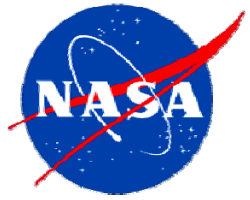


NASA Warming up to CubeSats for Science and Technology

Science Mission Directorate

David M. Klumpar

Discipline Scientist

Science Mission Directorate/Heliophysics Division

NASA Headquarters

david.m.klumpar@nasa.gov

April 25, 2013

The President's FY2014* NASA Budget Request

Science: Heliophysics: Heliophysics Research **OTHER MISSIONS AND DATA ANALYSIS**

FY 2014 Budget

* October 1, 2013 – September 30, 2014

	Actual			Notional			
Budget Authority (in $ millions)	**FY 2012**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**
FY 2014 President's Budget Request	61.3	--	**89.6**	54.2	58.8	63.5	65.5
Science Planning and Research Support	5.7	--	**6.3**	6.5	6.6	6.7	6.8
Directed Research & Technology	13.5	--	**37.8**	3.4	6.9	11.4	13.3
Space Weather Research to Operations	0.0	--	**0.3**	0.4	0.4	0.4	0.4
SOLAR Data Center	0.7	--	**1.0**	1.0	1.0	1.0	1.0
Data & Modeling Services	3.8	--	**3.2**	3.2	3.0	3.0	3.0
Space Physics Data Archive	1.4	--	**2.0**	2.0	2.0	2.0	2.0
Guest Investigator Program	10.4	--	**8.2**	7.2	8.0	8.0	8.0
Community Coordinated Modeling Center	2.0	--	**1.5**	1.4	1.4	1.4	1.4
Science Data & Computing	1.7	--	**2.1**	2.0	2.0	2.0	2.0
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CubeSat	0.0	--	**5.0**	5.0	5.0	5.0	5.0
[illegible]	[illegible]	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Solar and Heliospheric Obervatory	2.0	--	**2.2**	1.9	1.9	1.9	1.9
WIND	2.0	--	**2.2**	2.2	2.2	2.2	2.2
GEOTAIL	0.2	--	**0.2**	0.2	0.2	0.2	0.2
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

http://www.nasa.gov/pdf/740512main_FY2014%20CJ%20for%20Online.pdf page: HELIO-7/657

Media Teleconference: NASA Administrator Discusses 2014 Fiscal year Budget Proposal

April 10, 2013

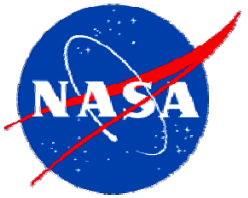
- Speaker: Dr. **ELIZABETH ROBINSON**, Chief Financial Officer, NASA

"We have a new feature in the Heliophysics budget of what we call "CubeSat investigations." These are very small satellites, costing about 1- to $2 million each, and they have a host of payloads and other ways, and they are very targeted and have some very innovative science they are going to do. So I would encourage you to talk to the science folks about that program."

Language from the President's FY2014 NASA Budget summary

- "CubeSats will address space technology and exploration systems development needs, will extend important hands-on experience to undergraduate and graduate students, and will leverage exploratory and systematic science observations at a minimal cost."
- "NASA plans to offer CubeSat Pilot-1 investigations as part of the SMD ROSES-13 announcement, and select multiple CubeSat investigations as part of the SMD award announcement in FY 2014. The CubeSats would be delivered approximately 24 months after award, and at least one CubeSat would be targeted to launch by 2016"

National Aeronautics and Space Administration



Administrator
Deputy Administrator
Associate Administrator

- Chief of Staff
- Associate Deputy Administrator
- Associate Deputy Administrator for Strategy and Policy
- Assistant Associate Administrator

Advisory Groups
NAC and ASAP

Inspector General

Chief Financial Officer*

Chief Information Officer*

Chief Scientist

Chief Technologist

Diversity and Equal Opportunity

Education

International and Interagency Relations

General Counsel

Legislative and Intergovernmental Affairs*

Communications*

Small Business Programs

Chief Engineer

Chief, Safety and Mission Assurance

Chief Health and Medical Officer

Mission Support Directorate

- Human Capital Management
- Strategic Infrastructure
- Headquarters Operations
- NASA Shared Services Center
- Internal Controls and Management Systems
- Procurement
- Protective Services
- NASA Management Office

Aeronautics Research Mission Directorate

Science Mission Directorate

Human Exploration and Operations Mission Directorate

Space Technology Mission Directorate

Ames Research Center

Dryden Flight Research Center

Glenn Research Center

Goddard Space Flight Center

Jet Propulsion Laboratory

Johnson Space Center

Kennedy Space Center

Langley Research Center

Marshall Space Flight Center

Stennis Space Center

Key

Stipple Outer Shading Indicates CubeSat-related Activities

Reporting Structure
Administrator
Deputy Administrator
Associate Administrator

Note:
* Center functional office directors report to Agency functional AA. Deputy and below report to Center leadership.

www.nasa.gov

February 2013

The new program is still in formulation

- investigations competitively funded (peer-reviewed proposals)
- funded through grants
- selection criteria will include: science, technology, training. Relative weighting tbd

Before focusing in on Science Mission Directorate CubeSat Ativities …

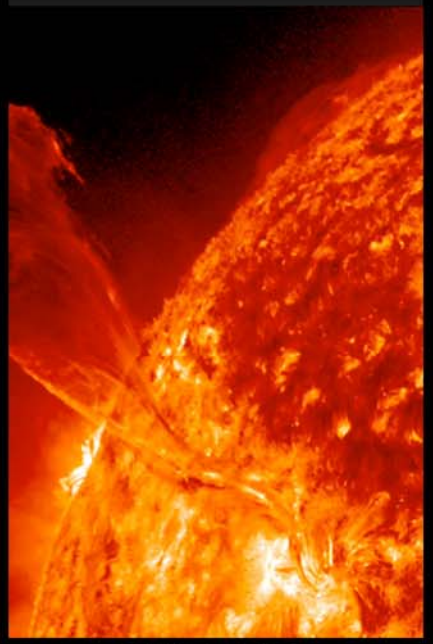
- **Outside of SMD**: ***A brief Cubesatter's guide to NASA at this Workshop***
  - Space Technology Mission Directorate (and Office of the Chief Technologist): Small Spacecraft Technology Program (**Andrew Pietro and Bruce Yost around noon)**
    - Multiple missions (e.g. PhoneSat(s), EDSN, Technology Demonstrations (PONSFD, ISARA, Optical Communications and Proximity Sensors)
    - Managed by Ames – multiple missions (e.g., **Elwood Agasid later this morning**)
  - Advanced Exploration Systems Division (Human Exploration and Operations Directorate)
    - **Jason Cruzan (morning Keynote)**: CubeSat Launch Initiative (CSLI)
    - Kennedy Space Center/Launch Services Program – Educational Launch of Nanosatellites (ELaNa) (**Garrett Skrobot – this afternoon**)
  - NASA Centers, Laboratories and FFRDCs
    - Goddard Space Flight Center (**Tom Flately, this morning**)
      - Wallops Flight Facility
    - Marshall Space Flight Center
    - Ames Research Center
    - Jet Propulsion Laboratory (e.g**. Freeman & Norton, later this morning**)
    - Johnson Space Center – ISS support

National Aeronautics and Space Administration

NASA SCIENCE MISSION DIRECTORATE

EARTH SCIENCE

Earth
Advancing Earth System Science to meet the challenges of climate and environmental change



HELIOPHYSICS

Heliophysics
Seeking to understand the Sun and its interactions with the Earth and solar system

PLANETARY SCIENCE

Planets
Ascertaining the content, origin and evolution of the solar system and the potential for life elsewhere

ASTROPHYSICS

Astrophysics
Discovering how the universe works, exploring how the universe began and evolved, and searching for Earth-sized planets

NASA's Science Plan is available at: http://science.nasa.gov/about-us/science-strategy/

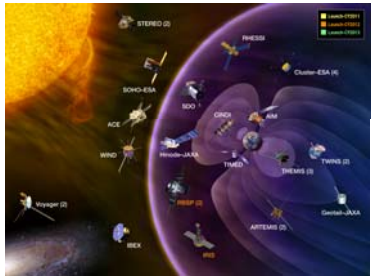
Heliophysics Division Objectives and Programs:

Strategic Objective: Understand the sun and its interactions with Earth and the solar system

Explorers

Smaller, Competed Flight Program

Research



Research tasks utilizing suborbital and existing assets

Solve <u>fundamental</u> mysteries of Heliophysics: Explore the physical processes in the space environment from the sun to the Earth and throughout the solar system

Understand the nature of our <u>home</u> in space: Advance our understanding of the connections that link the sun, the Earth and planetary space environments, and the outer reaches of our solar system.

Build the knowledge to forecast space <u>weather</u> throughout the heliosphere: Develop the knowledge and capability to detect and predict extreme conditions in space to protect life and society and to safeguard human and robotic explorers beyond Earth.

Solar Terrestrial Probes

Strategic Mission Flight Program

Living With a Star

Strategic Mission Flight Program

Current and planned CubeSat-related activity and solicitations across SMD's Divisions-1

- **Earth Sciences Division**
  - **ROSES:** Earth science proposals for CubeSats will be solicited under Earth Venture Instrument or Earth Venture Mission calls. TBA

- **Heliophysics Division**
  - ROSES-13 – Appendix B-3 *Heliophysics Technology and Instrument Development for Science (H-TIDeS) – LCAS Element*
  - Proposals Due:
  - 6/14/13: **Mandatory** Step 1: Investigation plan and all co-investigators
  - 8/15/13: Step 2: Full proposals
- Anticipated Funding
  - A total of about $5M program funds next fiscal year will allow the selection of about 12 new awards from proposals for LCAS ($3.5M/4-8), ITD ($1M/3-5), and LNAPP ($0.5M/1-3).

Research Opportunities in Earth and Space Sciences (ROSES) 2013 Solicitation (NNH13ZDA001N) released 2/14/13: https://nspires.nasaprs.com

Current and planned CubeSat-related activity and solicitations across SMD's Divisions-2

- **Planetary Sciences Division**
  - Approach: Develop enabling CubeSat technology to perform science in concert with a larger observatory at a planetary body
  - In orbit: Organism/Organic Exposure to Orbital Stresses (OREOS)
  - In development: "ExoPlanetSat" and "Interplanetary NanoSpacecraft Pathfinder in a Relevant Environment (INSPIRE)"
  - In Study: in concert with Europa Clipper mission
  - ROSES-13: Appendix C.5 Planetary Astronomy Program; Suborbital Flight Investigations Element
    - NOI 4/12/13
    - Full Proposals 6/7/13

- **Astrophysics Division**
  - ROSES-13, Appendix D.3, Astrophysics Research and Analysis Program (APRA)
    - NOI: 01/24/2013
    - Full Proposals: 03/21/2014

Research Opportunities in Earth and Space Sciences (ROSES) 2013 Solicitation (NNH13ZDA001N) released 2/14/13: https://nspires.nasaprs.com

Summary

- The President's FY14 Budget Proposal requests $5M for CubeSats – a new budget line for the Science Mission Directorate
  - competed
- Across NASA, multiple CubeSat efforts are under way or have been completed.
  - both internal and external.
- Multiple solicitations currently "open" will accept CubeSat-based proposals
- The future is bright for CubeSats through NASA!!