Science-enabling Technology

SMD

Requirements:

- new instruments
- cutting-edge capabilities

Divisions:

- Astrophysics
- Biological and Physical Sciences
- Earth Science
- Heliophysics
- Planetary Science

How to:

- division-sponsored technology development
- mission programs
- collaborative workshops

Cooperation:

- NASA directorates
- government agencies
- industry
- academia

Technology Highlights

Q: How Do You Water Plants in Space?

A: Omni-Gravitational Hydroponics

NASA is demonstrating that even without the help of gravity, hydroponic plant watering methods can enable plant habitats aboard crewed or robotic space missions.

SMD Technology Programs

Astrophysics

- Strategic Astrophysics Technology (SAT)
- Astrophysics Research and Analysis (APRA)
- Nancy Grace Roman Technology Fellowships (RTF)
- Pioneers Program

Heliophysics

- Heliophysics Technology and Instrument Development for Science (H-TIDeS)
- Heliophysics Low Cost Access to Space (H-LCAS)
- Heliophysics Flight Opportunities for Research and Technology (H-FORT)

Biological and Physics Sciences

- Space Biology Program
- Physical Sciences Program

Planetary Sciences, managed by the Planetary Exploration Science Technology Office [PESTO])

- *Planetary Instrument Concepts for the Advancement of Solar System Observations (PICASSO)
- *Maturation of Instruments for Solar System Exploration (MatISSE)
- *Development and Advancement of Lunar Instrumentation (DALI)
- *High Operating Temperature Technology (HOTTEch)
- *Concepts for Ocean worlds Life Detection Technology (COLDTech): technologies for instruments and technologies for vehicles
- *Scientific Exploration Subsurface Access Mechanism for Europa (SESAME)
- *Icy Satellites

- Instrument Concepts for Europa Exploration (ICEE 2)
- Radioisotope Power Systems Program (RPSP)

Earth Sciences, managed by the Earth Science Technology Office [ESTO])

- Instrument Incubator Program (IIP)
- Advanced Component Technologies (ACT)
- Sustainable Land Imaging Technology (SLI-T)
- Advanced Information Systems Technology (AIST)
- In-space Validation of Earth Science Technologies (InVEST)
- Decadal Survey Incubator (DSI) (new program)

Crosscutting Programs

- Applied Information Systems Research: Autonomous Robotics Research for Ocean Worlds (AISR-ARROW) (managed by PSD's PESTO)
- Sounding Rocket Program (managed by HPD)
- NASA Scientific Ballooning Program (managed by APD)
- Quantum Technologies Take Flight
- SPACE EXPERIMENTS
- Dec 22, 2020
- For the first time in orbit, atomic matter-wave interferometry has been performed, paving the way for precision quantum sensing in both basic and applied physics applications ranging from general relativity testing to planetary geodesy.
-
- Far-Infrared Detectors: Superconductivity Enables New Astrophysical Discoveries
- UNIVERSE
- Dec 8, 2020
- The far-IR is a powerful but little-studied spectral region that can be used to examine galaxies' birth and infancy.
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- A Small Satellite With Planetary Ambitions
- SOLAR SYSTEM
- Nov 24, 2020
- To better understand the initial stages of planet formation, Q-PACE will record video of thousands of mild collisions between particles in microgravity.
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- Prototype Ozone Monitoring Instrument Gets Its First Look at The Sun
- EARTH
- Nov 10, 2020
- The SAGE IV Pathfinder instrument, which is small enough to fit on a small satellite, could one day allow a constellation of small satellites to maintain and improve atmospheric ozone monitoring.

- New Radar to Monitor Volcanoes and Earthquakes from Space
- EARTH
- Sep 29, 2020
- NASA developed a new technology for a tiny satellite platform equipped with an S-band Interferometric Synthetic Aperture Radar (InSAR) to help monitor ground deformation from space.

- Surface and Exosphere Alterations by Landers (SEAL): NASA's Next Lunar Payload?
- SOLAR SYSTEM
- Sep 1, 2020
- When a spacecraft lands on the Moon, it kicks up dust, generates heat, and even leaves chemical residues on the lunar surface. To ensure correct examination of any surface, scientists require a technique to evaluate how materials in the vicinity of lunar landing sites are changed.

- Crafting Detectors Atomic Layer by Atomic Layer has a High Impact on Ultraviolet Astrophysics Missions
- UNIVERSE
- Aug 18, 2020
- The ultraviolet spectral range contains a wealth of information regarding exoplanet atmospheres, star formation, supernovae, the circumgalactic medium, and much more. Habitable Exoplanet Characterization (HabEx) and Large Ultraviolet/Optical/Infrared are two prospective flagship mission concepts.

- New CubeSat's First Light Shows Clouds and Aerosols
- EARTH
- Aug 4, 2020
- The measurements from the Hyper-Angular Rainbow Polarimeter help us understand how clouds and aerosols affect weather, climate, and air quality.

- Exploring a New Approach for Measuring Water Vapor on Earth and Mars
- SOLAR SYSTEM
- Jul 14, 2020
- NASA scientists are testing a new radar-based method for mapping water vapor in the Earth's atmosphere and near Mars' surface.

- Enhanced Mirror Coatings Will Enable Future NASA Observatory
- UNIVERSE
- Jun 30, 2020
- A group at the GSFC is looking at ways to make highly reflective aluminum mirrors that are sensitive to the far-ultraviolet as well as the infrared, optical, and visible wavelengths.

- Lightweight Mirrors Enhance Power Generation Near Gas Giants
- SOLAR SYSTEM
- Jun 9, 2020

- Solar cells and arrays are commonly used on spacecraft to capture energy from the Sun and power onboard systems. These cells and arrays, like any other spacecraft equipment, must be able to operate in the severe environments that their host satellite is exposed to.

- Taking Earth's Temperature from a Tiny Satellite
- EARTH
- May 26, 2020
- A satellite the size of a backpack will be able to reveal Earth's temperature from space thanks to a revolutionary small sensor and robust data processing capabilities.

- In-Space Telescope Assembly: When is it worth it?
- UNIVERSE
- May 12, 2020
- NASA did a thorough investigation to determine whether it is more cost-effective to assemble telescopes in space rather than folding them into a single rocket and launching them into orbit.

- Balloon-borne Investigation Provides First Simultaneous Measurements of Crucial Coronal Parameters
- SUN
- Apr 27, 2020
- For the first time, new technology presented on BITSE has detected the 2D density, temperature, and speed of electrons in the solar corona concurrently.

- Playing Lacrosse on Titan
- SOLAR SYSTEM
- Apr 14, 2020
- Access to the subsurface and a way to capture planetary material for research are required for the next phase of revolutionary planetary science.

- High-flying Moon Sensor Will Help Improve Earth Observations
- EARTH
- Mar 31, 2020
- NASA's ER-2 plane carried a new equipment to measure the brightness of the Moon. Data from this device will eventually be used to improve the Earth observations collected by other space-based sensors.

- Advanced Magnetic Cooling for Sub-Kelvin Instruments
- UNIVERSE
- Mar 18, 2020
- NASA is developing an advanced spacecraft magnetic refrigeration technology to chill anticipated future science instruments to operational temperatures considerably below one Kelvin.

- Planetary Exploration Science Technology Office

- SOLAR SYSTEM
- Mar 2, 2020
- For future planetary research missions, a new office has been established to manage the development of scientific instruments, space vehicle technologies, and mission support technologies.

- Big Weather Data from a Tiny CubeSat
- Feb 19, 2020
- This compact CubeSat exhibited millimeter wave radiometer technology that will allow constellations of small satellites to offer the first worldwide temporal studies of cloud and precipitation dynamics.

- A High Resolution "Color" X-Ray Camera with Thousands of Pixels
- UNIVERSE
- Feb 10, 2020
- An X-ray camera with 3168 pixels is being developed, with the ground-breaking capability of resolving distinct X-ray "colors." Observations of the behavior and composition of hot energetic material in galaxy clusters and surrounding black holes will be possible with this technique. These photos can be used by scientists.

- Nanoscale Vacuum Electronics: Back to the Future?
- SOLAR SYSTEM
- Feb 3, 2020
- NASA is developing a new line of vacuum electronics to help protect future space assets from the harmful effects of radiation exposure.

- Balloon-bourne Imaging Captures Turbulence Sources Revealed in Polar Mesospheric Clouds
- SUN
- Jan 28, 2020
- The PMC Turbo experiment, which was carried out by a balloon, successfully supplied data on small-scale instabilities and turbulence in the mesosphere, which will help to improve weather and climate models.

- Integrated Circuits to Enable Exploration of the Harshest Environments in the Solar System
- SOLAR SYSTEM
- Jan 15, 2020
- Spacecraft must be able to operate in severe settings if they are to explore the most dangerous parts of the solar system. Recent breakthroughs in silicon carbide (SiC) electronics have altered the paradigm of what may be explored in such contexts, including various surfaces.

- FOXSI's X-ray Optics and Detectors Put the Sun in Focus
- SUN, EARTH'S SPACE ENVIRONMENT
- Jan 6, 2020

- Solar X-rays enable us investigate the highest-energy processes in our solar system, such as solar storms and their origins. Researchers aiming to understand the Sun's high-energy behavior face some distinct hurdles.