A Front Row Seat to the NASA Proposal Review Process by Roger Varney

Earlier this fall I had an opportunity to see how NASA proposals are reviewed first-hand, and (as a postdoc who has never written a proposal) it taught me a great deal about proposal writing. One of my coworkers at HAO was appointed as a reviewer, and she recommended me to the panel conveners as someone who could serve as the panel’s executive secretary, a position usually filled by an early career scientist. A NASA panel is composed of ten members: eight voting scientists, one non-voting NASA representative who ensures that the other panelists follow NASA’s reviewing guidelines, and one non-voting executive secretary. The executive secretary’s job is fairly easy; I had to tally votes, enter information into various Excel spreadsheets, keep track of the sheet which detailed which panel member had a conflict of interest on which proposal, and other miscellaneous administrative tasks. This was a worthwhile use of my time, however, because I got to sit in the room silently listening to the entire review process.

NASA proposal reviews are single-blind, meaning that the identities of the reviewers are never revealed to the proposers. Thus I am not going to say which specific panel I was on, what the proposals were about, or who the proposers and panelists were. Instead I am going to share general information about the mechanics of the process with an emphasis on aspects that changed the way I thought about proposal writing. The information I am sharing is specific to NASA, but much of it probably applies to other agencies as well.

The purpose of the review panel is not to select which proposals get funded, but instead to provide grades and critical reviews of the proposals. These reviews are then used by the NASA program directors to decide how to allocate funding. The panelists are instructed to review each proposal on its own merits, not in relationship to the other proposals. Even though the panelists know who the proposers are, they are instructed to judge the proposal entirely on the text of the document itself with no consideration for the reputation and past record of the authors. The reports

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must follow specific semantic conventions to ensure that they address the text of the proposal and do not contain personal critiques of the authors. For example, the phrase “these authors are clearly ignorant of the work of Famousguy et al. (xxxx)” is unacceptable, but the phrase “the proposal does not clearly state how the proposed work will provide more than incremental improvements over what has already been accomplished by Famousguy et al. (xxxx)” is acceptable. Furthermore, the panelists ignore what the proposals will cost unless they believe that the cost estimates provided are too low to achieve the objectives of that proposal, in which case they would note that concern in the report. Ultimately, the program directors compare the proposals and consider questions like “do we want to fund this one expensive proposal or these two less expensive proposals?” and “are these two proposals too similar for us to fund them both at the expense of other research areas?”

The submitted reports follow a rigid format. They begin with a summary of the scientific objectives of the proposed work and the methodologies to be utilized. Then there are four sections that list the scientific strengths, scientific weaknesses, methodology strengths, and methodology weaknesses, respectively. Each strength and weakness is categorized as major or minor, and a short paragraph is written describing each one. Next comes a summary section, which summarizes the major strengths and weaknesses, then a grade on a 9-point scale (Poor, Fair, Good, Very Good, and Excellent with half grades between those marks) and a final section for comments to NASA. Everything in this report except the final section gets sent back to the proposers. Thus these reports not only serve to advise the NASA program directors but also to give feedback to the proposers.

In my opinion, the most striking linguistic peculiarity of these reports is the use of the words “compelling,” “important,” and “interesting.” In NASA language these adjectives have codified and specific meanings: “compelling” means we must find a way to do this, “important” means we give this a high priority, and “interesting” means we would fund this if we had unlimited resources. The distinction between “interesting” and “compelling” science questions is determined by their relevance to NASA’s larger strategic plan and upcoming missions. In the scientific strengths section, the reviewers will describe the proposed science question as “compelling,” “important,” or “interesting,” and the adjective used in that statement determines the maximum grade that proposal can receive (i.e., the grade it would receive if it had no weaknesses). Proposals with “interesting” science questions start at “Good,” those with “important” science questions start at “Very Good,” and only those with “compelling” science questions can ever achieve the grade “Excellent.” Sometimes the phrases “very important” and “very interesting” are used to allow proposals to start at half grades “Excellent/Very Good” and “Very Good/Good,” respectively. Because of the ramifications of the use of these specific adjectives, the panelists spent a substantial amount of time debating whether certain problems were compelling problems or important aspects of a compelling problem. In theory any proposal ranked “Good” or above can be funded, but in a funding environment where 10-15% of proposals are successful, the reality is much harsher than that.

A variety of attributes of a proposal can be called a scientific weakness, but the most damning is a lack of focused science questions. NASA has specific calls for proposals addressing instrument and model development, but the panel I saw was not for that type of proposal. For this panel, a statement in the report such as “this proposal lacks a focused science question,” or “this proposal addresses too many different science topics without a well-defined, focused, unifying theme,” or “this proposal is primarily for model development without a specific scientific motivation” was a mortal wound to that proposal. Furthermore, even if a proposal had a well-defined and compelling science question, if the

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Proposal Tips for Postdocs

Postdocs and graduate students spend a fair amount of time thinking about future careers and how their ability to attract research funds will impact those careers. We often hear from early career researchers that they want to learn more about the proposal process and what they can do right now to begin building their CVs in this area. To that end, the ASP assembled a panel of NCAR scientists to provide some insights about proposals and to answer questions at a recent NCAR Fellows Retreat.

The panel included:
- Alex Guenther, ACD Scientist and Section Head, Biosphere-Atmosphere Interactions (BAI) Group
- Marika Holland, CGD Scientist and Chief Scientist, Community Earth System Model (CESM)
- Bill Mahoney, RAL Scientist and RAL Deputy Director
- Art Richmond, HAO Scientist and Section Head, Atmosphere, Ionosphere & Magnetosphere (AIM) Section

Included below are tips and suggestions provided by the panel:

- Get involved in larger programs if possible and once involved, take on more responsibility to gain experience and recognition.
- Communicate with your program manager and follow up with him or her to ensure that your proposal made it to the right place.
- Reviewers are busy; don’t make them work too hard to understand your plan. Make sure that your proposal is clear and spells out your plan at the beginning. As Alex Guenther said, “Lead the reviewers by the hand through your proposal!” Don’t put your big idea at the end, put it at the beginning. Use bullets or any other method to emphasize the important points of your proposal.
- Don’t forget to factor in time to write up your results and to publish them.
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- Don’t forget to factor in time to write up your results and to publish them.
- It is the job of your program manager to interact with their scientific community, so don’t hesitate to call, email, or even make an appointment to visit if you are in their area.
- Do your homework: make sure that what you propose hasn’t already been done.
- Get your colleagues to review your proposal before you send it in.
- Make sure that your proposal fits what is being asked.
- Serve on a review panel. It’s the best way to see what makes a good proposal, what makes a bad proposal, and how proposals are reviewed.
- Write your proposal in such a way that the program manager/review panel understands why they NEED your research.
- Don’t be discouraged. Sometimes it takes a few submissions before a proposal is really right.

A sincere thank you to the panel for taking the time to share their excellent insights!
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proposed study would provide no or only incremental advancement beyond the current state of knowledge, that would be counted as a major scientific weakness.

In terms of methodology strengths and weaknesses, the onus is on the text of the proposal to prove that the proposed methodology can conclusively address the science question posed. The panelists have virtually no leeway to read between the lines of the proposals or to use a proposer’s past history of success as proof of future success. For experimental proposals, the text must clearly state how the data will be collected and must prove that the instrument resolution/sampling cadence/sensitivity/etc. are sufficient to address the question posed. For a statistical study, the proposal must demonstrate that the satellite(s)/ground station(s) are in an appropriate orbit/location to observe the phenomenon you want to study, estimate how frequently you will observe that phenomenon, and prove that you will see that phenomenon enough times in your observation window to compile statistically significant results. For modeling studies, the proposal text must prove that your model assumptions/grid resolution/boundary conditions/numerical methods/etc. are relevant to the physical situation you hope to address, sufficient to come to a conclusion about your science question, and feasible to implement with the computational resources you are requesting.

Almost all of the 20+ proposals reviewed by the panel proposed projects on which I personally would have enjoyed working; just about everything was at least “interesting.” What was amazing and educational to see was how the panelists went about separating the “Excellent” from the merely “Good.” This highly critical process was somewhat intimidating to watch, but the one reassuring aspect was that the reviews went back to the proposers. I was told that proposers regularly receive rejections but then use the feedback to strengthen their proposals for resubmission next year or to a different, possibly more appropriate, proposal call. The competition in any one proposal review is steep, but worthwhile research can eventually get funding if the proposers persevere.

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Happy Holidays!