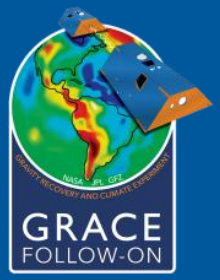
GRACE Follow-On Project

Mission Operations Status

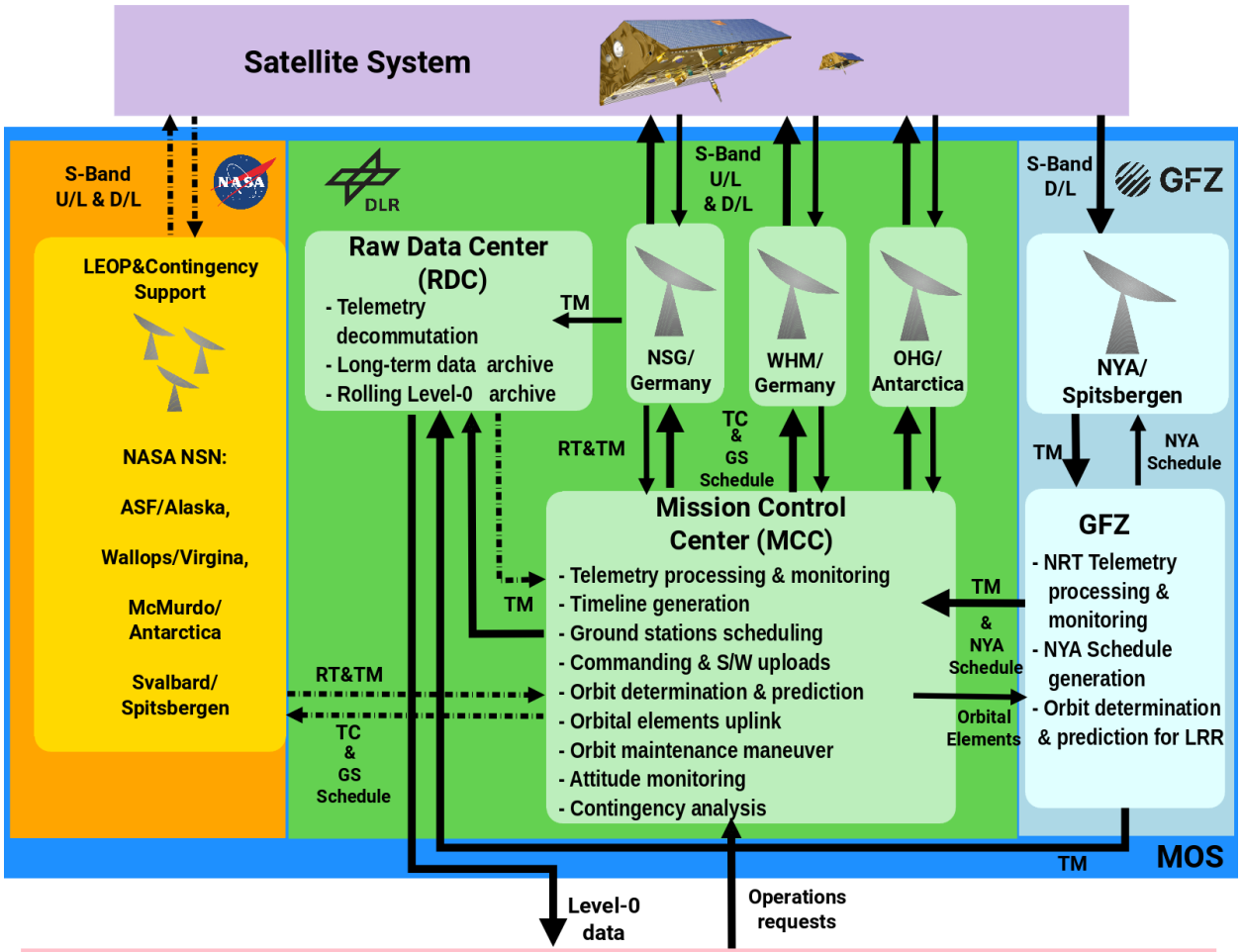


Krzysztof Snopek (GFZ), Mona Witkowski (JPL),

Sebastian Loew (DLR)

GRACE-FO Science Team Meeting, 7 October 2025

Ground Segment Status



Primary data downlink at Ny-Ålesund (NYA)

Uplink via Weilheim (WHM), Neustrelitz (NSG) and O'Higgins (OHG)

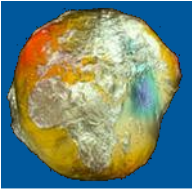
NSN stations for contingency support and software uploads.

Mission Control Centre (MCC) in Oberpfaffenhofen

Raw Data Centre (RDC) in Neustrelitz.

Ground segment performs nominally.

- Continued to resolve problems with NSN stations: ASF, Wallops and McMurdo
- Wallops was partially re-certified and its prime system is green for operations



Satellite Status

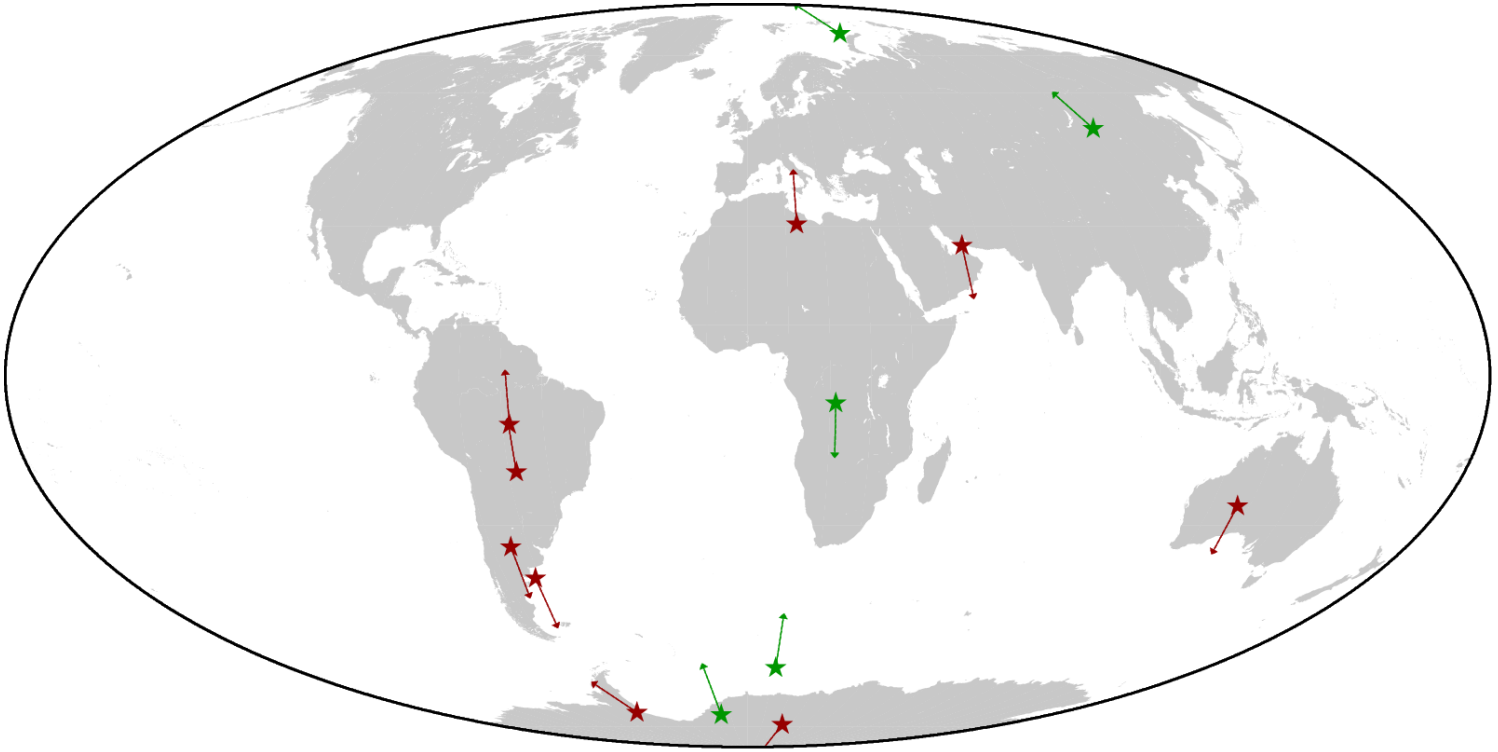
System	GF1	GF2
Bus		
- OBC	A - nominal	A – PM-A/1553 MilBus anomaly B – nominal
- PCDU	A - nominal	A – nominal
- SCA	STRE A,3 heads – nominal	STRE A,3 heads - nominal
- TX	A - nominal	A - nominal
- Battery	Nominal	Nominal
- CGPS	A & B – nominal	A & B - nominal
- IMU	3 units (IMU-4 Off)	3 units (IMU-4 Off)
AOCS	wide deadband mode, nadir pointing	wide deadband mode, nadir pointing
Payload		
- MWI	B – nominal (OCC On) IPU S/W v4.4	IPU-B failed A – nominal (OCC On), IPU S/W v4.4
- ACC	Normal Range Mode	Normal Range Mode - underperforming
- LRI	On (Diagnostic Mode, Master Role)	On (Diagnostic Mode, Master Role)

No changes last year. LRI in diagnostic mode due to the AOCS nadir pointing mode.

MOS Events Since Last GSTM

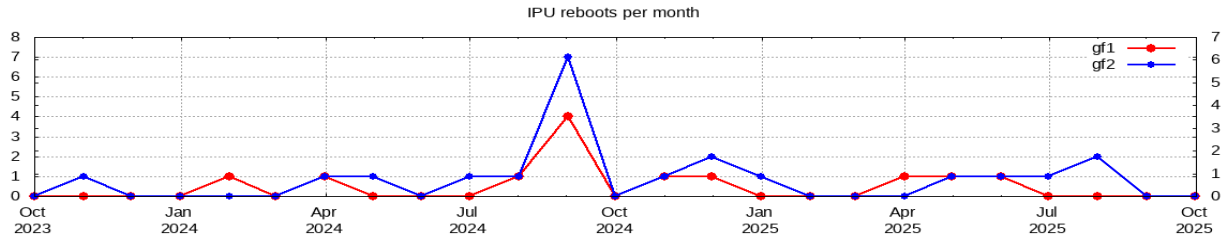
Date	Event
04-Dec-2024	GF2: drift and inclination correction maneuver
12-Dec-2024	GF2: collision avoidance maneuver (SKYKRAFT-3D)
14-Dec-2024	GF2: formation keeping maneuver
11-Feb-2025	GF2: drift correction maneuver
04-Jun-2024	GF2: drift and inclination correction maneuver
18-Jun-2025	GF1: collision avoidance maneuver
21-Jun-2025	GF2: formation keeping maneuver
26-Sep-2025	GF1: collision avoidance maneuver (GHOST-4)
29-Sep-2025	GF2: drift and inclination correction maneuver

Last year IPU Reboots (spontaneous)

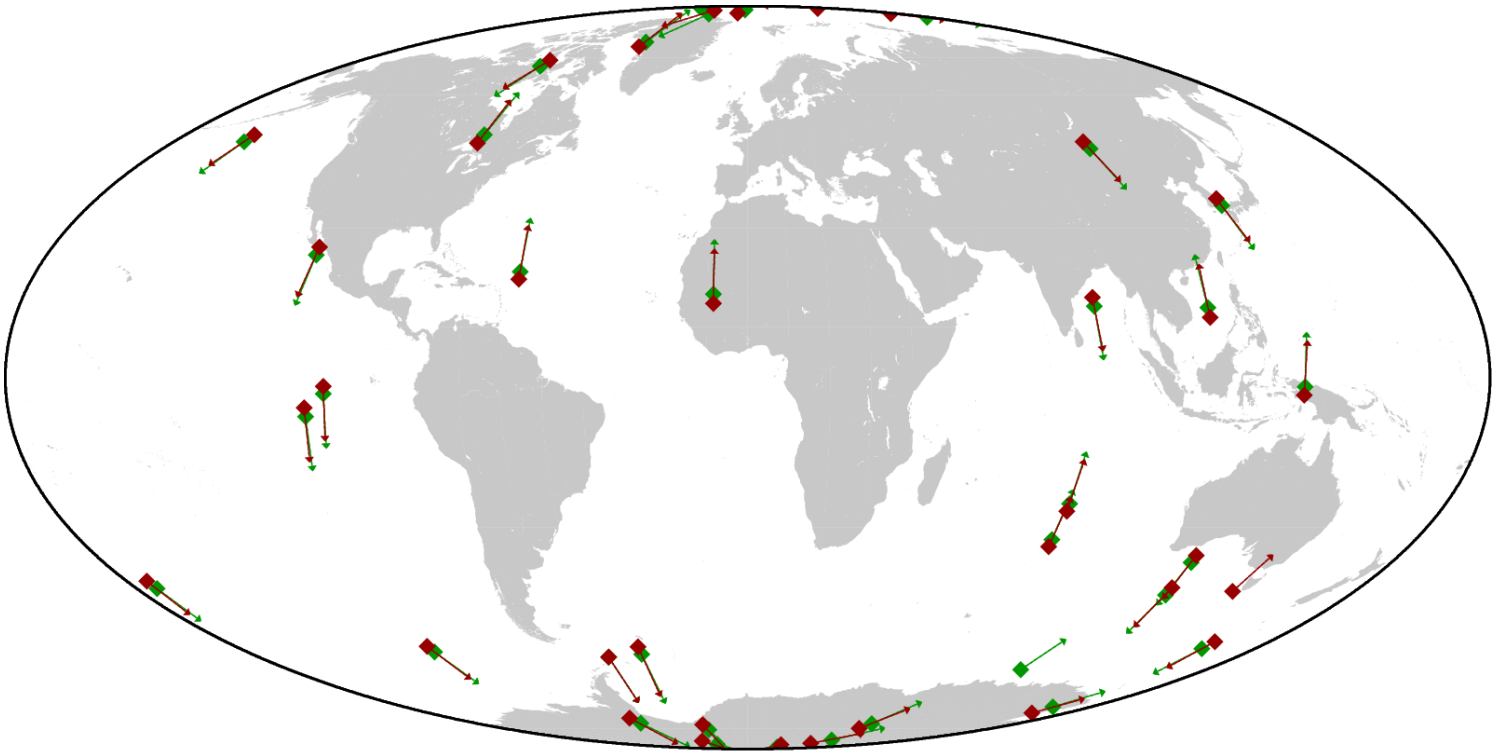


★ GF1 IPU spontaneous reboot (#5)

★ GF2 IPU spontaneous reboot (#9)

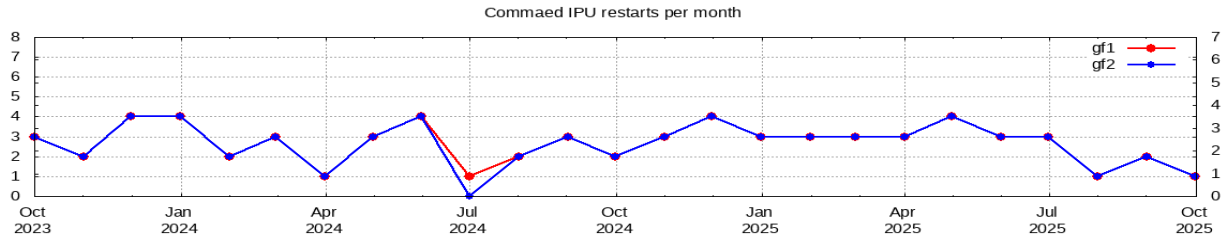


Last year IPU Reboots (commanded)

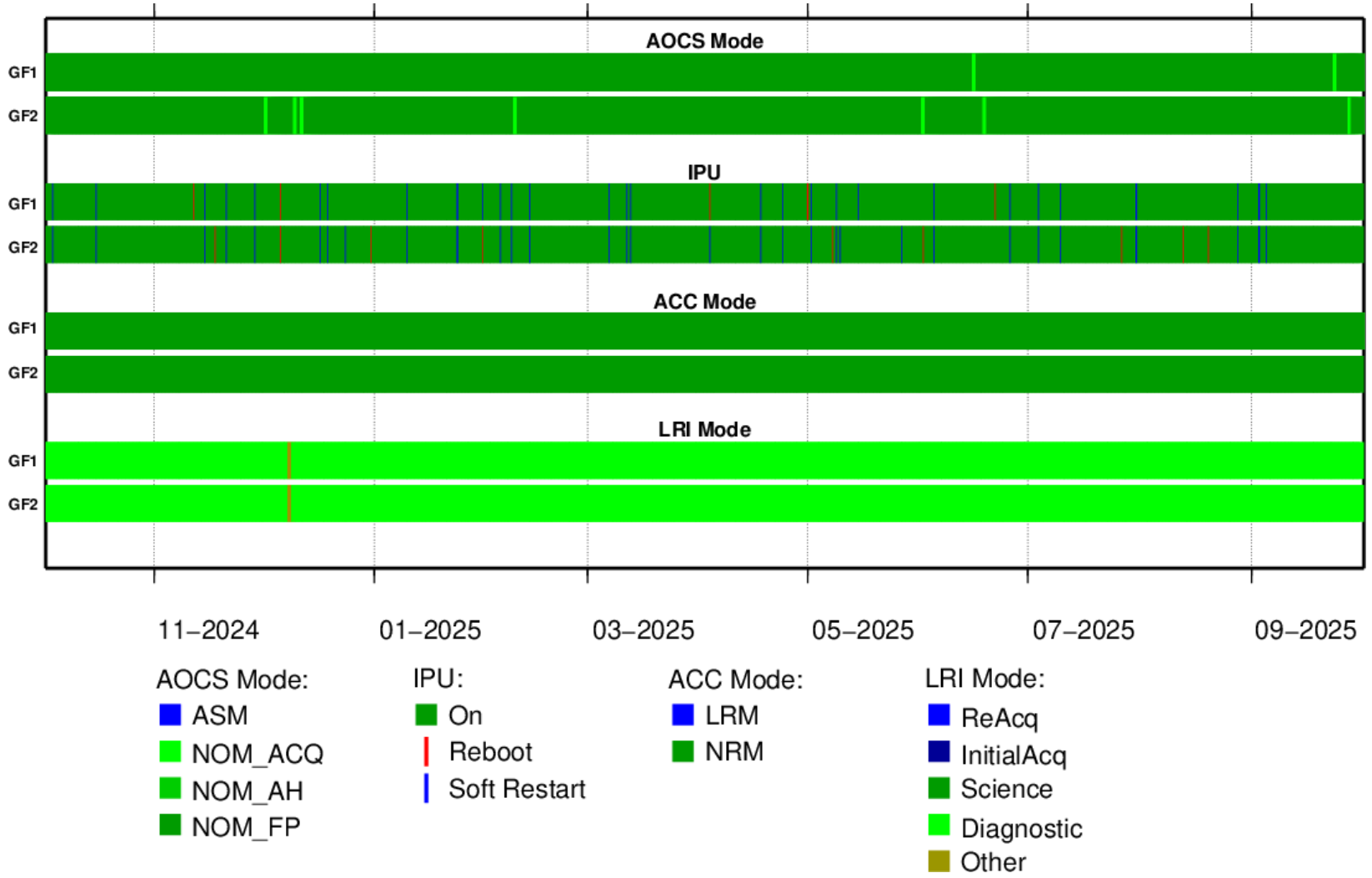


GF1 IPU commanded s/w restart (#35)

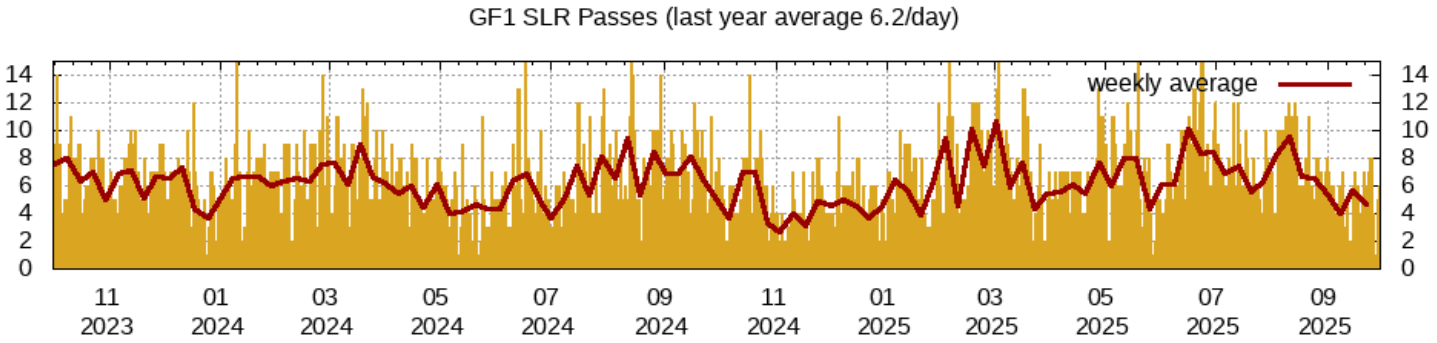
GF2 IPU commanded s/w restart (#35)

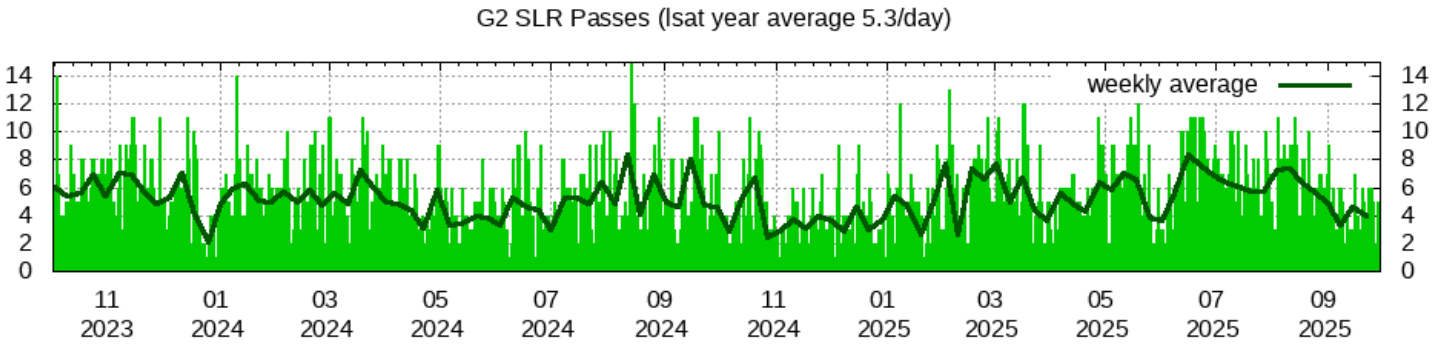


AOCS & Payload Status



SLR Observations





- Number of SLR observations stabilized on 5-6 passes per day.

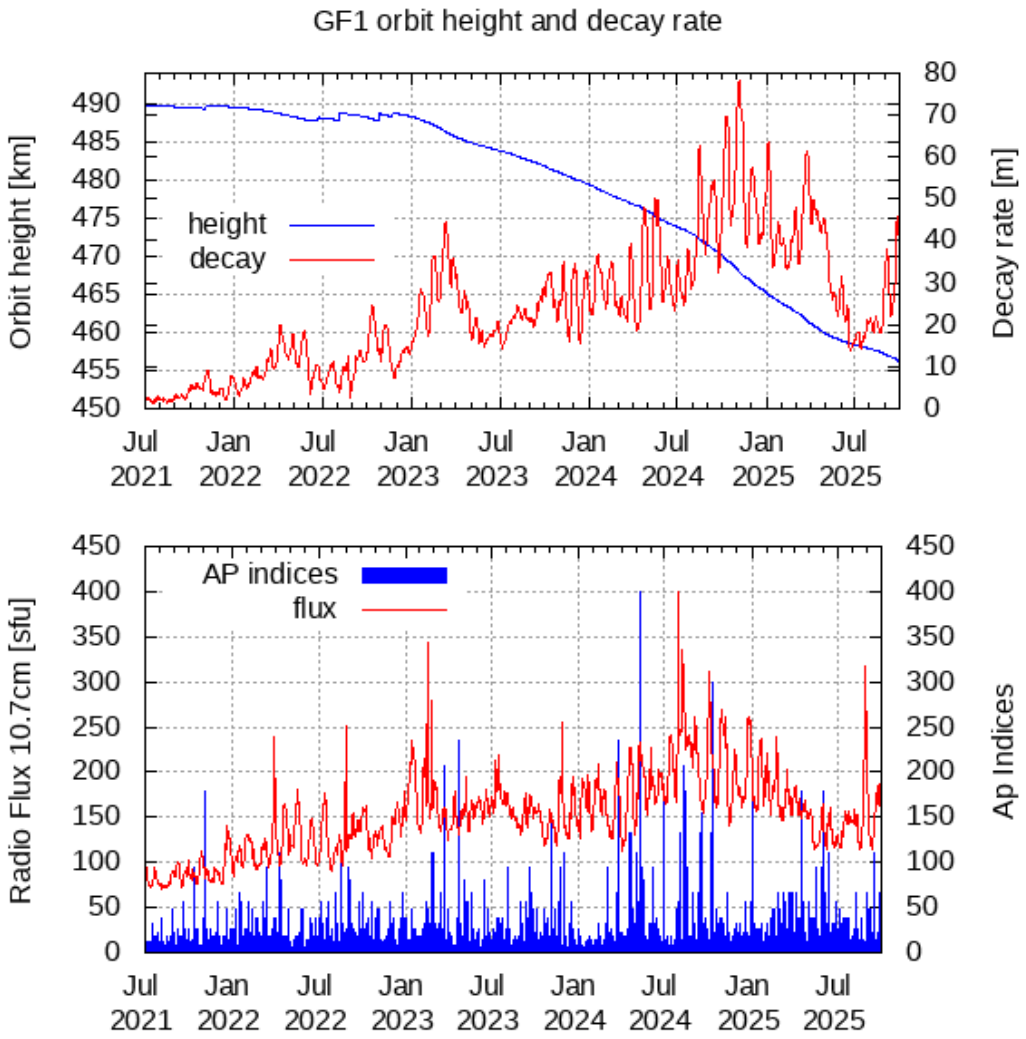
Orbit Height and Decay Rate

- ~6.5 Years in Orbit
  - 2695 days in orbit
  - 41100 revolutions completed
  - GF1 Leading / GF2 Trailing

- Orbital Height
  - 456 km (491.5 after launch)
  - Decay rate:
    - Launch – Oct 2020: **1.3 m/d**
    - Oct 2020 – Oct 2021: **2.6 m/d**
    - Oct 2021 – Oct 2022: **9.1 m/d**
    - Oct 2022 – Oct 2023: **21.6 m/d**
    - Oct 2023 – Oct 2024: **31.8 m/d**
    - Oct 2024 – Oct 2025: **38.3 m/d**

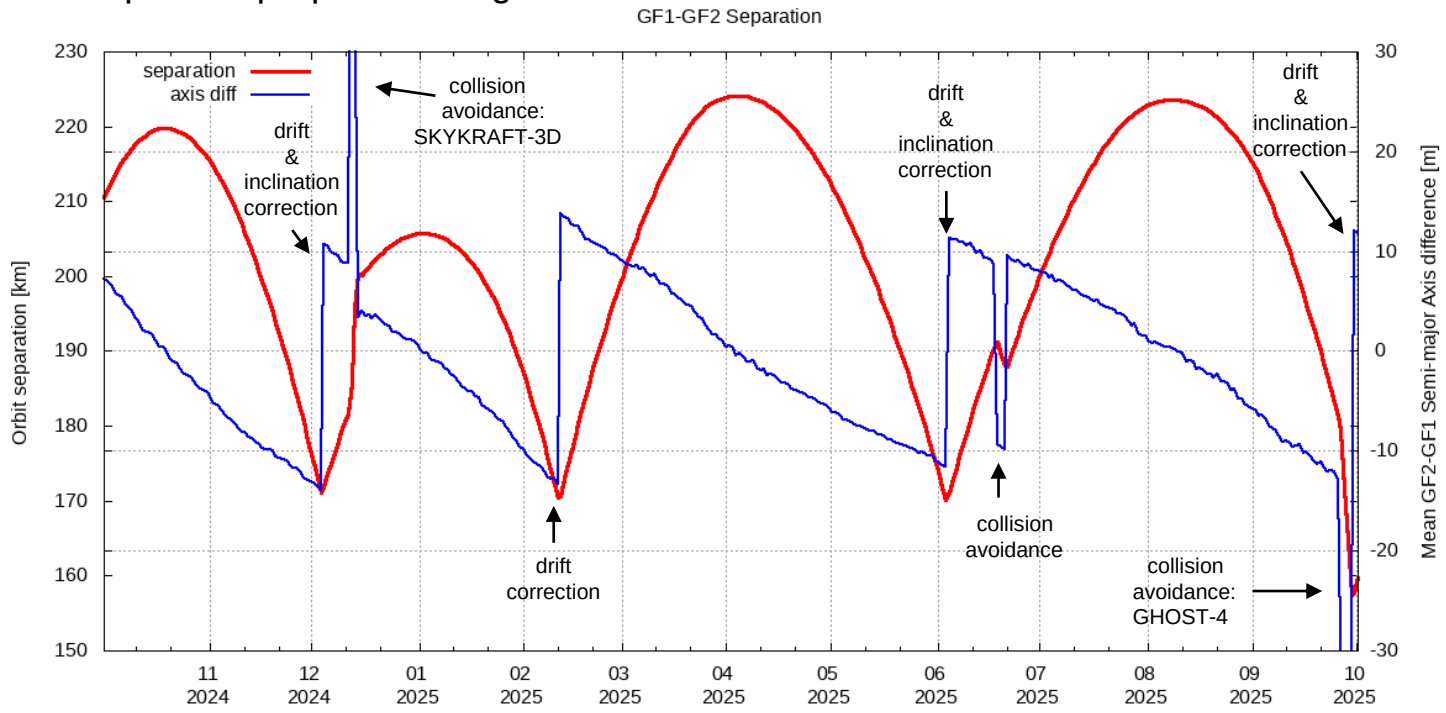
    (orbit decayed by **14 km**)

- Decay prediction will be presented by Himanshu Save



Orbit Separation

- Inter-satellite distance between 170 and 210km
- When in the current wide deadband AOCS mode, GF1 and GF2 altitude decay rates differ slightly which affect relative altitude difference between satellites and drift rate:
  - Drift correction maneuvers performed about every three months on GF2.
  - Collision avoidance maneuvers and subsequent formation keeping maneuvers used to correct the drift.
  - Minimal impact on propellant usage.

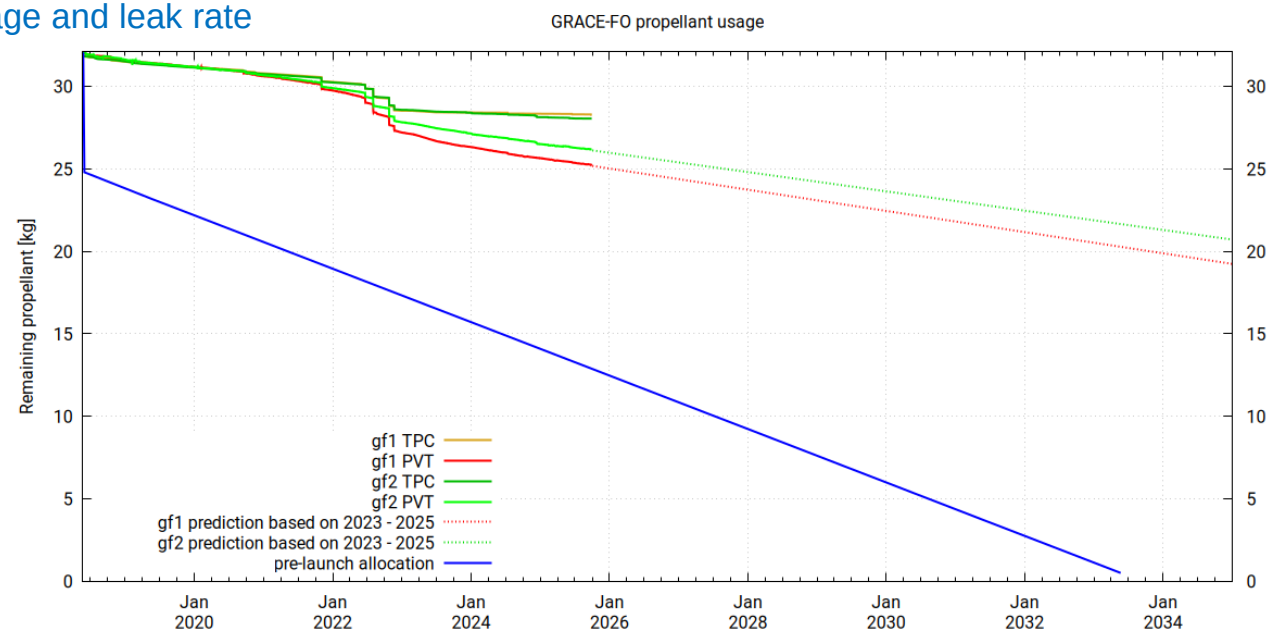


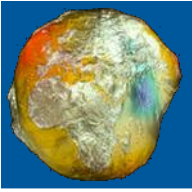
Lifetime Limiting Resources

- Propellant
  - Launched with 32 kg
  - Used ~7 kg on GF1 and ~6 kg on GF2, last year ca 0.6 kg on each satellite
  - Very low daily propellant consumption for AOCS (~1g/d, little more on GF2 than on GF1)
  - CGPS leaks dominate fuel consumption (details in H.Save talk)
  - Current extended deadband AOCS mode minimalizes thruster usage and leak rate

- Battery
  - Nominal
  - End of Charge Voltage: 32.8V

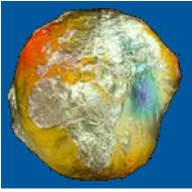
Battery is healthy

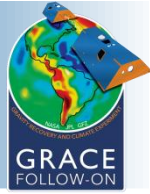




Summary and Outlook

- GFO mission operations proceeding nominally
- No significant satellite anomalies last year
- No life limiting resources prevent operations for the next year and beyond
- Plans for the next year:
  - Monitor and control orbit and propellant usage.
  - Continue routine operations in wide deadband mode.
- The Joint German/US Mission Operations Team continues to work well together
  - Annual Operations Status Meetings (the last one in July 2025)





Thank you !