

PSD Research and Analysis Programs

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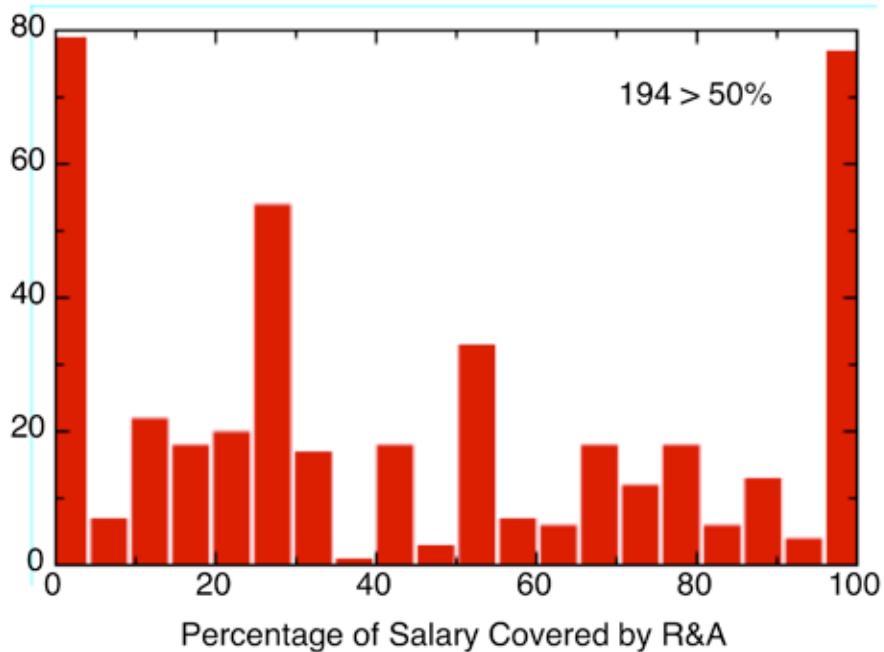
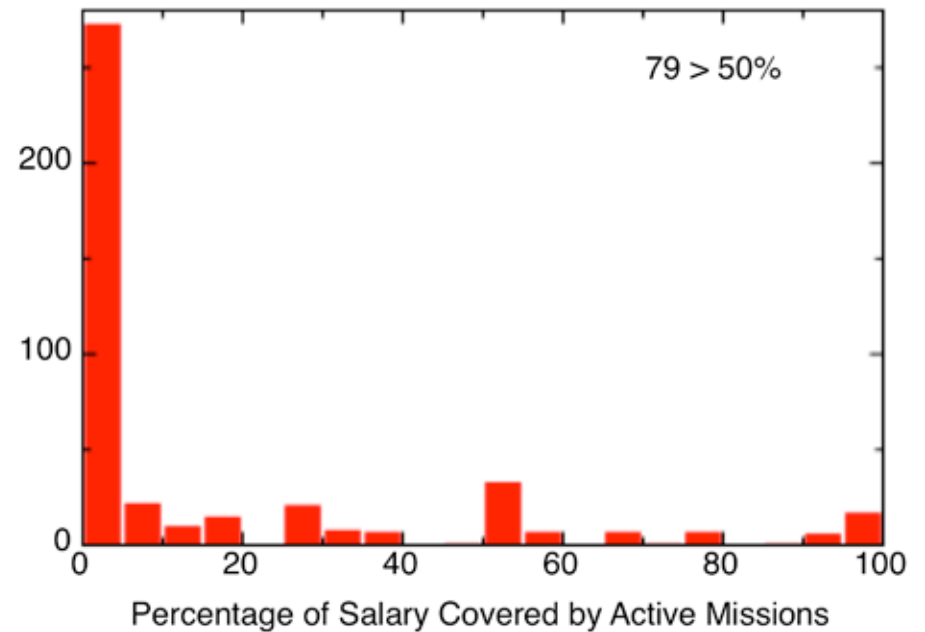
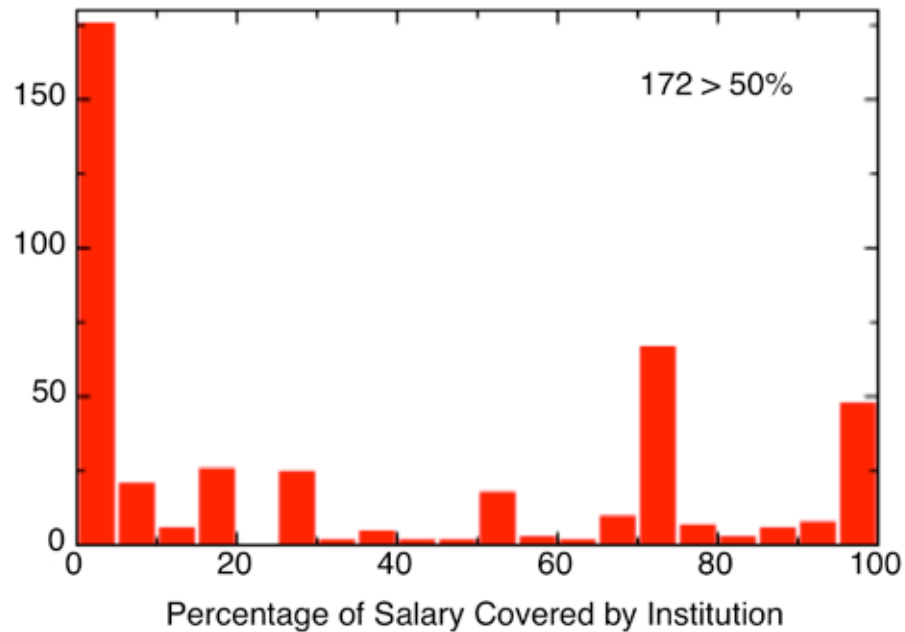
1/23/13

“In areas where NASA is the principal source of funding, funding volatility may have a disproportionately negative impact on the corresponding workforce. Newly funded areas may not be able to tap a sufficient population of scientists and engineers to make progress. Sudden decreases in funding in another area may cause scientists to exit that area or new graduates to not enter it, disrupting the workforce for years to come.”

An Enabling Foundation for NASA's Space and Earth Science Missions, NRC 2010

82% of funding for planetary research is from NASA.

Derived from the 2011 Survey of the Planetary Science Workforce, AIP



Sources of funding for which planetary scientists depend for more than 50% of their salary:

18% Active missions

39% Institutional support (including CS)

44% R&A programs

PSS Community Survey (445 Respondents),
October 2010

Planetary Science Operating Missions by Year 2012-2022

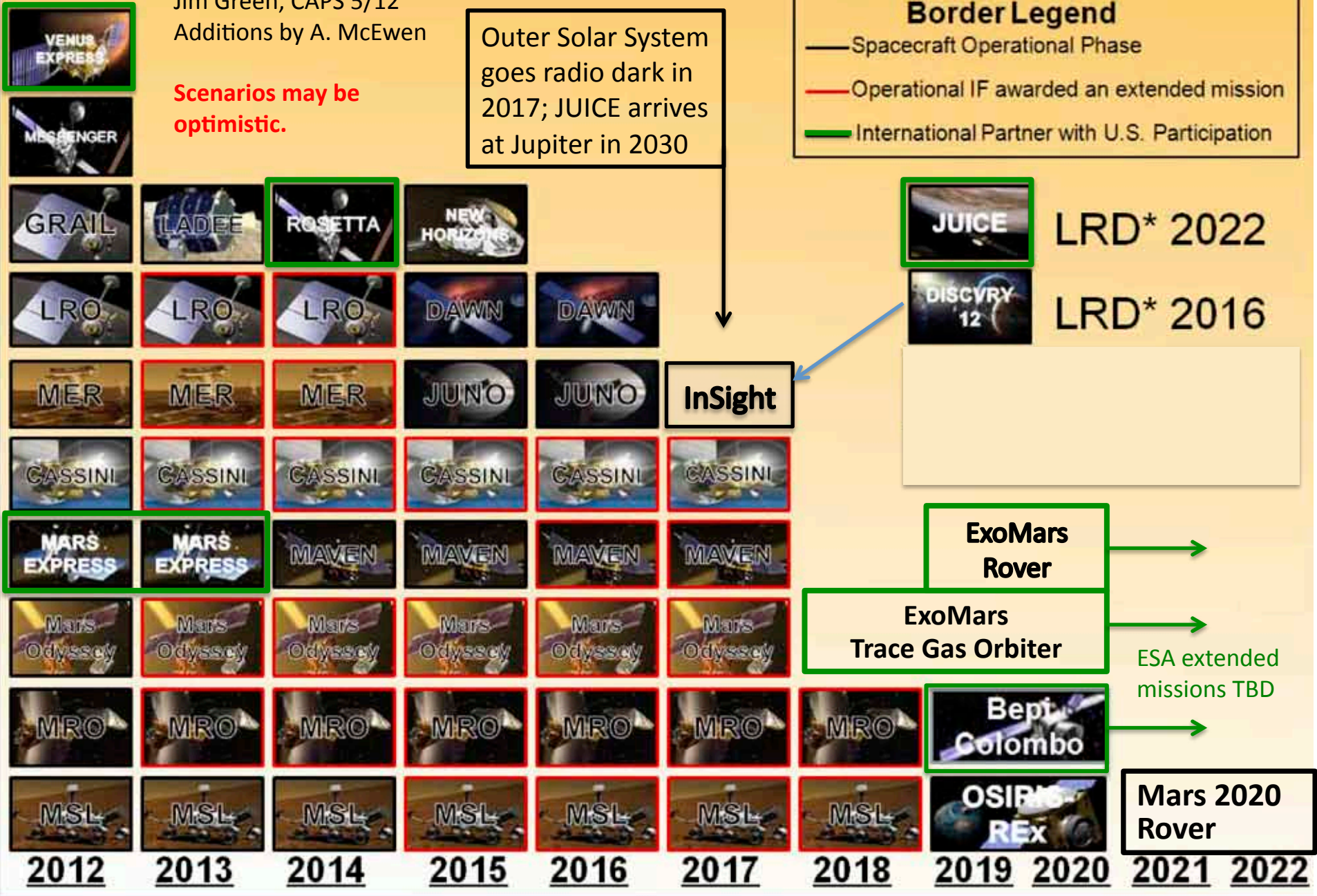
Jim Green, CAPS 5/12
 Additions by A. McEwen

Scenarios may be optimistic.

Outer Solar System goes radio dark in 2017; JUICE arrives at Jupiter in 2030

Border Legend

- Spacecraft Operational Phase
- Operational IF awarded an extended mission
- International Partner with U.S. Participation



JUICE LRD* 2022

DISCVRY 12 LRD* 2016

ExoMars Rover

ExoMars Trace Gas Orbiter

ESA extended missions TBD

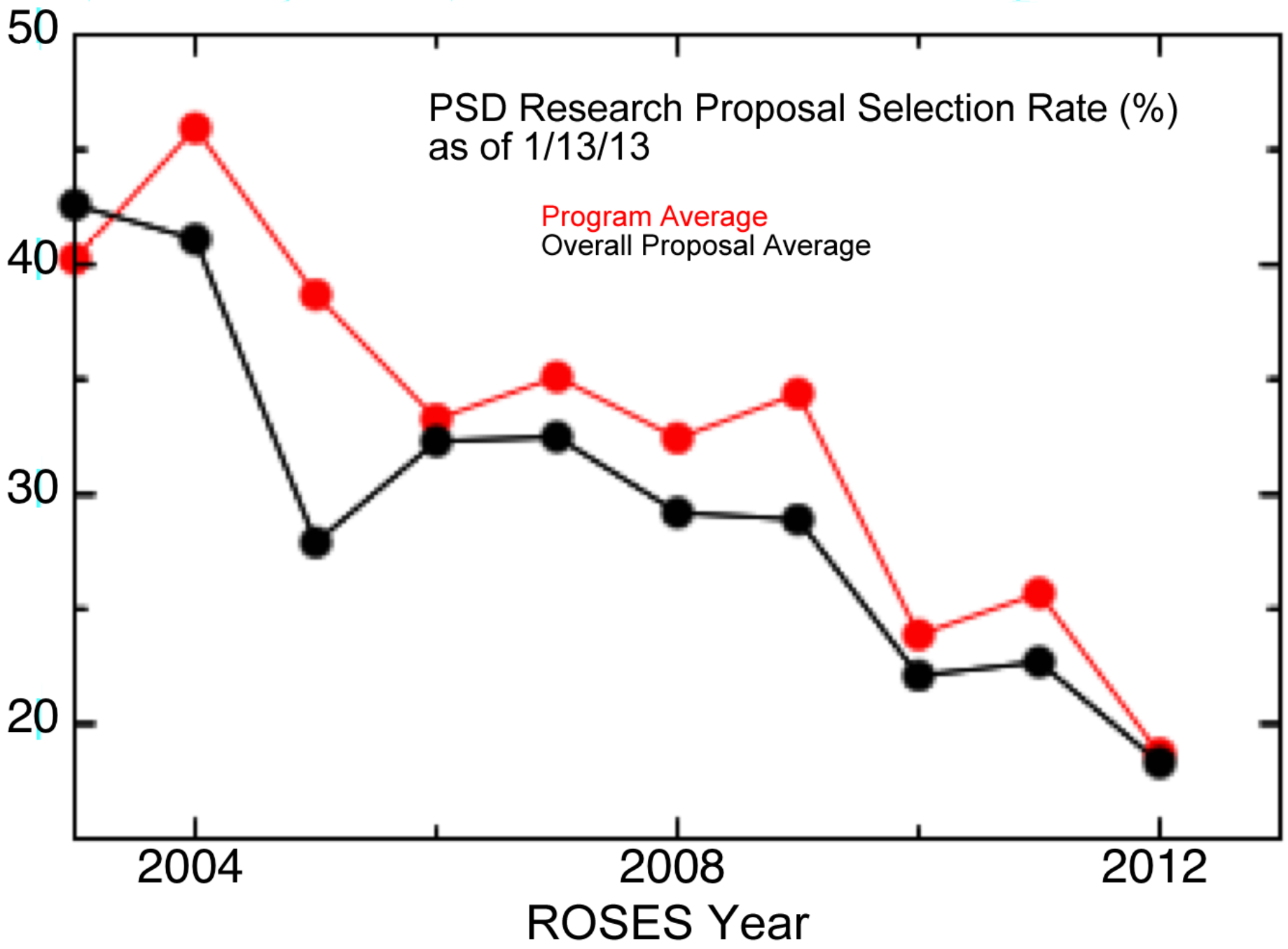
Bepi Colombo

Mars 2020 Rover

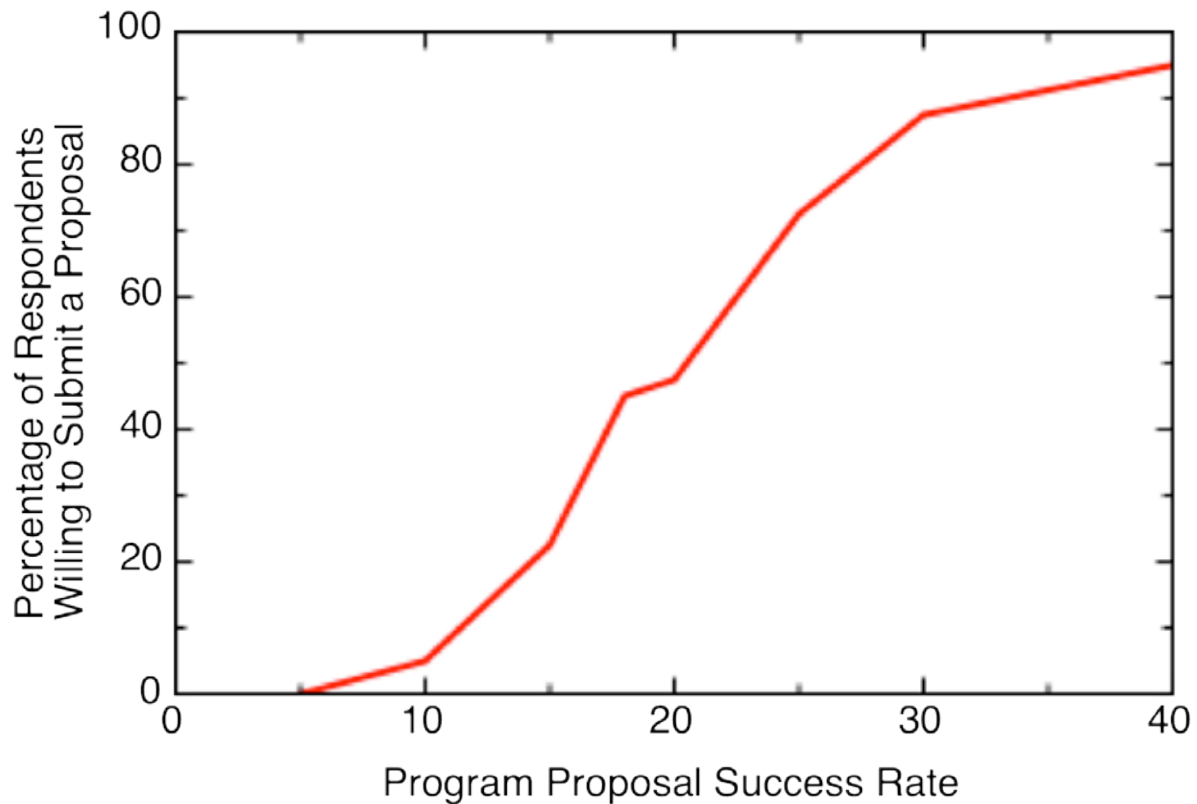
Prospect:

Significant reduction in NASA missions and mission targets (largely the consequence of the collapse of the Discovery program post-2001, which had selected two missions for flight on 24 month intervals. This will shift a significant fraction of mission scientists onto R&A programs for support, causing predictable workforce instability.

However, R&A programs are already under stress.

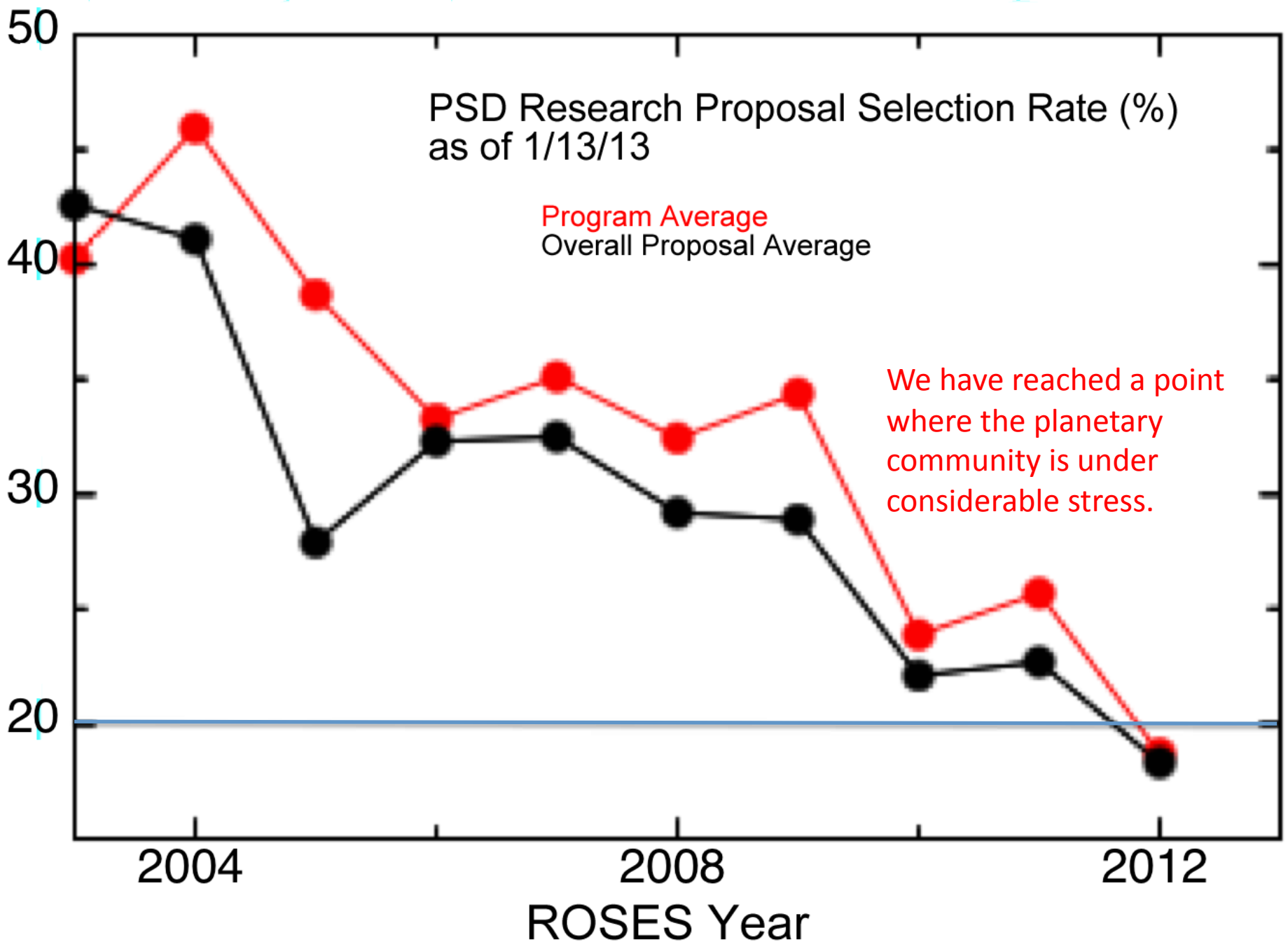


Below what percentage would you consider it not worthwhile to spend your time writing and submitting a proposal to that program?



When a program gets down to a success rate of ~20% (1/5), most people are not interested in investing the time in writing a proposal to it.

From MVS presentation to PSS on results from Proposal Success Rate Survey (Unofficial), October 2010



Reactions:

Testimonial statements primarily by early to mid-career planetary scientists were solicited and posted (with personal information removed) at:

<http://planetarypolicy.org>

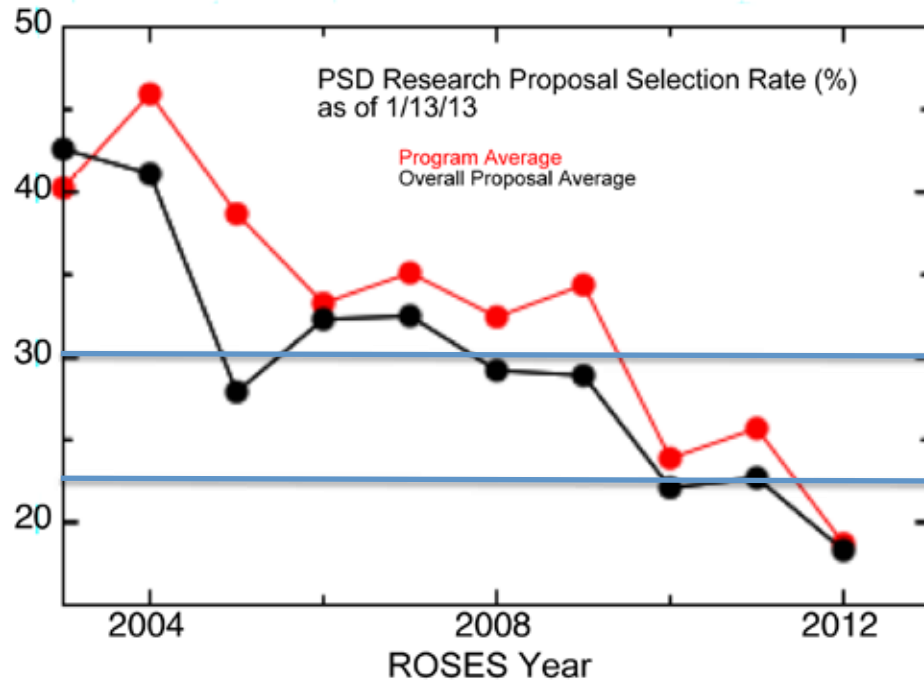
Similar postings are found on Facebook at Young Scientists for Planetary Exploration.

Summary:

Success rates are reaching or have reached a level at which it is not possible to sustain a career in planetary science. People are looking for alternative careers, particularly those whose incomes are needed to support young families.

“I think it is time to tell U.S. planetary science students and young scientists the simple truth, so they can reconsider their career paths.” *Alfred McEwen, Letter to Colleagues, 12/27/12 (private communication – “My intent is not to try to scare anyone away from the field, but to tell them what to expect so they can make informed decisions.”)*

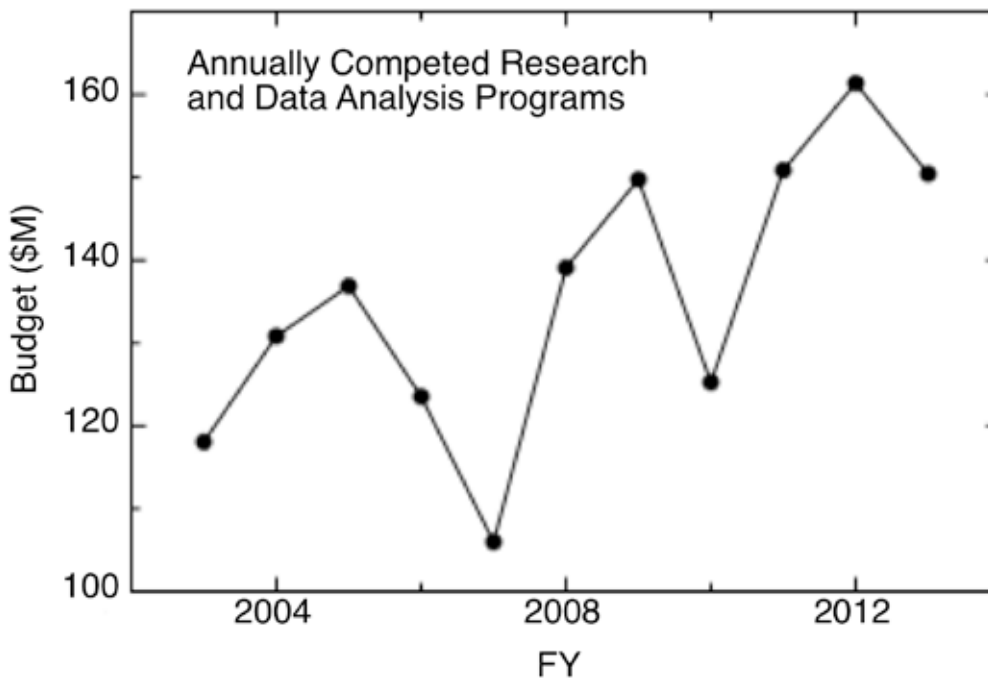
Explaining the Decline in Overall Selection Rates for ROSES 10 & 11 (FY 11 & 12)



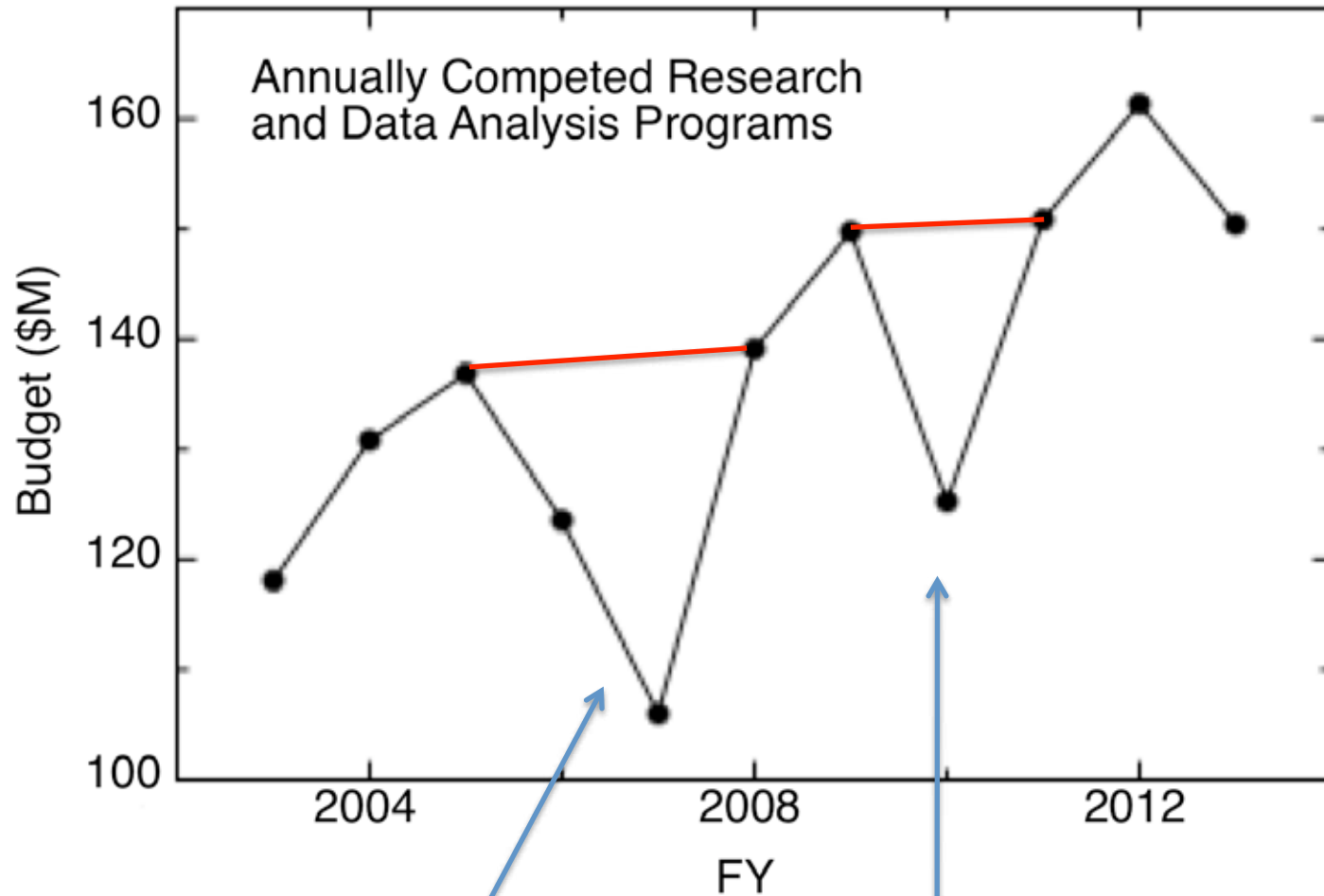
30%

22.5%

Consider the annually competed R&A programs which are of immediate concern and for which the selection statistics have been primarily calculated:



- Planetary Geology & Geophysics (PGG)
- Cosmochemistry
- Planetary Astronomy (PAST)
- Planetary Atmospheres (PATM)
- Origins of the Solar System (Origins)
- Astrobiology Science & Technology for Exploration of Planets (ASTEP)
- Exobio/Evolutionary Biology (EXO)
- Lunar Advanced Science & Exploration Research (LASER)
- Moon and Mars Mission Activities (MAMMA)
- Sample Return Laboratory Instrument & Data Analysis Program (SRLIDAP=LARS)
- Planetary Mission Data Analysis Program (PMDAP = Discovery DAP)
- Cassini DAP
- Outer Planets Research (OPR)
- Mars Fundamental Research (MFR)
- Mars Data Analysis Program (MDAP)



Contribution to support CEV & CLV
 (M. Cleave, SMD Operating Plan Cover Letter,
 3/13/06) – Astrobiology programs severely
 impacted.

Rephasing of ~\$25M primarily over
 next two fiscal years. Without
 additional funds, rephased
 obligations are removed from funds
 otherwise used for new awards.

Calculation (real back of the envelope):

Assume 1/3 of an R&A program budget is for new awards.

Funds for new awards in FY 11 + FY 12 are
 $(\$150.9\text{M} + \$161.4\text{M}) / 3 = \$104\text{M}$

All things being equal, the reduction in selection rates would equal the fractional reduction in funds available for new awards. The average selection rate from ROSES 2005-2009 was ~30%.

$$(1 - \$25\text{M} / \$104\text{M}) * 30\% = 22.8\%$$

Which pretty much reproduces the average reduced overall selection rates for FY11 and FY12. It was reported in a PSS meeting at the time that the funds made available by rephasing were expensed on MSL cost overruns.

R&A Selection Rates in FY 13 (as of 1/23/13):

The exceptionally low selection rates for Planetary Astronomy and Planetary Atmospheres (12% and 11%, respectively) caused great consternation in anticipation of their being reproduced in other programs. The program statistics for selections announced this fiscal year are:

	Sub	Sel	%Sel	Av Y1	NOTE
Planetary Atmospheres (PATM)	90	10	11	112	Halving of selection rate due to program budget cut.
Planetary Astronomy (PAST)	42	5	12	85	Halving of selection rate due to program budget cut.
Cassini Data Analysis	112	19	17	95	Decrease in selection rate attributable to increased # proposals.
Cosmochemistry	85	16	19		Decline from 34% in FY12 and >40% in prior years unexplained.
Mars Fundamental Research (MFRP)	122	30	25		Higher than 16% in FY12, but closer to recent year averages.
Laboratory Analysis of Returned Samples (LARS=SRLIDAP)	24	8	33		Increase from 29% in FY12, but lower than >40% in prior years, unexplained.

The systematic decline in Planetary Astronomy since 2009 (\$10.7M) to today (\$8.5M) is unexplained. This is exacerbated by the fact that this budget includes facility costs for the IRTF. Similarly, the decline of Planetary Atmospheres from 2009 (\$9.9M) to today (\$7.9M) is unexplained.

Implications:

The annually competed R&A programs seem to be treated as a contingency reserve fund, without regard for the workforce impact caused by funding instabilities in these programs. This has severe consequences to scientific capabilities supporting US solar system exploration, that can be long-term.

“PSD Policy - Funding distribution: Flight programs before R&A programs”

Jim Green, Presentation to PSS, 12/21/12

Problem: Upon questioning of Jim Green during the 12/21/12 PSS fact-finding telecon, apart from a few “technology programs” (which are largely book-kept under R&A) everything else in the PSD budget was considered a “flight program”. This reinforces the role of R&A programs as a contingency reserve fund for PSD.

What is the Role of the R&A Programs?

“The scope of Planetary’s mission supporting R&A is very broad, addressing NASA goals and providing the foundation for the formulation of new scientific questions and strategies for accomplishing those goals. R&A will provide new theories and instrumentation concepts that will enable the next generation of flight missions. Discoveries and concepts developed in the R&A project aid in the genesis of scientific priorities, missions, instrumentation, and investigations. R&A supports research tasks in areas such as: astrobiology and cosmochemistry; the origins and evolution of planetary systems; and the atmospheres, geology, and chemistry of the solar system’s planets, other than Earth. R&A provides for instrument and measurement concepts, and supports the initial definition of mission concepts and development of instruments for future Discovery, New Frontiers, Mars, or outer planets missions.”

President’s FY13 NASA Budget Proposal, under Planetary Science Research
– Non-Operating Missions – Research and Analysis (Note: additional data analysis programs considered “R&A” are book-kept under various mission lines.)

Can planetary missions be undertaken without R&A?

NO.

Is mission development and mission data analysis the only role of R&A?

Interesting question.

“NASA is at the leading edge of a journey of scientific discovery that will yield a profound new understanding of our solar system. **Robotic exploration is the current approach to planetary science** and is the necessary precursor to the expansion of humanity beyond Earth. **Ground-based observations supplement our space-based assets.** In the future, humans will go to and explore the Moon, asteroids, Mars, and ultimately other bodies.”

2010 Science Plan for NASA's Science Mission Directorate

*Suggests that we do missions,
with some help from ground-based telescopes,
all at some point to be replaced by human exploration.*

“NASA’s goal in Planetary Science is to ‘Ascertain the content, origin, and evolution of the solar system, and the potential for life elsewhere.’ Underlying this goal are the themes of comparative planetology and habitability—the capacity of an environment (which pertain to an entire planet) to harbor life in the past, present, or future. We pursue this goal by seeking answers to fundamental science questions that guide NASA’s solar system exploration:

- What is the inventory of solar system objects and what processes are active in and among them?
- How did the Sun’s family of planets, satellites, and minor bodies originate and evolve?
- What are the characteristics of the solar system that lead to habitable environments?
- How and where could life begin and evolve in the solar system?
- What are characteristics of small bodies and planetary environments that pose hazards and/or provide resources?”

2010 Science Plan for NASA’s Science Mission Directorate

To be addressed only to the extent allowable by spacecraft?

The strategic goal of the NASA Planetary Science Division and the fundamental science questions that guide NASA's solar system exploration in pursuit of this goal cannot possibly be addressed by missions alone. Basic research, funded by the R&A programs, is an essential and independent component.

So, R&A programs serve two functions:

- (1) Provide the context within which missions are defined and their data understood, and maximize the return from missions through the analysis of their data.
- (2) Directly support, along with missions, the pursuit of the strategic goal of the NASA Planetary Science Division.

R&A may also be argued to support a third function: to provide resources to train the next generation of planetary scientists.

Recommendations regarding R&A's role:

Activities and requirements should flow down from strategic goals. Budget requests and other documents should reflect this or strategic goals should be modified accordingly.

R&A required to address the planetary strategic goal should be supported.

NOTE: Theoretically, all R&A can be justified as being mission-supportive. However, when missions are focused on a narrow suite of targets, a strictly mission-focused R&A program may fail to adequately support the broader planetary strategic goal.

Managing and Supporting R&A Programs:

“The committee recommends that NASA increase the research and analysis budget for planetary science by 5 percent above the total finally approved FY2011 expenditures in the first year of the coming decade, and increase the budget by 1.5 percent above the inflation level for each successive year of the decade.”

“If cuts to the program are necessary, the committee recommends that the first approach should be descoping or delaying Flagship missions. Changes to the New Frontiers or Discovery programs should be considered only if adjustments to Flagship missions cannot solve the problem. And high priority should be placed on preserving funding for research and analysis programs and for technology development.”

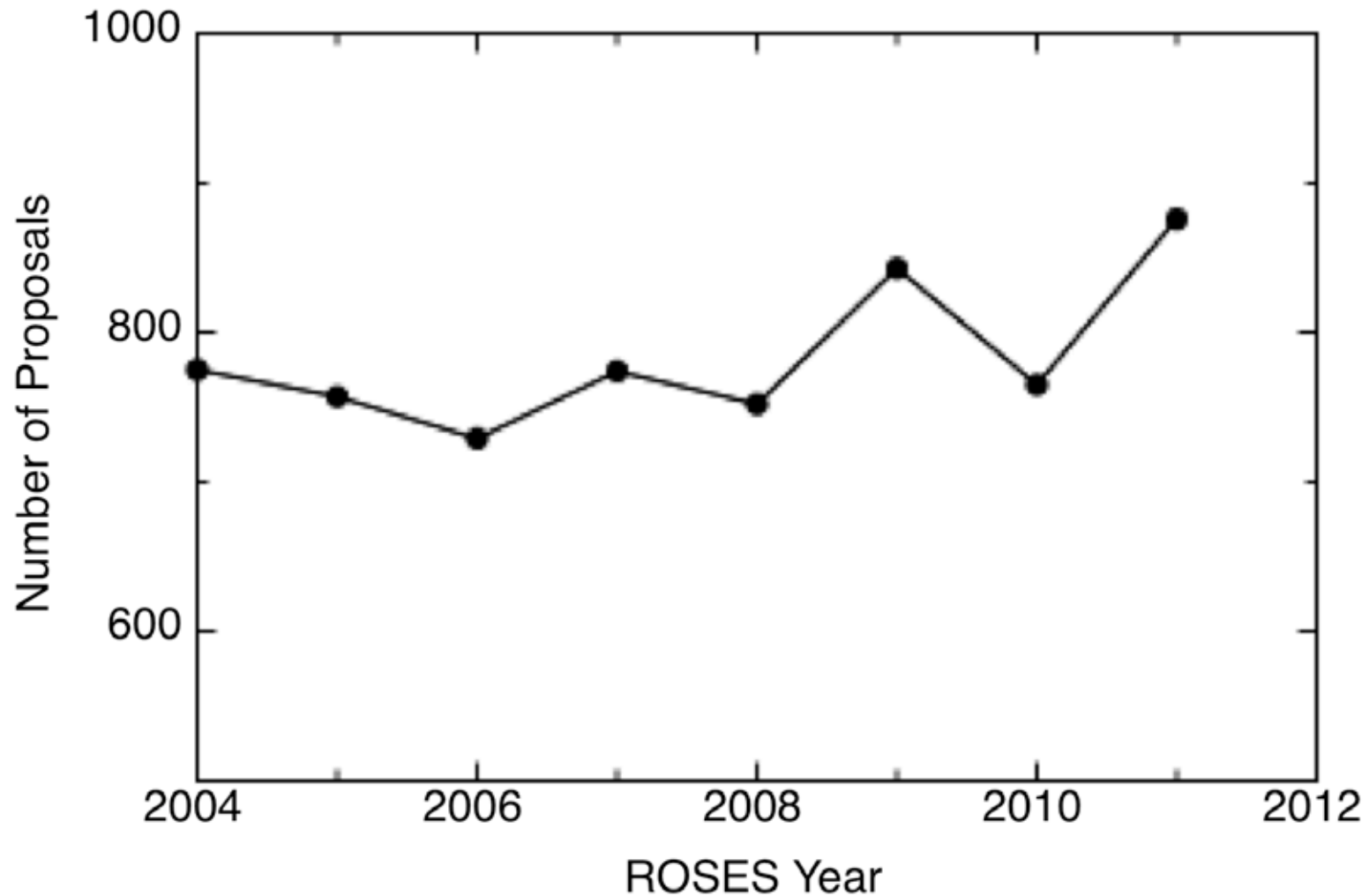
Vision and Voyages for Planetary Science in the Decade 2013-2022, NRC 2011

The Planetary Decadal Survey and prior NRC studies recognize the importance of the R&A programs, even in the context of NASA planetary as a “mission-centered” enterprise. They are often referred to as the “seed-corn” of the planetary program. Funding stability and predictability are essential as a consequence of the negative, inelastic consequences of funding volatility.

Recommendations:

- (1) R&A programs should not be treated as contingency reserves.
- (2) In FY13, individual programs should be funded at a level that, at a minimum, allows for a 30% selection rate or a number of new awards comparable to more historical averages.
- (3) R&A budget planning and commitments should be multi-year (like a mission), allowing program officers to effectively manage their programs and allowing the planetary community to have reasonable expectations based on program stability and predictability.
- (4) PSD needs to determine, in detail, the potential impact of mission reductions to R&A programs, and create a plan to mitigate that impact in the context of workforce management needs in anticipation of a future restoration of the Discovery program (if that is the plan). This might require significant budget increases to some R&A programs in future FYs.

Backup Slides



Number of proposals submitted to 10 programs (EXO, Cosmo, LARS, MDAP MFR, OPR, PAST, PATM, PGG, PIDDP) for which statistics are available for all years plotted. The modest growth in the number of proposals submitted, if extrapolated across all programs, is insufficient to explain the steeper decline in selection rates over the same period. Unfortunately, statistics on average Year 1 award sizes are relatively sparse.