National Aeronautics and Space Administration

Goddard Contractors Association (GCA) Meeting

-

NASA Goddard Space Flight Center Flight Projects Directorate

David F. Mitchell
Director, Flight Projects

December 9, 2020

NASA Goddard Space Flight Center

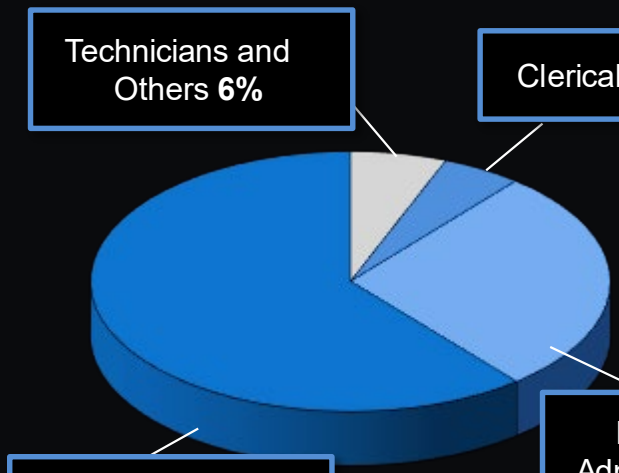
ONE World-Class Science and Engineering Organization

SIX Distinctive Facilities & Installations

Greenbelt Main Campus *1,270 Acres*	Wallops Flight Facility *6,188 Acres*	Goddard Institute for Space Studies	Independent Validation & Verification Facility	White Sands Test Facility Ground Stations	Columbia Balloon Facility
Executing NASA's most complex science missions Est. 1959	Launching Payloads for NASA & the Nation Est. 1945	Understanding our Planet Est. 1961	Providing Software Assurance Est. 1993	Communicating with Assets in Earth's Orbit Est. 1963	Directing High Altitude Investigations Est. 1982
					
MARYLAND	VIRGINIA	NEW YORK	WEST VIRGINIA	NEW MEXICO	TEXAS

The Goddard Community

More than 10,000 People



GSFC Workforce

3,000+ Civil Servants
6,000+ Contractors
1,000s of Others*

The Nation's largest community of scientists, engineers, and technologists

**Including off-site contractors, interns, and Emeritus*

Goddard Space Flight Center

Employees Receive Worldwide Accolades for Their Work

Dr. Piers Sellers
Most Excellent Order of the British Empire
2011

Dr. John Mather
Nobel Prize in Physics – 2006
Rumford Prize – 1996
Franklin Medal – 1999

Dr. Mather is the recipient of more than 30 honors in the physical sciences.

Dr. Compton Tucker
Galathea Medal – Denmark 2004
Vega Medal – Sweden 2014
In Physical Geography

The Intergovernmental Panel on Climate Change (IPCC) was awarded the Nobel Peace Prize in 2007 for its work on climate change, together with former US Vice-President Al Gore.
Over 50 scientists from the Goddard Space Flight Center contributed to the IPCC Assessments that formed the basis for the award.

NASA – The Best Place to Work in the Federal Government 2019

What We Strive to Do

Lead in Science and Technology

Goddard's end-to-end capabilities, world-class scientific expertise, top-tier engineering talent, and facilities enable it to develop & manage NASA's most complex science missions

Enable Exploration

Goddard's science missions, launch facilities, and space communications/navigation capabilities help us understand the universe and explore deeper within it

Improve Lives & Protect the Nation

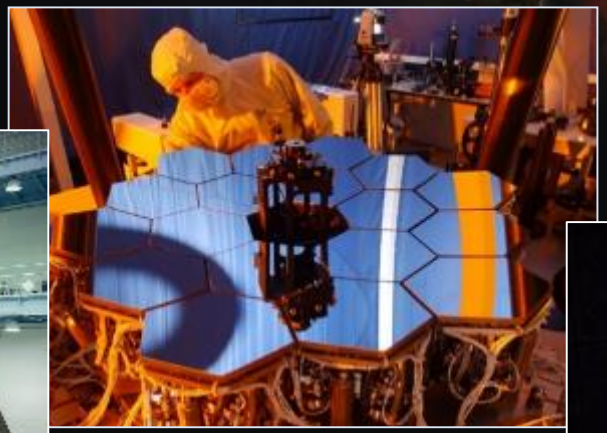
Goddard enables improvements in our understanding and forecasting of extreme weather, the spread of water-borne diseases, crop yields, etc. to inform national security objectives

Invest in America

Goddard is committed to strengthening the US economy by seeding new technologies, creating business opportunities, and inspiring young innovators and engineers

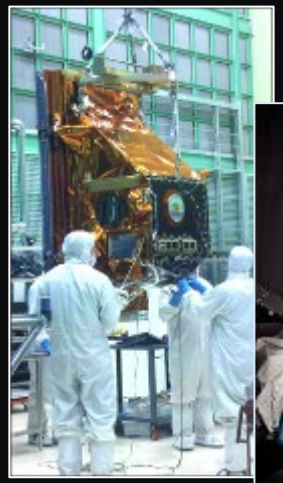
Our Capabilities

World Class Facilities

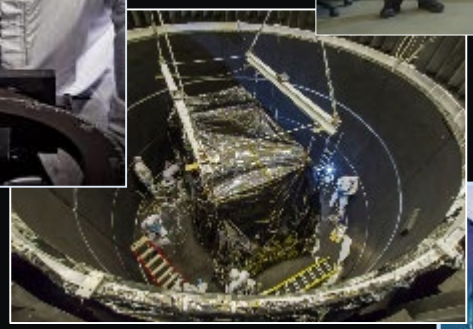


End-to-End Capabilities from Concept through End of Mission Life

Expertise in Core Science and Cross-Cutting Disciplines



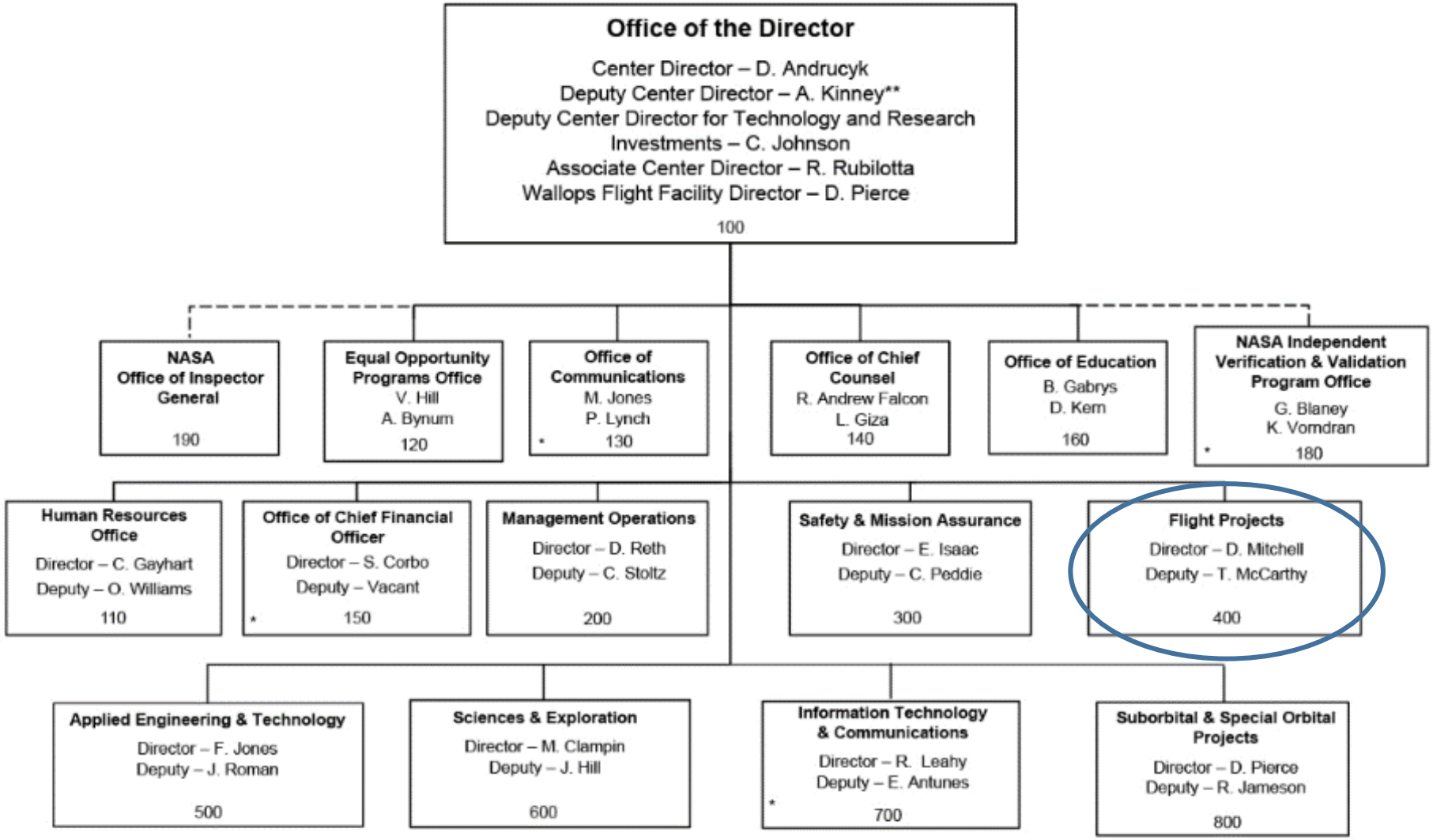
Engineering and Technology Development



Exceptional Human Capital

Diverse Partnerships

Goddard Organization Chart

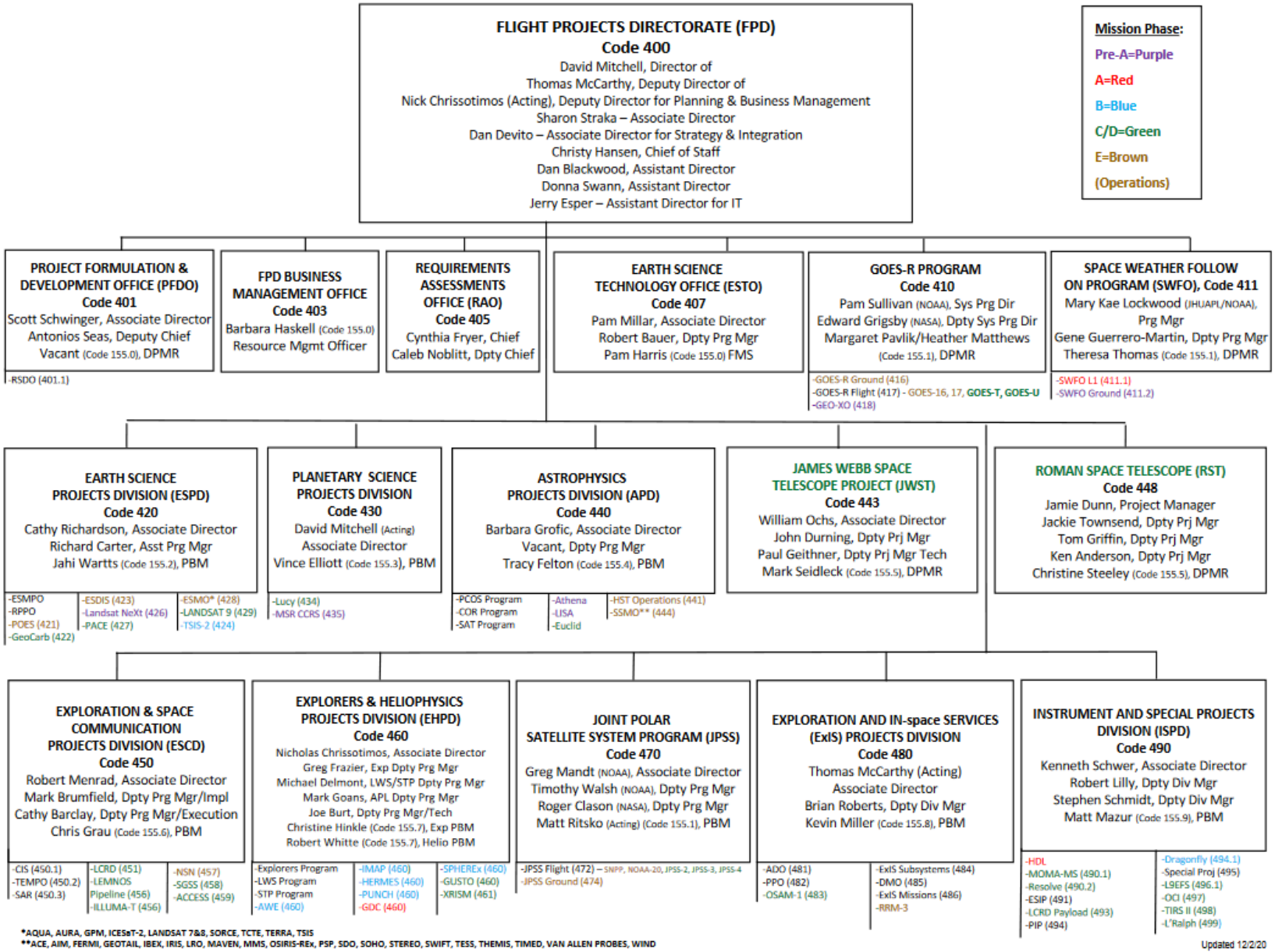


Updated: Nov. 2020

* Reports directly to NASA Headquarters

** as of May 24, 2020

Flight Projects Directorate Organization Chart

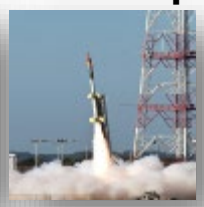
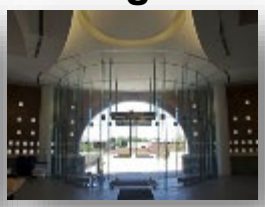


Flight Projects Services

The Flight Projects Directorate is responsible for overall management and implementation of flight, ground, and instrument projects at Goddard Space Flight Center.






IDEA	DESIGN	FORMULATION/ INTEGRATION	TEST	LAUNCH	OPERATIONS	DATA ANALYSIS

FUNCTION	DESCRIPTION OF SERVICES
Leadership	Deliver vision, context, and enable performance to achieve customer needs.
Technical Expertise	Direct and train team of technical experts through formulation, implementation, and operations.
Mission Development	Manage mission formulation and implementation for both in- and out-of-house.
Project Control	Provide planning, resource management, risk management, and the latest methods, tools, and practices.
Monitoring & Guidance	Assess performance; guide consistency, effectiveness, timeliness, and accountability.
Advocacy	Liaise with external stakeholders on behalf of flight projects.
Compliance & Control	Execute project activities in accordance with Center, Agency, and Federal standards.
Mission Support	Offer mission support services for Space and Earth Science flight projects/missions.
Knowledge Management	Recognize, collect, represent, and enable the delivery of and adoption of insights and experiences that will improve performance.

Flight Projects Mission Portfolio

November 11, 2020

Pre-Phase A/ Phase A*	Phase B	Phase C	Phase D	Phase E	Extended Phase E	
LISA	AWE	GUSTO	James Webb	TESS	Fermi	IRIS
ATHENA	HERMES	Roman (WFIRST)	XRISM	NICER (ISS)	Hubble	MMS (4)
TSIS-2	PUNCH	PACE	Landsat 9	GEDI (ISS)	Swift	SDO
Landsat Next	IMAP	GeoCarb	GOES-T	Landsat 8	AQUA	SOHO
GDC	Dragonfly MS	JPSS-2	GOES-U	ICESat-2	AURA	Stereo (2)
Dorado**		JPSS-3	LUCY	TSIS-1	GPM	Themis (5)
SETH**		JPSS-4	LCRD	PSP	LAGEOS(2)	TIMED
STORM**		OSAM-1	SGSS	SET-1	Landsat 7	TWINS (2)
TRACERS		LEMNOS/020	LCRD Payload	SOC	SMAP	WIND
GEO/XO		ILLUMA-T	Lucy L-Ralph	POES/Met-Op C	S-NPP	LRO
SWFO-L1		PACE OCI	MOMA (ExoMars)	DSCOVR	TERRA	MAVEN
MSR/CCRS		Landsat 9 EFS	XRISM-Resolve	OSIRIS-REx	ACE	
DAVINCI+**			Landsat 9 TIRS II	RiTS	AIM	
HDL				RRM-3	Geotail	
				SAR	IBEX	
				SN		
				NEN		

Astrophysics
Earth Sciences
Heliophysics/Explorers
Joint Agency Satellite Division
Other

Planetary
Satellite Servicing
Space Communications
Instruments

Program Offices at GSFC:
Earth Systematic Missions
Reimbursable Projects
GOES-R Program
Explorers Program
Living with a Star
Solar Terrestrial Probes
Joint Polar Satellite System
Space Weather Follow-On

HQ Study Offices at GSFC:
Physics of the Cosmos
Cosmic Origins

HQ Technology Offices at GSFC:
Earth Science Technology Office

Recently Ended:
SORCE – Feb 2020
TCTE – Feb 2020
Van Allen (2) – Nov 2019
RHESSI – April 2018
RAVEN (ISS) – Jan 2020

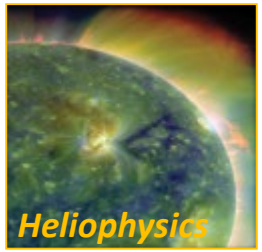
*Does not include competitive AO missions in formulation, unless Agency-selected for further study
**Missions selected for Pre-Phase A/Phase A competitive AO studies

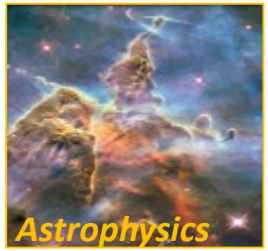
GSFC: A Diverse Mission Portfolio

FPD Portfolio Major Champions

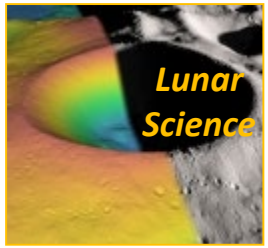
NASA Internal

Science Mission Directorate (SMD)





Human Exploration and Operations Mission Directorate (HEOMD)



Science Technology Mission Directorate (STMD)

External

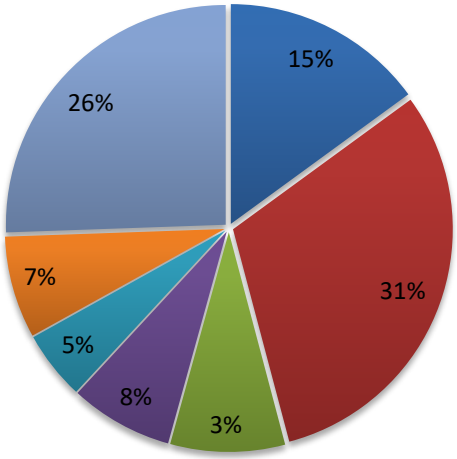
NOAA – National Oceanic and Atmospheric Administration, U.S. Department of Commerce

USGS – science for a changing world

Department of Defense, United States of America

Flight Projects FY2020 Annual Portfolio

FY20 NOAs



- **Earth Science Reimbursable – 26%**
  FY20 NOA: $1,068M
- **Earth Science – 15%**
  FY20 NOA $625.5M
- **Astrophysics – 31%**
  FY20 NOA: $1291.8M
- **Communications & Navigation – 8%**
  FY20 NOA: $313.9M
- **Heliophysics –8%**
  FY20 NOA: $352.3M
- **Planetary – 8%**
  FY20 NOA: $316.7M
- **Cross-cutting Technologies – 5%**
  FY20 NOA: $211.2M

FPD Workforce (FY 2020)

- 372 Civil Service Employees*
- 2,536 Contractors
- 2,908 Total Employees

*Includes 118 CFO employees

Funded $4.2B annual New Obligation Authority (NOA)

Version: 10/9/20

Project Highlights During the Pandemic
March and April 2020

- **Joint Polar Satellite System spacecraft 3 and 4** were confirmed at the KDP-C Joint Agency Program Management Council review on March 18.

- FPD received a Project Authorization Letter on April 9 authorizing the development of **Landsat Next.**

- **Landsat 9** Mission Operations Review (MOR) successfully held from March 31 to April 1.

- On April 24th the **HST** mission celebrated its 30th Anniversary on orbit with the "Cosmic Reef" image, a vast star-forming region in the Large Magellanic Cloud.

- The **GOES-T ABI** flight model 3 delta Pre-Environmental Review was completed.

- **LCRD** payload exchanged commands and telemetry data while mated to the U.S. Space Force's STPSat-6 spacecraft.

- The **O2O** combined Phase I/Phase II Safety Review was completed at JSC.

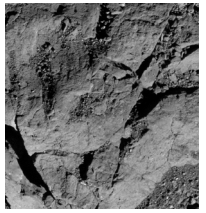
- **NIMO** Human Space Flight coordinated the Antares/Cygnus NG-13 resupply of the International Space Station from Wallops Flight Facility.

- **Mars Sample Return - Capture, Contain and Return System** team supported ESA's Earth Return Orbiter (ERO) System Requirements Review (SRR) kickoff meeting on 2/27.

- **MAVEN** supported the Mars relay network with a single MSL overflight. The 30 minute overflight returned over 1.68 Gb. That is a new single relay record (for MAVEN or anyone else).

- Two new Project Authorization Letters were received for NOAA's GEO-XO project and NASA/SMD's Heliophysics Instrument Suite on Gateway **(HERMES).**

- On 3/3, the PolyCam camera on **OSIRIS-REx** imaged a detailed view of a large boulder that is located northwest of the sample site Nightingale. Fine-grained material is visible in the boulder's crevices and at its base.



- **SGSS** completed its Operational Readiness review #1 on April 7-8.

Project Highlights During the Pandemic
May and June 2020

- A process was developed to slowly phase-in critical project activities, while maintaining the safety of our workforce. **Restart Readiness Reviews** initially resulted in limited key on-site activities that increased over time.

- **Lucy's** spacecraft structure was lifted from the assembly dolly to the propulsion integration stand in the LM SSB high bay.

- A successful **James Webb Space Telescope** (JWST) Pre-Environmental Review (PER) was conducted.

- **Landsat 9** received a delegation memo from the Associate Administrator, dated May 29, delegating KDP-D approval to DPMC on June 4.

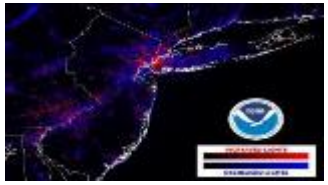
- **The Transiting Exoplanet Survey Satellite (TESS)** made observations in orbit 60, which represents the completion of TESS's prime mission science collection, effectively a full sky survey.

- **OSAM-1** successfully completed KDP-C and was given approval to enter Phase C.

- The **XRISM Resolve electronic boxes** (XBOX and ADRC) completed the delivery review with JAXA on May 27.

- **SWFO-L1** spacecraft was awarded to Ball Aerospace three months ahead of schedule.

- **Suomi-NPP** continued to provide observations of nighttime lights in the U.S. during the pandemic, allowing scientists to discern marked differences in nighttime light levels between February and March 2020.



- Installation of the **Roman** Aft Metering Structure/Forward Metering Structure (AMS/FMS) was completed in preparation for thermal cycling tests. Thermal cycling was completed in April, 2020.

- The **O2O** team successfully completed four virtual mandatory inspection points with subsystem vendors.

- On Saturday May 30, SpaceX launched the first commercial crewed Dragon spacecraft (DM-2) on the Falcon 9 rocket. **HSF managed all the preparations and planning of the Human Spaceflight Communications and Tracking Network (HSF-CTN). SN, NASCOM, FDF, NEN, and NIMO** provided outstanding support throughout the free-flight, rendezvous, and docking phases. The launch was supported by **Search and Rescue.** Code 450 also provided extensive support coordinating.

Project Highlights During the Pandemic
July and August 2020

- Advanced Baseline Imager (ABI) was re-integrated to **GOES-T**.

- **LCRD** successfully completed the Key Decision Point-D Directorate Program Management Council meeting on July 17.

- Successful **Geospace Dynamics Constellation** Mission Concept Review.

- The SPEXone polarimeter instrument on **PACE** completed integration and started environmental testing.

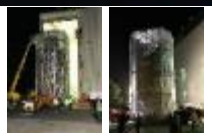
- Goddard's STORM (**Solar-Terrestrial Observer for the Response of the Magnetosphere**) concept was one of five Medium-Class Explorer proposals selected to conduct a nine-month mission concept study.

- This NOAA-20/VIIRS Corrected Reflectance image of Tropical Depression Cristobal moving into the southern U.S. was acquired on June 8. This imagery shows the most recent enhancements to the **ESDIS** Worldview interactive data viz app.

- **Roman Space Telescope:** the primary mirror completed its post-coating Ambient optical test.

- **ExIS:** RiTS and RELL tools were installed on the space station by the spacewalking astronauts during the EVA on July 21.The astronauts thanked the team and Dave Parker (480) out loud over the space to ground loop.

- **JWST** successfully completed acoustics testing and started vibration testing.



- **Lucy** passed KDP-D on Aug. 25 at the combined CMC/DPMC. ATLO began Aug. 17 with the continued installation of telecom hardware onto the forward deck and daily meetings.

- **LRO** completed its 50,000th orbit around the Moon on Aug. 1.

- The **GOES-T** spacecraft entered the thermal vacuum chamber at Lockheed Martin's Waterton, CO facility. The pump-down began shortly thereafter.

- The **OSAM-1** project completed the servicing payload mechanical eCDR (Aug. 27-28) and the SPIDER team completed the SMSIM PDR. The RPO VisCam qualification lenses underwent bakeout and the C&DH engineering model backplane build was completed at SEAKR.

- **LISA** Telescope Integrated Baseline Review (IBR) was held on Aug. 21.

- The first of the five new antennas for the **Near Earth Network's** NIKA project was assembled in Alaska! The AS4 Antenna System completed mechanical assembly at the Alaska Satellite Facility (ASF) in Fairbanks.

- The **JPSS-3** CrIS instrument began pre-environmental thermal vacuum testing.

Project Highlights During the Pandemic
September and October 2020

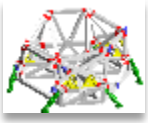
- **L'Ralph** completed its first TVAC testing campaign. The team prepared for instrument level vibe and EMI tests followed by a second TVAC testing campaign prior to shipment.

- The **GeoCarb** project completed its CDR.

- **JWST** was lifted to the vibe table in late August at Northrup Grumman and successfully completed two of three axes of vibration test in September. The observatory sine vibration testing program completed on Oct. 2.

- FEMA used flood maps derived from NOAA-20 and **Suomi-NPP** data for emergency response after Hurricane Laura.

- **Roman Space Telescope** Instrument Carrier Engineering Critical Design Review was successfully conducted on Sept. 16 and 17.

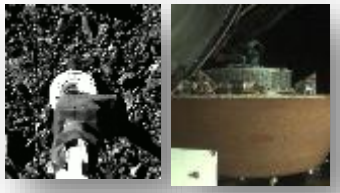


- **TSIS-2** completed their Systems Requirements Review of the spacecraft and mission operations center with General Atomics, Centennial, CO, on Sept. 9-10, with Goddard's standing review team.

- The USSF STPSat-6 with **LCRD** integrated completed acoustic testing. This continued environmental qualification to certify the spacecraft can withstand launch phase noise levels.

- **Landsat 9** successful mission Pre-Environmental Review was held Oct. 13 - 15. Observatory level EMI/EMC testing began at Northrop Grumman.

- **OSIRIS-REx** had a successful touch and go event on the surface of the asteroid Bennu on Oct. 20. The collector went more than 50cm. into the asteroid. The stow operations were successfully carried out on Oct. 27 and 28; all was nominal.



- **RRM3:** Using (VIPIR2) in one hand and the Cryogen Servicing Tool (CST) in the other, the Dextre robot guided an 11-foot fuel hose into a port on RRM3, and VIPIR2 to extend a snake-like camera into the piping system.

- The **Science-Enabling Technologies for Heliophysics (SETH)** site visit was conducted on Sept. 21-22.

- On Sept. 10, a press release was issued entitled "**Hubble** Observations Suggest a Missing Ingredient in Dark Matter Theories." The accompanying GSFC produced video had over 1.2M views.

- **JPSS-2** completed their Systems Integration Review on Oct. 27-29.

Project Highlights During the Pandemic
November 2020

- **LCRD STPSat-6** completed TVAC testing.

- **JWST** completed solar array, GAA, AFT flap and STSA post-env releases.

- The **L'Ralph** Instrument completed its Instrument-level vibration testing and is approaching completion of Instrument-level EMI testing.

- **TSIS-2** completed the Total Solar Irradiance Radiometer Facility upgrade plan, paving the way for unprecedented ground test validation of the Total Irradiance Monitor instrument.

- **Roman** focal plane assembly mosaic plate serial number 003 (test unit) completed gold plating.

- **JPSS-2** had a successful SIR.

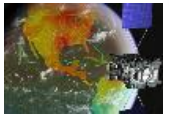
- **DAVINCI+** submitted their Concept Study Report.

- **LCRD** payload completed thermal vacuum testing with the STPSat-6 space vehicle at Northrop Grumman in Sterling, VA. The LCRD team also completed end-to-end #3 testing, ground readiness testing #3, and the final integrated system test.

- **MSR** conducted a DPMC for KDP-A.

- **GOES-T** completed thermal vacuum testing.

- The **GeoCARB** mission conducted successful negotiations.

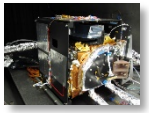


- **ESC** completed a joint NASA and National Science Foundation (NSF) study to increase data rates for science activities in Antarctica. NSF activities are critical to understanding the impact of global warming in Antarctica and the proposed upgrade will enable more data from the region.

- The **LRO** servicing study report was completed and briefed to GSFC management.

- The **Lucy** flight system continues its integration with the installation of the L'LORRI instrument using the EM Data Processing Unit (DPU) in place of Flight. Flight DPU undergoing jackpost rework and is scheduled to deliver to LM week of Dec. 3.

- Completed the **JPSS-2** Ozone Mapping and Profiler Suite (OMPS) instrument mechanical integration.

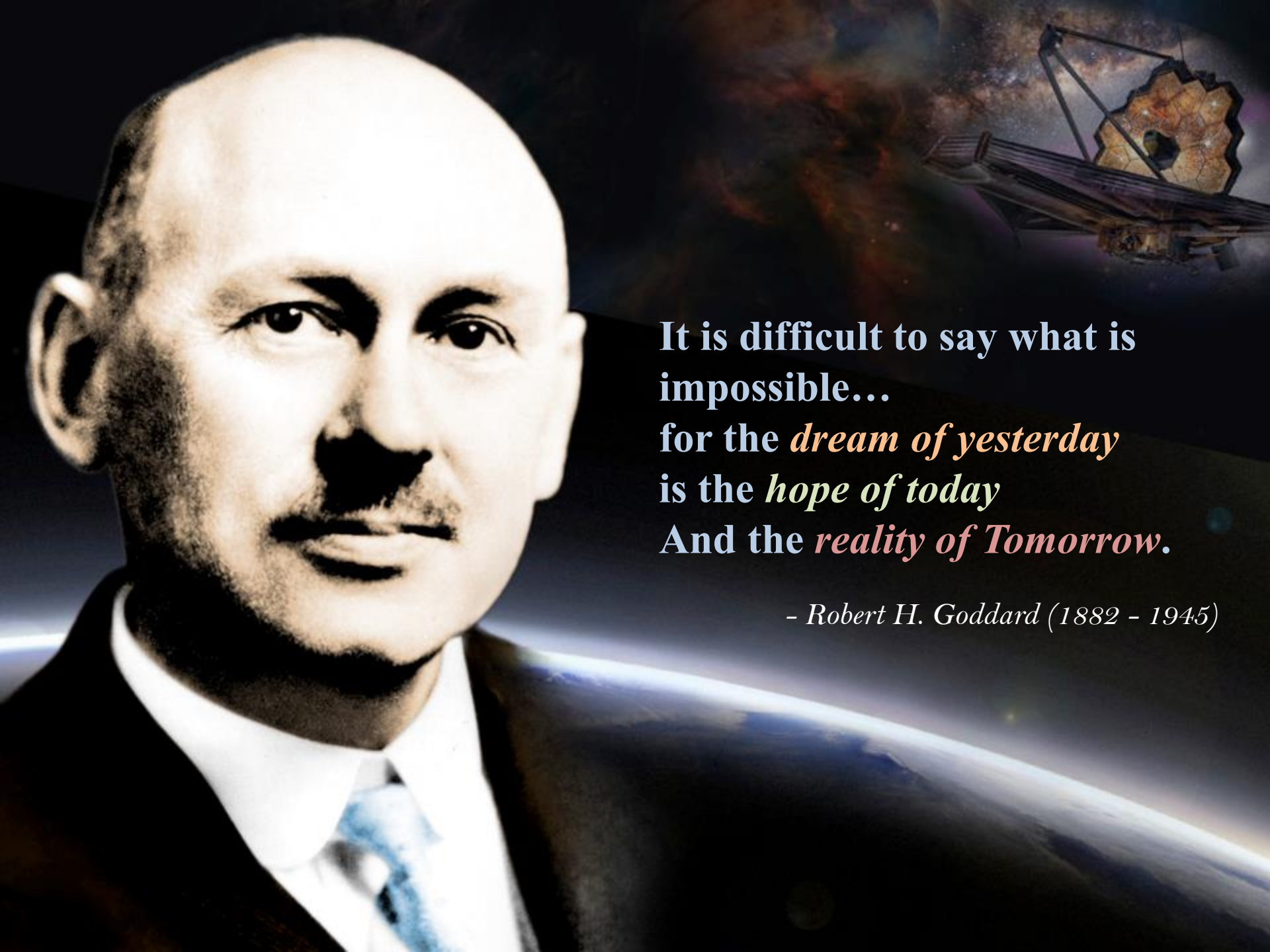


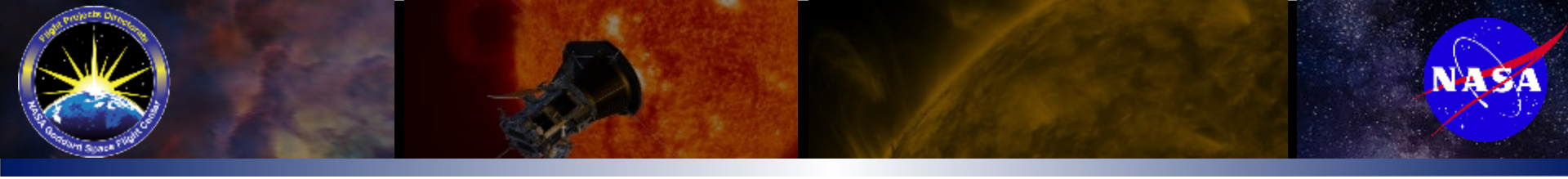
- The **SWFO** spacecraft and project completed SRR and MDR.

- The @NASA**Hubble** Twitter account gained a new follower - @jimmyfallon

What's Next: Launches in 2021!

- **LCRD payload on STPSat-6 –** February 2021
- **Landsat 9 –** September 2021
- **Lucy/L'Ralph –** October 2021
- **JWST –** October 2021
- **IXPE –** November 2021
- **GOES-T –** December 2021
- **GUSTO (long duration balloon mission) –** December 2021


It is difficult to say what is impossible…
for the dream of yesterday
is the hope of today
And the reality of Tomorrow.
- Robert H. Goddard (1882 - 1945)



Question & Answer and Discussion