Response to the High Risk/High Reward Charge

Charge to the SMD Advisory Committees: Review NASA SMD R&A Methods to Foster High-Impact Research

Purpose: Determine how SMD's Research and Analysis (R&A) program can foster and enable, in the best way, potentially high-impact and highly innovative endeavors, while preserving important foundational and/or more gradual research activities, to the benefit of the nation and scientific community. Both content and process aspects (which are connected) will be involved.

- Originated from a letter from Thomas Zurbuchen dated May 7, 2017.
  - **Purpose:** Determine how SMD's R&A program can foster and enable, in the best way, potentially high-impact and highly innovative endeavors, while preserving important foundational and/or more gradual research activities, to the benefit of the nation an scientific community. Both content and process aspects (which are connected) will be involved.
  - **Task:** Deliberate and provide written advice on the two question posed below, utilizing the full capabilities of the NAC Science Committee and the four new SMD division committees […]. Each committe is asked to review materials , represent the views of the scientific community, and draw on member experience with both SMD and the research programs. The advice delivered should address the issues at a tactical use-focused level, rather than focus on generalities at a stratetgic level. Each question should have an answer which includes options and solutions and their associated pros/con, as well as any supporting data for a given option.
- The APAC heard a presentation from Michael New on July 19, 2017, that described the charge in more detail. In that presentation, it was stated that "This task has been formulated by SMD (Front Office, Division Directors, R&A Leads & Division Advisory Committee Executive Secretaries)."

Two questions asked of the ACs.

- Does the SMD R&A program have effective processes in place to solicit, review, and select high-impact/high-risk projects?

- Does the SMD R&A program have effective processes in place to solicit, review, and select focused, interdisciplinary, and interdivisional projects?

Naturally, there are sub-questions

From Michael New's Presentation

For high-impact/high-risk research:

a) What is your committee's working definition of a high-impact project? A high-risk project?

b) Are there aspects of the solicitation, review and selection process that could be added, removed or modified that would allow SMD to more effectively elicit and support high-risk/high-impact projects or, is the current practice of soliciting by topic and evaluation for merit followed by flagging high-impact/high-risk projects for the selection official adequate?

c) If it were to be recommended that solicitations or evaluation methods be modified for high-impact/high-risk projects, how should these be designed?

d) Acknowledging the value of incremental progress on achieving strategic objectives, and thus recognizing that much of the research that SMD supports will be of moderate impact, how should SMD determine the correct balance between moderate impact research and high-impact/high-risk research?

Naturally, there are sub-questions

From Michael New's Presentation

For interdisciplinary and inter-divisional research:

a) How should SMD determine the right balance between division-specific and interdivisional research?

b) Once determined, does SMD have effective processes in place to achieve this balance?

c) How should each of SMD's divisions determine the right balance between discipline-focused and interdisciplinary research?

d) Once determined, do SMD's divisions have effective processes in place to achieve this balance?

e) Is SMD missing out on important interdisciplinary and/or interdivisional work because of the way in which we solicit, review, and select projects? If so, what specific research foci are missing?

f) Are there aspects of the solicitation, review and selection process that could be added, removed, or modified that would allow SMD to more effectively elicit and support interdisciplinary and or interdivisional projects?

g) If it is recommended that solicitations or evaluation methods be modified for interdisciplinary and/or interdivisional projects, how should these be designed?

h) What role, if any, should collaborative research structures such as NIH-style "Program-Project" grants, virtual institutes (the NASA Astrobiology Institute (NAI) and Solar System Exploration Research Virtual Institute (SSERVI)) and research coordination networks (the Nexus of Exoplanetary System Science (NExSS)) play?

COPAG's Response

- High Risk-High Reward: A project that has the potential for impactful scientific outcome, but also carries high risk, due to factors including, but not limited to, unique or difficult observation or analysis techniques, or new technology development or usage.

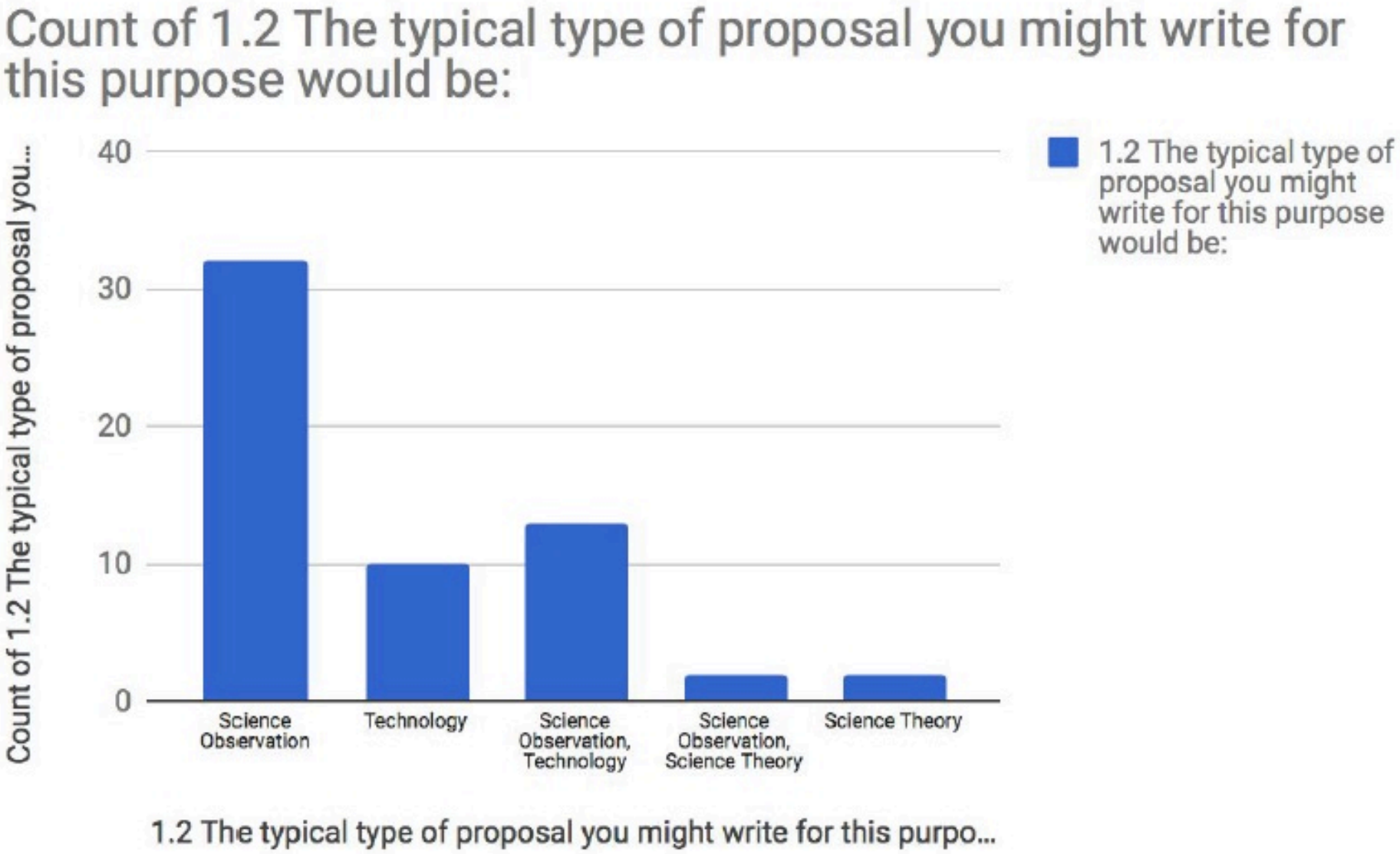
- Interdisciplinary and InterDivisional: A topic that crosses one or more programmatic borders within NASA. Examples might include high-redshift GRBs (of interest to both Cosmic Origins and Physics of the Cosmos), star formation (of interesting to Cosmic Origins and Exoplanet Exploration), or comparative planetology (of interest to both Astrophysics and Planetary Science).

COPAG's Response

Demographics

Number of respondents: **59**

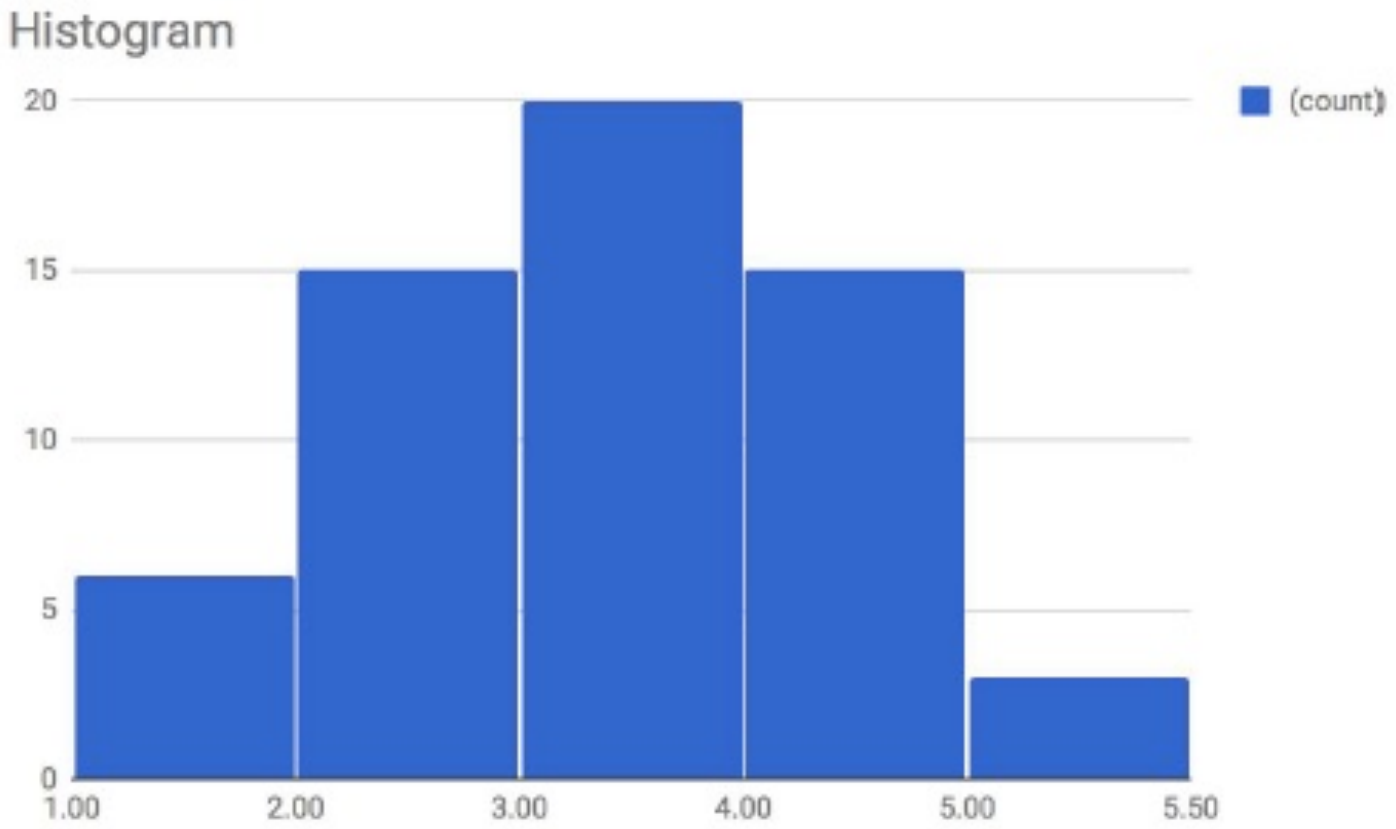
COPAG's Response



COPAG's Response

2.1 How strongly do you agree/disagree with the statement, on scale of 1-5:

The current practice of soliciting by topic and evaluation for merit, followed by flagging high-impact/high-risk projects for the selection official, is adequate.
1=Strongly Disagree; 5=Strongly Agree



COPAG's Response

There are definitely hurdles to getting high-risk/high-reward projects (of all sorts - technological, observational, theoretical) getting funded. These include, but are not limited to:

- Panels are too conservative, risk adverse, and ingrained, and tend to prefer incremental but 'safe' proposals over possibly transformative proposals that have a more significant chance of failing (or a less predictable chance of success).
- "High risk/high reward proposals simply cannot compete with incremental continuation of well-established projects."
- Many attributed this to oversubscription (we need more money for R&A!)
- Practical limitations were also considered a significant factor (new ideas require more explanation, and thus may run into page limitations).

COPAG's Response

There was little consensus on the appropriate solution. Among those suggested:

- Set aside a small fraction of the funding in existing calls for these proposals.
- Have an explicit call for such proposals (one person suggested 5-10% of funding go toward a separate call).
- Change the review/proposal process:
  - Direct the reviewers to identify high-risk/high-reward proposals.
  - Direct them not be be as risk adverse.
  - Create a separate category for such proposals.
  - Bring in an external group of experts.
  - Have less specific proposal calls.

COPAG's Response

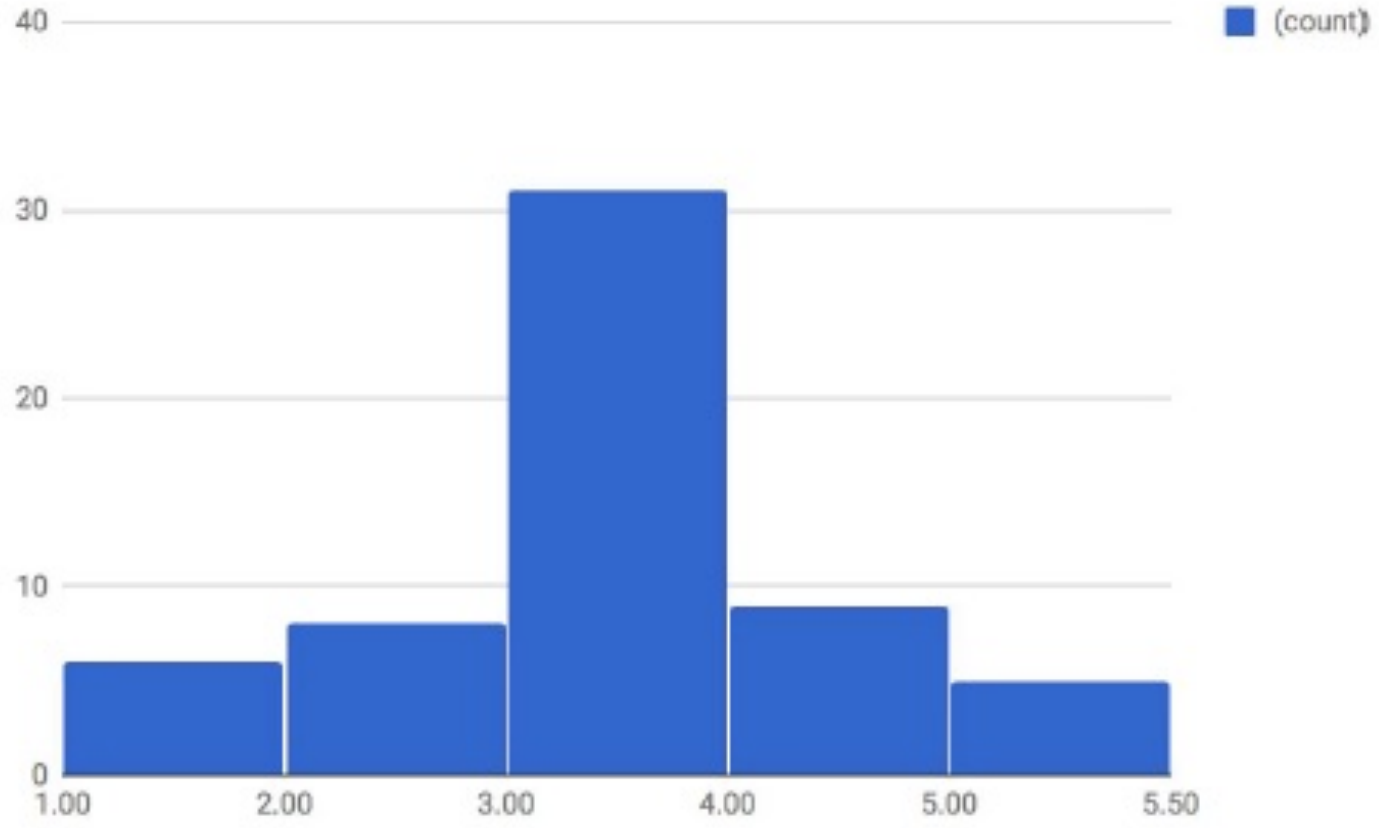
Provide specific examples where high risk/high reward proposals have or have not been selected:

- High risk technology proposals require appropriate reviewers.
- Interferometry (SIM and TPF-I fall-out).
- Poorly rated innovative University group proposals passed over for incremental proposals from NASA centers.
- Innovative detector proposals
- "They do not get written in the first place"

COPAG's Response

3.1 Similarly, how strongly do you agree/disagree with the statement, on scale of 1-5:

The current practice of soliciting by topic and evaluation for merit, followed by flagging important interdisciplinary and/or interdivisional projects for the selection official, is adequate.
1=Strongly Disagree; 5=Strongly Agree



COPAG's Response

Is the current practice of soliciting by topic and evaluation for merit, followed by flagging interdisciplinary and/or interdivisional projects is adequate?

- There seemed to be a general consensus that reviewers tend to be picked from a narrowly-defined fields, and there exists some 'territorial' tendencies toward funding.
- A key challenge is assembling panels with diverse backgrounds.
- Narrow solicitations would allow informed panels with higher acceptance fractions; interdisciplinary proposals are especially hard to review.

Future Activities.

- “We are now asking peer review panels to identify HR/HR proposals (started recently).”
- “After a year or two we can show some statistics (e.g., do proposals that the panel think are HR/HR have lower average grades?)

-Paul Hertz

Conclusion of HR/HR Activity (this meeting).

- Each committee is requested to provide a presentation to the DD, as well as a letter.
- Chair of each division committee is requested to make a presentation at the SC meeting. SC deliberates and produces written answers (could be recs/findings). SC Chair provides a summary and overview presentation to the SMD AA, as well as a letter.