with a 2-axis pointing capability of +/- 5° and sensing to 1°. Actuation is provided by a set of 6 magnetorquers and sensing by a MEMs gyros, accelerometers and magnetometers. Coarse sun sensors are mounted on the solar arrays. A GPS daughterboard is optional.

**STR:** Pumpkin off-the-shelf (skeletonised) Primary Structure with integrated Separation Microswitch.

**IMI:** The Inter-Module Interface uses the CSK PC/104 format headers providing all common data and power bus lines and signals. Four Data Buses are provided through the interface, 100 kbps Platform I2C, 100 kbps Payload I2C, Up to 1 Mbps SPI and 9600 bps UART.

## ENVIRONMENTAL TEST

All Clyde Space products are subject to a strict qualification process before being released as a product, including: Component TID radiation testing to 15krads following ECSS guidelines, Qualification thermal cycling, Vibration and shock to NASA GEVS. Test data can be found in the product User Manuals.



Clyde Space is ISO9001:2008 certified. We perform and inspect conventional and surface-mount solder assembly, repair and modification operations in conformance with; ECSS-Q-ST-70-08, ECSS-Q-ST-70-28 & ECSS-Q-ST-70-38

## DESIGN, ASSEMBLY, INTEGRATION AND TEST

To ensure ease of integration with your satellite and mission, Clyde Space provides a detailed 3D model (in .step format) and a detailed user manual with our products as standard. User Manuals and 3D models for standard products can be found at [www.clyde-space.com](http://www.clyde-space.com)