

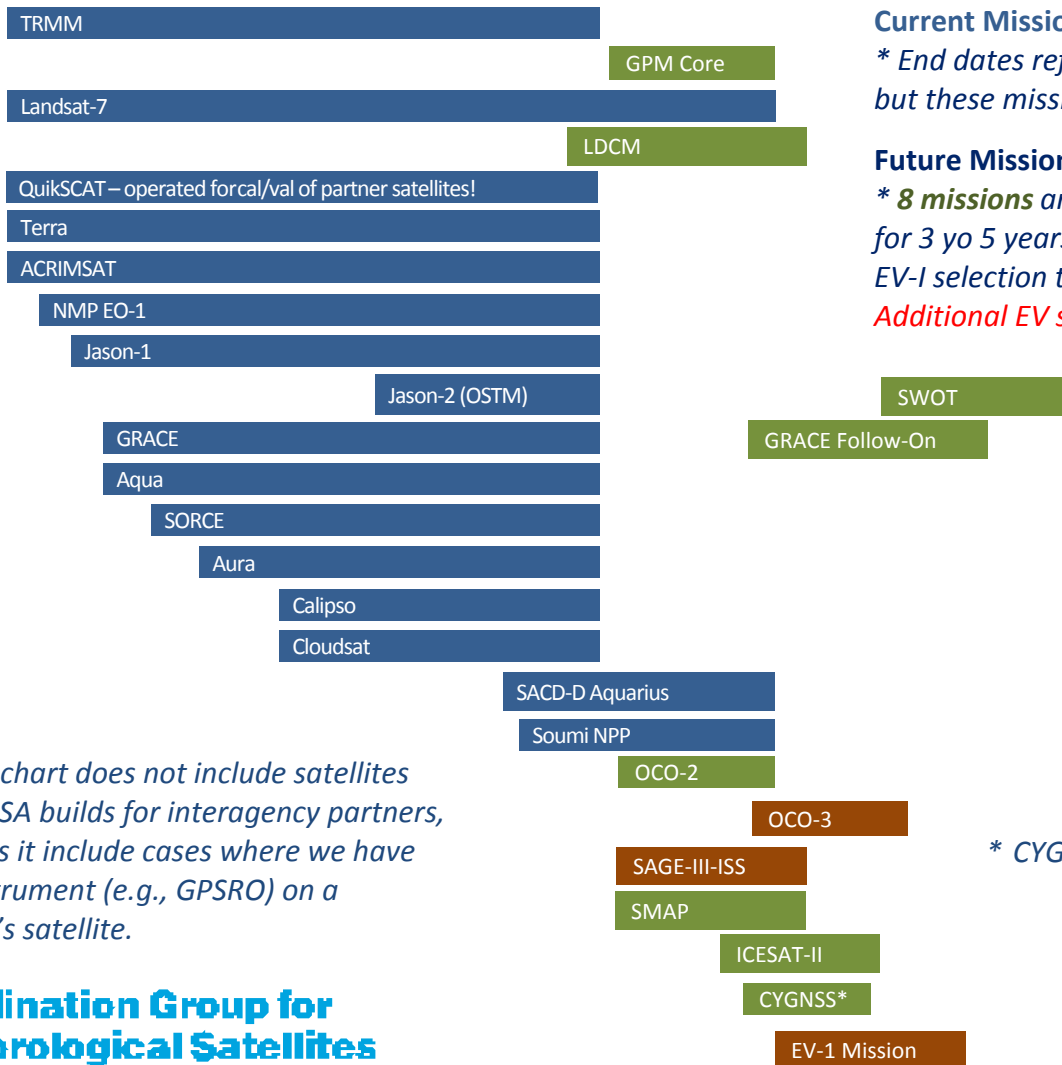
Status report on the current and future satellite systems by **NASA**

Presented to CGMS-40 plenary session
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Overview of NASA's current and future satellite systems

YEAR... 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30



Current Missions – 16 total

* End dates reflect NASA "Senior Review" approved dates, but these missions will likely operate much longer.

Future Missions – at least 11 total through 2020

* **8 missions** and **3 instruments**. Typical NASA missions are planned for 3 to 5 years life but have lived much longer in the past.

EV-1 selection to be announced shortly (~2018 launch).

Additional EV selections are expected but not identified at this time.

• Note: chart does not include satellites that NASA builds for interagency partners, nor does it include cases where we have one instrument (e.g., GPSRO) on a partner's satellite.

* CYGNSS is a newly selected small satellite mission



CURRENT NASA LEO and R&D SATELLITES ... Mission News

- NASA is currently operating **16 Earth Science missions**. 2 missions are operational LEO (Jason-2 and NPP) and 14 are R&D satellites.
- Most recent launches were **SAC-D/Aquarius** (June 2011) and **Suomi NPP** (Oct 2011). NASA's missions are aging ... the 13 other missions have passed their operational design life and are in extended operations.
- **Battery aging** observed in GRACE, CloudSat, and SORCE, reduces sampling.
- Aura TES instrument has **restricted spatial coverage** and in the past year has caused an extended data outage until the instrument could be reserviced.
- Instruments with **reduced capability** are the Landsat-7 ETM+ (failed Scan Line Corrector), QuikSCAT's SeaWinds (antenna no longer rotates so that the data are used primarily to cross-calibrate with other on-orbit scatterometers), Terra's ASTER (SWIR module is no longer functional), and Aqua AMSU (Channel 4 has failed).
- Instruments that are **not operating** are Aqua's AMSR-E and HSB, TRMM's CERES, Jason's TRSR, **SORCE's SIM and XPS**, and Aura's HIRDLS.
- **Jason-1** orbit lowered to 1324 km in May 2012 due to **spacecraft** memory reliability issues.
- **Cloudsat** mission added back to the A-Train afternoon constellation in May 2012 following severe (~ 90% loss!) battery issues in 2011. Only collects daylight datasets, **reducing the data collection to slightly more than 50% of available observable time**.
- JAXA's **GCOM-W1** mission joined the A-Train constellation ahead of Aqua in June 2012.

CURRENT NASA LEO and R&D SATELLITES ... Non-Mission News

- **Orbital debris** continues to be an issue for most low-earth orbit missions, with the debris from Fengyun-1C and the Cosmos 2251/Iridium constellation now decaying through the earth observation orbit regimes. Increased solar activity has also led to more uncertainty in the conjunction analysis calculations and collision avoidance maneuvers. NASA has updated the agency's orbital debris procedures and invested in analysis tool improvements.
- NASA's missions were conceived as research missions, but have supported operational and near-real-time applications due to their longevity, sustained calibration and validation, and data quality. Interagency partners have rated all NASA missions as High Utility for operational applications, with Terra, Aqua, and OSTM rated Very High. Operational utilization is facilitated through Joint Center for Satellite Data Assimilation (JCSDA) and Short-Term Prediction and Research Transition Center (SPoRT)
- Continued operation of the missions is determined through a biennial science review process, called the "**Senior Review**", which considers operational use but primarily uses science for defining factor for continuation. The next Senior Review is scheduled for early 2013.
- **Direct Broadcast** is currently available for three NASA missions including: Aqua, Terra, and Suomi-NPP. More information can be found at NASA's Direct Readout Laboratory (DRL) website: <http://directreadout.sci.gsfc.nasa.gov>
- NASA also provides access to **Near Real-Time (NRT)** products from the MODIS (on Terra and Aqua), OMI and MLS (on Aura), and AIRS (on Aqua) instruments in less than 2.5 hours from observation from the Land and Atmosphere Near real-time Capability for EOS (LANCE) data system at <http://earthdata.nasa.gov/lance>
- Recently initiated effort on Satellite Calibration Interconsistency Studies emphasizes connection between NASA and non-NASA satellites.



FUTURE NASA LEO and R&D SATELLITES

- NASA's Earth Science FY13 budget request is **\$1.72B**. A balance of satellite measurements, science research, technology development and applications are being planned to address a complex global Earth system.
- NASA's future plans include the launch of **multiple new missions and instruments of opportunity**
- NASA's **Earth Systematic Mission (ESM)** program includes 6 missions in formulation or development
 - Landsat Data Continuity Mission (**LDCM**) in 2013, the Global Precipitation Measurement (**GPM Core**), Soil Moisture Active-Passive (**SMAP**), and Stratospheric Aerosols and Gas Experiment (**SAGE**)-III in 2014, the Ice, Cloud, and Land Elevation Satellite (**ICESat**)-2 in 2016, and the Gravity Recovery and Climate Experiment Follow-On (**GRACE-FO**) mission in 2017.
 - NASA continues with the pre-formulation studies, formulation, and development of 11 other missions with launch dates that extend well beyond 2020 (see tables in CGMS paper).
- NASA's **Earth System Science Pathfinder (ESSP)** program provides competitive opportunities for small and innovative instruments and missions. The Program currently includes two satellites in formulation and development, and includes the **Earth Venture-class (EV)** line of competitive opportunities:
 - The Orbiting Carbon Observatory (**OCO-2**) mission will launch in 2014, and the Cyclone Global Navigation Satellite System (**CYGNSS**) in 2016.
 - In the EV line, the competitive approach is intended to select instruments, small satellites, or airborne science campaigns to complement the larger NASA Earth science missions. 5 airborne science missions have been funded since 2011. The first small satellite mission (CYGNSS) was selected in 2012, and the first small instrument payload will be selected before the end of this year. In 2013 there should be calls for both the next suborbital and instrument opportunities.

