LEIDEN, NETHERLANDS - DECEMBER 2015

THE FUTURE OF ISS UTILIZATION:
AN INDUSTRY PERSPECTIVE

NANORACKS

BLUE ORIGIN

AIRBUS
DEFENCE & SPACE

#FUTUREISS

Featured Speaker: Dennis Elgaard, APAC Sales Manager, Gomspace

GOMX-3 DEPLOYMENT FROM ISS

GOMSPACE

GOMX-3 CubeSat Deployment

## NanoRacks event 7-8 Dec 2015
Dennis Elgaard, GomSpace

GomSpace at a Glance

- A space company situated in Denmark Established in 2007

- Experienced management team with background in defense, cyber and space

- Has exported space hardware to customers in more than 45 countries spanning the globe

- Focus on product design, mission design and mission implementation

- Manufacturing with network of aerospace manufacturers (AS9100C QA)

- 30+ highly qualified international staff

What we do at GomSpace?

- Nano-Satellite Subsystems off the shelf
  - Batteries, solar panels, power supply & distribution
  - On-board computers and software
  - Radio communication systems and antennas
  - Attitude control hardware and software

- Complete nanosat platforms
  - Reference platforms for payload integration by customers
  - Platform design, integration and test to customer requirements

- Payloads
  - Software defined radio technology and applications

- Mission design & implementation
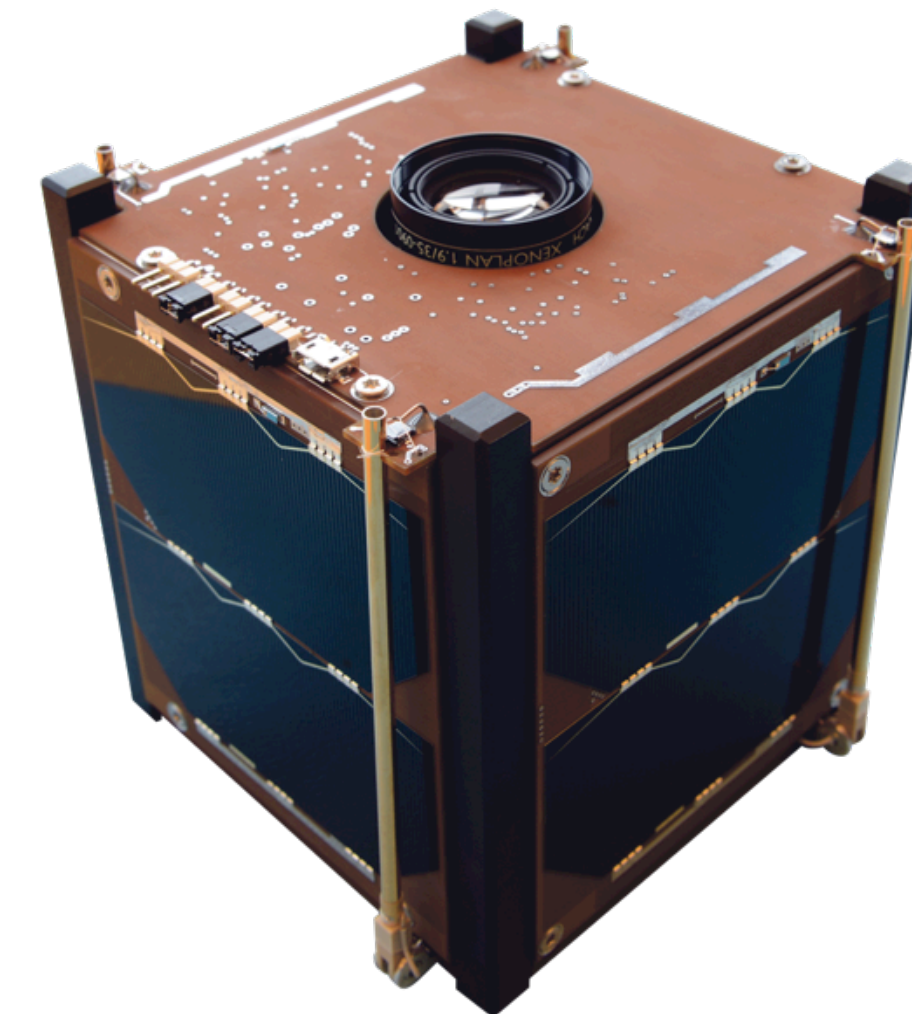
GOMX-3 Mission & Objective

- GOMX-3 is the result of a cooperation between ESA and GomSpace under the ESA IOD GSTP……

- ESA objectives
  - First CubeSat mission from ESA
  - First use of ECSS based quality standards for CubeSats

- GomSpace objectives
  - To test our new sub-systems in space
  - Improve the sADS-B receiver and data management
  - Test new SDR receiver (SOFT)
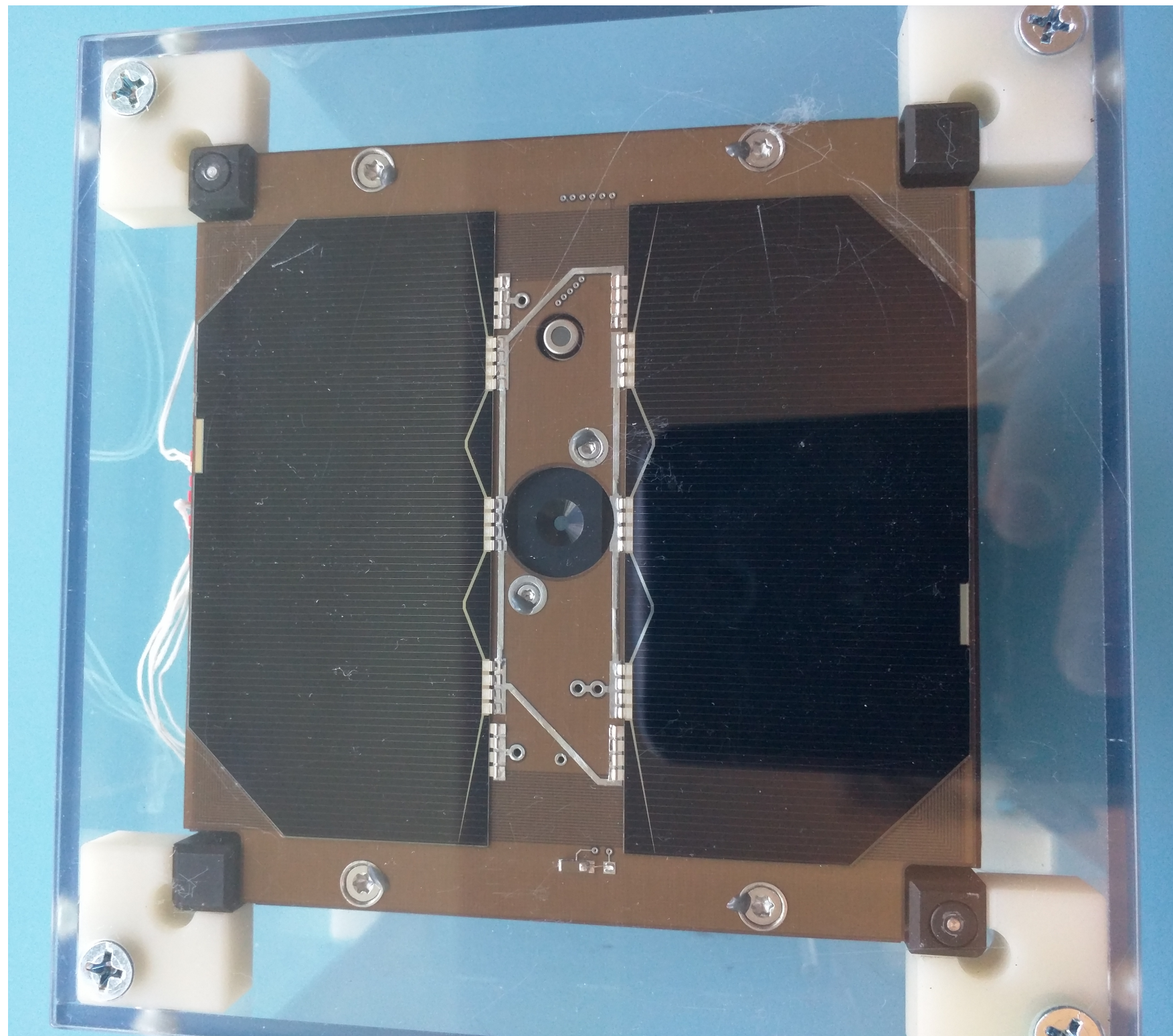 - Racking up flight heritage

GOMX-2….

October 28th, 2014

GOMX-2 …. Today!

- Back at GomSpace!
- Alive and in good health!

Launch

- GOMX-3 was launched on HTV 5, Aug 19th 2015
  - Departed 11:50 UTC
  - Tanegashima Y2, Japan
  - Bad weather delay for 5 days
  - ISS arrival Aug 24th,10:29 UTC
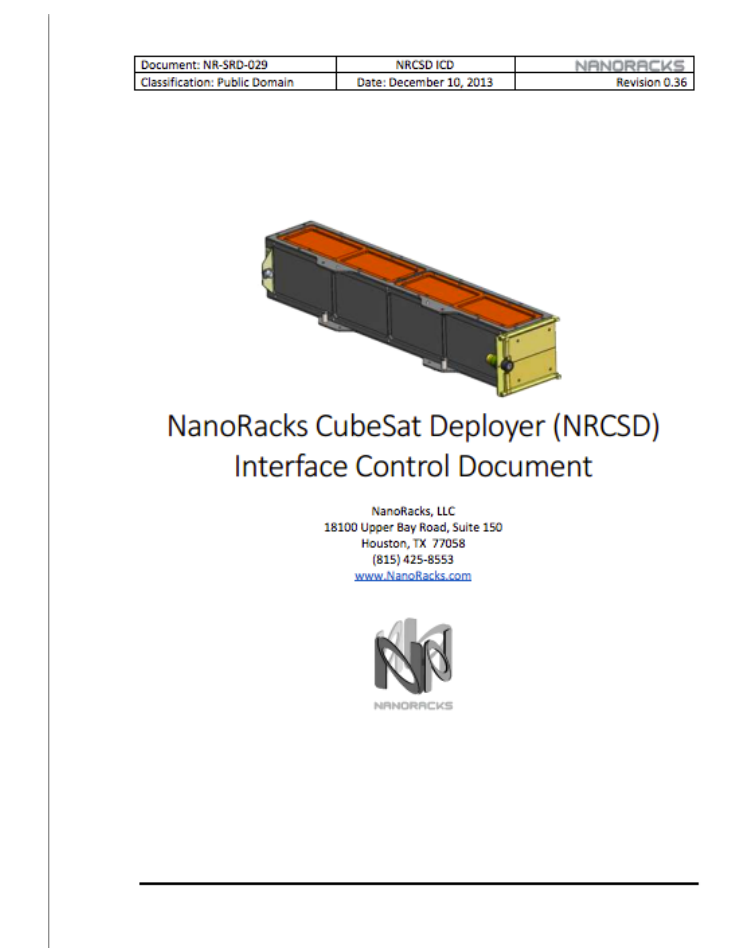- Stored in NanoRacks PODs until October 5th when it was deployed

GOMX-3 Deployed from ISS

GOMX-3 Deployed from ISS

- Deployed from ISS on the 5th of October together with AAUSAT5.

- First pass had Roger Walker (head of CubeSat development at ESA) present @ GomSpace

- Successful Tx & Rx during first pass

- Result of first day:
  - Confirmed: we have a healthy spacecraft
  - UHF link operating at 4X baseline speed
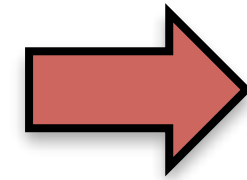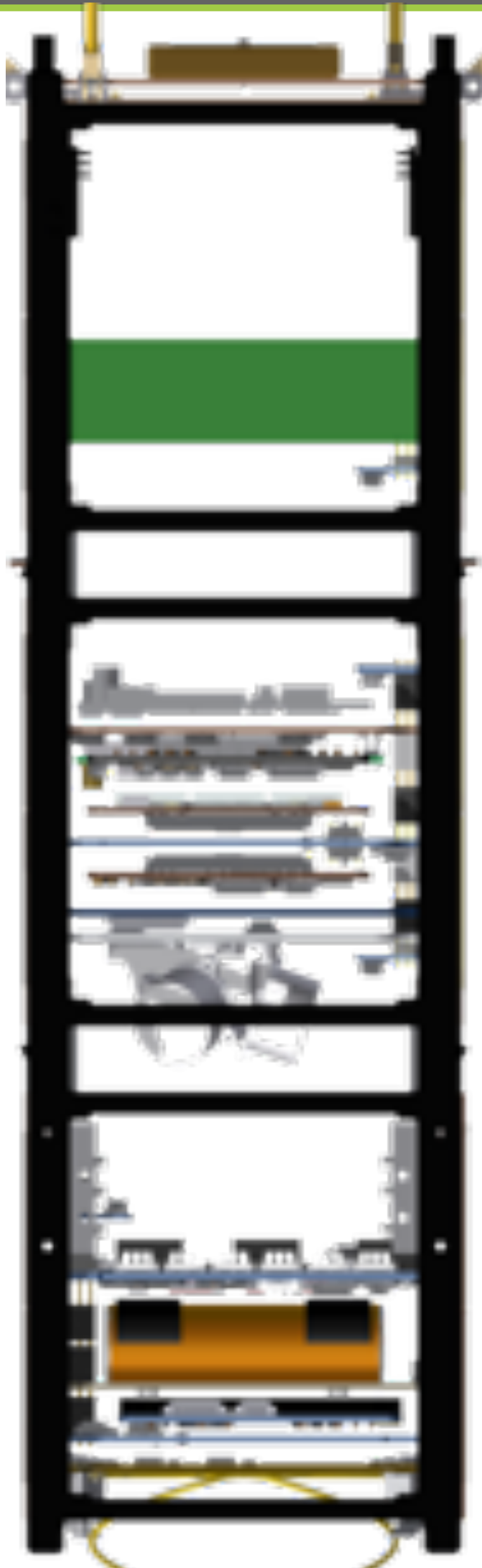
ISS Design considerations

- Launcher considerations
  - Follow the NanoRacks ICD (Interface Control Document)
  - Perform basic vibration testing
  - Documentation of design

- ISS Considerations
  - 1) Battery safety and 2) Inhibitor (kill switches)
  - Batteries approved after NASA requirements
    - Various test, including destructive testing
    - GomSpace has a batch of approved batteries, summer 2013
    - Each CubeSat has to perform basic battery testing
  - 3 level of inhibitors.
    - GomSpace use 2 around the batteries, and 1 general power switch
    - Redundant rail and end switches
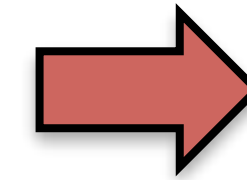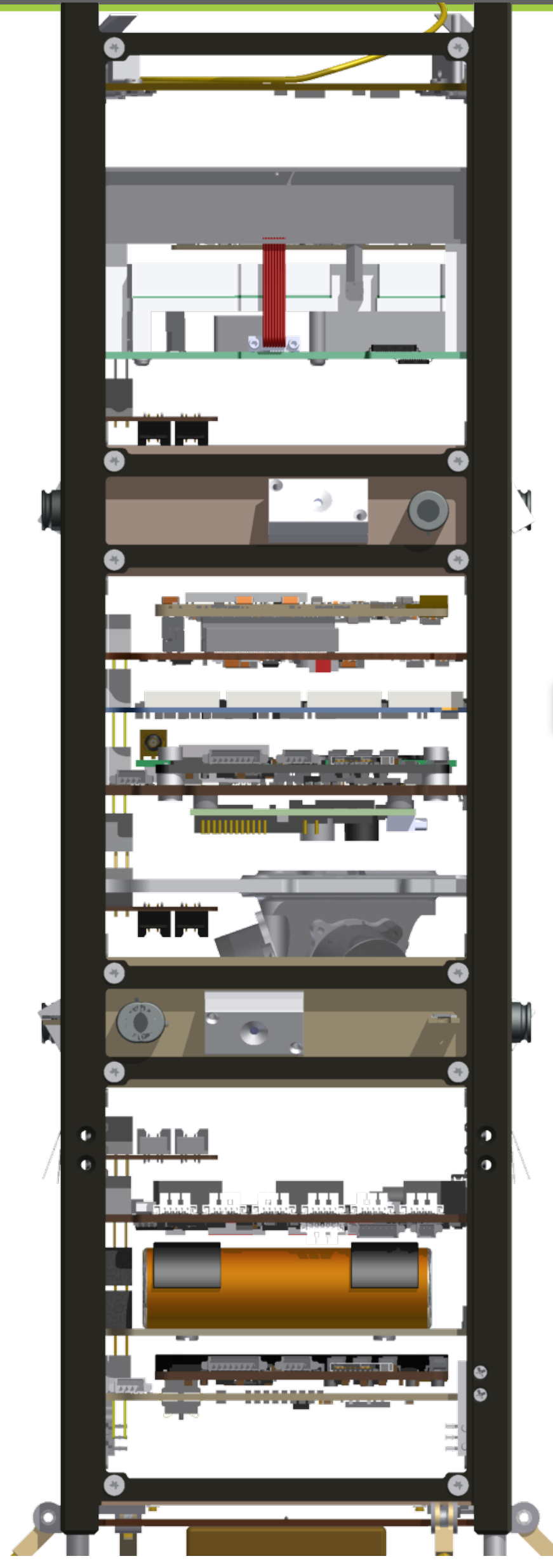 - Testing & documentation

NanoRacks CubeSat Deployer (NRCSD)
Interface Control Document

NanoRacks, LLC
18100 Upper Bay Road, Suite 150
Houston, TX 77058
(815) 425-8553
www.NanoRacks.com

+Z

2014.07

2015.01

2015.04

First ADS-B Data (Day 2)

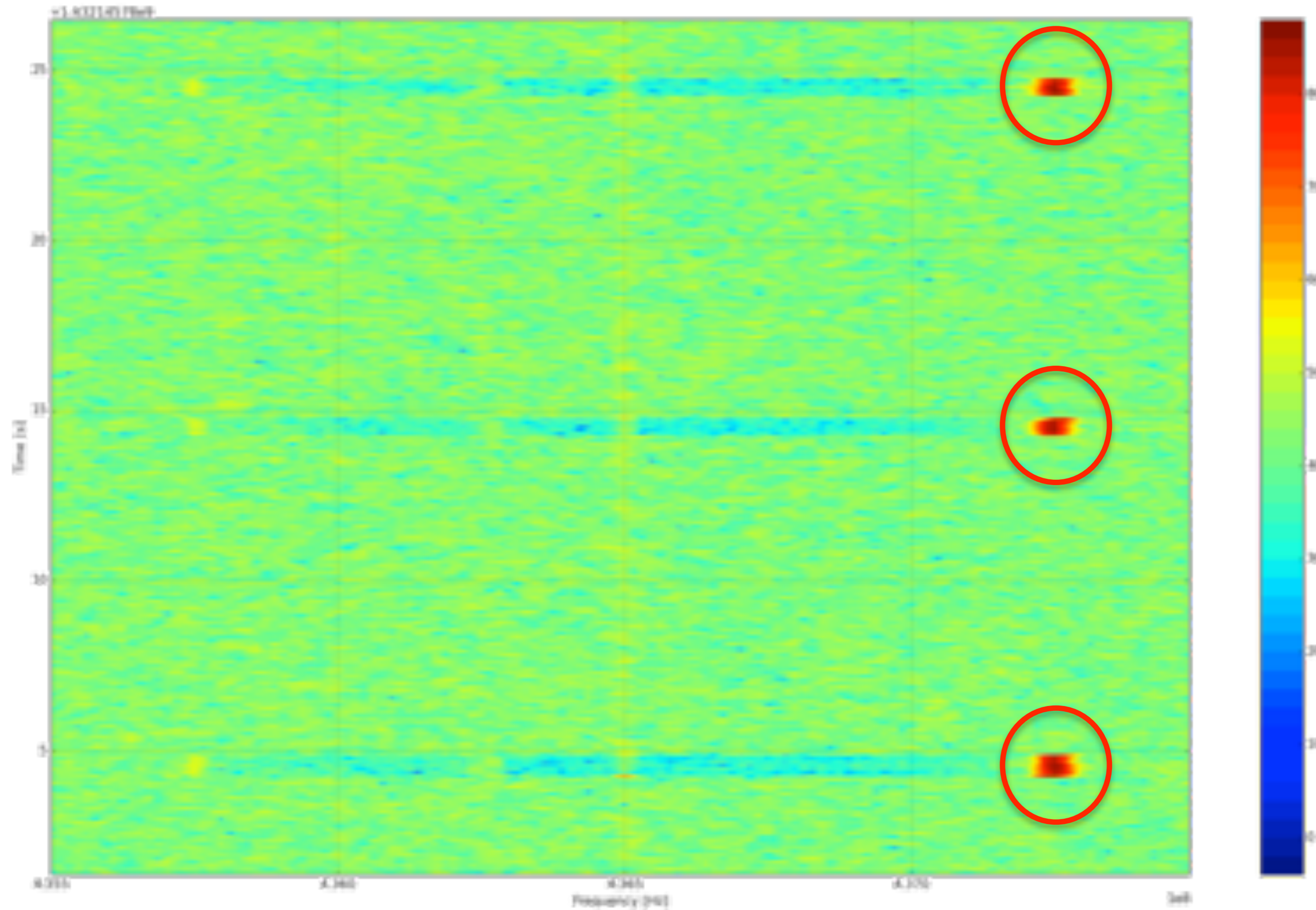- Received immediately after deploying antenna

Nadir Pointing Enabled (Day 3)

# SOFT Application: UHF Tx
(Oct 17th)

On-going activities

- ## ADCS fine tuning
  - Aiming for 2° pointing, w/o star tracker

- ## X-band Transmitter Passes
  - Working with ESA groundstation in Kourou, French Guiana

- ## sADS-B receiver fine tuning
  - Aiming for improved data return

- ## SOFT Operations

- ## Advance Operations Automation
  - Automated FTP up/download & payload scheduling
  - Aim to maximize data return

GOMX-3 Success

- Healthy Satellite
  - Power positive, Temperatures as expected
- UHF link stable
  - Bit rate increased from 4.8 to 19.2 kbps
  - Uplink freq. shifted to avoid in-orbit noise
- Achieved 3-axis Control
  - Pointing accuracy of 5°
  - Align RAM / Nadir or track an ECEF target
- Achieved GPS Locks in-orbit
- sADS-B Data Collection
  - Database growing by the day
- Tested Xband Transmitter
  - Viterbi lock achieved with Kourou groundstation
- Tested SOFT payload
  - Monitored UHF environment of s/c
  - Monitoring Lband environment
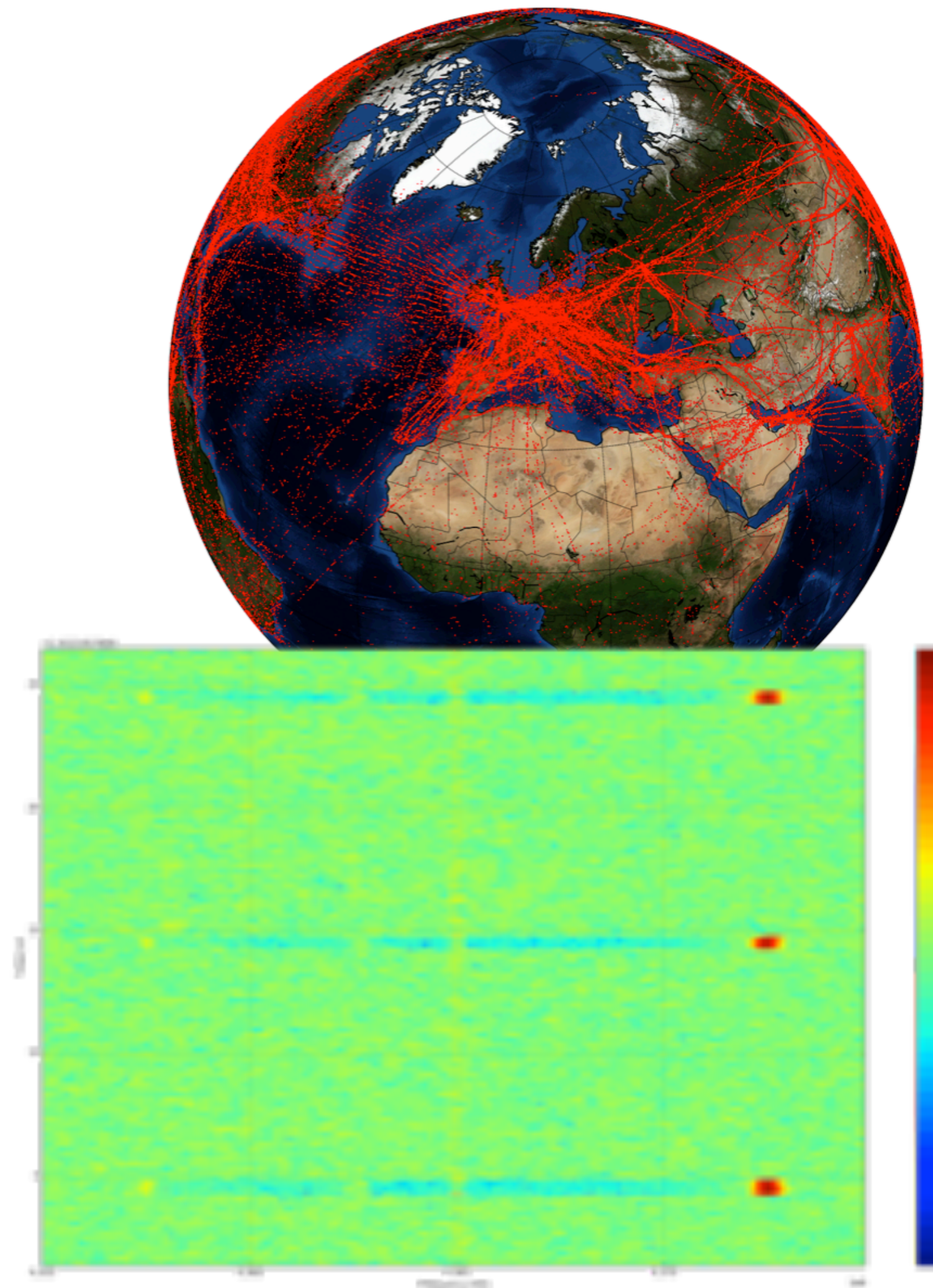
GOMX-3: an extremely **capable** satellite…

…well on the way to **complete mission success.**