NASA Planetary Research and Analysis: Strategy for Reorganization

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Introduction

This is a summary of Sykes et al. (2019) - Reorganizing NASA Planetary Research Programs for ROSES 2020 at http://planetarypolicy.org/REREORG/ReReorg_Proposal_Submitted.pdf
This proposal was informed by 249 responses to a survey of the planetary science community, conducted October 1-7, 2019, and advertised through the Planetary Exploration Newsletter, AAS DPS Newsletter, and other community forums. Raw survey data are at http://planetarypolicy.org/REREORG/191008_RA_REORG_Survey_Raw_Data.xlsx

Key Findings

- Program management must be knowledgeable of capabilities that must be maintained, and baseline research and the areas of cutting-edge research that need to be supported. This is a difficult task for any individual, even when one has experience as a funded researcher in the general subject matter of a program.
- The reorganization of R&A programs in 2014 was not informed by community input and was made in disregard of the Decadal recommendation that NASA "find ways to increase average grant sizes and reduce the number of proposals that must be written" by (among other things) "merging related research programs" (NRC, 2011).
- A number of unrelated programs were merged into the Solar System Workings program, proving unwieldy for managers, reviewers and proposers alike. Its preservation against breakup is supported by only 10% of the community survey.
- There is strong survey support for creating new Data Analysis Programs (DAPs) of limited duration for recent and current Discovery and New Frontiers missions. There is also support to merge the analysis of older mission data currently covered by DDAP into new core R&A programs.

Recommendations

(1) Management Operation Working Groups (MOWGs) should be restored for at least core programs (for a pre-2014 overview of planetary MOWGs, go to https://www.lpi.usra.edu/opag/nov_06_meeting/presentations/PSSMOWG.pdf). MOWGs would be comprised of scientists with expertise encompassing the span of science covered by a program. Most may be scientists funded by the program. A MOWG would be a resource for the program manager, providing insight into things such as underrepresented areas of research, new areas of research, the importance of certain techniques and facilities to a program, desired modifications of the AO, and other matters.
(2) NASA should seriously consider reconstituting the Senior Scientist program, under which experienced mid-career scientists from universities/research institutes were brought to Headquarters for a few years to run one or more R&A programs aligned with their expertise. Part of the administrative cost of this program was to provide these individuals with funding sufficient to restore them to their prior situation upon their return to their previous job. From the 1980s into the early 2000s, more than half of planetary program managers were Senior Scientists.
(3) Solar System Workings should be broken up into five core programs that are more target specific: Inner Planets and General Planetology (IPGP), Small Bodies Research and Analysis

(SBRA), Outer Worlds Research and Analysis (OWRA), Lunar Research and Analysis Program (LRAP), Mars Fundamental Research Program (MFRP)

(4) Specific mission DAPs should be created and continue for three calls after the end of a mission, after which they are merged with a core program in (3). In some cases, data volume and diversity may call for an earlier end to the program, or a much longer duration (e.g., CDAP). With regards to other existing DAPS, LDAP merges with LRAP, MDAP remains with strong support from the survey, and CDAP remains perhaps for many more years given the significant amount of work still to be done as evidenced by the number of proposals that continue to be submitted. Eventually, when it is decided to close out CDAP as an independent DAP, Cassini data analysis would continue within OWRA.

(5) All geologic mapping would move from the DAPs (including MDAP) and PDART to a pilot Planetary Geologic Mapping Program.

I. PRINCIPLES

This proposal is designed to be revenue neutral. It does not propose to reallocate existing resources from one discipline to another. However, new programs (particularly focused data analysis programs) are apt to attract a net increase in proposals for which new funding should be added to R&A.

This proposal is meant to ensure that all subdisciplines and techniques have a programmatic home or homes. This includes theoretical work, laboratory studies, field work, modeling, etc.

Comparative planetology is also important, and clear rules need to be provided in assigning program coverage.

None of this is of any value, however, without an explicit and rigorous definition of "R&A" by the next Decadal Survey (Sykes, 2020).

II. FUNDING

Given the foundational importance of R&A to NASA's mission, and given that we have continuously striven as a nation to expand the reach of our solar system exploration efforts and continue to expand the range and detail of our corresponding scientific investigations, it makes sense that funding for R&A should be substantial and also growing. NASA has failed to meet the recommendation of the last Decadal Survey in the funding of R&A, revealing what it considered to be included in R&A to be very fluid (Figure 1, discussed in Sykes, 2020).

The recommendation for funding R&A made in the first Decadal Survey (NRC, 2003) says: "The SSE Survey recommends an increase over the decade 2003-2013 in the funding for fundamental research and analysis programs at a rate above inflation to a level that is consistent with the augmented number of missions, amount of data, and diversity of objects studied." So, while NASA needs specific guidance on baseline funding for R&A, as was attempted in the last Decadal Survey, NASA needs to keep in mind that circumstances (new missions, new

discoveries, new science) can easily arise that argues for raising funding above such a baseline level.

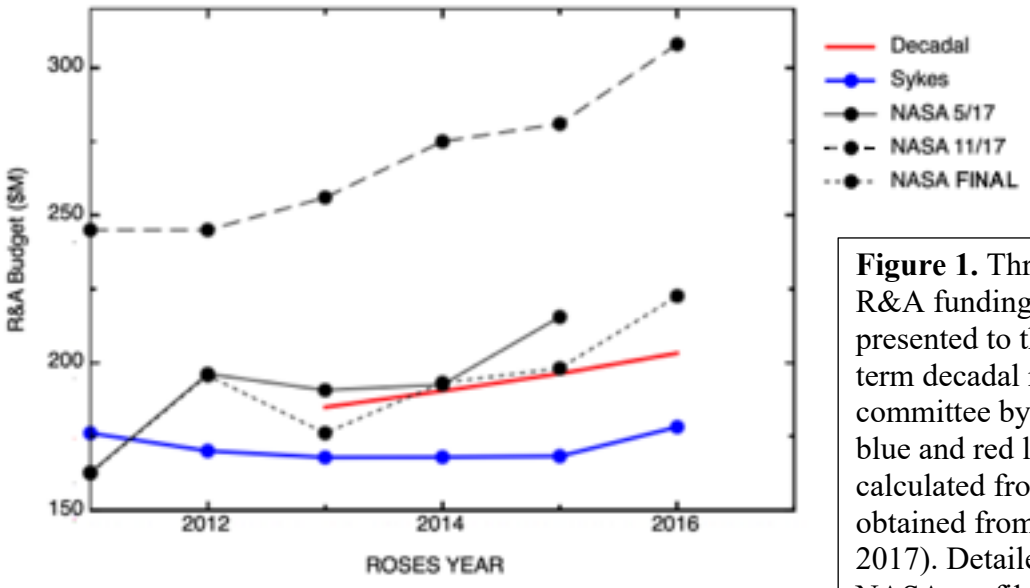


Figure 1. Three separate R&A funding profiles presented to the NRC mid-term decadal review committee by NASA. The blue and red lines were calculated from budget data obtained from NASA (Sykes, 2017). Detailed support for NASA profiles is not publicly available.

III. BREAKING UP SOLAR SYSTEM WORKINGS INTO NEW CORE PROGRAMS

Solar System Workings is broken up into the following five programs:

(1) Inner Planets and General Planetology (IPGP)

Targets covered: Mercury, Venus, Earth

This program covers fundamental Mercury and Venus science including (but not limited to) investigations of their surfaces and interiors, the evolution of their crusts and interiors, the physics and chemistry of their interiors, their atmospheres (exospheres) and their chemistry and dynamics, theoretical studies, laboratory work, and modeling. It also includes mission and other data analysis.

Comparative planetology: Science comparing Mercury or Venus to any other object, as well as research comparing the Moon and Mars with each other.

General planetology: Science that is not object- or object-class specific that seeks to improve the understanding of geological and geophysical processes in the Solar System (e.g., atmospheric dynamics, cratering in rocky targets)

Data analysis: Ground-based and space-based observations of Mercury, Venus and Earth-as-a-planet, Mariner, Pioneer, Magellan, MESSENGER, Akatsuki. Future: BepiColombo, Parker Solar Probe

Note: Planetary Geologic Mapping

The Survey indicated significant support for a new Planetary Geologic Mapping Program, which would include "non-science" maps currently submitted to PDART. We recommend that such a pilot program be established. In the event it does not command enough proposals to be considered sustainable, it is recommended that all planetary geologic mapping be supported in the Inner Planets and General Planetology program. This is at variance with the alternative provided in the survey (to distribute mapping among the core R&A programs), however considering the most popular option was to have a single stand-alone mapping program, the better alternative would be to have all mapping done within this program (as part of its General Planetology).

(2) Small Bodies Research and Analysis (SBRA)

Targets covered: Asteroids (including Vesta, Ceres), Comets, Interplanetary Dust, Meteors, Centaurs, KBOs (excluding icy dwarf planets), Interplanetary Environment, Interstellar Objects

This program covers fundamental small body science including (but not limited to) investigations of their surfaces, interiors, coma studies, space weathering, dynamical processes and evolution, collisional mechanics, theoretical studies, laboratory work, relevant meteorite studies, and modeling. It also includes mission and other data analysis.

Comparative planetology: Science comparing small bodies with Phobos or Deimos, and science comparing small bodies to OWRA targets (e.g., small irregular satellites of Jupiter and Saturn).

Data analysis: Ground-based and space-based observations (e.g., IRAS, Spitzer, Chandra) of small bodies, Vega (Halley), other Halley missions, ICE (Comet G-Z), Galileo (dust, asteroids, SL9), NEAR, Deep Space 1, Stardust/Stardust-NExT, Genesis, Ulysses, Cassini (dust), Pioneer (dust), Rosetta, Deep Impact/DIXI, Hayabusa, NEOWISE. Future: Hayabusa 2, NEOCam, Dawn (after end of DAP), OSIRIS-REx (after end of DAP), New Horizons (Arrokoth, after end of DAP), Psyche (after end of DAP), Lucy (after end of DAP)

Note: Ceres, a dwarf planet, is somewhat of an outlier here, but is included due to the large body of existing research on Ceres in the context of other asteroids in the main belt.

(3) Outer Worlds Research and Analysis (OWRA)

Targets: Jupiter system, Saturn system, Uranus system, Neptune system, Pluto-Charon system, Icy Dwarf Planets

This program supports fundamental Outer Worlds science including (but not limited to) atmospheric dynamics and chemistry, ring dynamics, magnetophysics, plasma physics, icy surface processes, interior evolution, theoretical studies, laboratory work, modeling, impact processes on their surfaces. It also includes mission and other data analysis.

Comparative planetology: Comparing Outer Worlds to Mars or the Moon.

Data analysis: Ground-based and space-based observations of Outer Worlds targets, Pioneer, Voyager, Ulysses, Galileo. Future: Europa Clipper, Cassini (after end of DAP), Huygens (after end of DAP), New Horizons (Pluto-Charon system, after end of DAP), Dragonfly (after end of DAP)

(4) Lunar Research and Analysis Program (LRAP)

Target covered: Moon

This program covers fundamental lunar science including (but not limited to) investigations of its surface and interior, the evolution of its crust and interior, the physics and chemistry of its interior, its exospheres, the interaction of its surface with the solar wind, theoretical studies, laboratory work, relevant meteorite studies, modeling, impact processes on its surface. It also includes mission and other data analysis.

Comparative planetology: No comparative planetology is supported.

Data analysis: Ground-based observations, Luna, Pioneer, Ranger, Zond, Surveyor, Lunar Orbiter, Apollo (not including samples), Hiten, Clementine, Lunar Prospector, SMART, Kaguya, Chang'E, Chandrayaan, LRO, LCROSS, GRAIL, LADEE. Future: KPLO, Chang'E

(5) Mars Fundamental Research Program (MFRP)

Note: There was strong survey desire (75%) not to merge MFRP and MDAP

Targets covered: Mars, Phobos, Deimos

This program covers Mars fundamental/basic research, including modeling, theoretical work, laboratory studies, and terrestrial field studies that improve understanding of features and processes on Mars and past and future in situ measurements on Mars.

Comparative planetology: No comparative planetology is supported.

Data analysis: Separately covered by MDAP (including ground-based and space-based observations of Mars).

Note: In future AOs, what laboratory work that is covered by MFRP and MDAP must be more clearly distinguished than in the past.

IV. RESTRUCTURING DATA ANALYSIS PROGRAMS

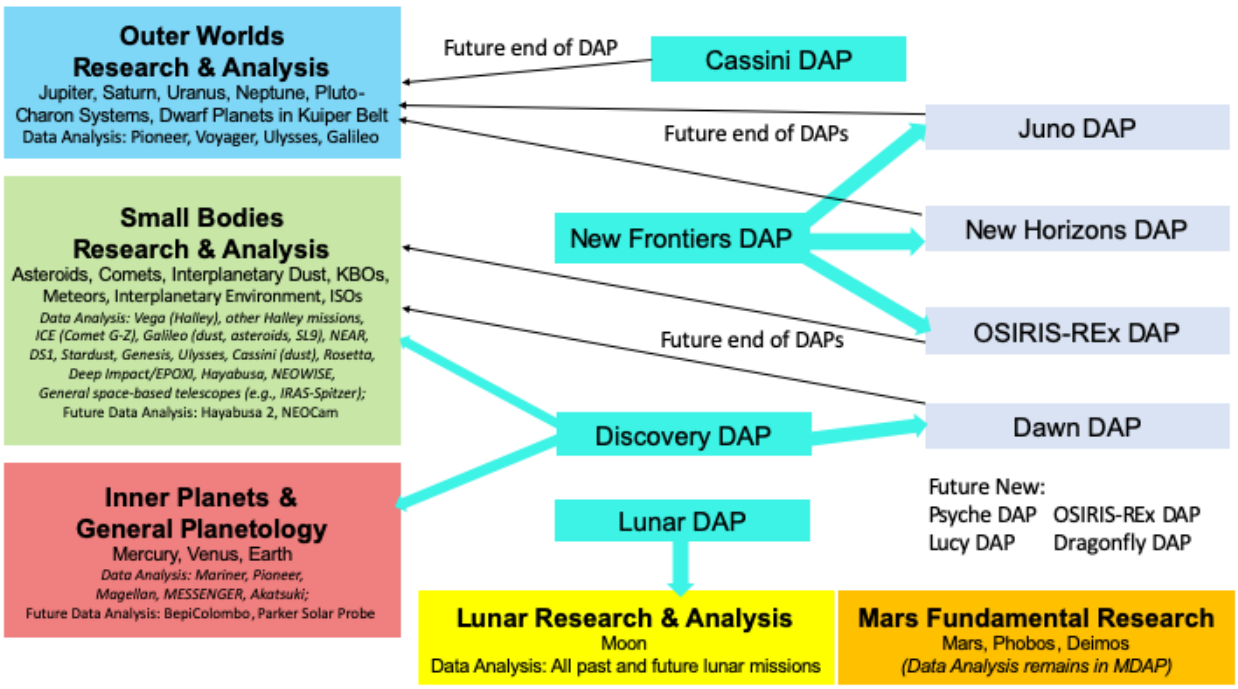
There is strong survey support for creating new DAPs of limited duration for recent and current Discovery and New Frontiers missions. There is also support to merge the analysis of older mission data currently covered by DDAP into SBRA or IPGP. This results in our proposal to form four new DAPs from DDAP and NFDAP:

Juno DAP
New Horizons DAP
OSIRIS-REx DAP
Dawn DAP

It is proposed that the duration of specific mission DAPs continue for three calls after the end of a mission. In some cases, data volume and diversity may call for an earlier end to the program, or a much longer duration (e.g., CDAP).

With regards to other existing DAPS, LDAP merges with LRAP, while MDAP remains as a separate program with strong support from the survey, and CDAP remains perhaps for many more years given the significant amount of work still to be done as evidenced by the number of proposals that continue to be submitted. Eventually, when it is decided to close out CDAP as an independent DAP, Cassini data analysis would continue within OWRA.

Under this proposal, all geologic mapping would move from the DAPs (including MDAP and PDART) to a Planetary Geologic Mapping Program (see Note within the IPGP description above).



V. CONTINUING PROGRAMS

Programs by Targets:

Mars Data Analysis Program (MDAP)
Cassini Data Analysis Program (CDAP)
Exoplanets (XRP)

Specific Science/Techniques Focus:

Solar System Observations (SSO)
Near-Earth Object Observations (NEOO)
Exobiology (EXOBIO)
Emerging Worlds (EW)
Habitable Worlds (HW)
Laboratory Analysis of Returned Samples (LARS)

Note: The survey provides strong support to fund the analysis of Apollo samples within LARS.

Technology:

Development and Advancement of Lunar Instrumentation (DALI)
Planetary Science and Technology Through Analog Research (PSTAR)
Planetary Instrument Concepts for the Advancement of Solar System Observations (PICASSO)
Maturation of Instruments for Solar System Exploration (MATISSE)

Archiving:

Planetary Data Archiving, Restoration, and Tools (PDART)

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