



***Report from the Small Bodies Assessment
Group to the Planetary Science Subcommittee***

Nancy Chabot, SBAG Chair
March 10, 2016

Last SBAG Meeting:

- **January 27 – 29, 2016:** 14th SBAG Meeting, Monrovia, CA



Findings abbreviated. Full SBAG 14 findings at:
<http://www.lpi.usra.edu/sbag/findings/>

- SBAG celebrates the recent successes of spacecraft missions focused on small bodies across the Solar System: New Horizons' historic exploration of the Pluto system, Dawn's discoveries at Ceres, NEOWISE's characterization of thousands of Solar System objects, and Rosetta's investigation of comet 67P/Churyumov-Gerasimenko.
- These missions have proven to be not only scientifically successful but have also captured public attention in demonstrating how fascinating and diverse these worlds can be.
- At the same time, SBAG eagerly looks to the future, enthusiastically encouraged by a NASA budget for planetary science that enables scientific priorities in the exploration of our Solar System to be accomplished.
- New discoveries by OSIRIS-REx's asteroid sample return, partnerships with Hayabusa2, and New Horizons' proposed 2019 Kuiper Belt Object encounter are highly anticipated, as are future small bodies missions currently under development and consideration.
- To support the realization of such a future, **SBAG encourages the small bodies community to make every effort to engage with the public and to share the excitement of our current and future exploration of the Solar System.**



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Planetary Defense Coordination Office

SBAG enthusiastically supports the formation of the Planetary Defense Coordination Office (PDCO). This new office will allow greater ease in coordinating planetary defense activities across NASA, other U.S. federal agencies, foreign space agencies, and international partners. The formation of the PDCO is a significant advancement in recognizing the importance of planetary defense activities. Now that the PDCO is established, SBAG encourages the PDCO to investigate means to: 1) complete the NEO population survey to assess the impact threat to Earth, and 2) find ways to support flight validation missions of mitigation techniques.

Discovery Program

SBAG reiterates the importance of the Decadal Survey recommendation of a ≤ 24 month average launch cadence for Discovery missions as an essential guideline. SBAG sees Discovery missions as crucial to enable the exploration of the Solar System and views an active and healthy Discovery Program as a key priority. Given the large number of compelling and mature concepts submitted to the Discovery 2014 AO, selecting two missions would be a means of addressing the Decadal Survey guidelines and regaining the recommended cadence, given that the previous Discovery AO was released in 2010. The selection of two missions would also leverage the considerable investment of time and resources expended by NASA and the community on this effort.



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New Frontiers Program

The New Frontiers program is a critical component of achieving NASA's Solar System exploration goals, and **SBAG strongly supports the release of a New Frontiers Announcement of Opportunity (AO) in January 2017, to meet the Decadal Survey recommended cadence of two New Frontiers class missions between 2013–2022.**

Extensive studies and thorough community-wide discussions formed the foundation for the strategy identified in the Decadal Survey to achieve a robust and balanced exploration of the Solar System, with specific priority missions identified for the upcoming New Frontiers 4 and 5 opportunities. **SBAG emphasizes that the New Frontiers 4 candidate missions should be those specifically identified as priorities for the New Frontiers 4 opportunity by the Decadal Survey process.** Alternatively, if additions or other changes to the candidate mission list for the New Frontiers program are necessary, SBAG supports an appropriate and transparent community-wide process by NASA to properly re-evaluate the overarching strategy and priorities. Such an open and transparent approach would further support the credibility and balance of the entire Decadal Survey and increase confidence in the Decadal Survey process, thereby affirming a means through which the input of the entire planetary science community is freely solicited and carefully balanced.



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Arecibo Observatory as a Critical National Asset

Arecibo Observatory provides a unique capability for a range of cutting-edge science that includes astrophysics, aerometry, and planetary science as well as planetary defense and human and robotic exploration missions. Arecibo is a critical national asset whose loss would not only affect science return but also increase the nation's risk exposure. SBAG is highly concerned about a potential disinvestment in Arecibo facilities and maintenance. **SBAG encourages NASA to continue its current support of Arecibo and urges NSF to find a funding formula for Arecibo that reflects the nation's science and security interests and provides for the stability and productivity of this critical national asset.**

Support for Dawn's Extended Mission

The Dawn mission's investigation of Ceres has revealed fascinating new discoveries about this previously unvisited world, providing new insights into the Solar System's formation and evolution. Given the compelling results achieved to date and the unique potential to further advance our knowledge of Ceres, **SBAG strongly supports the continued operations of the Dawn spacecraft through an extended mission** that lasts through the mission's full potential lifetime, estimated as extending to the end of January 2017. This would only extend Dawn operations by roughly seven months but is a unique opportunity to fully utilize NASA's investment in Dawn and maximize the mission's science return.



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Value of NEO Survey Capabilities to NASA's Agency-Wide Goals

SBAG is pleased to hear that NASA is conducting studies in 2016 to develop the best-integrated solution for achieving the 2005 G. E. Brown Survey Act (*discovering >90% of NEOs >140 m by 2020 to assess the threat of to Earth (Public Law 109> 155 Sec.321)*). SBAG continues to emphasize: (1) that enhanced NEO survey systems are a foundational asset to achieve the goals of NASA's Asteroid Initiative, and (2) that NASA has asteroid-based activities across multiple directorates as a cornerstone for human and robotic exploration, planetary defense, resource utilization, and science. Therefore, **SBAG finds that enhanced NEO survey capabilities should be considered an agency-wide initiative**, with the pursuit of a new start, and should not rely solely on resources available to the Planetary Science Division (PSD).

Asteroid Redirect Mission

SBAG continues to appreciate NASA's efforts to engage and communicate with the small bodies community regarding the Asteroid Redirect Mission (ARM). The 100 applications for the Formulation Assessment and Support Team (FAST) show the high level of interest in participating. SBAG thanks the ARM team for creating the FAST and the FAST members for the substantial work completed in a short timeframe. **SBAG encourages the continued engagement between the ARM team and the small bodies community as the mission moves forward and supports the plan for a competed opportunity this year to establish the Investigation Team membership.** As previously, for science-driven missions, SBAG continues to support the Decadal Survey priorities to guide the use of PSD resources.



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Planetary Science Division Research and Analysis (R&A) Program

NASA spends a significant fraction of its PSD funds supporting the development, implementation, and operation of robotic missions. Ultimately it is the R&A funding that drives the discoveries of the planetary mission portfolio. The results of current missions form the basis of knowledge that both reduce the risk for future missions and raise new questions that drive subsequent exploration and future Decadal Survey priorities. Because of this, **it is essential that NASA fund a robust and reliable R&A program, and SBAG encourages PSD to explore potential means to increase funding to R&A programs to improve the selection rate of highly rated proposals.** Additionally, SBAG urges PSD to avoid delays in R&A programs that result in severe gaps in funding opportunities, which have negative repercussions across the community, and early-career individuals can be especially vulnerable. SBAG urges PSD to engage early-career scientists to explore means to lessen any hardships, even on an individual basis.

Data Analysis Programs

Data Analysis Programs (DAPs) enhance the scientific value of NASA's missions by opening up analysis of data sets to a broad segment of the scientific community, offering expertise and viewpoints beyond those of the flight teams. **SBAG encourages the speedy establishment of two new programs: A New Frontiers Data Analysis Program and a Rosetta Data Analysis Program.**



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Midterm Decadal Survey Assessment

SBAG supports a 2013-2022 Decadal Survey midterm assessment to evaluate and reinforce the decadal process. SBAG hopes that a midterm assessment does not merely confine its attention to the account of “any new discoveries”, but rather in accounting for “other changes that have taken place”, **SBAG encourages a midterm Decadal Survey assessment to address the broader issue of identifying the elements of a healthy scientific community capable of supporting NASA's needs, and what should be done to maintain that community.** SBAG particularly encourages the inclusion of early-career participation in the midterm assessment by membership on the panel. Furthermore, SBAG hopes the midterm review may address key assets and facilities in planetary science studies, such as PI-led laboratories that are particularly vulnerable to funding fluctuations. The productivity of these assets and facilities are often disrupted as a result of the loss of key personnel during times of low grant award rates.



SBAG Goals Document

Goals and Objectives for the Exploration and Investigation of the Solar System's Small Bodies

Small Bodies Assessment Group (SBAG)

Version 1.2.2016

March 4, 2016



Recommended citation:
SBAG (2016), Goals and Objectives for the Exploration and Investigation of the Solar System's Small Bodies. ver. 1.2.2016, 41 p, at <http://www.lpi.usra.edu/sbag/goals/>

Efforts of the SBAG community over the last year have led to the finalization of the SBAG Goals Document

available at:

<http://www.lpi.usra.edu/sbag/goals>

Lead: Nancy Chabot (APL)
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Goal 1: Small Bodies, Big Science

Lead: Tim Swindle (Univ. Arizona)
Kieran Carroll (Gedex)
Julie Castillo-Rogez (JPL)
Will Grundy (Lowell Observatory)
Emily Kramer (JPL)
Joe Nuth (NASA Goddard)
Carol Raymond (JPL)
Andy Rivkin (APL)
Heather Smith (NASA Ames)

Goal 2: Defend Planet Earth

Lead: Tommy Grav (PSI)
James Arnold (NASA Ames)
Brent Barbee (NASA GSFC)
Steve Chesley (JPL)
Paul Chodas (JPL)
Leviticus A. Lewis (FEMA)
Paul Miller (LLNL)
Angela Stickle (APL)
Tim Titus (USGS)

Goal 3: Enable Human Exploration

Lead: Paul Abell (NASA JSC)
Brent Barbee (NASA GSFC)
Josh Hopkins (Lockheed Martin)
Sam Lawrence (ASU)
Stan Love (NASA JSC)
Carrie Nugent (IPAC)
Andy Rivkin (APL)
Mark Sykes (PSI)



SBAG Steering Committee:

- Nancy Chabot (*JHU/APL*), **Chair (8/13–8/16)**
- Tim Swindle (*Univ. Arizona*), **Vice Chair (8/15–8/16)**
- Brent Barbee (*NASA Goddard*), Human Exploration Lead (8/14-8/17)
- James Bauer (*JPL*) (8/14-8/17)
- Beau Bierhaus (*Lockheed Martin*) (8/14-8/17)
- Dan Britt (*UCF*) (8/14-8/17)
- Bonnie Buratti (*JPL*) (8/13-8/16)
- Lori Feaga (*Univ. Maryland*) (8/15-8/18)
- Tommy Grav (*PSI*), Planetary Defense Lead (8/13-8/16)
- Carolyn Mercer (*NASA Glenn*), Technology Lead (8/15-8/18)
- Angela Stickle (*JHU/APL*), Early Career Secretary (8/15-8/17)

Question for PSS meeting: What do we need to do to get Tim Swindle on the PSS starting in August 2016?

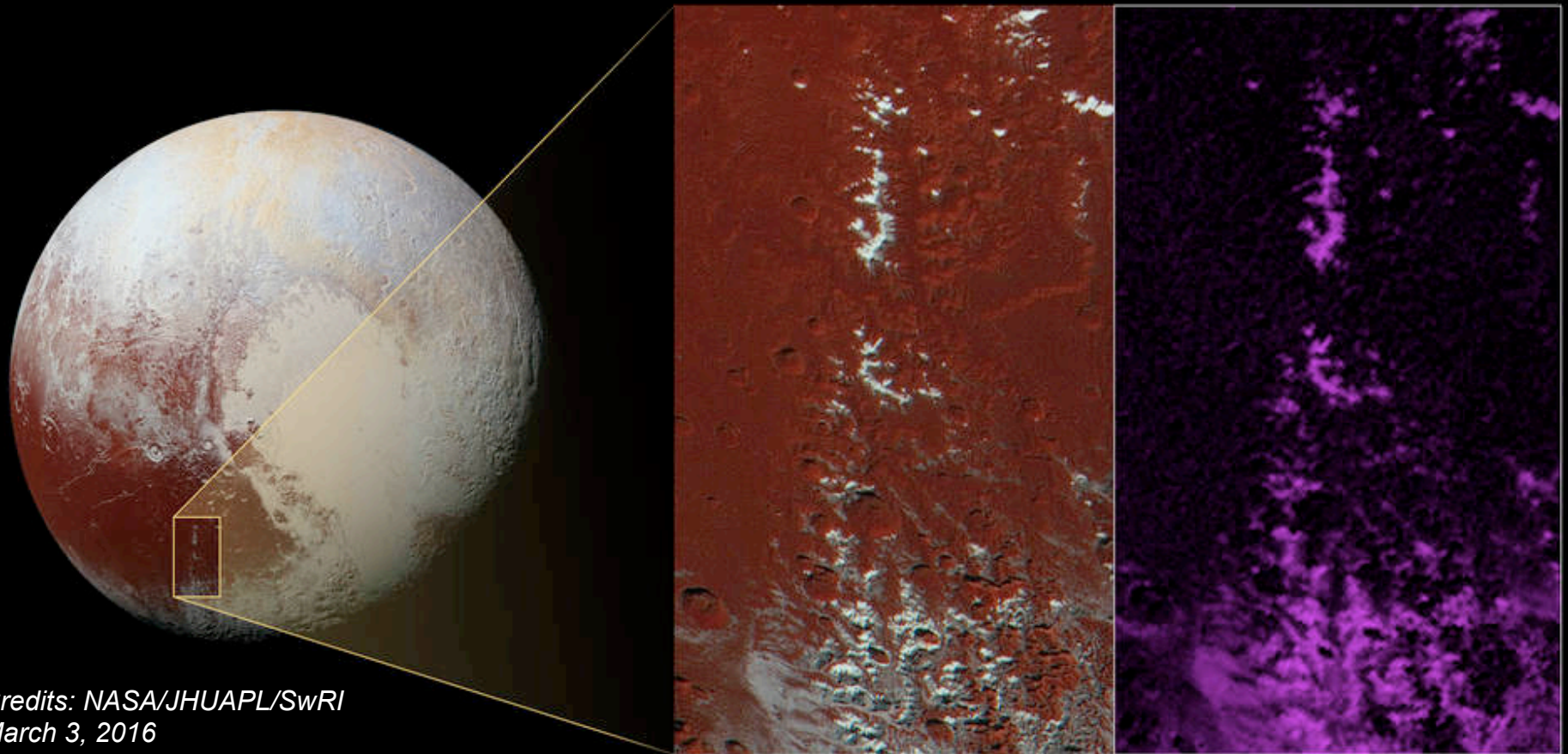


Future SBAG Meetings:

- **June 28 - 30, 2016:** 15th SBAG Meeting
Johns Hopkins University Applied Physics Lab, Laurel, MD
- **January 11-13, 2017:** 16th SBAG Meeting
University of Arizona, Tucson, AZ

Methane Snow on Pluto's Peaks

The New Horizons team has discovered a chain of exotic snowcapped mountains stretching across the dark expanse on Pluto.

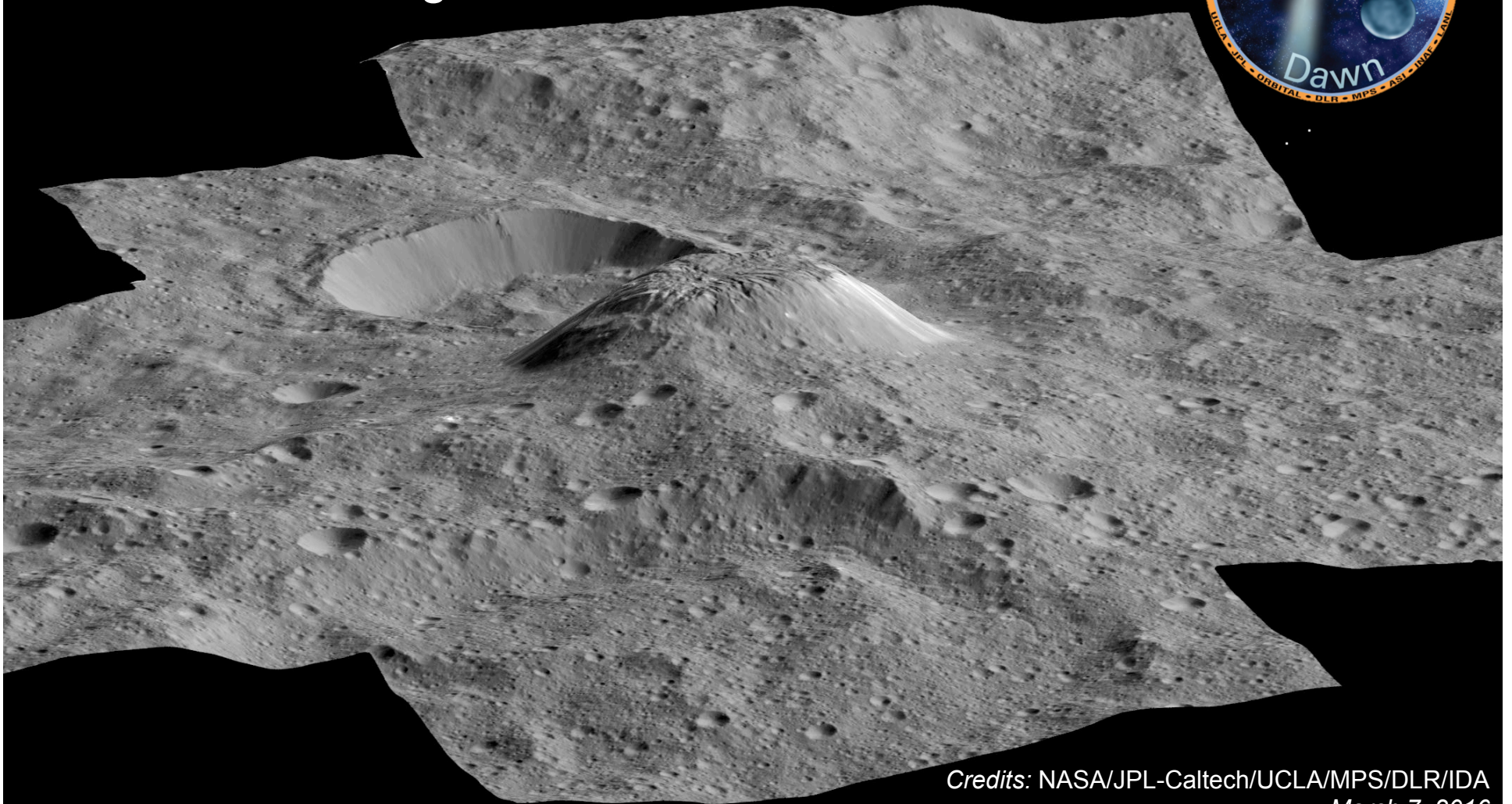


Credits: NASA/JHUAPL/SwRI
March 3, 2016

The reddish enhanced color image (middle) reveals a mountain range located in southeast Cthulhu that's 260 miles long, largely covered by a layer of dark tholins. The bright peaks are thought to be predominantly methane (right image is a map of methane ice) that has condensed as ice from Pluto's atmosphere.

Dawn's First Year at Ceres

A Mountain Emerges: Ahuna Mons



Credits: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA
March 7, 2016

One year ago, on March 6, 2015, the Dawn spacecraft slid into orbit around Ceres, and since then, has delivered a wealth of images and other data of this previously unexplored world. Ahuna Mons has an average height of 4 km, and Dawn's latest images are yielding new details of this enigmatic feature.