



NASA HQ Update

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On-Orbit Flight Missions – Partnerships

- International
- Interagency



Bi-annual Senior Review Completed Summer 2013

Operating Satellite Status



Mission	Launch	Phase	Design Life (yr)	Current Life (yr)	Expected End
Terra	18-Dec-99	Extended	5	14	2020
ACRIMSAT	20-Dec-99	Extended	5	14	2020
Aqua	03-May-02	Extended	5	12	2022
SORCE	25-Jan-03	Extended	5	11	2015
Aura	15-Jul-04	Extended	5	9	2023
CloudSat	28-Apr-06	Extended	3	8	2015
CALIPSO	28-Apr-06	Extended	3	8	2016
OCO - 1	24-Feb-09	Launch Failure	2	N/A	N/A
Glory	04-Mar-11	Launch Failure	3	N/A	N/A
Suomi-NPP	25-Oct-11	Prime till Oct 2016	5	2	not enough data

Operating Instrument Status



INSTRUMENT	INSTRUMENT	MISSION	STATUS
Spectral Irradiance Monitor	SIM	SORCE	Operating in daylight only
Solar-Stellar Irradiance Comparison Experiment	SOLSTICE	SORCE	Operating in daylight only
Total Irradiance Monitor	TIM	SORCE	Operating in daylight only
XUV Photometer System	XPS	SORCE	Operating in daylight only
Clouds and the Earth's Radiation Energy System	CERES	Terra	Operating nominally
Moderate Resolution Imaging Spectroradiometer	MODIS	Terra	Operating nominally
Multi-Angle Imaging Spectrometer	MISR	Terra	Operating nominally
Measuerment of Pollution in the Troposphere	MOPITT	Terra	Operating nominally
Advanced Spaceborne Thermal Emission & Reflection Radiometer	ASTER	Terra	SWIR failed (VNIR & TIR operational)
High Resolution Dynamics Limb Sounder	HIRDLS	Aura	Failed
Ozone Monitoring Instrument	OMI	Aura	Row anomaly
Microwave Limb Sounder	MLS	Aura	Operating nominally with Band 13 powered off & THz channel in standby; on redundant mirror switching mechanism electronics
Troposphere Emission Spectrometer	TES	Aura	Interferometer Control System currently working
Cloud-Aerosol Lidar with orthogonal Polarization	CALIOP	CALIPSO	Operating nominally second laser unit
Imaging Infrared Radiometer	IIR	CALIPSO	Operating nominally
Wide Field Camera	WFC	CALIPSO	Operating nominally
Active Cavity Radiometer Irradiance Monitor-III	ACRIM-III	ACRIMSAT	Battery problems
Atmospheric Infrared Sounder	AIRS	Aqua	Operating nominally
Advanced Microwave Scanning Radiometer for EOS	AMSR-E	Aqua	Operating at 2rpm for cross-calibration with GCOM-W1 AMSR2
Advanced Microwave Sounding Unit-A	AMSU-A	Aqua	10 of 15 channels performing well
Humidity Sounder-Brazil	HSB	Aqua	Failed
Clouds and the Earth's Radiation Energy System	CERES	Aqua	Operating nominally
Moderate Resolution Imaging Spectroradiometer	MODIS	Aqua	Operating nominally
Cloud Profiling Radar	CPR	Cloudsat	Daylight Only operations
Visible Infrared Imaging Radiometer Suite	VIIRS	Suomi-NPP	Operating nominally
Cross-track Infrared Sounder	CrIS	Suomi-NPP	Operating nominally
Clouds and the Earth's Radiation Energy System	CERES	Suomi-NPP	Operating nominally
Advanced Technology Microwave Sounder	ATMS	Suomi-NPP	Operating nominally
Ozone Mapping and Profiler Suite	OMPS	Suomi-NPP	Operating nominally

Science Objectives are Provided through External Recommendations



2007 DECADAL SURVEY



EARTH SCIENCE AND APPLICATIONS FROM SPACE

NATIONAL IMPERATIVES FOR THE NEXT DECADE AND BEYOND

NATIONAL RESEARCH COUNCIL OF THE NATIONAL ACADEMIES

- Research/Applications priorities
- No realistic budget constraint
- Shopping list of missions & activities
- Assumed Legacy missions completed

National Aeronautics and Space Administration

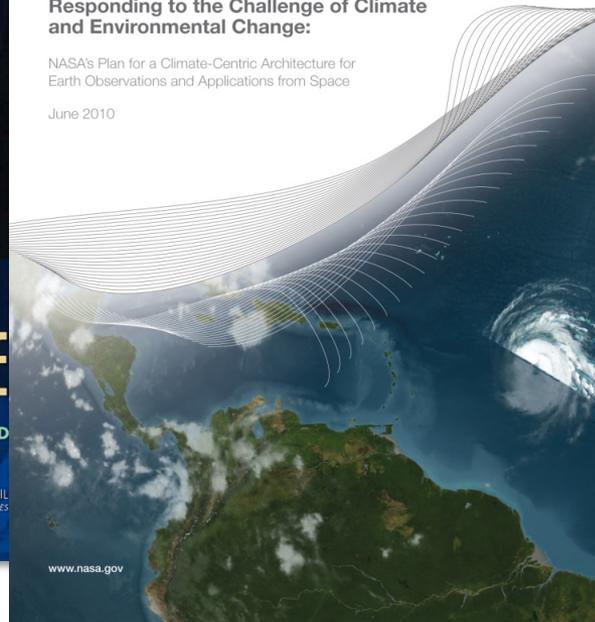


2010 NASA RESPONSE TO CLIMATE PLAN

Responding to the Challenge of Climate and Environmental Change:

NASA's Plan for a Climate-Centric Architecture for Earth Observations and Applications from Space

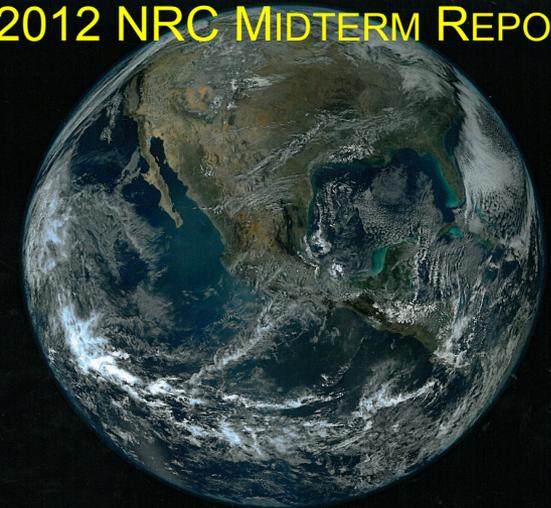
June 2010



www.nasa.gov

- Identified new Climate Measurements
- Matched against President's budget
- Vetted w/OSTP, OMB & Admin

2012 NRC MIDTERM REPORT



EARTH SCIENCE AND APPLICATIONS FROM SPACE

A Midterm Assessment of NASA's Implementation of the Decadal Survey

NATIONAL RESEARCH COUNCIL OF THE NATIONAL ACADEMIES

- Endorsed NASA's implementation
- "Encouraged" more rigorous cost control
- Endorsed additional Venture calls

Common in all guidance is the focus on the long term science objectives

Venture Class Activities



- EVS (“EV-1” - Suborbital, Airborne; solicited every 4 years)
 - All 5 investigations are well into their sustained field campaigns
 - All EV-1 investigations flew during 2013
 - ***Second EV-S solicitation released June 2013, proposals due 10 Jan 2014***
- EVM (“EV-2” - Small-sat; solicited every 4 years)
 - CYGNSS successful KDP-B in July 2013, planned LRD October 2016 – April 2017
 - ***FY14 budget proposal includes EV-M/2 solicitation on-schedule in June 2015***
- EVI (Instrument; solicited every 18 months)
 - TEMPO selected for GEO hosted payload opportunity (early FY18 launch)
 - ESD making progress on formal host selection
 - ***Second “EV-I/2” solicitation released July 2013, proposals received 25 November 2013***
 - ***FY14 budget proposal includes EVI-3 and subsequent solicitations on-schedule***

Near-Term Formulation & Development Missions



GPM
Early CY2014
w/ JAXA; Precip
H-IIA



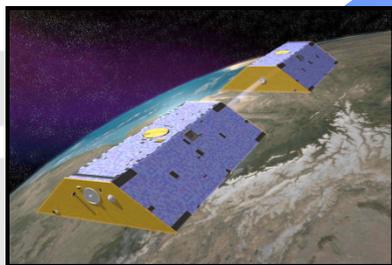
OCO-2
1 July 2014
Global CO₂
Delta II



CATS
Aug 2014
w/ ISS
Aerosol & Cloud
Falcon-9



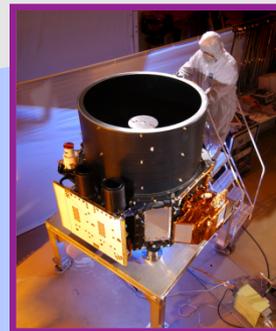
SMAP
5 Nov 2014
w/CSA
Soil Moist., Frz/Thaw
Delta II



GRACE FO
Aug 2017
w/Germany; Global Mass
& Water Variation
German-supplied Dnepr LV



CYGNSS
2016-2017
Tropical Cyclone
Generation, Air-sea
Interaction in Extreme
Conditions



ICESat-2
Dec 2016 (TBR)
Ice Dynamics
Delta II



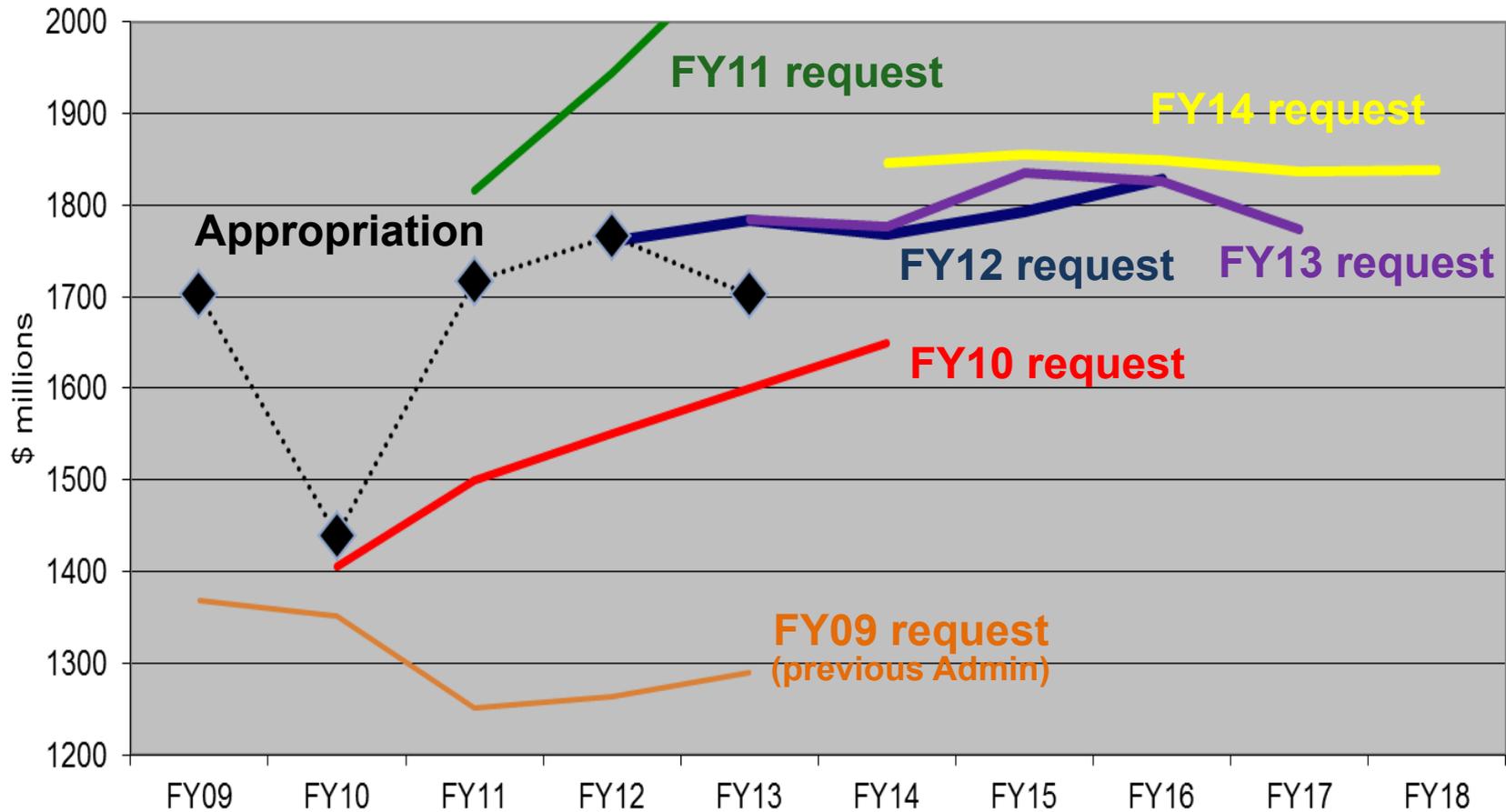
SAGE III
NET Mar 2015 (TBR)
Ozone & Trace Gases
Falcon-9

NASA ESD Flight Portfolio 2013 - 2022

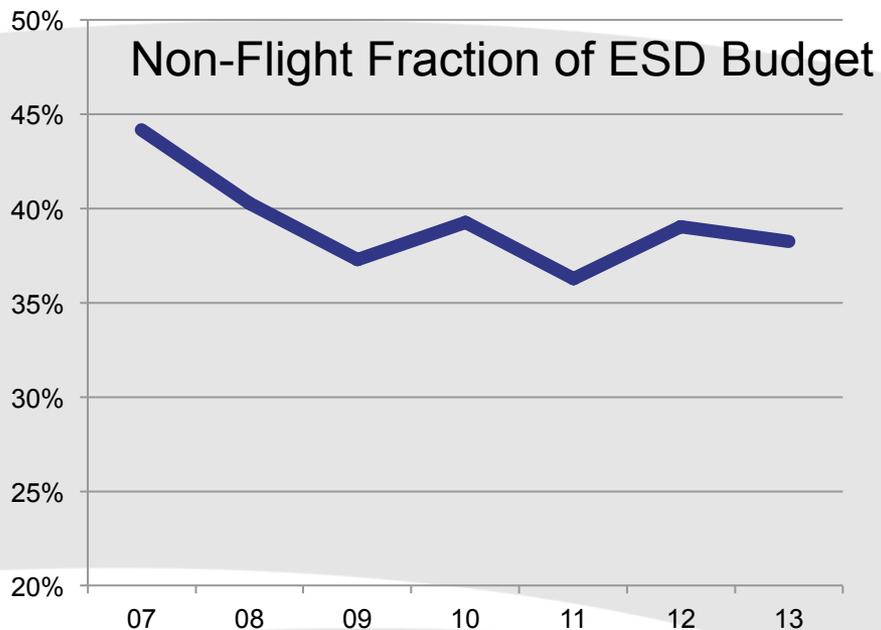


- **GPM** (2/2014) – Global Precipitation mapping, w/JAXA
- **OCO-2** (7/2014) – Atmospheric CO₂ monitoring, recovery mission
- **CATS** (8/2014) – Aerosol and Cloud vertical profile
- **SMAP** (10/2014) – Soil Moisture and Freeze/Thaw cycling, w/CSA (minor)
- **SAGE-III/ISS** (3/2015) – Ozone, Temp, Humidity profiles, w/HEOMD, ESA
- **ICESat-2** (12/2016) – Precision Ice Topography, Ecosystem monitoring
- **CYGNSS [EVM-1]** (late 2016)
- **GRACE-FO** (8/2017) – Gravity/Ice Mass/Ground Water, w/GFZ & DLR
- **OCO-3/ISS** (Fall 2017) – CO₂ continuity, from ISS, OCO-2 spares
- **TEMPO [EVI-1]** (2019) – Tropospheric Emissions from geosynchronous vantage
- **SWOT** (2020) – Wide-swath ocean altimetry, land water, w/CNES
- **EVI-2 Venture-Class** (NLT 2020)
- **PACE** (2020) – Ocean Color, possibly Aerosols
- **L-band SAR** (2021?) – Solid Earth, Cryosphere, Ecosystems, w/ISRO
- **CLARREO** (2022?) – Precise global radiation balance, possibly w/UK
- **EVM-2** (NLT 2022)
- **EVI-3** (NLT 2022)
 - Significant studies ongoing for all other Tier-2 Decadal Survey missions
- **And on the horizon:**
 - ***Sustained Land Imaging program for the U.S. for 2018 – 2038***
 - ***Solar Irradiance, Ozone profiles, and Earth Radiation Budget measurements for beyond 2020***

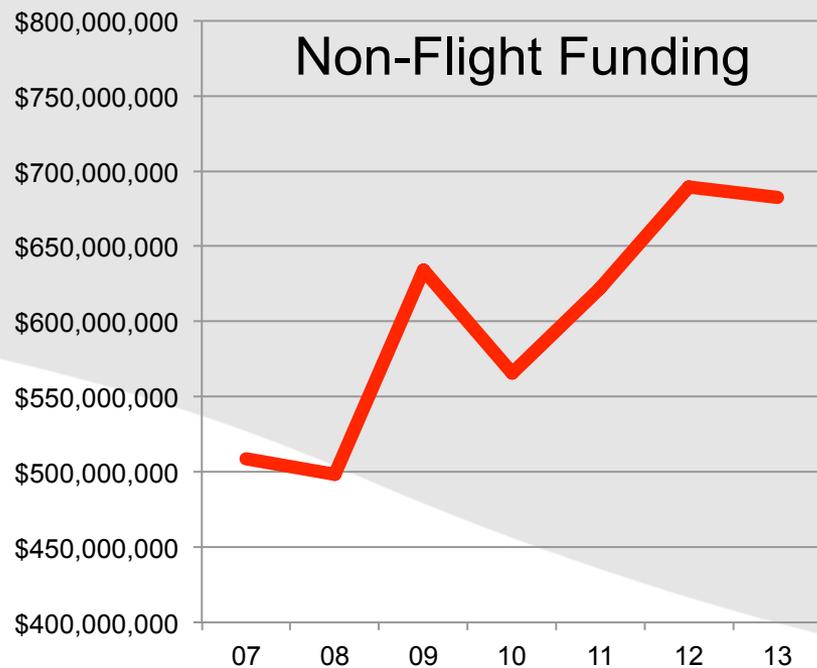
Appropriation and Budget Requests for ESD



Non-Flight Budgets: 2007-2013



- R & A
- Applied Sciences
- Technology
- Competed Science Teams

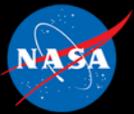


NASA ESD's New Responsibilities



- ✦ The responsibility for **sustained** measurements of **Solar Irradiance**, **Ozone Profiles**, and **Earth Radiation Balance** beginning in the 2021 (“JPSS-2”) timeframe was transferred **from NOAA to NASA/ESD** in the FY14 President’s Budget Request.
- ✦ Additional funding (\$40M, FY14) was provided to ESD for this new scope in FY14; no funds were added in FY15 and beyond.
- ✦ FY14 President’s budget proposal calls for NASA to lead the architecture design and space component implementation of a sustained system for moderate-resolution, global land imaging – with USGS
 - NASA role:
 - ❖ System architecture study lead
 - ❖ Design, implement, launch, on-orbit commissioning of USG space-borne segment
 - USGS role:
 - ❖ Represent user communities in system architecture study
 - ❖ Post-commissioning operations, downlink, ground data processing, data distribution, archiving
 - Study Parameters (OMB)
 - ❖ **Cost is a constraint:** \$120M/year **NASA** average cost (and near-flat budget) over system lifetime
 - ❖ Examine international and private sector partnerships
 - ❖ Specifically examine infusion of hyperspectral technology
 - ❖ Balance initial capability, gap risk/continuity, technology infusion over system lifetime, cost
 - ❖ Study results due August 2014

CLARREO Results from Annual Review



✧ Observations

- ❑ Productive SDT has completed a number of journal articles documenting the team's activities.
- ❑ Mission architecture options have been well defined, outlining ISS options

✧ Concerns

- ❑ Proposed approach supports an SDT (67% of funding) plus three side elements at ~10% each. Is this the appropriate mix for a flight activity?
- ❑ Is there a better way to handle the coordinated science team support for measurement science as opposed to instrument or mission science?

✧ Recommended Action/Direction

- ❑ Work with ESD PS for RBI instrument to investigate an integrated approach showing how CLARREO measurement objectives are integrated with the CERES/RBI measurements
- ❑ Future OSSEs should support study of climate instrument development options, including alternative approaches for RBI

❖ Results needed by mid FY14

FY 13			FY 14			FY 15
NOA	Uncosted	Months	Base	Reserves	Total	Planning
4,000	2,150	6.4	2,202	798	3,000	3,000



Questions?