SPACE advisory company

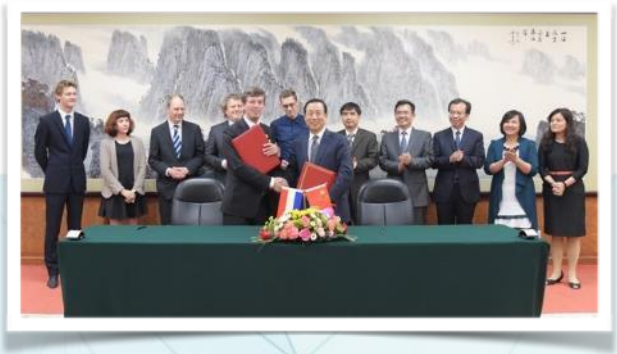
SPACE ADVISORY COMPANY (PTY) LTD [SAC]

UNITED NATIONS
Office for Outer Space Affairs

South Africa's contribution to the Netherlands China Low-Frequency Explorer

Presented by : Dr Francois Malan

Date : 12 December 2017
Stellenbosch, South Africa



Netherlands Space Office

CNSA

the Netherlands China Low Frequency Explorer NCLE

Radboud University Nijmegen

ISIS Innovative Solutions In Space

ASTRON Netherlands Institute for Radio Astronomy

NAOC

NCLE: Part of Chang’e 4

- Chang’e is part of the Chinese Lunar Exploration Program – CLEP
- “Chang’e” = Chinese Moon Goddess
  - a series of robotic lunar missions from the Chinese National Space Administration (CNSA)
  - Chang’e 1-6, all to be launched with Long March Rockets

中国探月
CLEP

Chang’e - Chinese Moon Goddess

Chang’e Missions

- 1 : Lunar Orbiter (2007)
- 2 : Lunar Orbiter (2010)
- **3 : Lander + Rover (2013)**
- **4 : Orbiter + Lander + Rover (2018)**
- 5 : Lander + Sample Return (2019)
- 6 : Follow-up of Chang’e 5 (2020?)

Long March 5 Rocket

Chang’e 3 (2013) – success

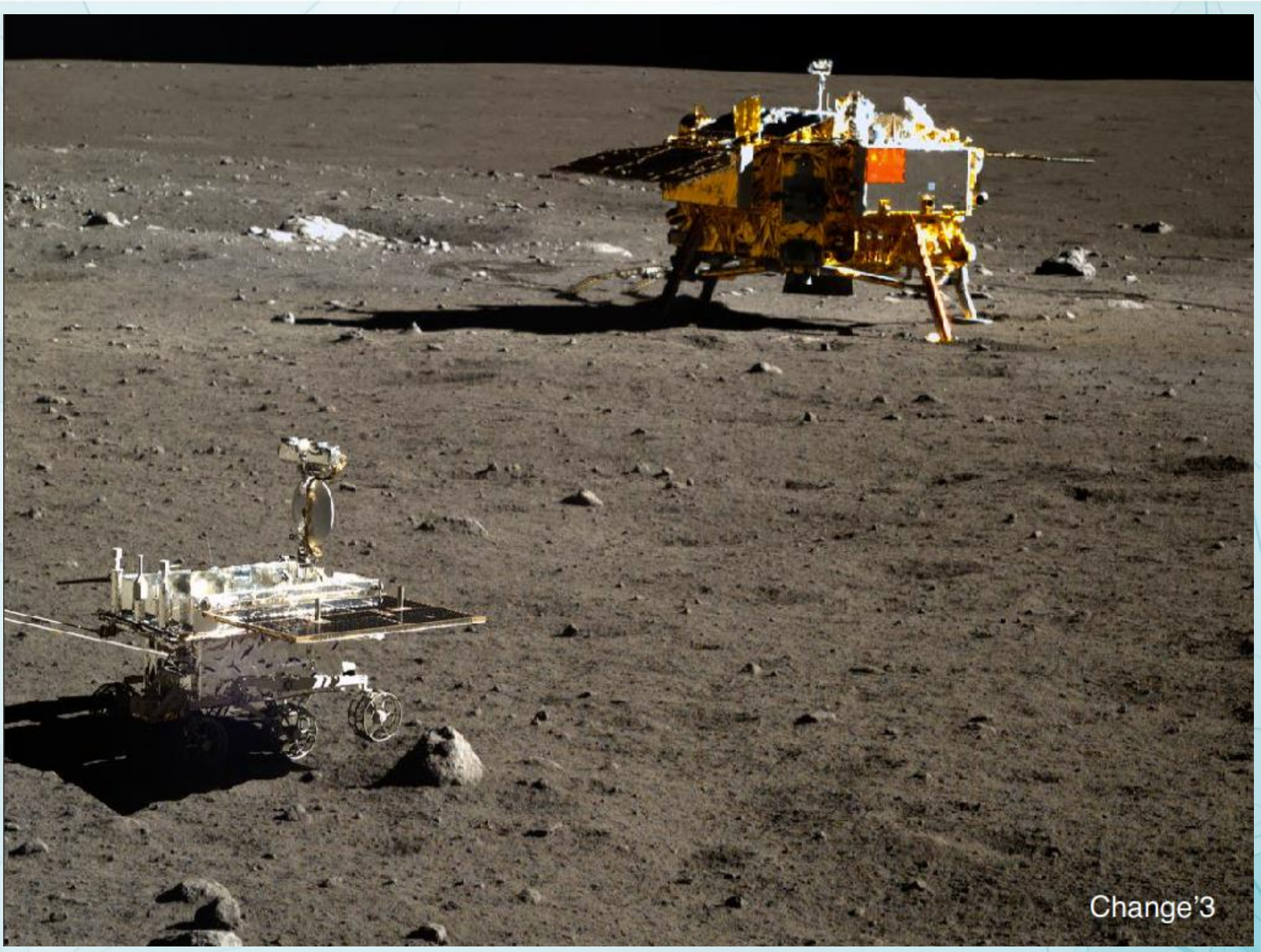
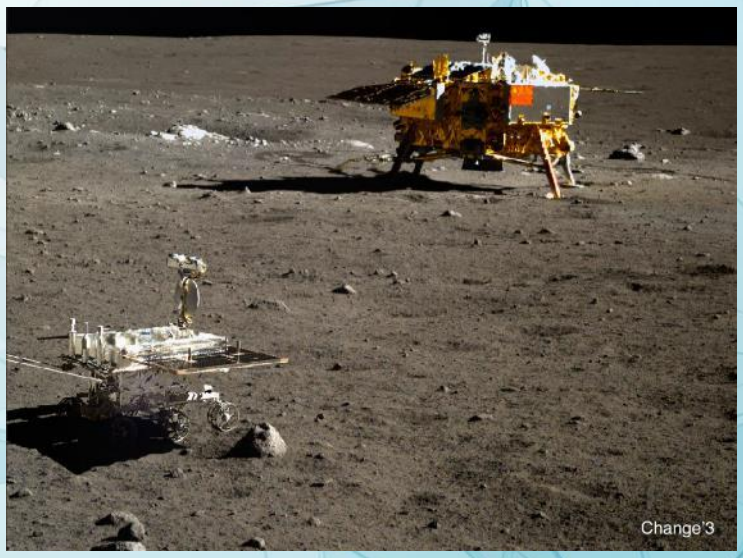


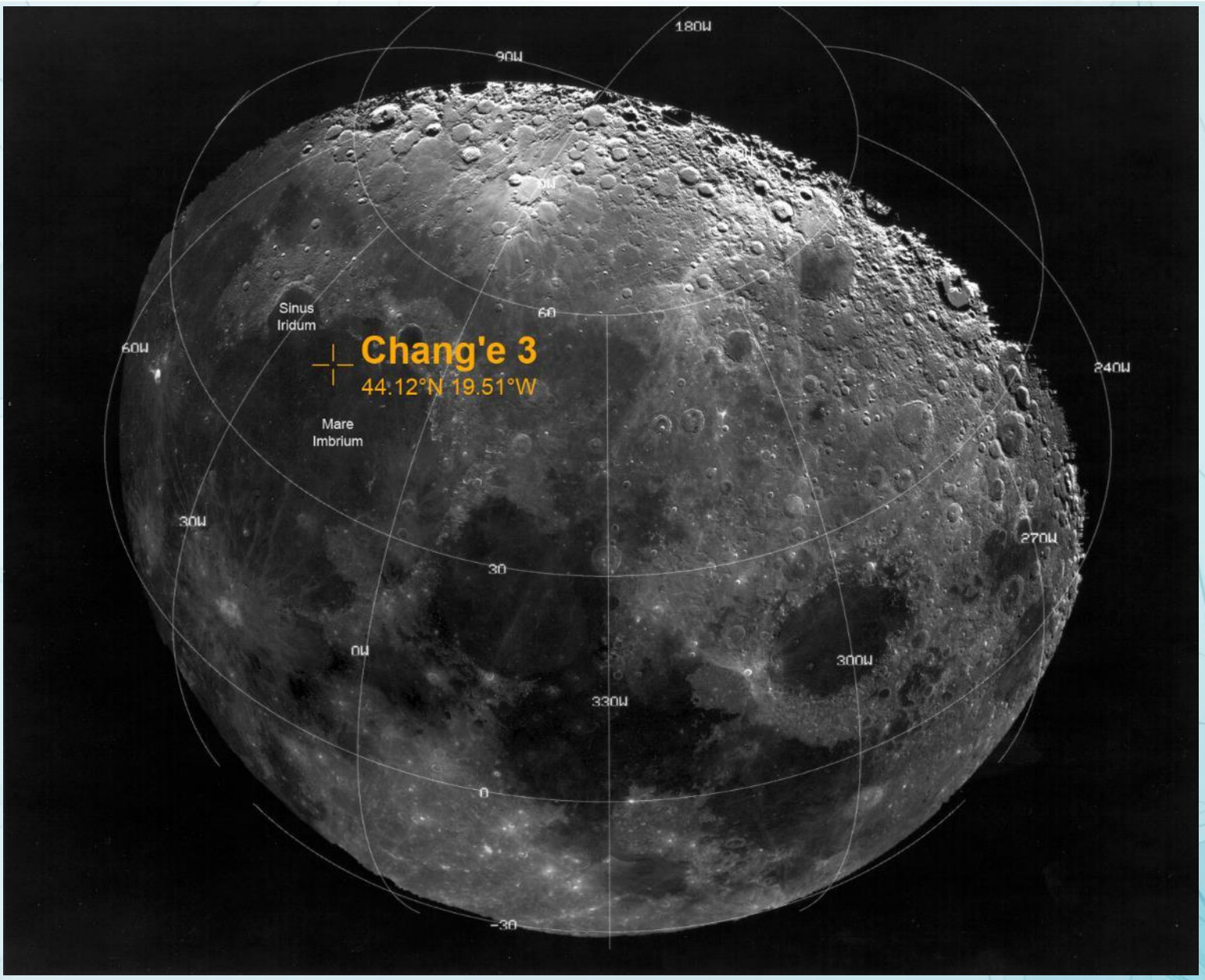
Image: CNSA

Chang’e 4

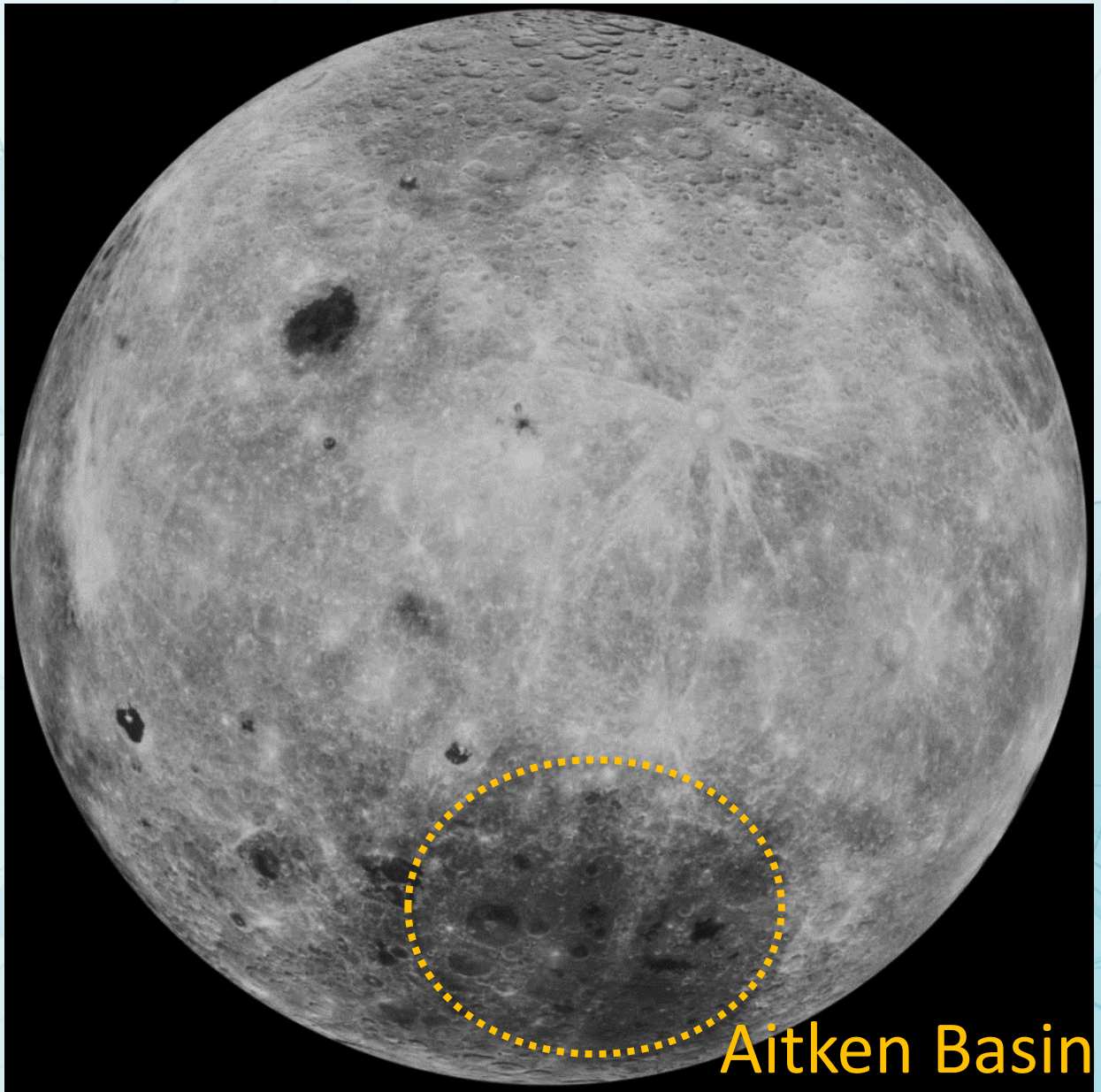
- Originally: a backup for Chang’e 3
  - i.e. Lunar lander + Rover
- Chang’e 3 was a success
  - Chang’e 4 mission expanded
  - Different landing site
  - More science



Chang’e 3 Landing Site



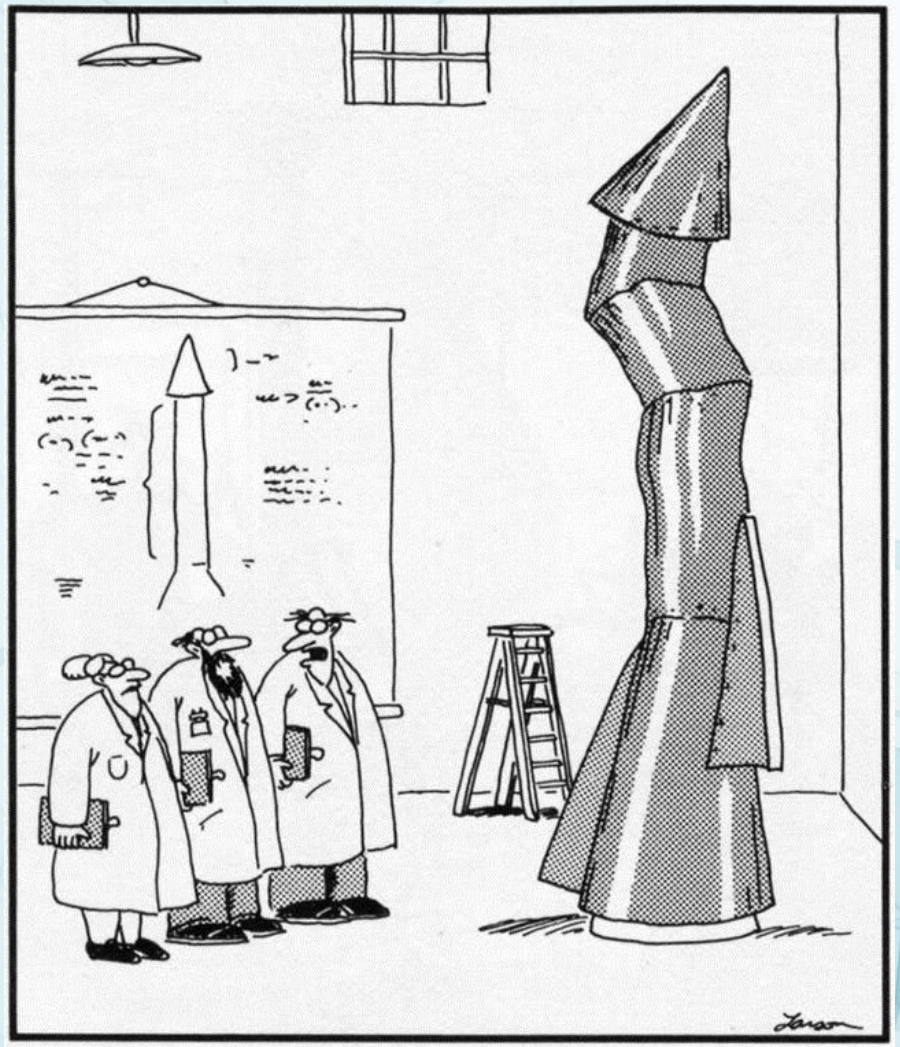
Chang’e 4 Landing Site (far side of Moon)

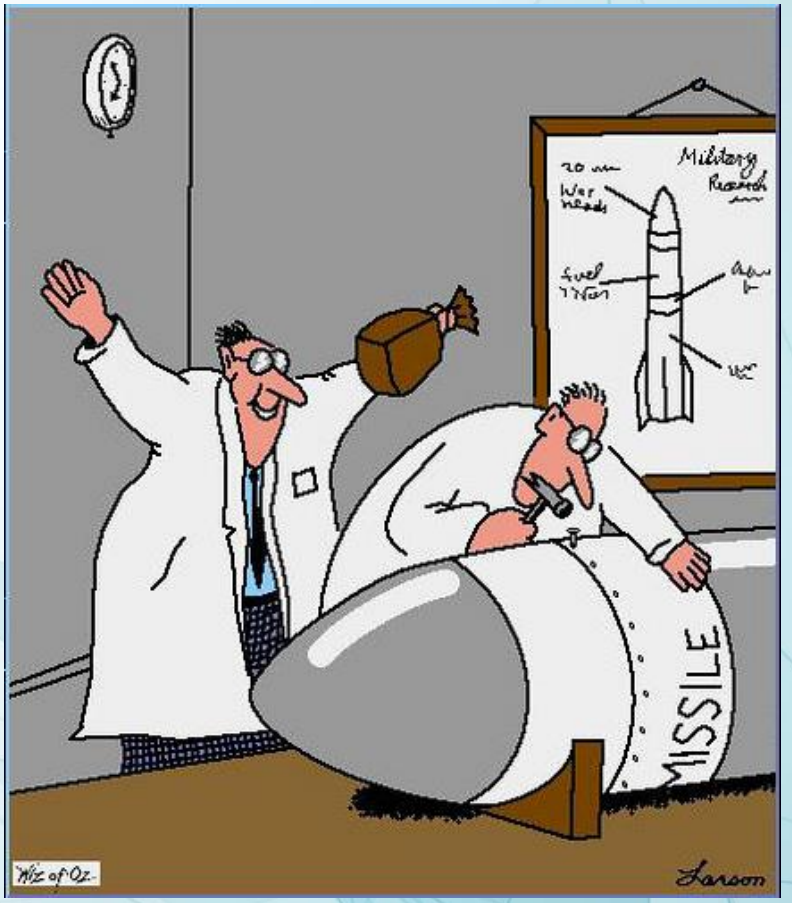


The Dark Side of the Moon

Pink Floyd,
1973

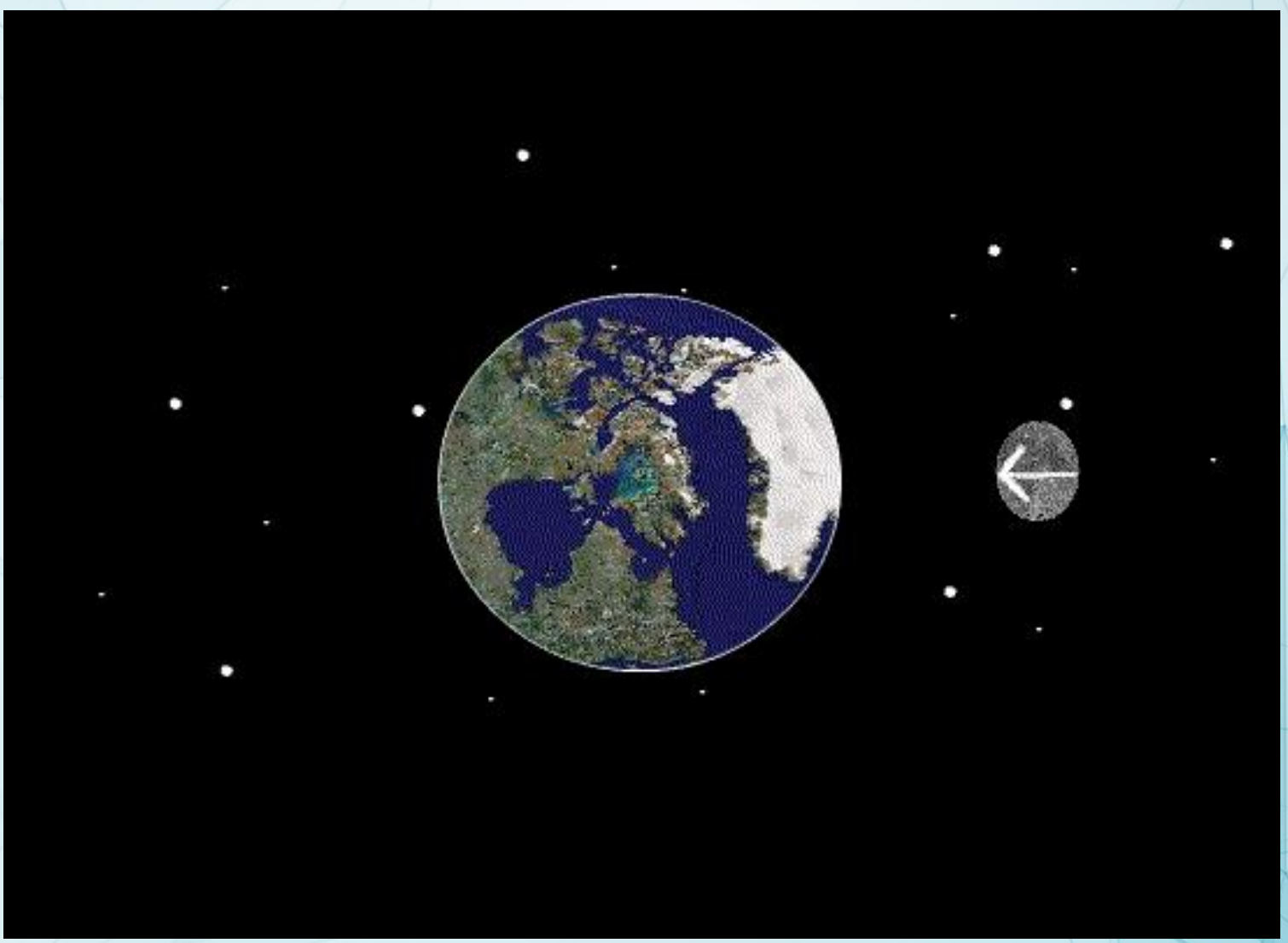
“Dark Side”? No, actually “Far Side”





Gary Larson, “The Far Side”

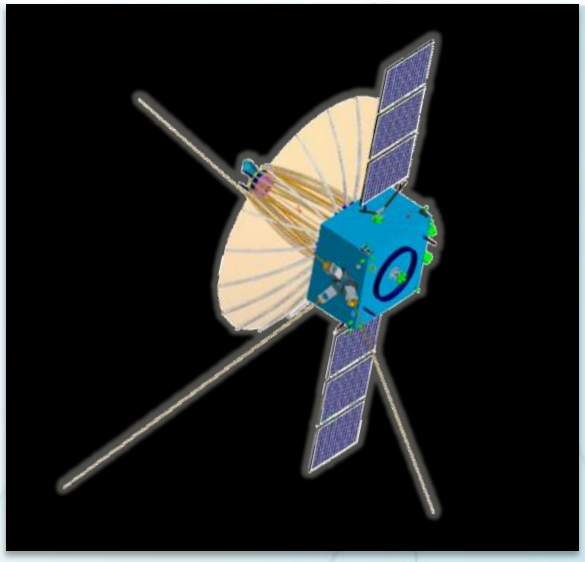
Far Side of the Moon always faces away

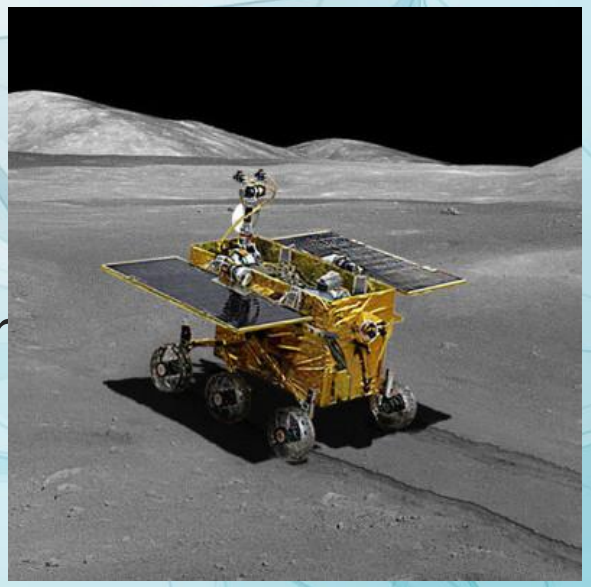


Akash Tiwari, http://astronomywithastrophysics.blogspot.co.za/

Chang’e 4 : two components

- Two parts:
  - “Mother Ship Satellite” – at Earth-Moon L2 point
  - Lunar Rover – on the far side of the Moon (e.g. Aitken Basin)
- Launch of the Chang’e 4 satellite expected June 2018, the Lander ar Rover follow half a year later.

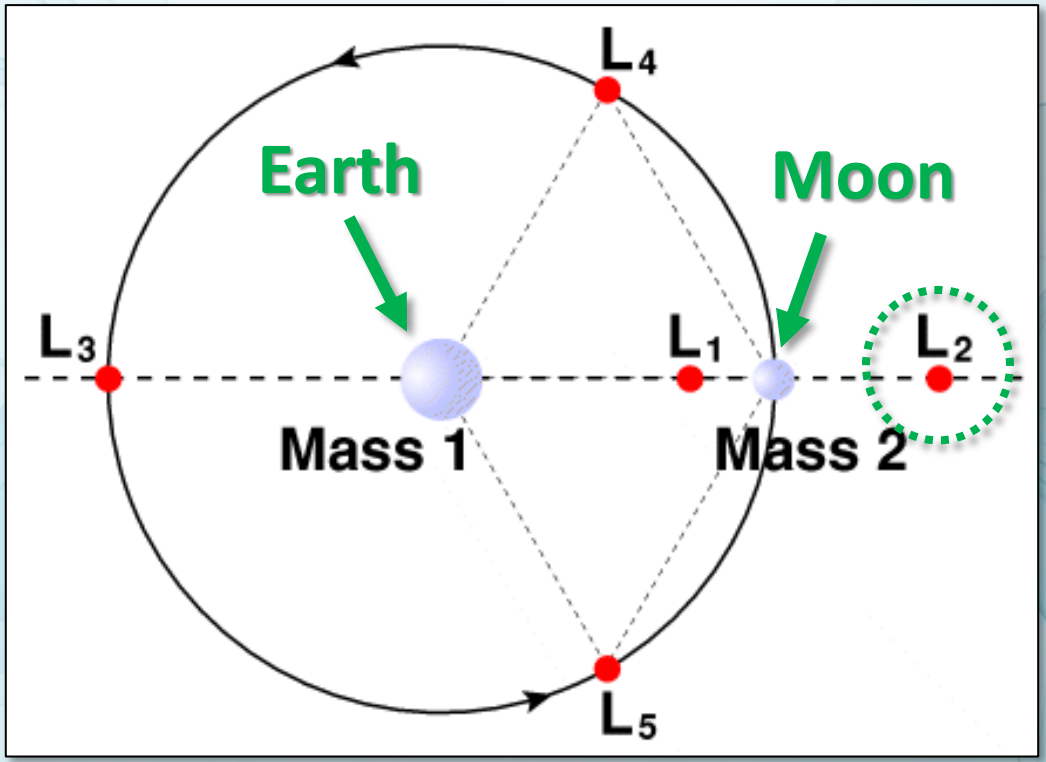




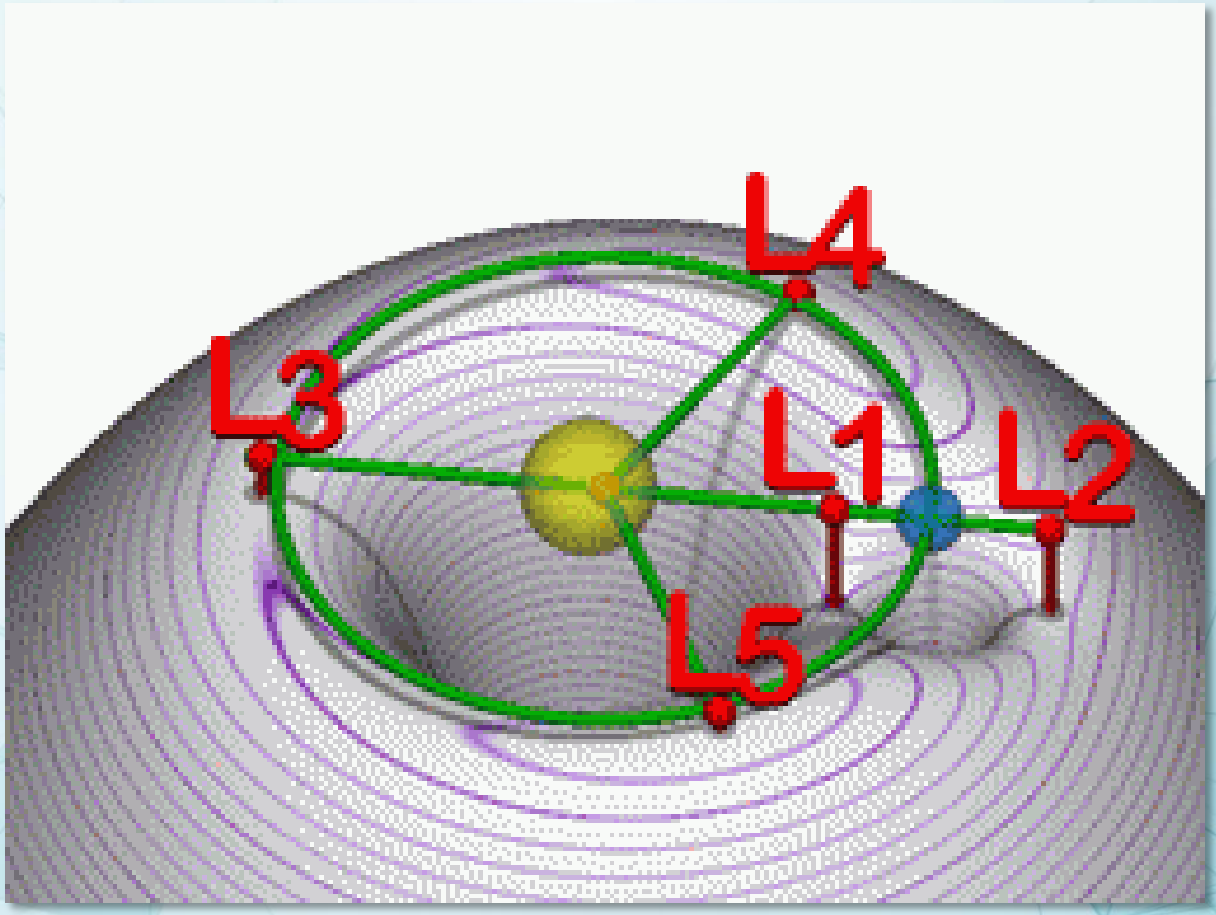
Images: CNSA

L2 = second Lagrange Point

- Smaller mass orbiting larger mass, e.g.
  - Sun and Earth
  - Earth and Moon
- Gravity in equilibrium



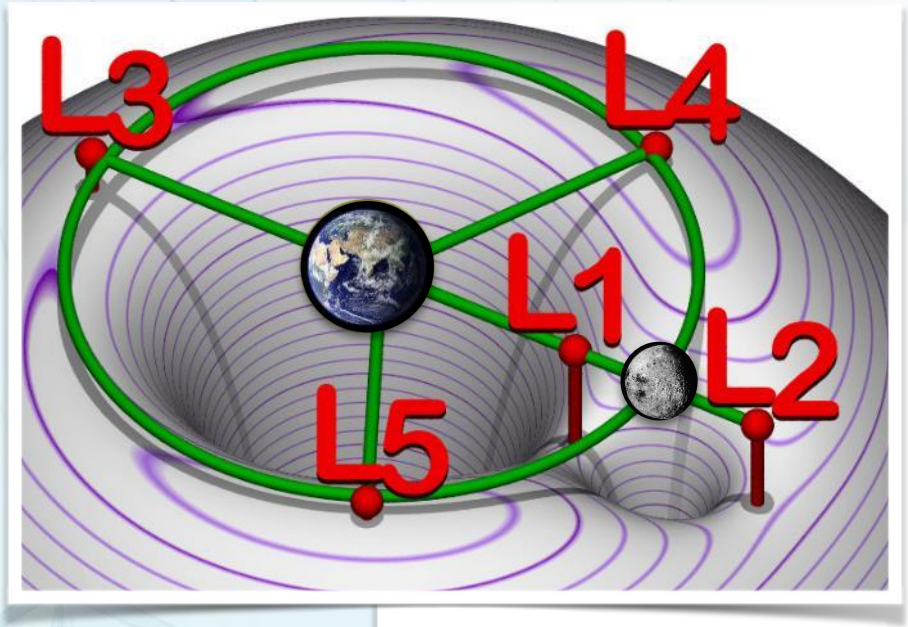
Lagrangian Points : animation



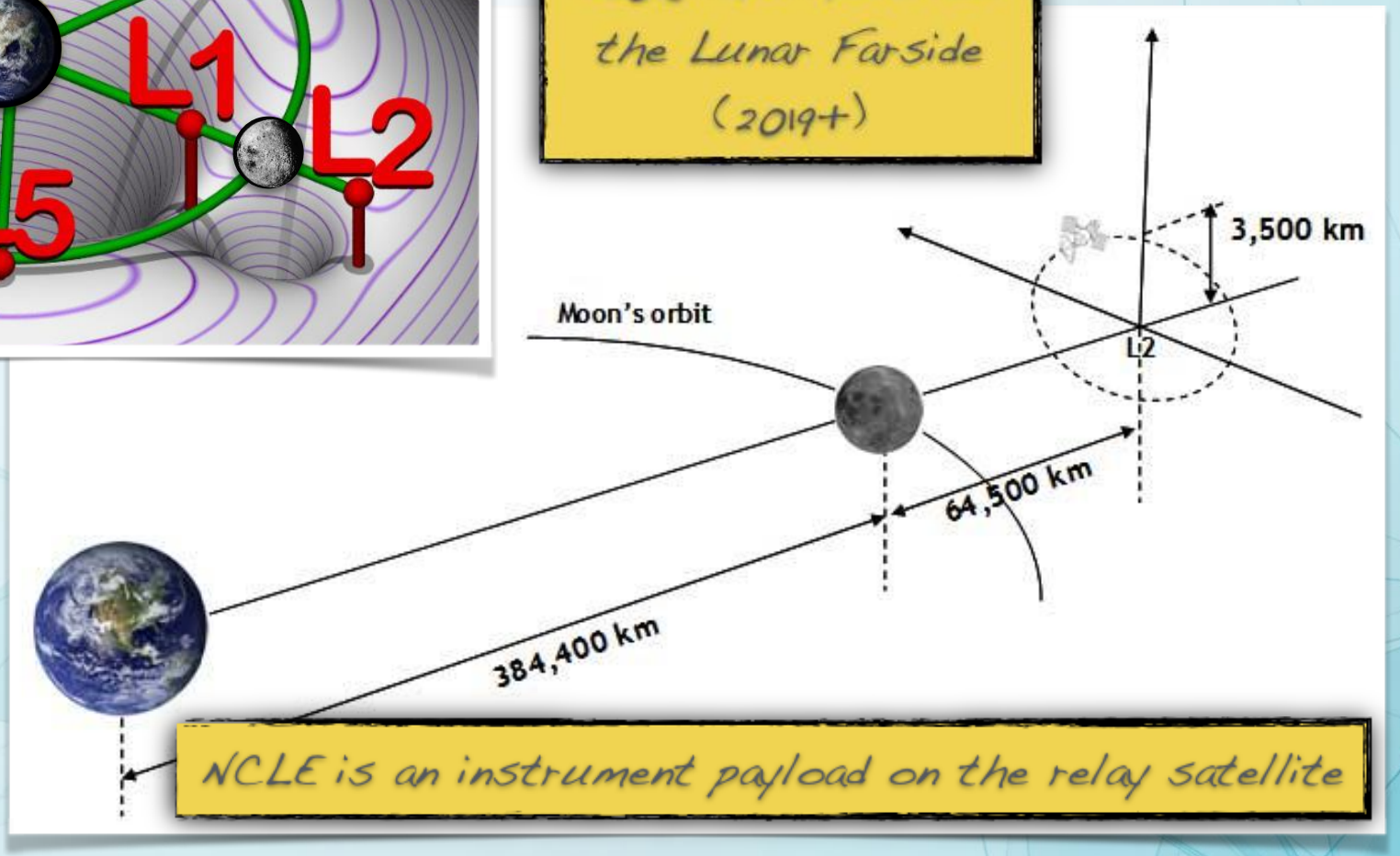
User:cmglee, Wikimedia Commons

CHANG'E 4 MISSION

Dr. Marc Klein-Wolt : RRL / NCLE Consortium



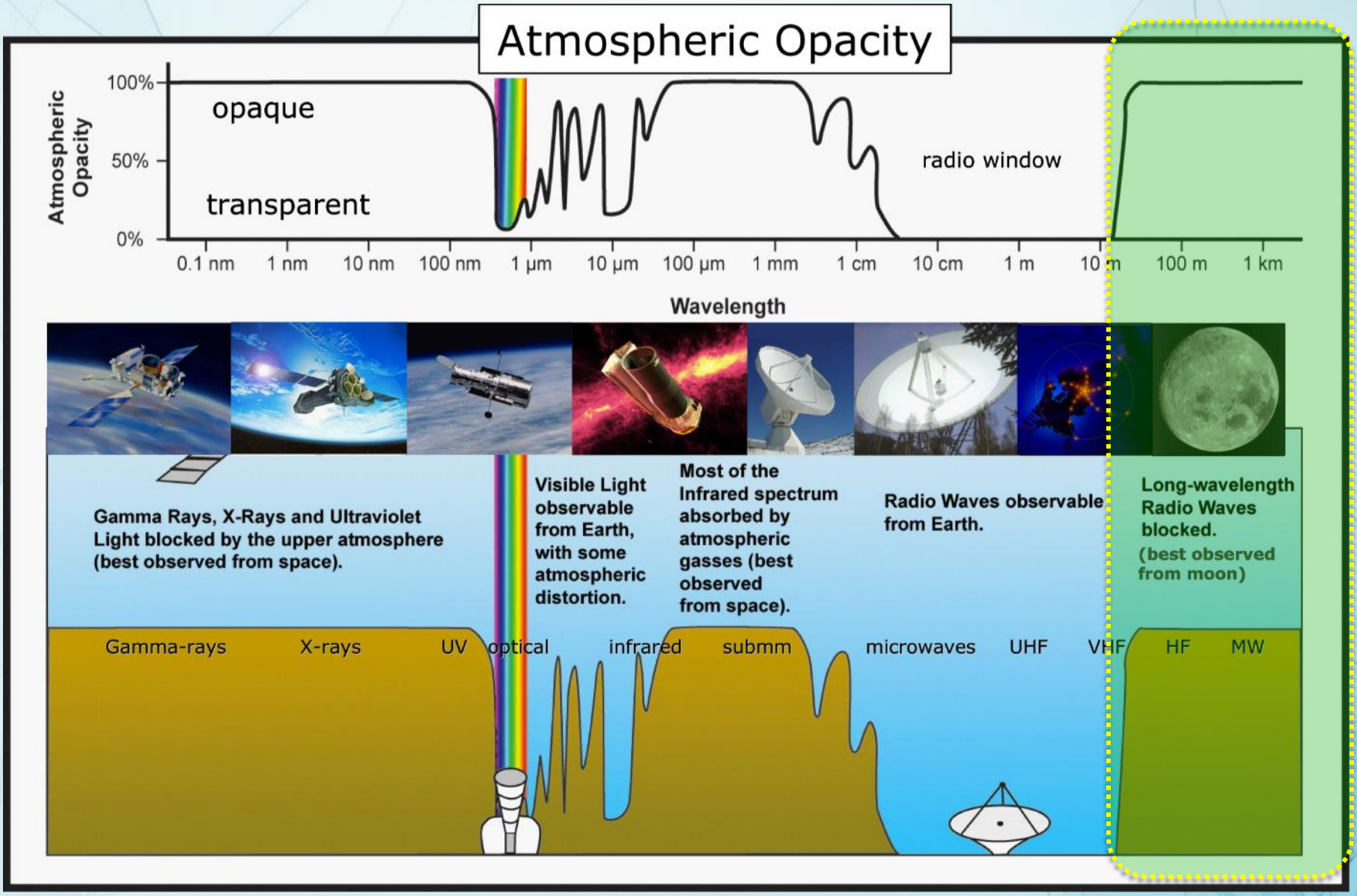
Relay satellite in Earth-Moon L2 (2018) and Rover on the Lunar Farside (2019+)



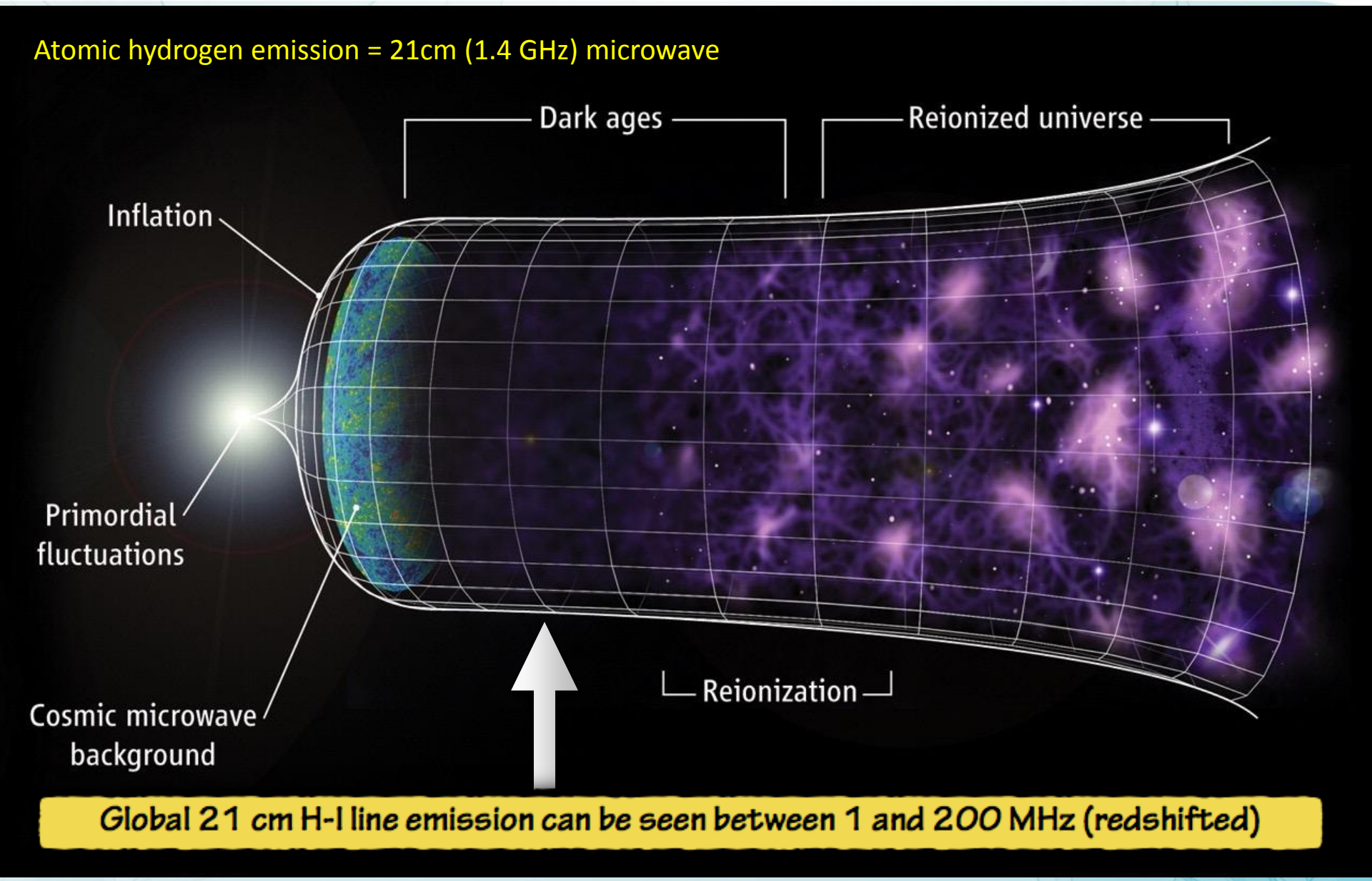
NCLE is an instrument payload on the relay satellite

Science : Unexplored Frequency Domain

Funded through ESA PRODEX program

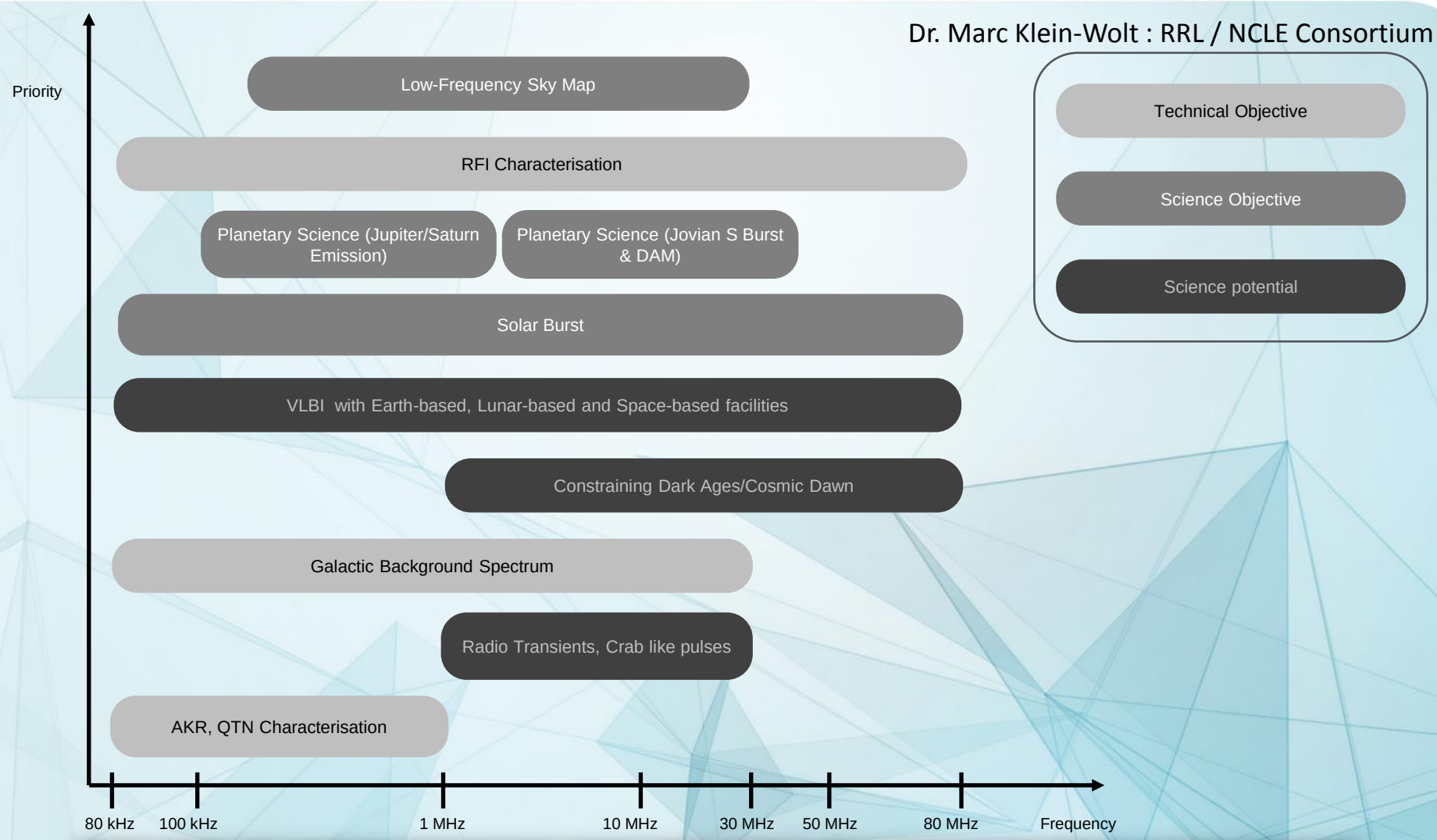


Detect the history of the Universe



NCLE Science Objectives

Dr. Marc Klein-Wolt : RRL / NCLE Consortium



To perform astrophysical studies in the unexplored radio regime of 80 kHz to 80 MHz from translunar locations as a precursor to future space based missions

NCLE on Chang'e 4

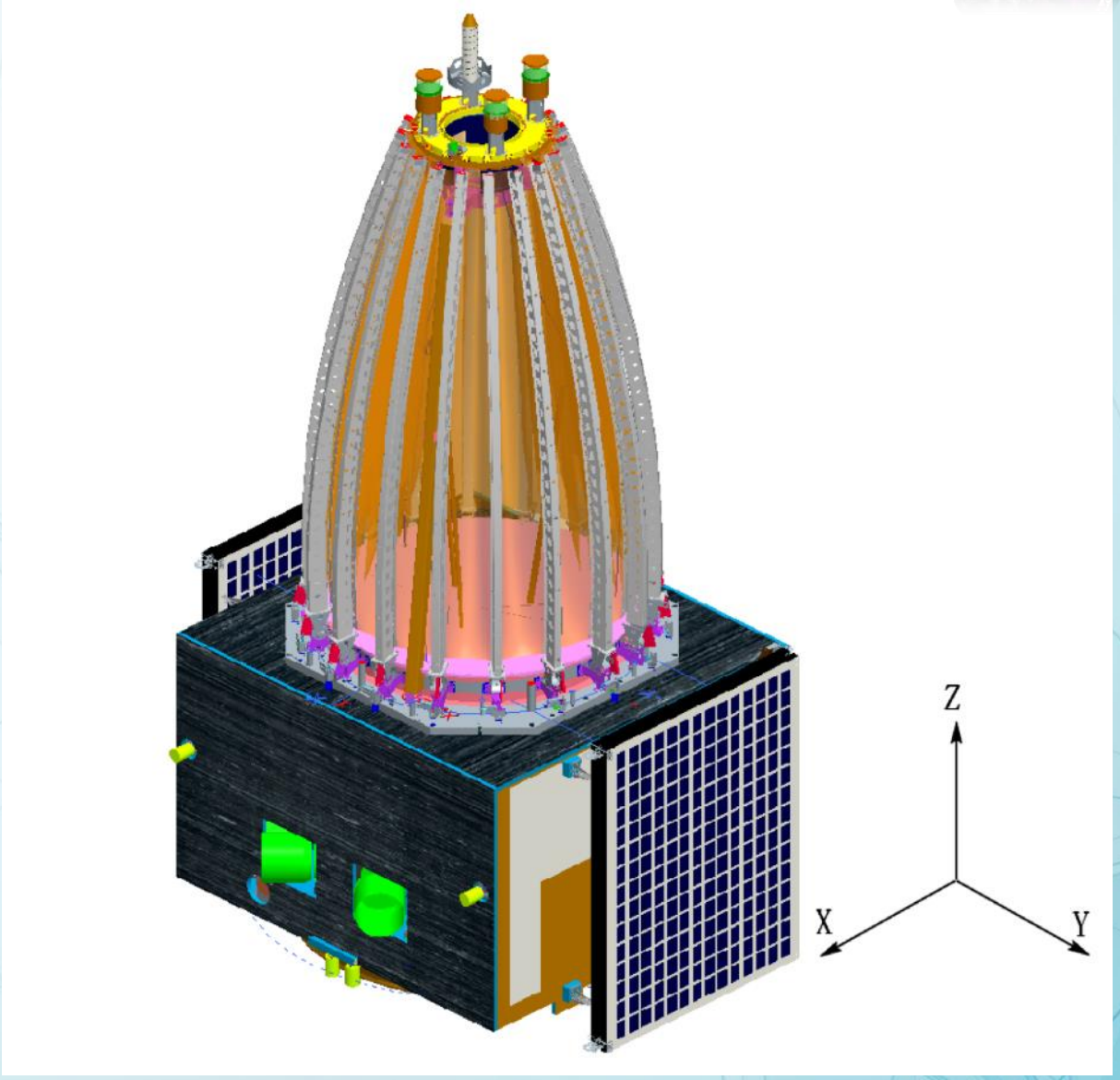
The first in many ways..

Dr. Marc Klein-Wolt : RRL / NCLE Consortium

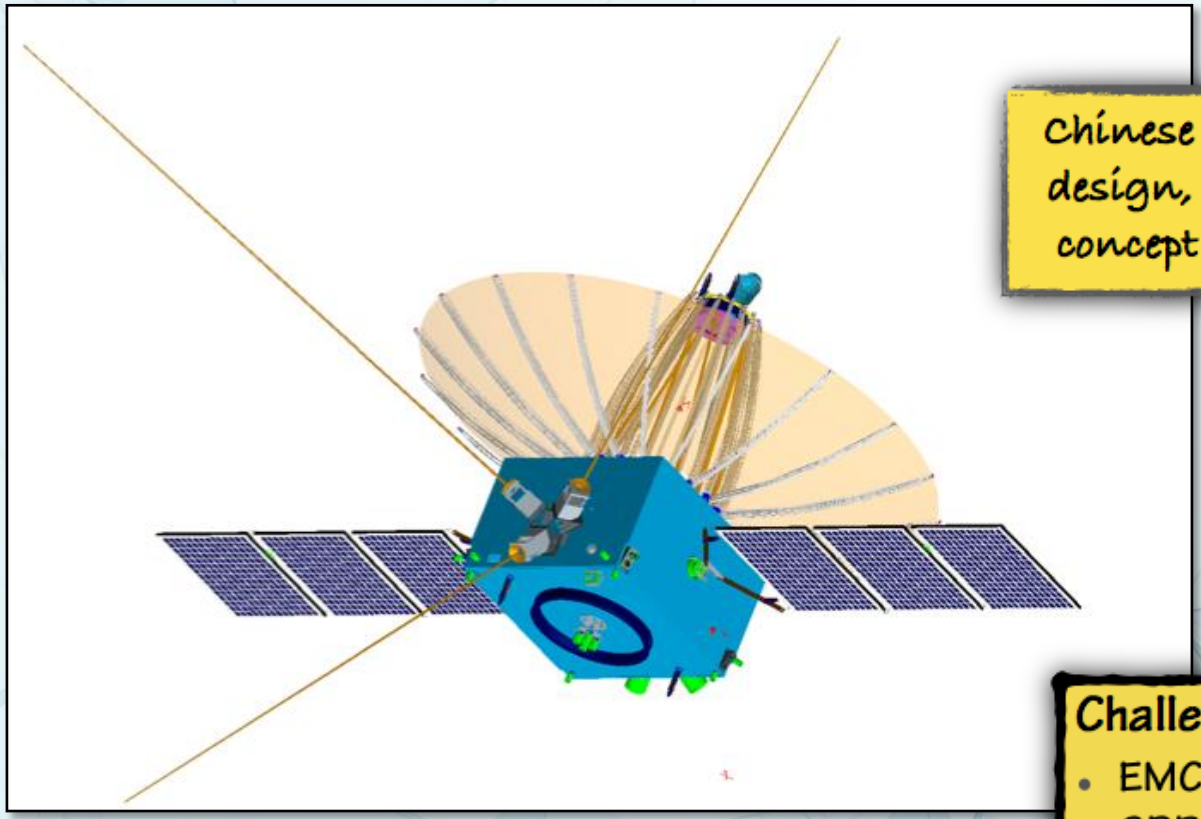
The first International payload on a Chinese mission, the first Dutch instrument to the Moon and the first serious LF radio mission attempting to detect the redshifted 21 cm line emission from the Hydrogen in the very Early Universe

Chang’e 4 spacecraft

Space craft in stowed configuration



Chang'e 4 spacecraft



Chinese space craft design, including concept antennas

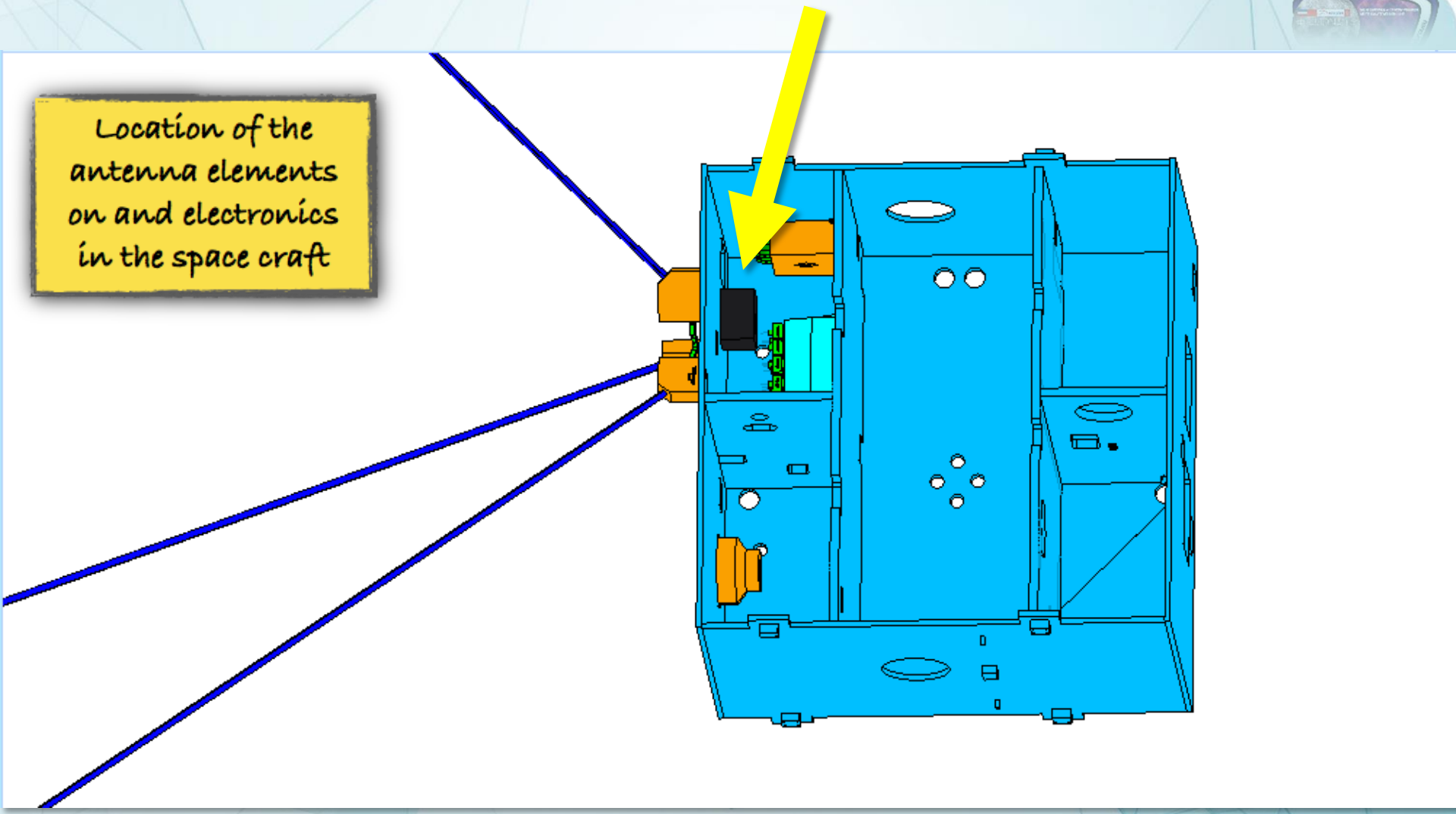
Design philosophy:

- space-proven concepts
- COTS components
- Technology Demonstration mission
- 3 year mission lifetime

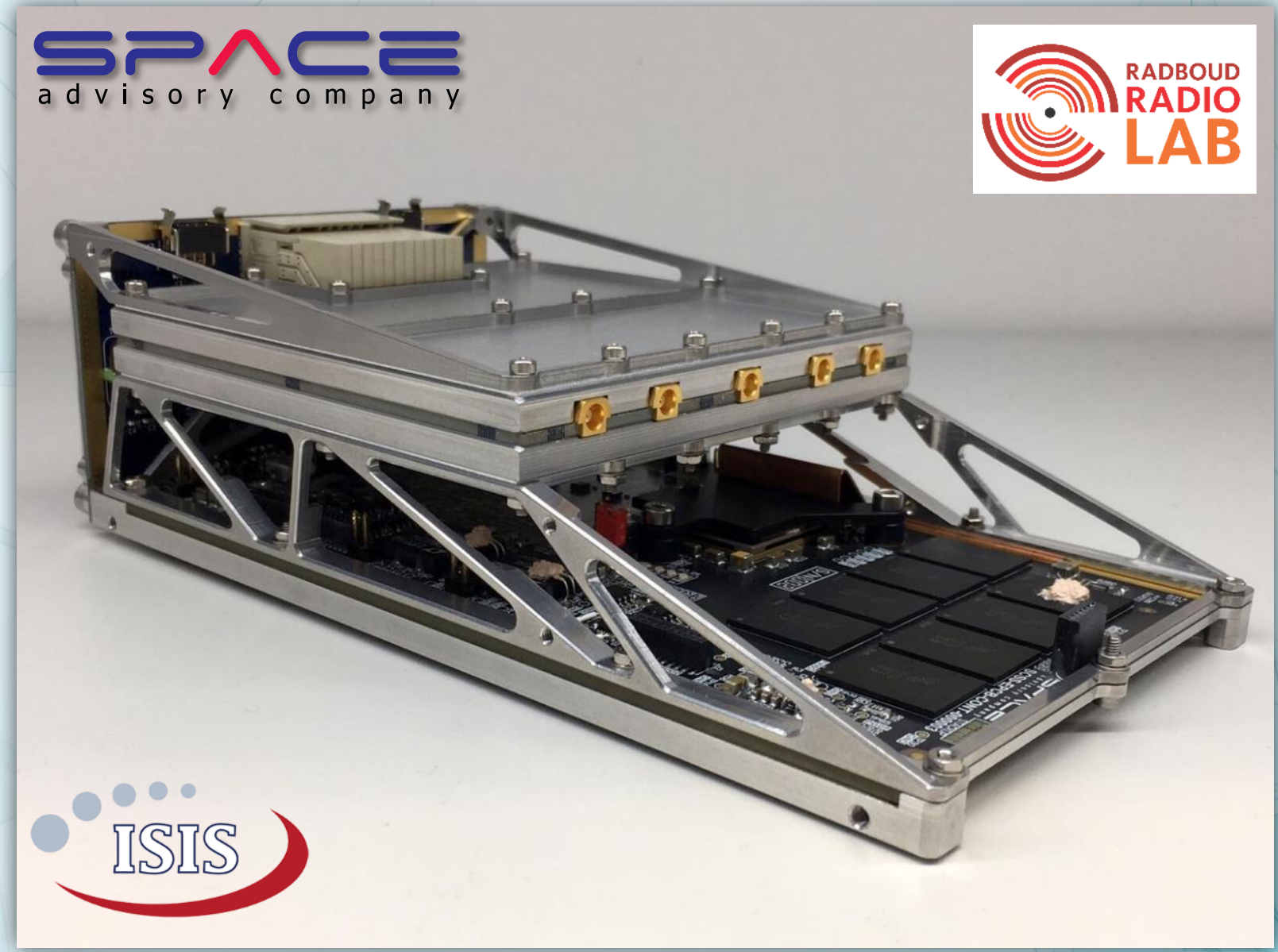
Challenges:

- EMC noise Space Craft
- SDR with 3 year lifetime
- Thermal control analogue frontend (LNA)
- short lead time!
- Information sharing with Chinese teams

NCLE Science Payload



NCLE receiver & data processing unit

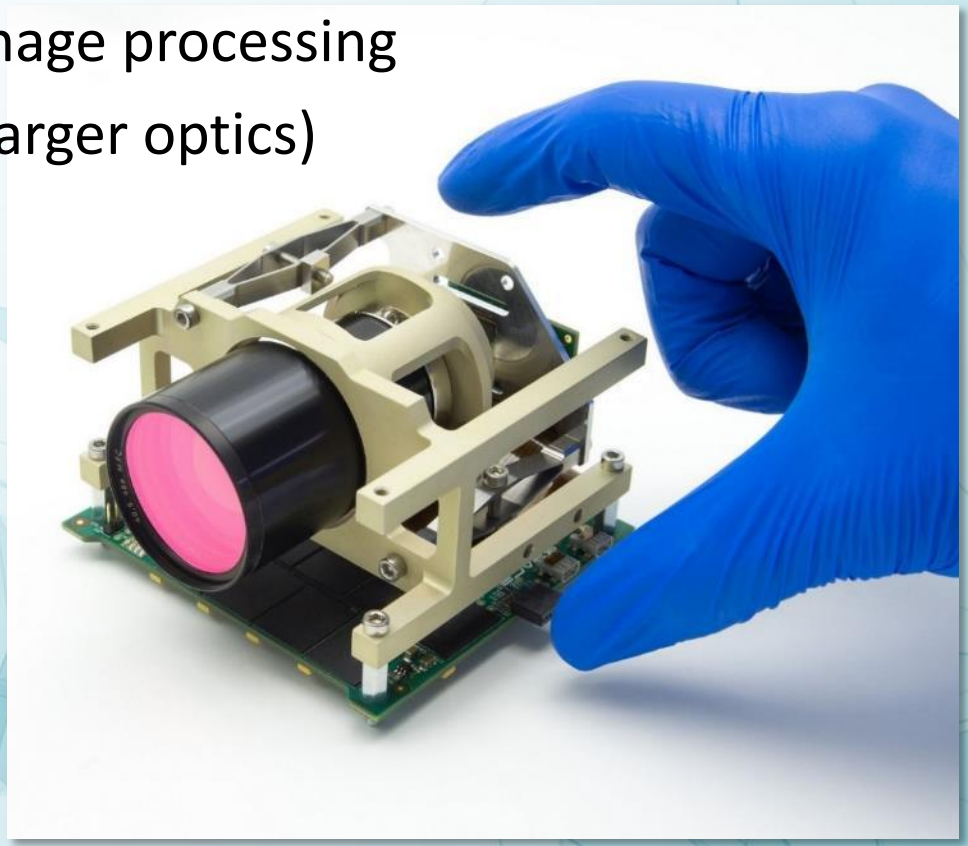


Origin: SCS Gecko Imager

SPACE ADVISORY COMPANY (PTY) LTD
[SAC]

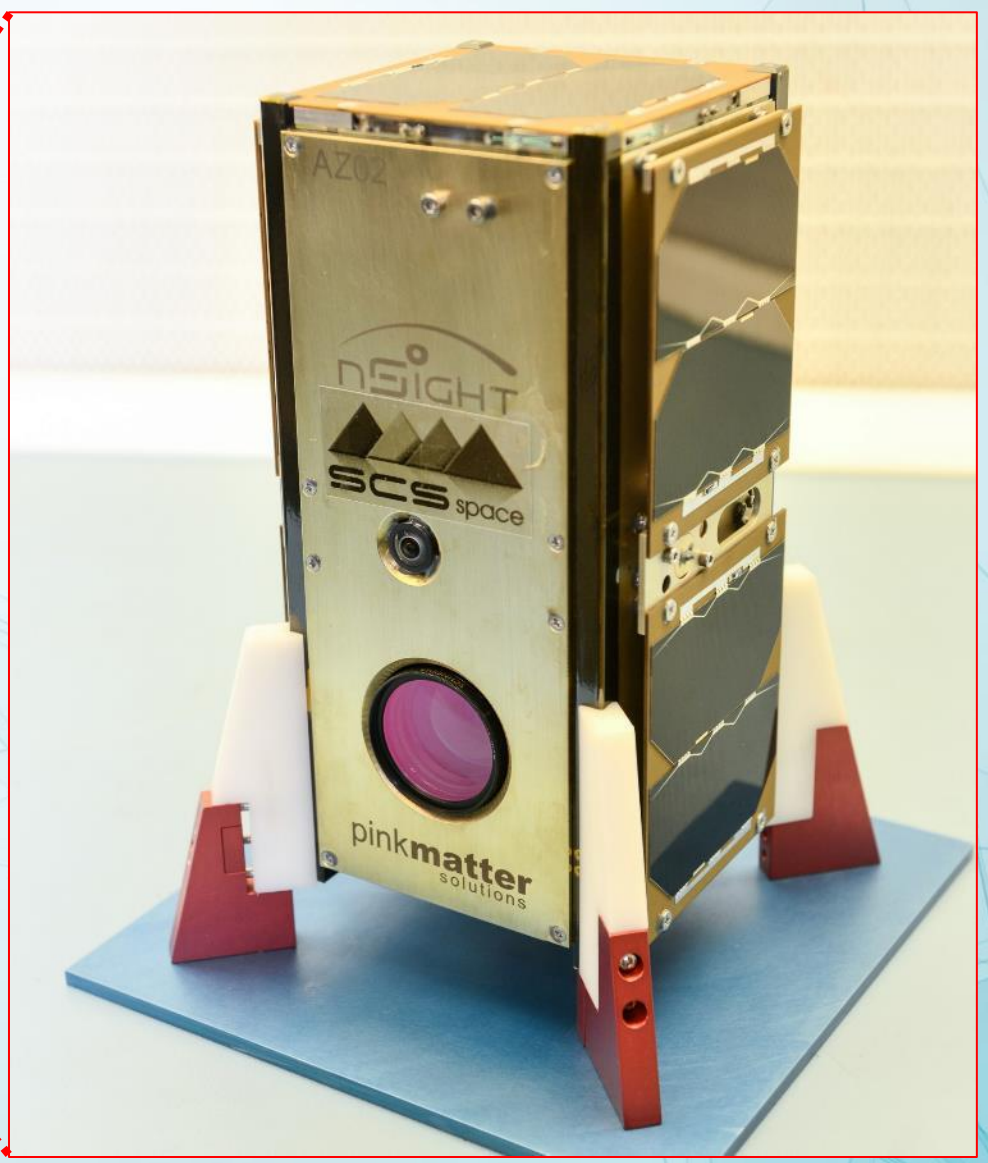
- Modular design
- Compatible with CubeSats
- High-speed high-capacity mass data storage
- FPGA processor for real-time image processing
- High frame rate capability (for larger optics)

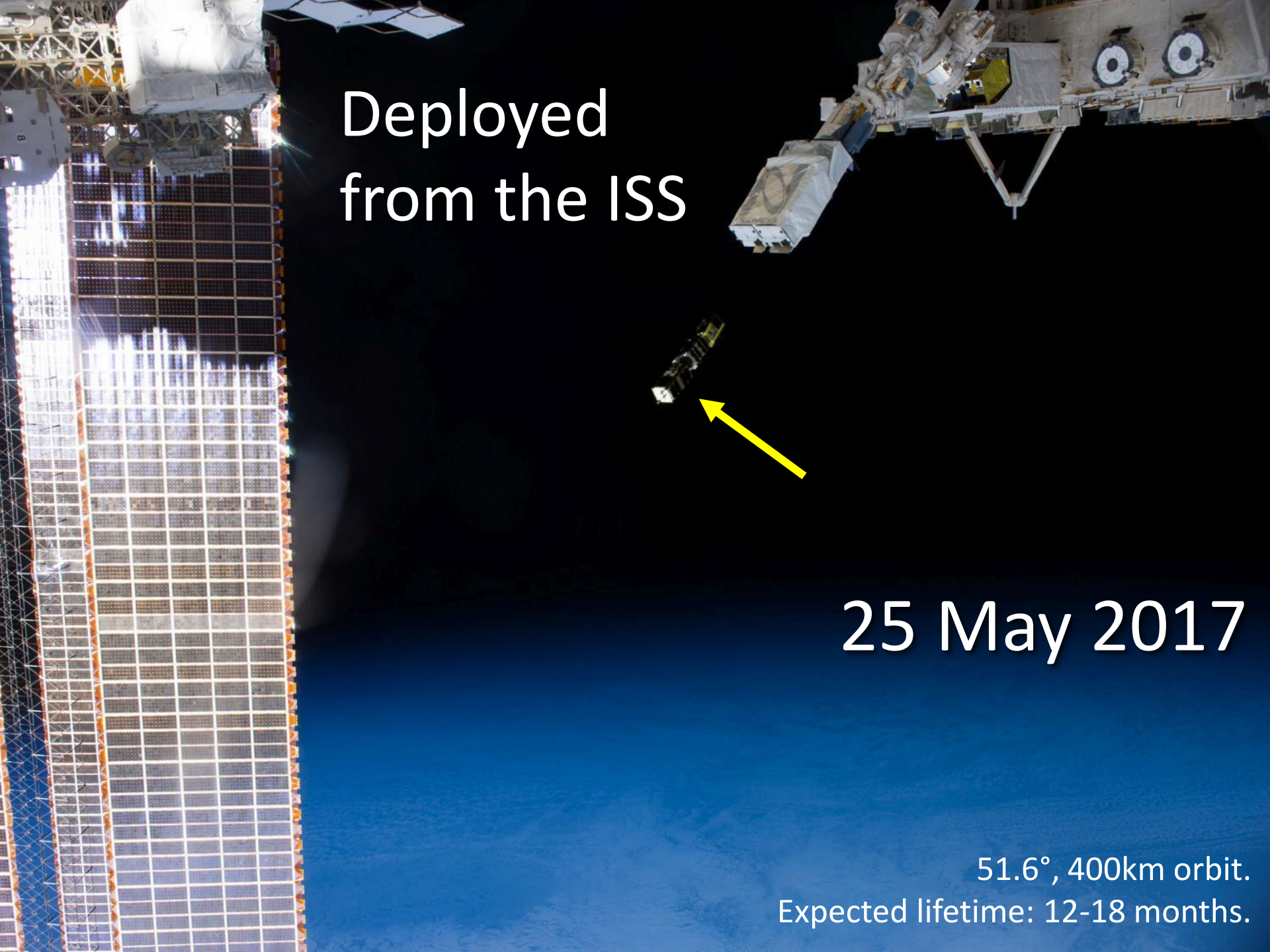
Characteristics	
Form factor	< 1U
Mass	< 480 g
GSD	31 m from ISS orbit
Image Sensor	2.2 Megapixel RGB
Storage	128 GB
Rad. tolerance	Tested to 30 krad TID
Space heritage	2017 !



Succesfully Flown in nSIGHT-1

SPACE ADVISORY COMPANY (PTY) LTD [SAC]




Deployed
from the ISS
25 May 2017
51.6°, 400km orbit.
Expected lifetime: 12-18 months.

Commercialized (CubeSatShop.com)

SPACE ADVISORY COMPANY (PTY) LTD [SAC]

SCS Gecko imager - CubeSat

https://www.cubesatshop.com/product/scs-gecko-imager/

Search

CubeSatShop

PRODUCTS ▾ VENDOR INFORMATION ▾ HOW IT WORKS FAQ INQUIRY LIST (0)

Home » Products » Cameras & payloads » SCS Gecko imager

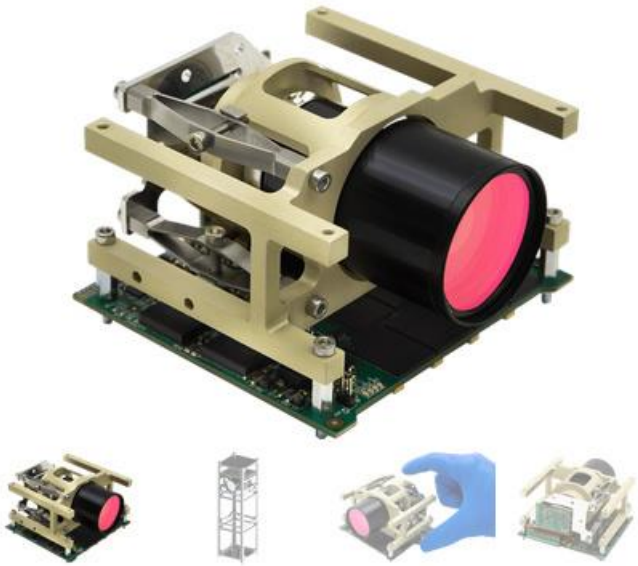
PRODUCT SEARCH

Search products…

Search

PRODUCT CATEGORIES

- Antenna systems
- Attitude actuators
- Attitude sensors
- Cameras & payloads
- Command & data handling
- Communication systems
- CubeSat kits & buses
- CubeSat Structures
- Ground stations
- Ground support equipment
- Integrated ADCS
- Launch adapters



SCS Gecko imager

€18,000

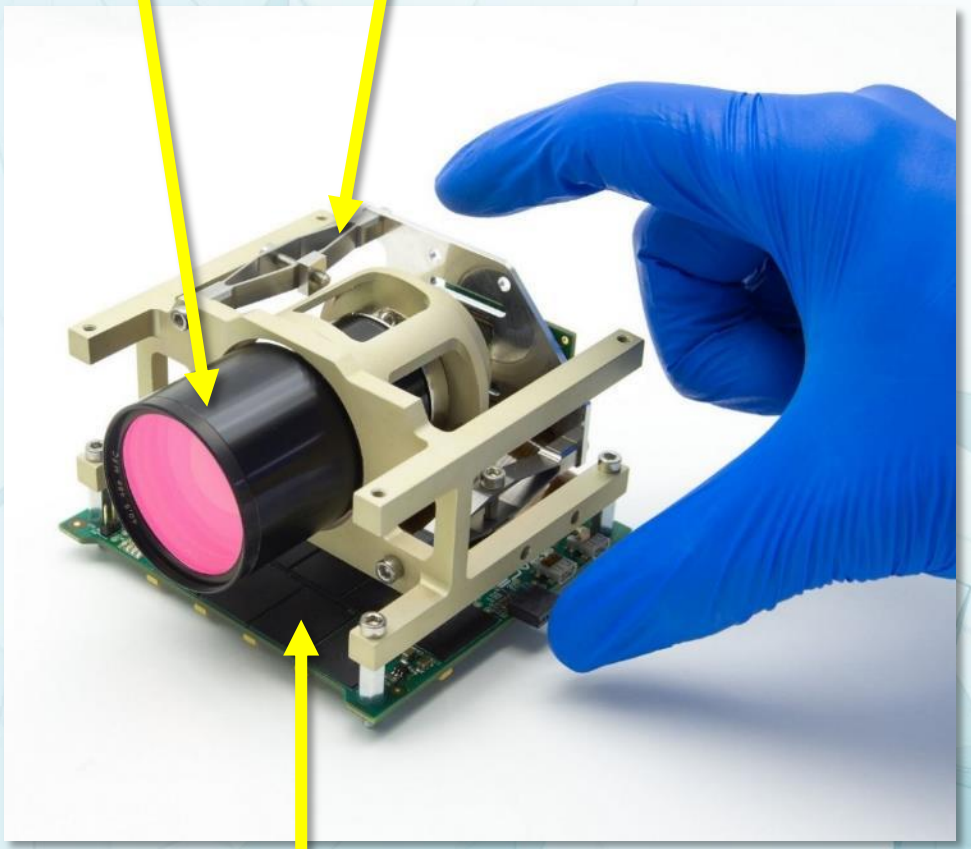
The Gecko imager is an easy-to-integrate imaging solution for your CubeSat mission. A customizable high performance mass storage unit is integrated into the compact design. The Gecko imager offers mechanical compatibility with standard frames.
RGB images are captured at up to 5 frames per second† using a matrix sensor in snapshot (global shutter) mode.
Image data is captured directly to the integrated mass storage. Data may be streamed out to an on-board computer and downlinked a lower data rate, as required.
Reliable operation achieved by using a combination of proprietary hardware and space-proven ruggedized optics.

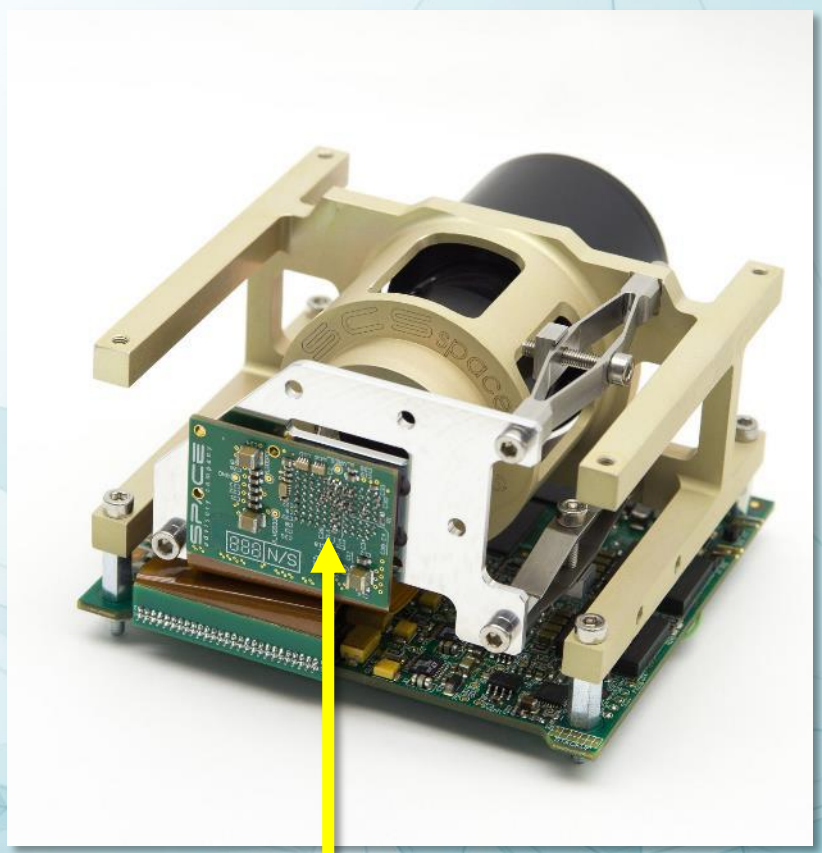
Availability: 12 – 16 weeks

Quantity 1

Request more info

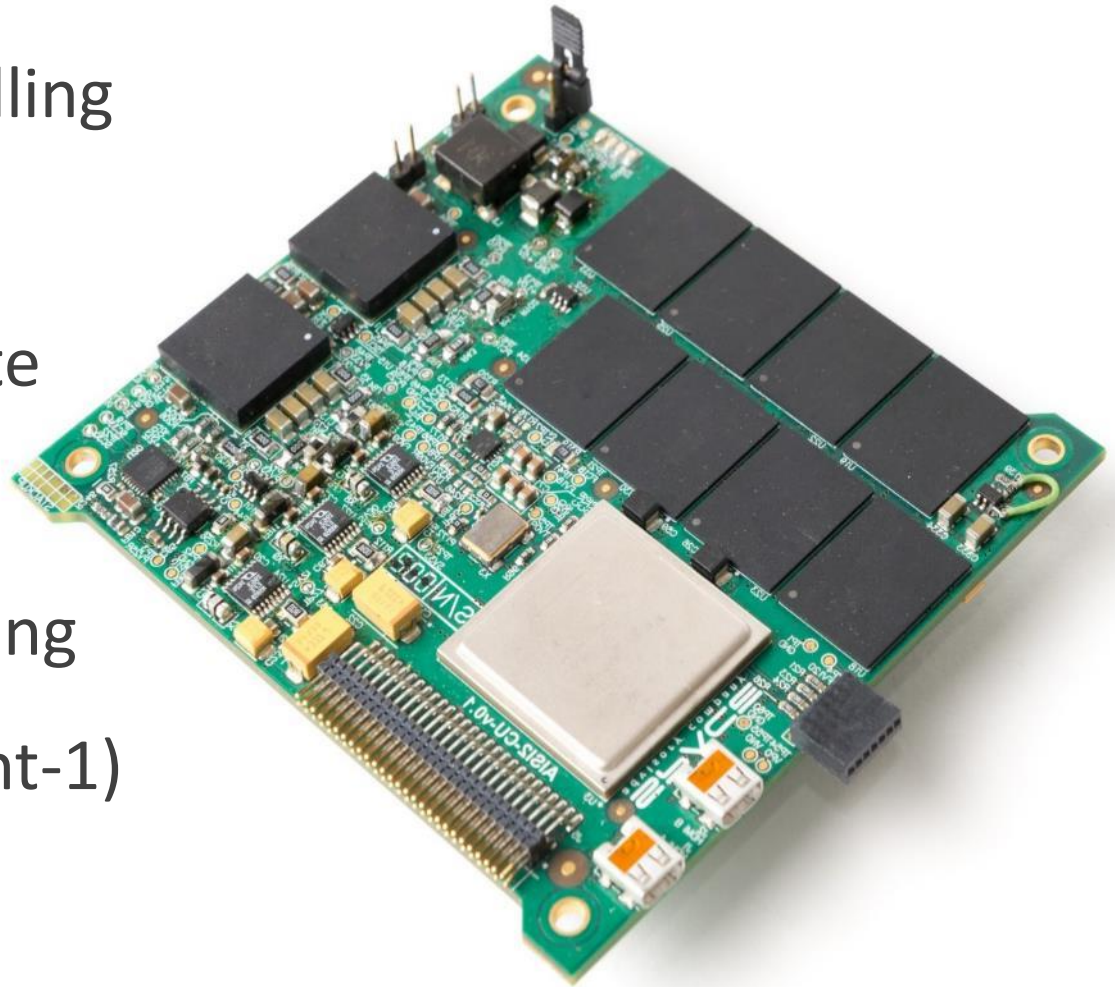
Modular design





Versatile “Control Unit”

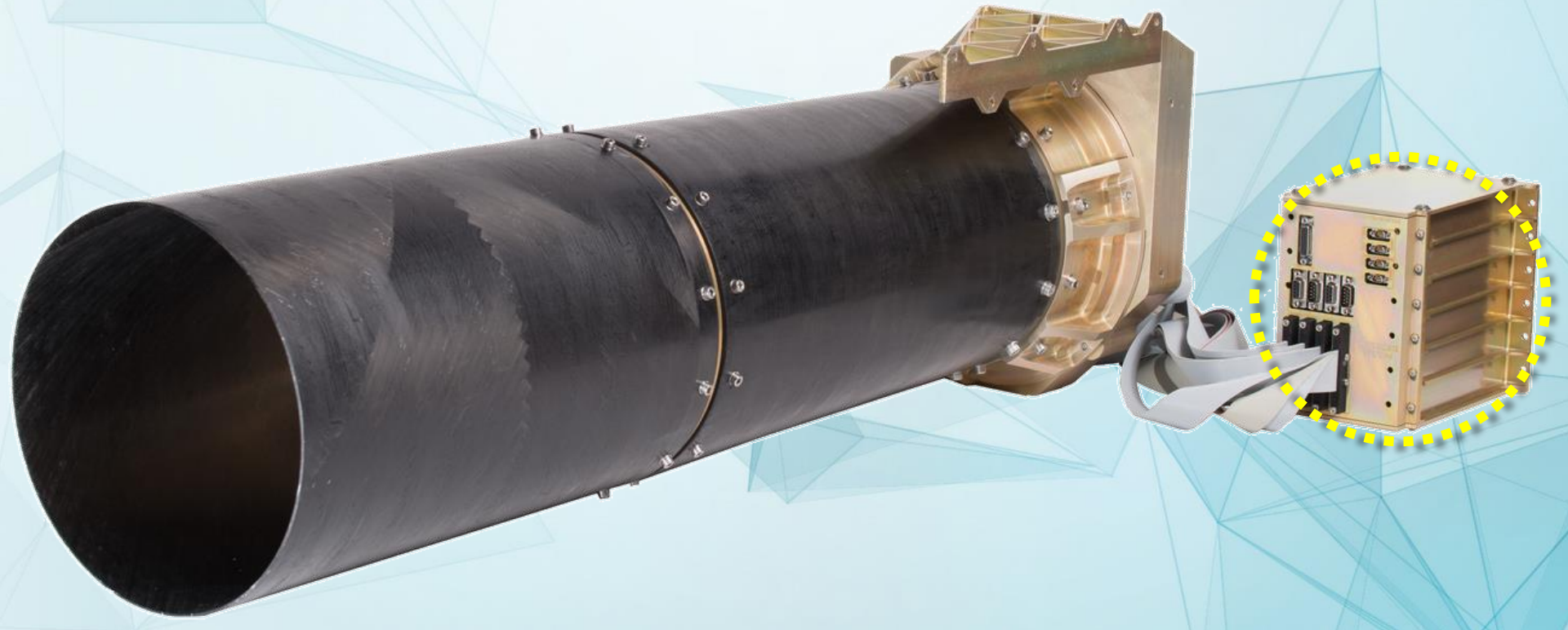
- Mass data storage (128 GB or more)
- Automatic wear levelling
- Error-correction
- High data capture rate
- Thumbnails
- RGB Bayer demosaicing
- JPEG2000 (post nSight-1)



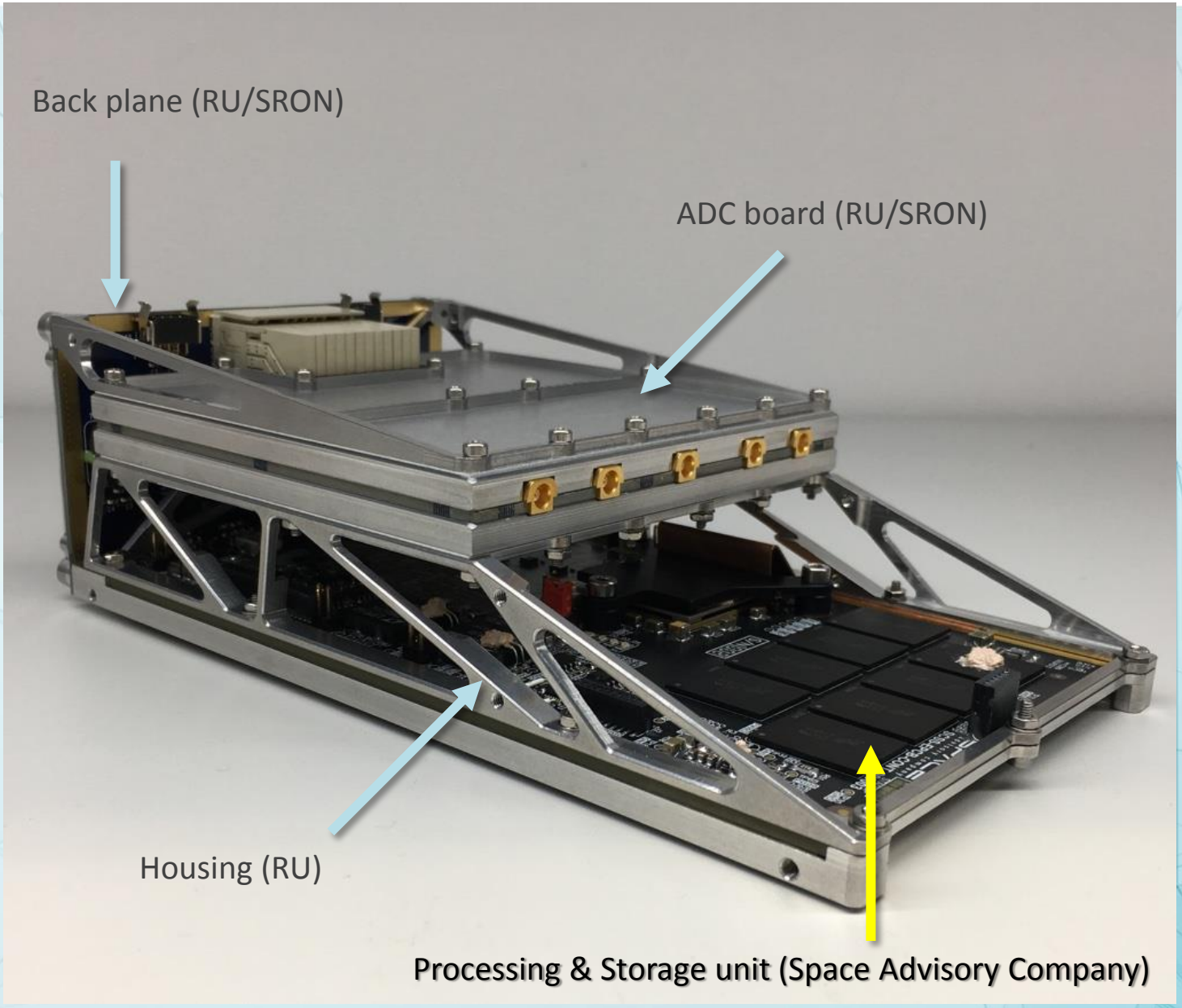
PC/104 form-factor (~100 mm x 100 mm x 15 mm)

SCS Tegu EO-1 shares heritage

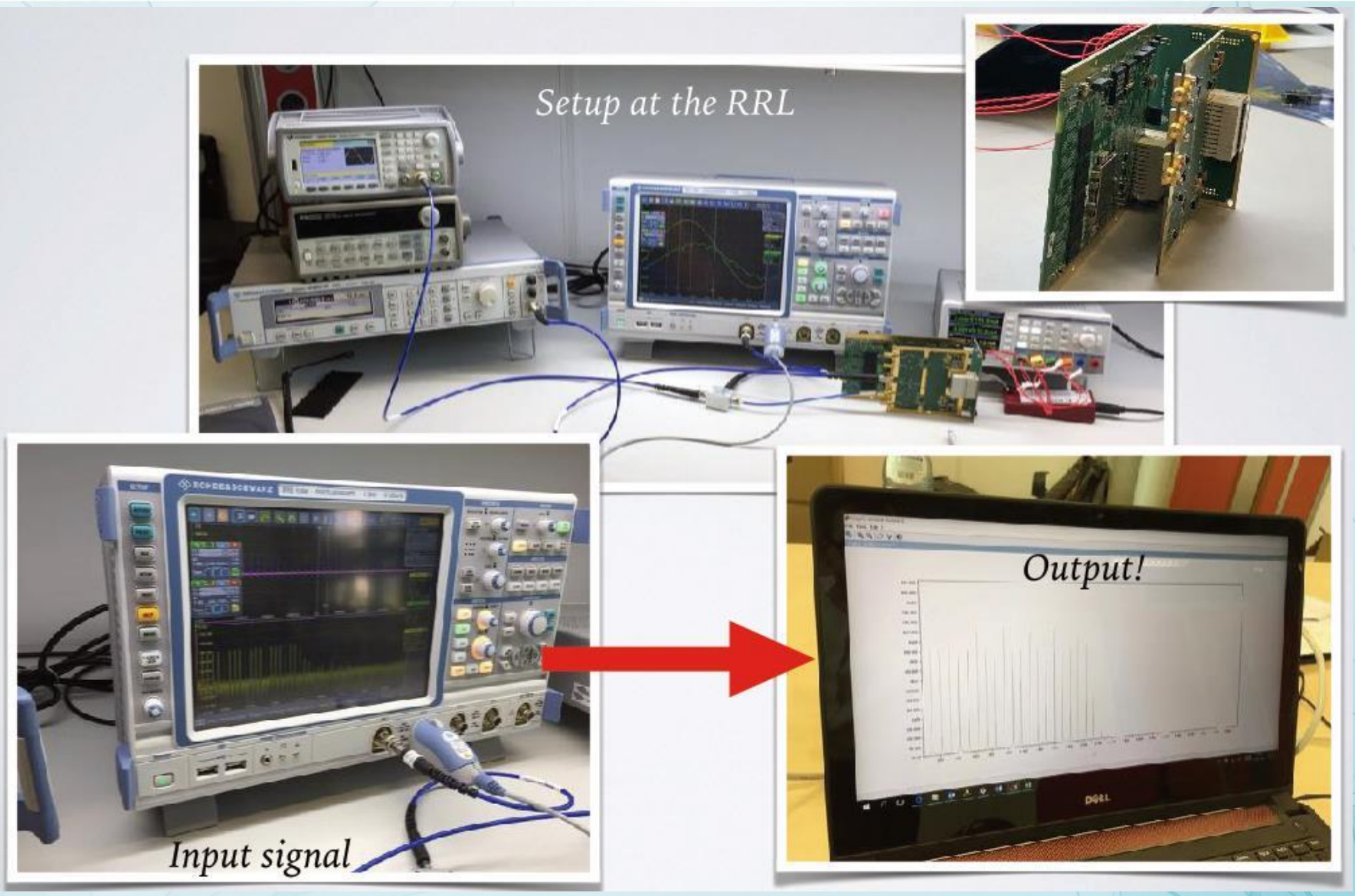
- 2m PAN, 10m multispectral GSD
- 24 km swath
- VIS-NIR coverage in 11 bands
- 1 Terabyte on-board storage
- JPEG2000 compression



NCLE receiver & data processing unit

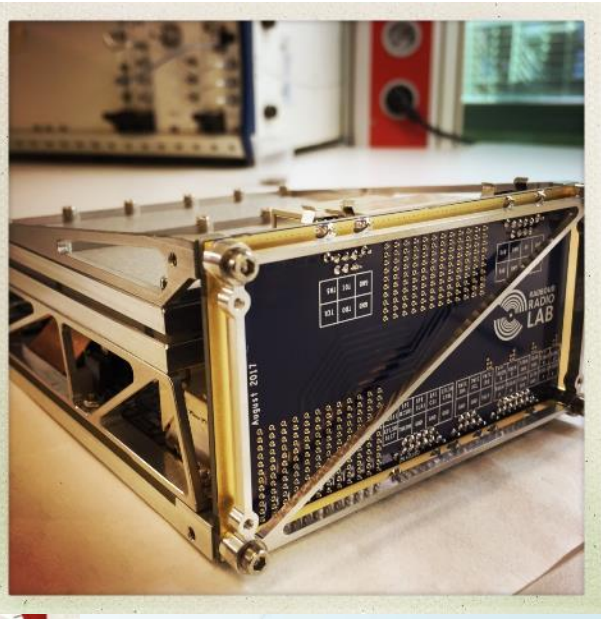


Engineering Model

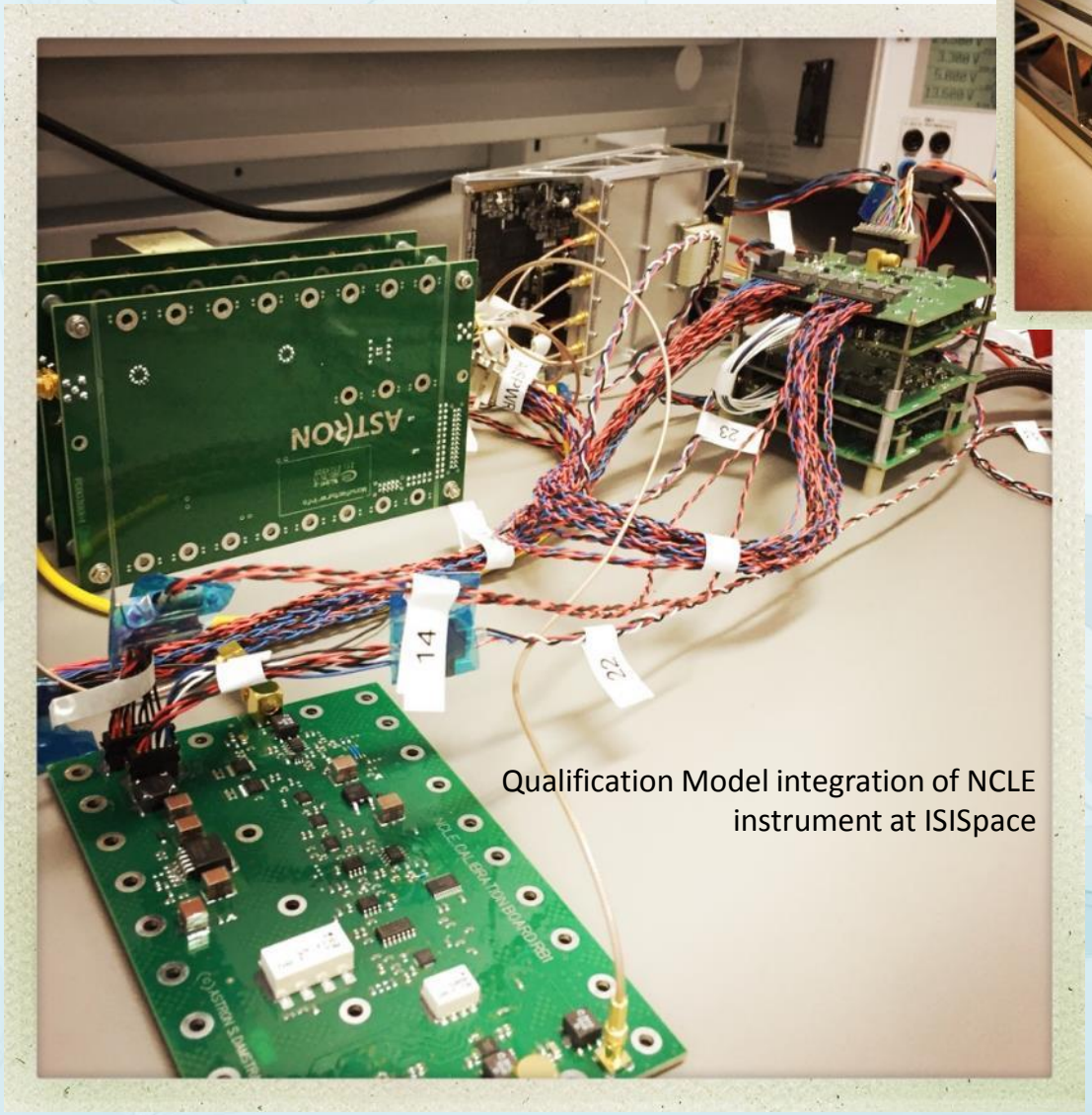


RRL / NCLE Consortium

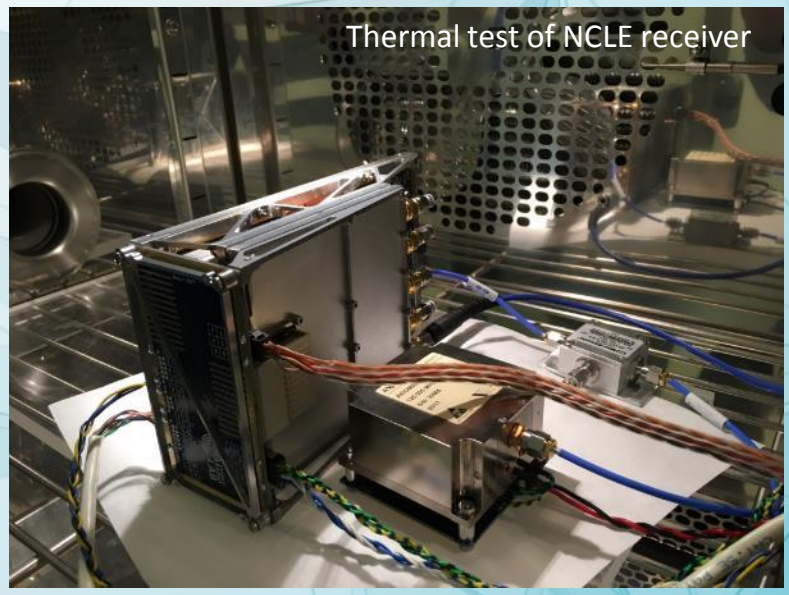
NLCE Development



NCLE Receiver at Radboud Radio Lab



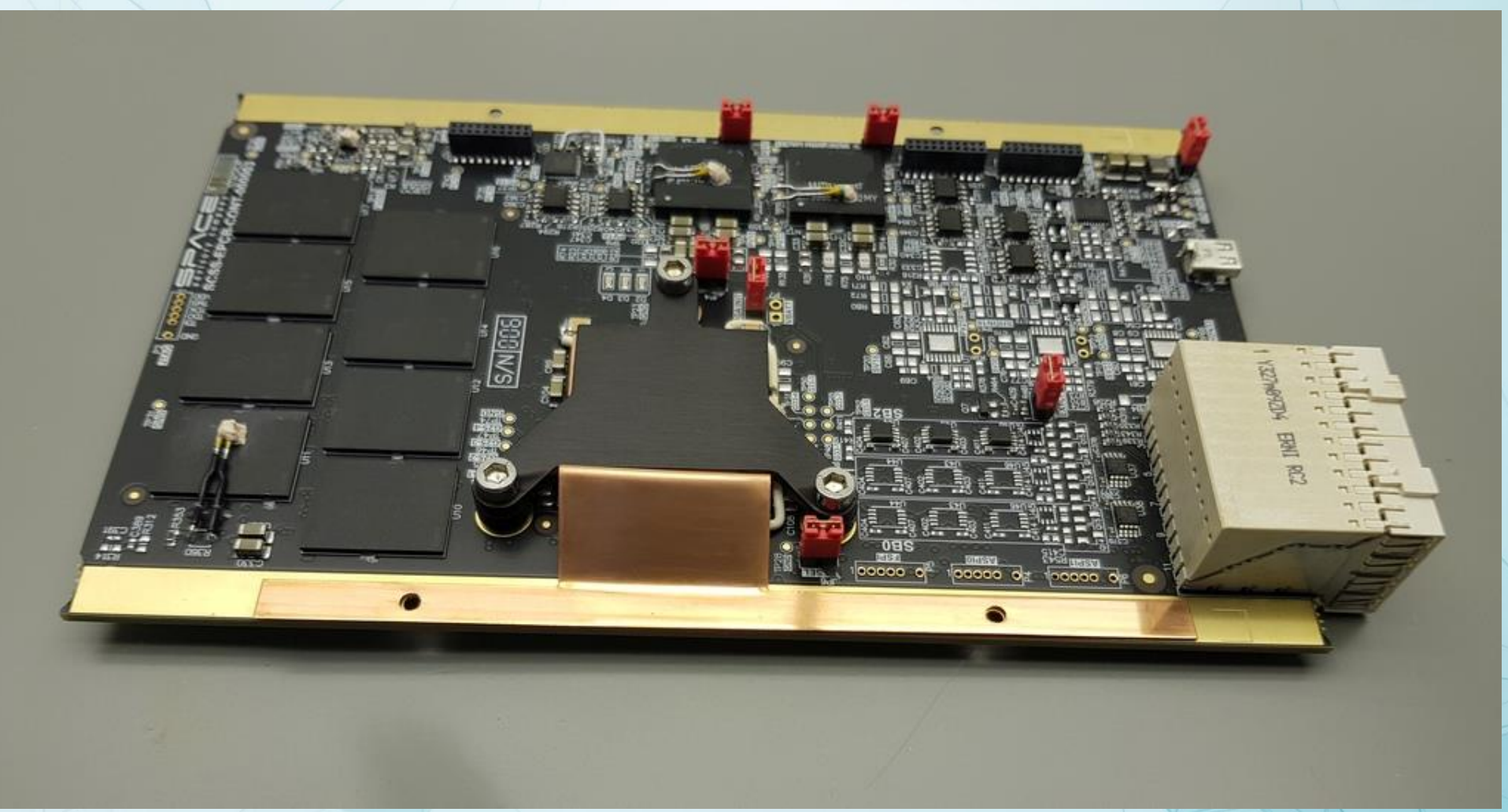
Qualification Model integration of NCLE instrument at ISISpace



Thermal test of NCLE receiver

RRL / NCLE Consortium

The (first) FM Board : delivered!



Looking towards success in 2018

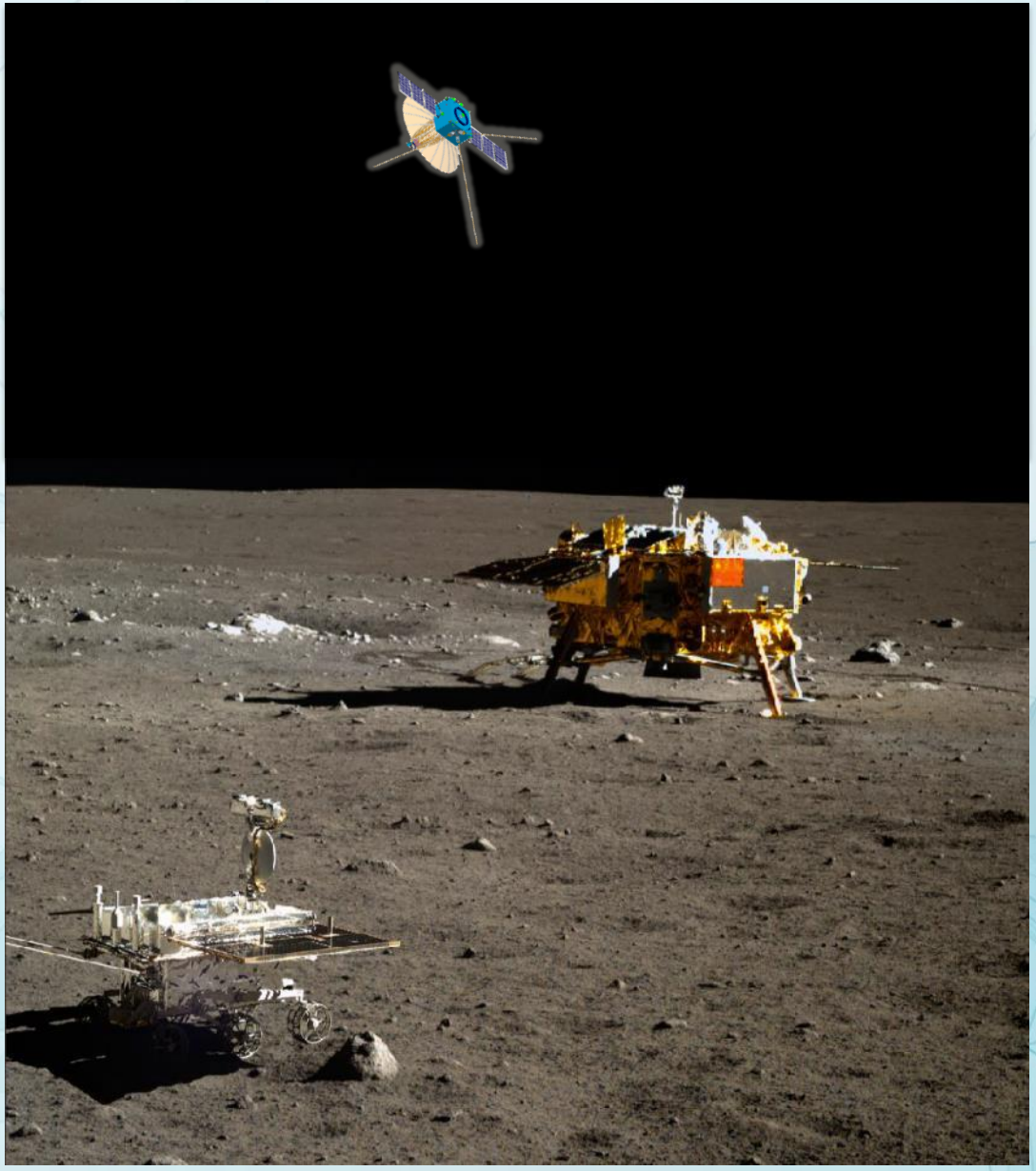


Image: CNSA

Some of our partners and customers

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

Cape Peninsula
University of Technology

Nelson Mandela
Metropolitan
University

for tomorrow

Dr. Francois Malan
francois@spaceadvisory.com

Tel : +27 (0)21 300 0060
http://www.spaceadvisorycompany.com