An Update on Genesis Mission Status

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OVERVIEW OF THE GENESIS MISSION

- **The Genesis Mission Objective** is to **contribute to improve the International Terrestrial Reference Frame (ITRF) accuracy and stability**, towards an **accuracy of 1 mm** and a **stability of 0.1 mm/year (GGOS goals)**. The ITRF is the global coordinate system that provides the foundation for precise navigation and positioning worldwide.
- Genesis aims to achieve its unprecedented precision by **combining and cross-calibrating all 4 space geodetic techniques**, reducing individual system biases and improving long-term consistency.
- The resulting improved reference frame will bring benefits to the **Navigation systems** (e.g. Galileo, EGNOS) and their applications, for example aviation, autonomous vehicle driving and traffic management. In **Earth sciences** it will help refine models used for climate and environmental monitoring and much more.

Overview

- **Genesis** is a **satellite mission** managed by the ESA Navigation Directorate and part of its **FutureNAV Programme**
- Supported by the **ESA Navigation Support Office**
- Supported by the **GNSS Science Support Centre (GSSC)**

Mission scope

- Design, development, qualification and calibration of the **satellite (incl. payloads) and ground segment**
- **Launch and early operations** including commissioning and calibration
- **Operations** (2 years, option for extension)
- **Data exploitation** (Including processing, archiving and data distribution from ESA facilities → input to the Scientific Community)
- Key involvement of the **Scientific Community** and **International Geodetic Services** → maximize benefits

GENESIS SCIENCE EXPLOITATION TEAM (GSET)

Since the beginning, the geodetic community has contributed to the development and definition of the services and products derived from Genesis data in a strong international collaboration led by European scientists. The GSET was established in 2024 and consists of 5 Working Groups:

- Working Group 1: ITRF & Combination of Techniques
- Working Group 2: GNSS
- Working Group 3: VLBI
- Working Group 4: DORIS
- Working Group 5: SLR

Scientific Involvement in the Genesis mission

- Participation already from requirements consolidation in Phase A
- Support ESA in the follow up of the industrial activities, with emphasis on instruments and calibration
- Analysis of mission performance and the mission contribution towards target ITRF improvement
- Preparation of the scientific data exploitation, covering any gaps in algorithms, tools or ground infrastructure required
- Preparation and execution of required ground-based campaigns (in particular VLBI, SLR)

In addition to the GSET, Genesis is working closely with the International Association of Geodesy (IAG) and the international geodetic services:

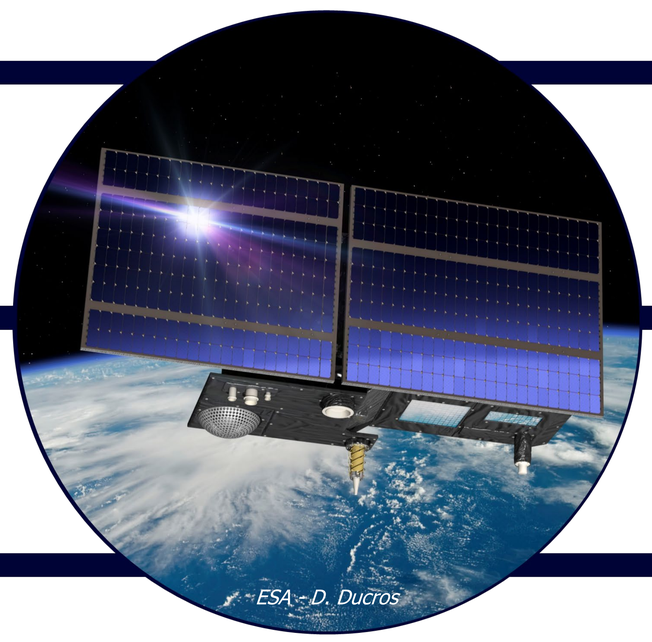
- International GNSS Service (IGS)
- International Laser Ranging Service (ILRS)
- International VLBI Service (IVS)
- International DORIS Service (IDS)
- International Earth Rotation and Reference Systems Service (IERS)

GENESIS SYSTEM OVERVIEW – PDR STATUS

Satellite
- Mass: 406 kg
- Power: 280 W (nominal)
- Envelope: 1.9m X 1.3m X 3.4m
- Attitude: 3-axis stabilized, Nadir-pointing, yaw steering law, pointing accuracy: < 1 degree (2 Sigma)

Payload
- 4 co-located geodetic instruments: GNSS, DORIS, SLR, VLBI
- Ultra-Stable Oscillator for synchronization

Orbit
- 6000km altitude (low MEO)
- 95.5 deg inclination



Platform module in Aluminium sandwich panels
- It houses platform units and payload electronic boxes
- Box shape providing radiation shielding
- S-band antennas elevated on brackets
- Launcher Interface Ring (LIR) on the bottom

Payload module in CFRP sandwich panels
- It hosts the payload antennas, the SLR, and two star-trackers
- Connected to the platform module through four Titanium bipods

Solar panels
- Two-body mounted, fixed Solar Panels
- One integrated on the Platform module and one on the Payload module

GENESIS REFERENCE PRODUCTS FOR SCIENTIFIC USE

Genesis Reference Products have been generated by the ESA Navigation Support Office and published by the GSSC to provide a common baseline for collaborative simulation, analysis and scientific activities related to Genesis.

- Genesis orbit files for each day of 2025 (365 files) in SP3 format
- Genesis attitude (quaternion) files for each day of 2025 (365 files)
- Document containing description of the dynamical models, orbital elements used to generate the orbit, attitude description and ICD

These files are available in the GSSC Archive, under the path /satellite/genesis/

GENESIS MISSION TIMELINE

LAUNCH 2028 (TBC)
2 years of Operations with option for extension

Scientific exploitation

- 03/04 2024: Contract Signature and Kick Off of activities
- Q4 2024: System Requirements Review (SRR)
- 2025: Preliminary Design Review (PDR)
- 2026: Critical Design Review (CDR)
- 2028 (TBC): Qualification and Acceptance Review (QAR)

CONCLUSIONS AND ONGOING PHASE C WORK

Global Navigation Satellite Systems (GNSS) depend critically on accurate, stable geodetic information. ESA's Genesis mission strengthens the Global Geodetic Supply Chain through contributions to all major space geodetic techniques and supports safe and precise navigation into the future.
In Phase C, the ground segment design and operations will be finalized, and the detailed definition of the satellite design will be completed and verified. Additionally, the planning for the flight model integration and verification will be established.

Genesis is bringing the community together and building momentum.
Genesis data will soon be there – we all need to be ready – together.

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