UKube-1: technology, mission and operations

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Summary

- How did I do that?
- What is UKube-1?
- UKube-1 status
- What is a Ground Station?

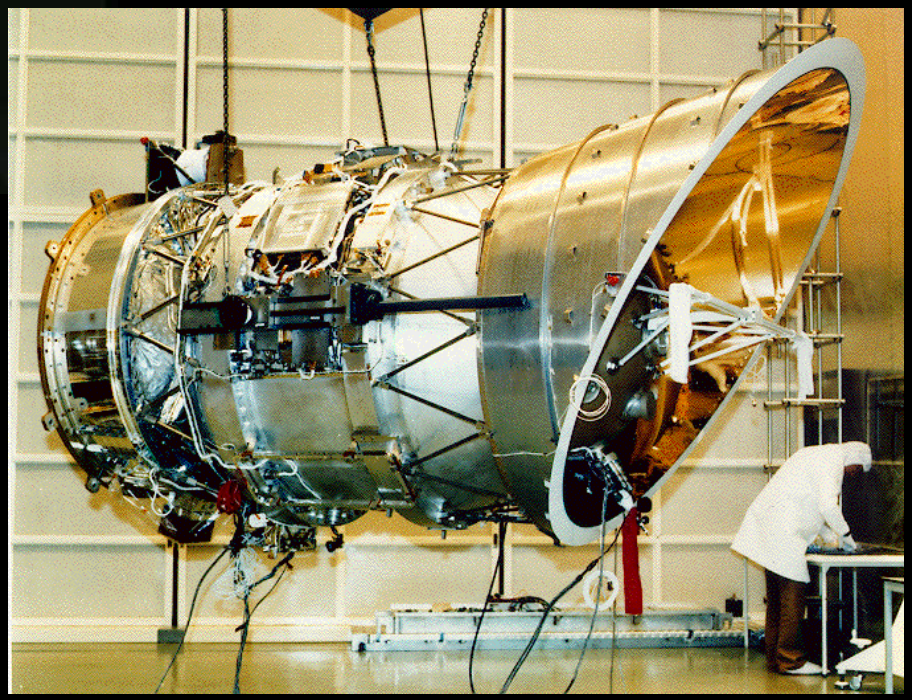
  What is it not?

  What do I do?
- UKube-1 – after one year
- What next?

IRAS

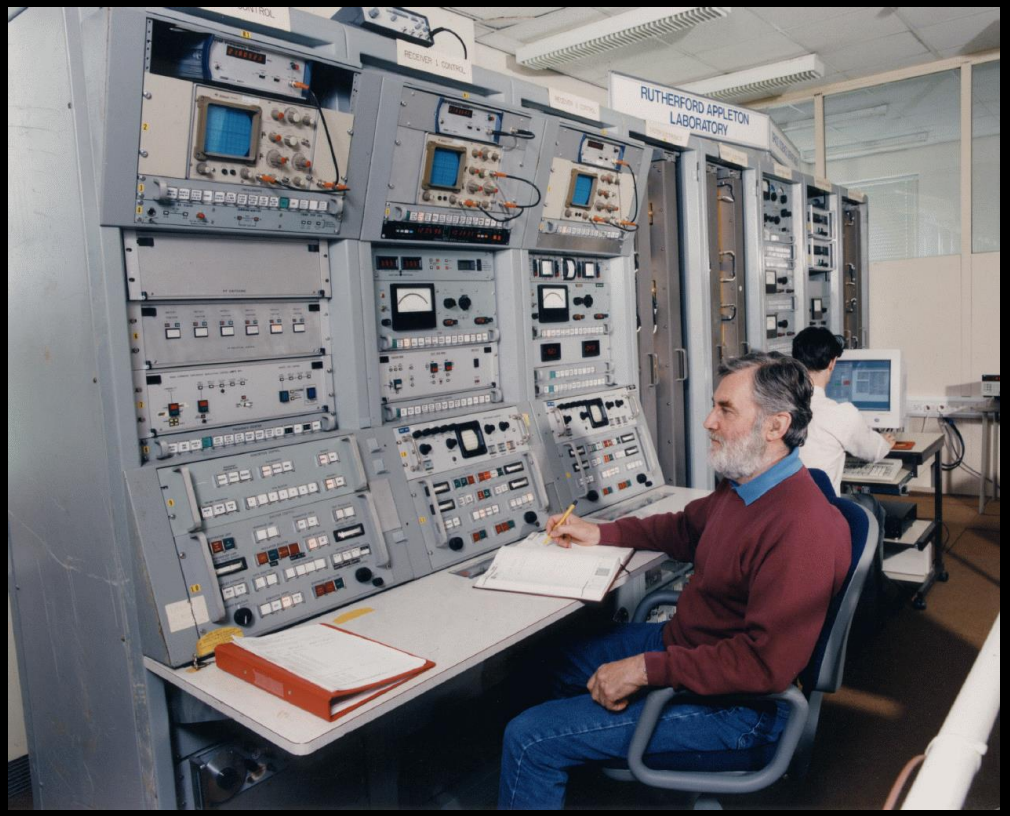
Infrared Astronomical Satellite - launched 1983

A joint American, Dutch, British project



IRAS was the first infrared satellite and it made a survey of the whole sky

IRAS Ground Station



12 metre S-band antenna plus Apollo 16 (flight spare) control rack

Satellites I have known

IRAS
1983

ISO

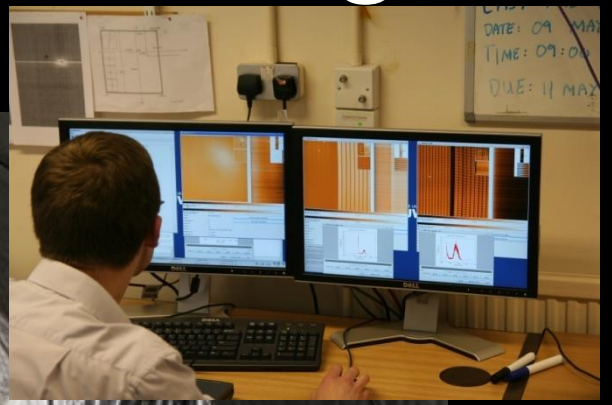
Mars
Express

JWST
2018

Cluster

JWST MIRI

MIRI Flight Model Testing



UKube-1 satellite

Image from AMSAT

- Ukube-1 is a 3-unit cubesat
- It orbits around 630km above Earth at a velocity of 7.5 km/s
- It has 6 payloads on it:

- a camera from OU
- ionospheric experiment from Bath University
- 2 computer-related experiments from industry
- FUNCube-2 from AMSAT
- S-band transmitter

UKube-1 teams

Engineer

Ground Station

Payload Providers

Support

Software

UKube-1 preparations

Operations rehearsals
at Clyde Space

Deploying the solar panels

- Build the satellite (and test)
- Build the payloads (and test)
- Build the software
- Fit the payloads into the satellite
- Test the satellite
  - Operations
  - Thermal
  - Vibration

Status of satellite

- In correct orbit
- Solar panels and antenna deployed
- Batteries in good shape
- Slow spin rate
- Still working, after one year of operations

- Uplink and downlink capability checked
- Large Data Transfer checked (up and down)
- Downlink at 1k2, 2k4, 9k6 successfully tested
- Redundant comms checked
- Platform systems checked
- Payloads commissioned (not STX), and checked
- All payloads (except STX) operated and delivered data

Two issues: UVTRX deafening and resets

UKube-1 Ground Station

UKube-1 Mission Manager

SO….

What is a ground station?

Chilbolton Observatory

UKube-1 uses amateur radio frequencies for communication (VHF downlink and UHF uplink)

Ground Station system

Satellite Operations Engineers

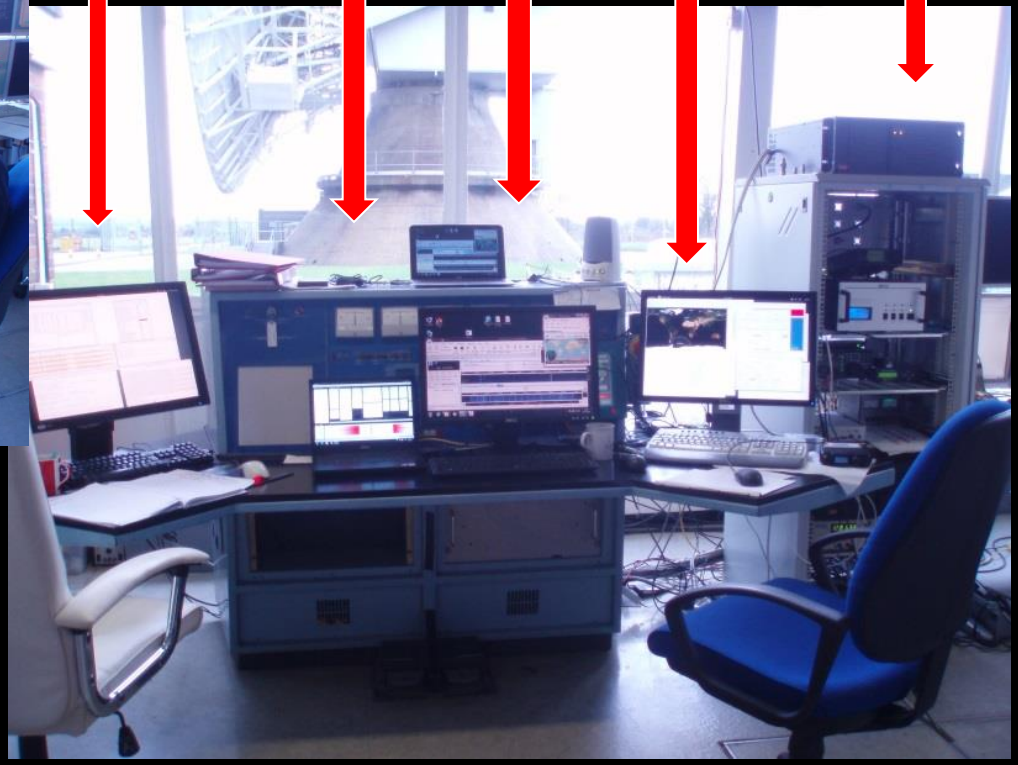
Mission Planning System

FUNcube dashboard

SDR MOVE

GS control

Antenna control



This is not just a Ground Station
This is a Mission Operations Centre

What do I do, and how?

- The Mission Planning Software package creates the commands to send to the satellite
- The Ground Station computer (and me) keep track of when the satellite passes over the antennae
- I send up the commands and get data downloaded

- I decide what to command and which data to download next
- I process the data and send it out
- I handle updates to the on-board software, and cope with (or solve) problems

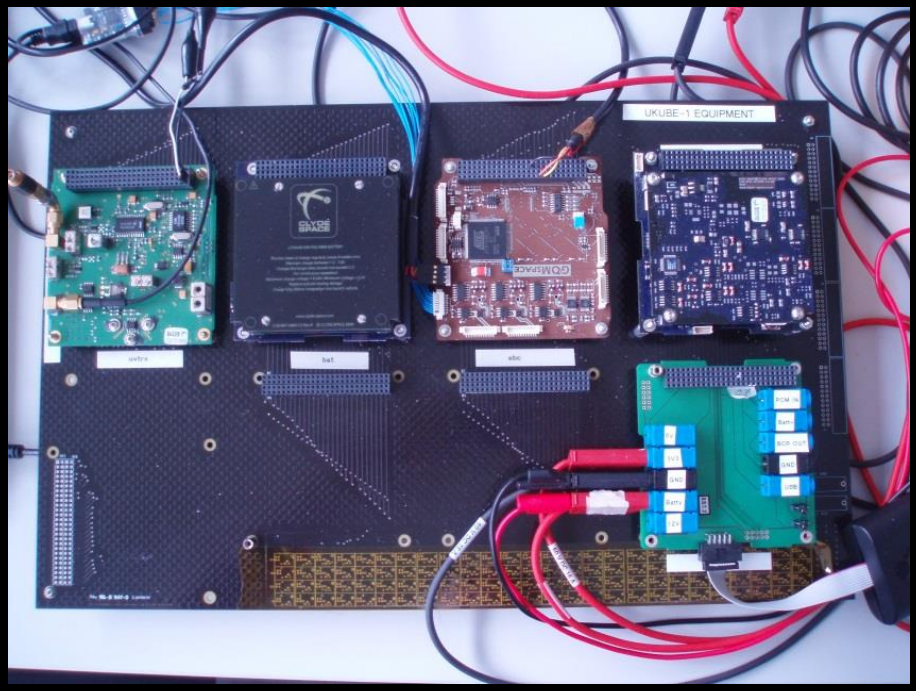
UKube-1 – after one year

Image from AMSAT

- It has 6 payloads on it:
- a camera from OU
  - Images taken
  - Housekeeping
  - RDM
- ionospheric experiment from Bath University
  - Data taken
- 2 computer-related experiments from industry
  - JANUS LP data
  - MIC data
- FUNCube-2 from AMSAT
- S-band transmitter

For the Future

- UKube-1 will continue until 8 July 2015, one year after launch.
- Then AMSAT has it for 2 more years.
- Hopefully there will be more cubesats funded by UKSA after that.
- Centres at Harwell, Edinburgh and Glasgow, to allow payload providers to test payloads and interfaces.
- When the nominal mission complete UKube-1 gets its OSCAR.



FlatSat

OSCAR – Orbiting Satellite Carrying Amateur Radio