

SOSMAG

Service Oriented Spacecraft Magnetometer

General Overview

SOSMAG Concept:

- Magnetometer on standard satellites
- Piggyback instrument as guest on long term missions
- Magnetically “dirty” spacecraft
- No long booms
- „Ready to use“ data with low delay

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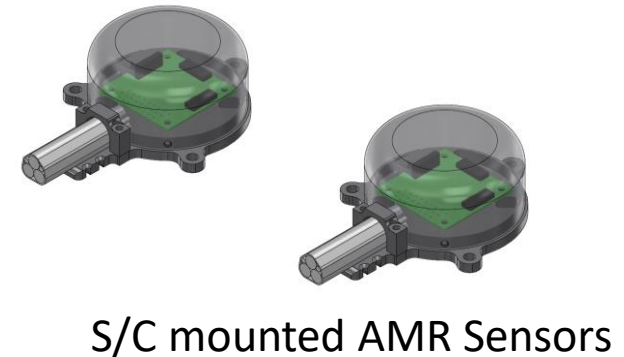
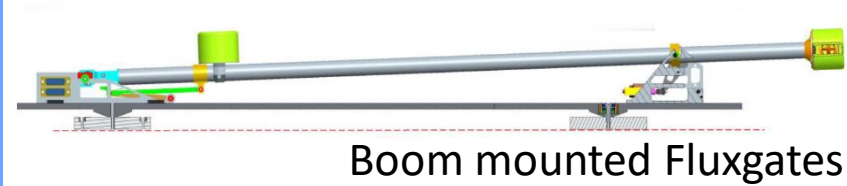
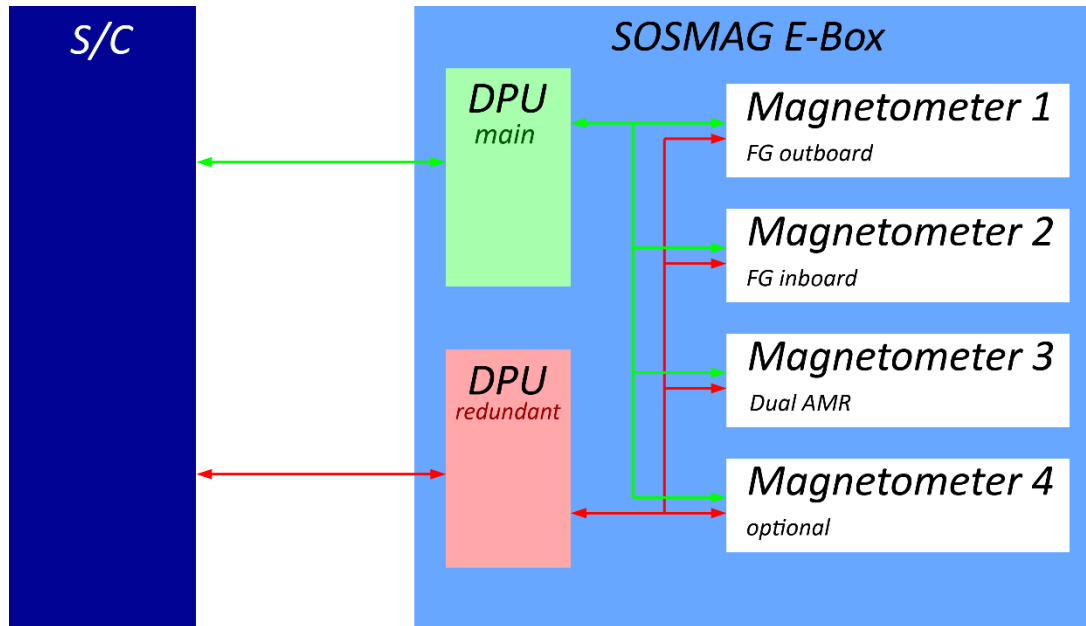
SOSMAG Team:

- | | |
|---------------------|------------------------------------|
| • Magson GmbH: | DPU, fluxgate magnetometers, E-box |
| • IWF Graz: | AMR electronics, DC cleaning, GP |
| • TU Braunschweig: | Boom, AC cleaning algorithm |
| • Imperial College: | AMR sensors |

Hardware Overview

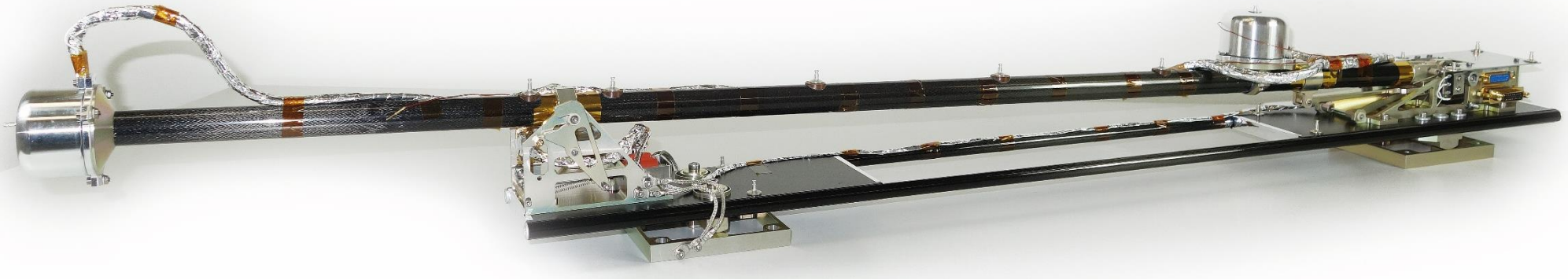
- Four sensors (2 fluxgate sensors, 2 AMR sensors) or more
- 1m boom with deployment mechanism
- 3 sensors closer to magnetic disturbers
- Mounting interface with little requirements on spacecraft structure
- Associated electronics
- Design heritage: Themis, Rosetta, Venus Express, MMS
- Onboard data correction

Block Diagram



- Redundant Power and Telemetry Interface
- Redundant DPU
- Cross strapping for power and telemetry

Hardware: Boom



Boom Design:

- Two sensors in gradiometer configuration
- Spring driven deployment mechanism
- Frangibolt activator (no pyros)
- Base plate with a fixed and a movable mounting foot point to balance different expansion coefficients of base plate and S/C structure

Technical Data:

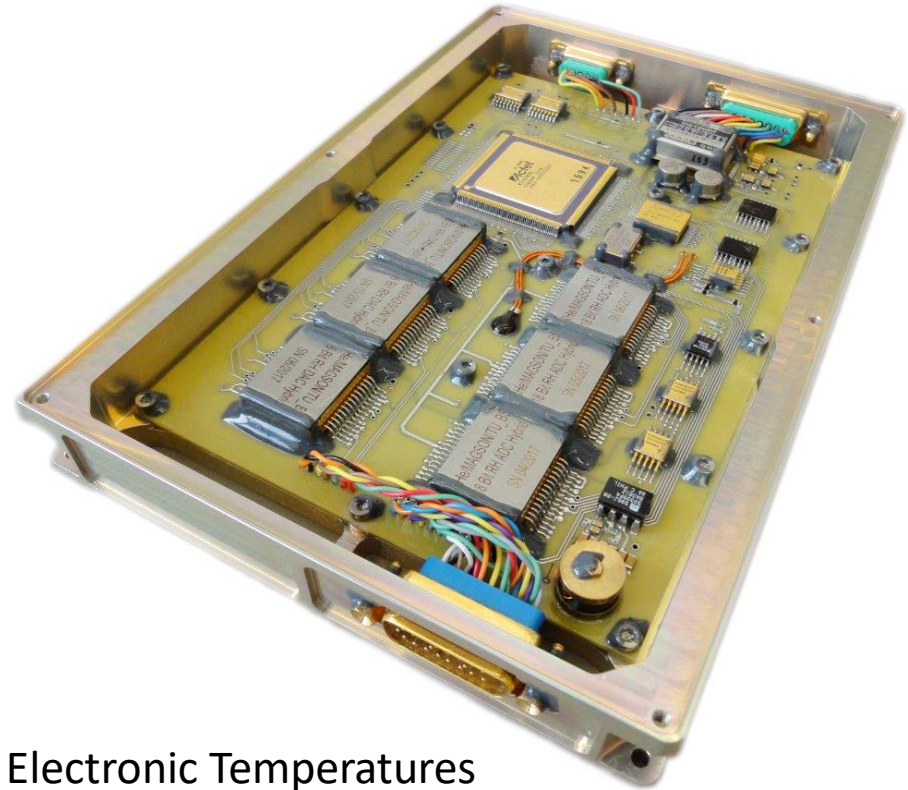
- Length: 1m
- Weight: 1.3kg (with sensors and harness)

Hardware: Fluxgate Magnetometer

- Range: 60.000nT
- Noise: $< 10\text{pT}/\sqrt{\text{Hz}}$
- Data rate: 128Hz

Hardware facts:

- RH DAC and ADC hybrid with LNA
- Red. power I/F
- Red. RS422 I/F
- Synchronized measurement
- FPGA based 32 bit RISC processor
 - inflight firmware update
 - inflight parameter upload
- RAMs EDAC and triple voting protected
- HK measurement
 - secondary voltages and currents, Sensor and Electronic Temperatures
- Power: 1,5W @28V
- Mass: 600g with box frame

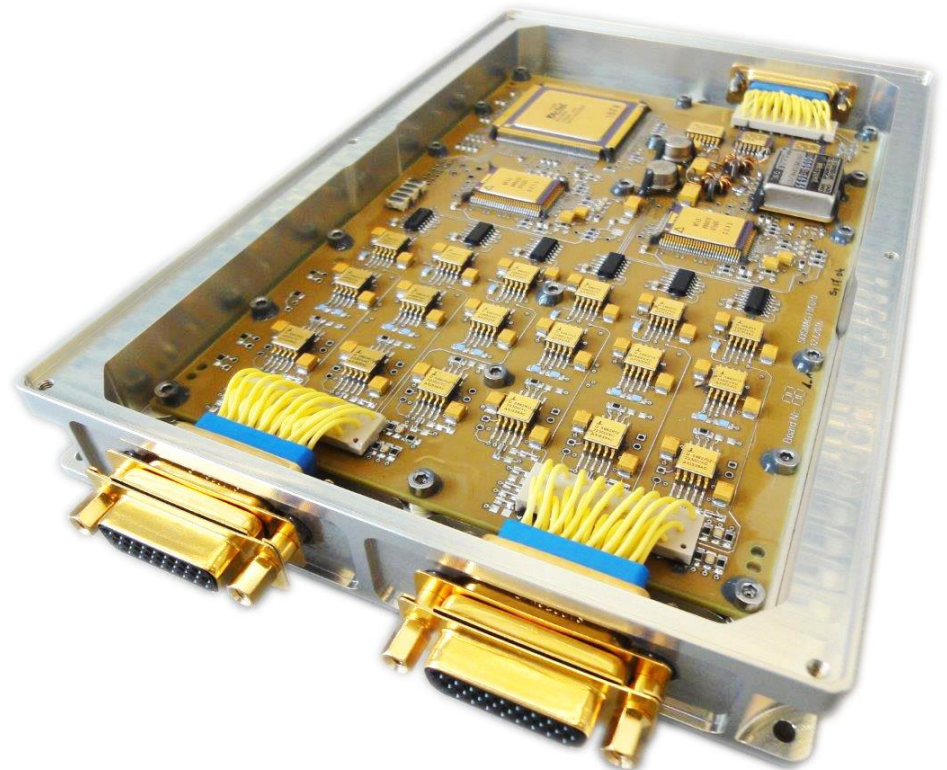


Hardware: AMR Magnetometer

- Range: 60.000nT
- Noise: $< 300\text{pT}/\sqrt{\text{Hz}}$
- Data rate: 128Hz

Hardware facts:

- Electronics for 2 sensors on one PCB
- Red. Power I/F
- Red. RS422 telemetry I/F
- Synchronized measurement
- HK measurement
secondary voltages and currents,
sensor and electronics temperatures
- Power: 1,5W @28V
- Mass: 530g with box frame



DPU

- FPGA based 32 bit RISC processor system
- Inflight firmware and parameter upload
- RAMs EDAC and triple voting protected
- Red. RS422 Telemetry Interface
- Red. Power I/F
- Red. Frangibolt I/F
- Client on/off and power distribution
- Synchronization master
- Extended HK measurement
 - Prim. and secondary side voltage, supply currents, Temperatures
- Onboard data processing
 - Rotation to a common coordinate system
 - Scaling of magnetometer data
 - Data cleaning algorithms
 - Averaging to desired telemetry data rate (e.g. 1 Hz)
- Power: 16-50V / internal: 2W
- Mass: 670g with box frame



E-BOX

Dimensions:

Width: 142 mm, 162 mm with mounting points

Depth: 214 mm

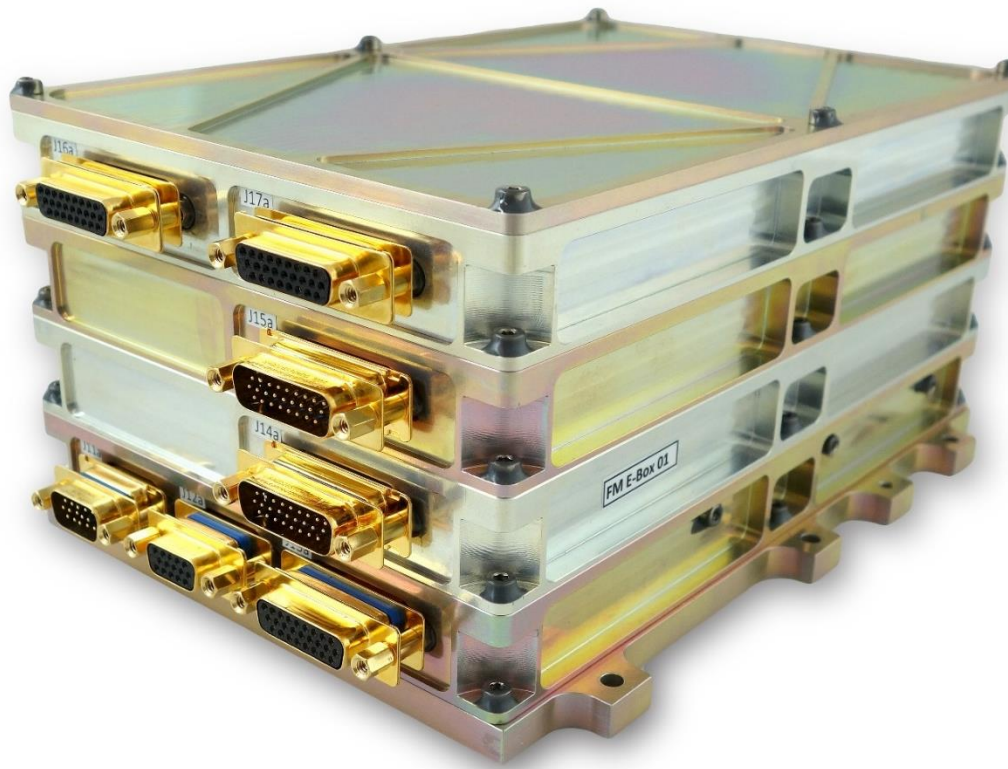
Height: 101 mm

AMR Electronic

Fluxgate OBS

Fluxgate IBS

DPU



Unit	Mass [g]
Top plate	355
AMR	530
Two FG	1.200
DPU	660
Bottom	400
Harness	135
Sum	3.280

SOSMAG Flexibility

- Fewer sensors
- Use common DPU
- Use common PSU
- Less sturdy or no box
- No redundancy
- But: no gain without a loss
- More sensors...

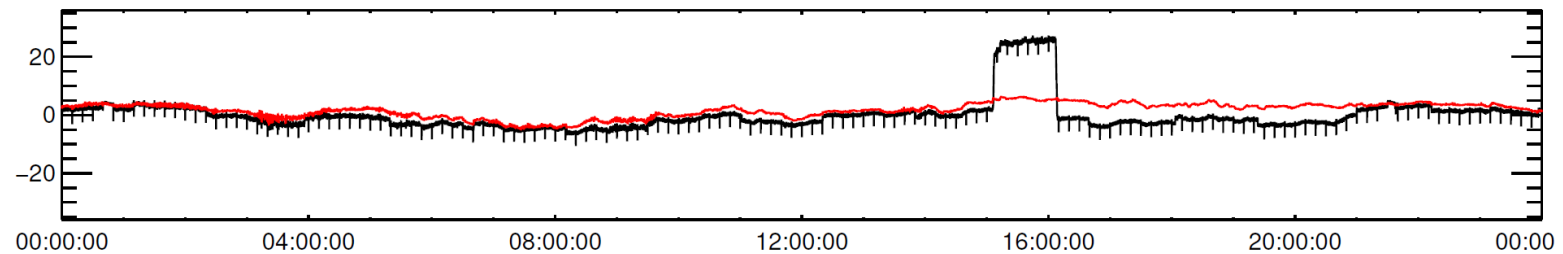
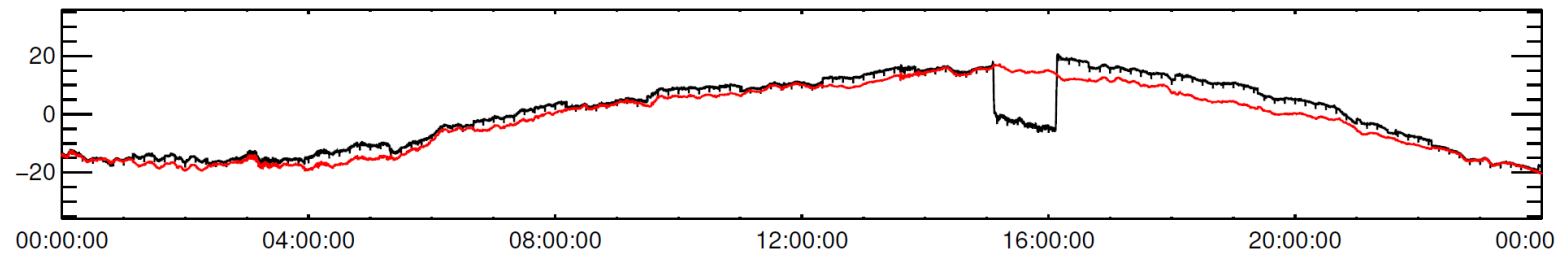
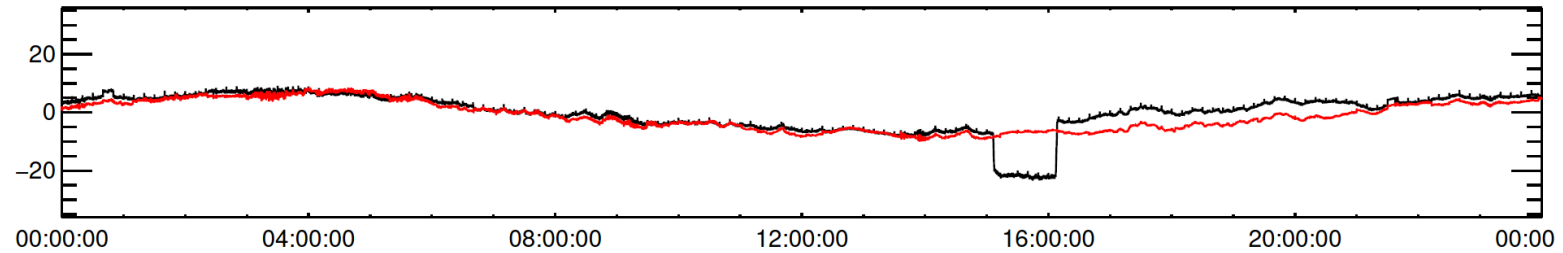


SOSMAG Status

- Launched on Geo-Kompsat 2A, 2018-12-04
- Geostationary orbit
- Part of KSEM instrument suite
- Commissioned 2019-01-04
- 6 month commissioning phase completed
- Expected mission duration 10 years
- Calibration efforts ongoing



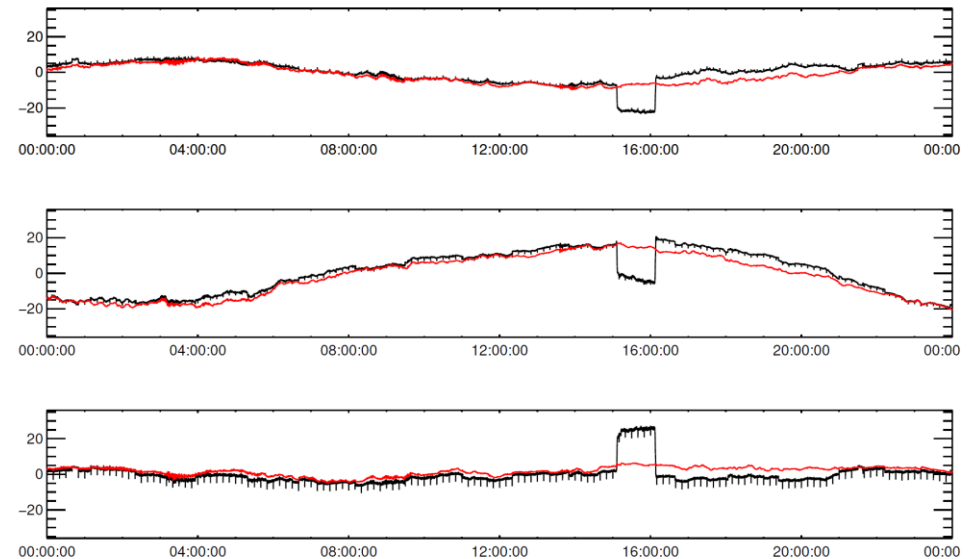
Data



2019-03-10

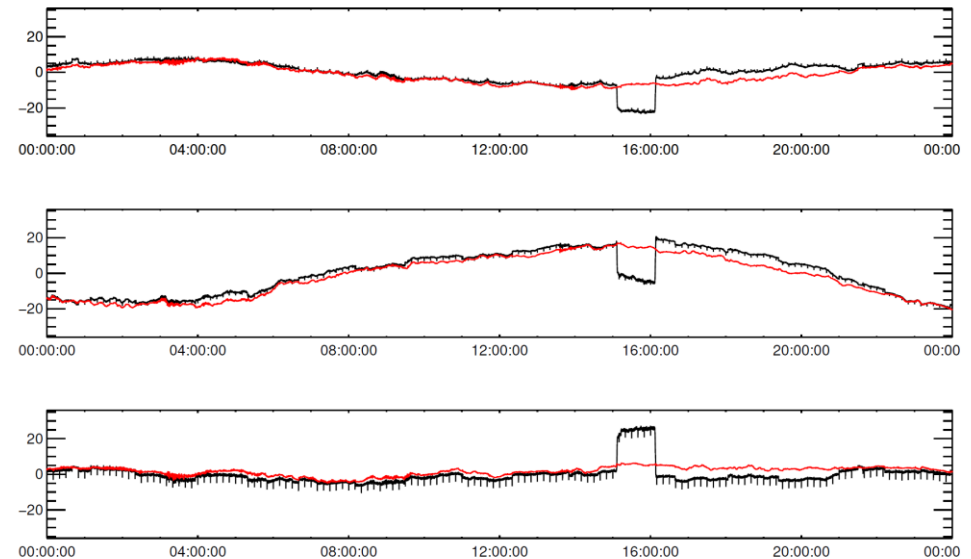
Calibration & Cleaning

- Onboard Cleaning Algorithm
- Parallel on-ground cleaning possible if raw data is transmitted



Calibration & Cleaning

- Onboard Cleaning Algorithm
- Parallel on-ground cleaning possible if raw data is transmitted
- On-ground DC offset removal
 - [values removed, publication pending]
- Preliminary results
 - [values removed, publication pending]

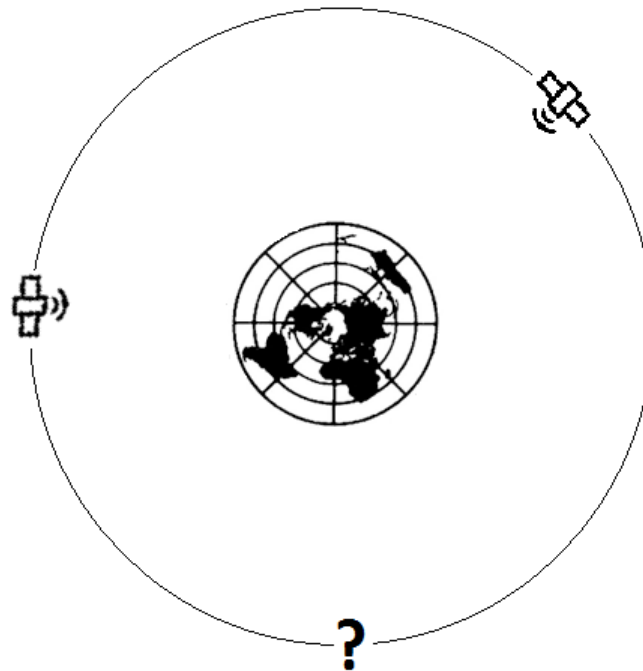


Ground Processing

- Ongoing project with ESA
- Real-time processing
 - 5 minute delay (TBC)
- Offline processing
 - 1 day delay (extrapolated calibration)
 - 28 day delay (updated calibration, science grade)
- Cleaned and calibrated data in HPEN and GSE

Outlook

- Geostationary:
 - America: GOES (4x)
 - Asia: GK-2A
 - Europe: ?



Outlook

- Geostationary
 - America: GOES (4x)
 - Asia: GK-2A
 - Europe: ?
- Other Orbits

