**TEMPORAL TRENDS IN PLANETARY MISSION ANNOUNCEMENTS OF OPPORTUNITY AND PROPOSAL EVALUATIONS.** P. Thaler[1] and C. Niebur[2], [1]Cornell University (pt367@cornell.edu), [2]NASA Headquarters (330 E ST SW, Washington, D.C. 20546-0001).

**Introduction:** Many mission proposers have anecdotally commented in response to Discovery and New Frontiers Announcements of Opportunity (AOs) that writing mission proposals has become increasingly difficult with time. This criticism has been shared to such an extent that a thorough consideration of NASA's mission proposal process was deemed valuable. This study considered the content of AOs and the proposal evaluations from AOs from 2003-2019 for the Discovery and New Frontiers programs. The fundamental question to be answered was, "How have AOs and proposal evaluations changed in recent history?" AOs, documents released by NASA with requirements and guidelines for proposals, are meaningful documents to study because they act as the primary source of information provided by NASA upon which proposers base their proposals. In addition, evaluation results produced by peer review provide insight on the perceived quality of the submitted proposals. This project used data from five Discovery AOs, released in 2004, 2006, 2010, 2014, 2019, and three New Frontiers AOs, released in 2003, 2009, and 2016. This dataset spans 16 years and is effective in searching for trends that highlight a potential growing burden on proposers.

The three goals of this study were to 1) answer the question raised above, 2) produce data plots to support said answer, and 3) suggest reasons for and effects of observed trends.

**Methodology:** Before beginning data collection, six questions were defined to constrain the data gathering and analysis effort: Are AOs getting more complex with time? Is the burden put on proposers increasing with time? Are evaluations providing more findings with time? Are evaluation findings getting longer with time? Are evaluations changing focus with time? Is the quality of proposals, as judged by the evaluation process, changing with time?

After establishing these questions, metrics were gathered from AOs and evaluation results, colloquially known as Forms A, B, and C, for each proposal within the determined time frame. These metrics included the length of each AO, the number of requirements per AO, the length of each evaluation form, and the number of strengths and weaknesses per evaluation form, among many others. All data was collected and plotted in Excel.

**Findings:** Observed trends are divided by the documents on which they are based.

*Announcements of Opportunity.* AOs are becoming more complex with time. The length of AOs increased 78% and the number of references to outside documents increased by 95% in the 16-year period. The number of pages dedicated to appendices grew proportionally to the total number of pages, meaning that the majority of total length increase is attributed to an increase in the size of the main body text. The burden placed on proposers is also increasing with time. The allotted proposal page limit grew 61%, as seen in Figure 1, and the average length of text describing a requirement almost doubled within the timespan.

Some significant questions in this area to be considered are, "Are the benefits of growth in AOs worth the cost and increased workload? What do NASA and/or proposers gain from growth?" and, "Does increasing the proposal page limit allow proposers to explain their plans more clearly, or has it had no significant difference?" These questions could potentially be answered by studying the proposal evaluation forms.

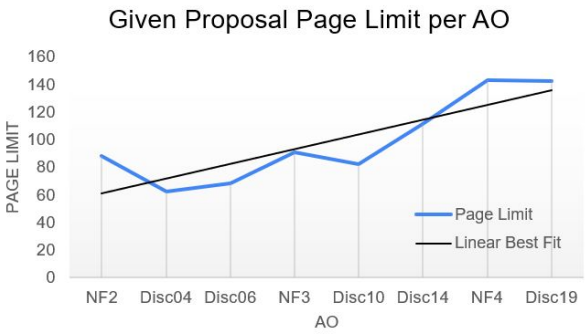


Figure 1. The given proposal page limit per AO and associated linear best fit.

*Proposal Evaluations.* The conversation surrounding evaluations must include many more variables than those regarding AOs and there are not obvious trends in evaluations, so it is more challenging to come to simple conclusions. Evaluations are possibly providing more findings with time within Discovery proposals, but the average number of total major findings per form is variable. Consistently, though, in Forms A and B, the number of strengths outweighs the number weaknesses. In Form C, the number of weaknesses outweighs the number strengths for most AOs. For each AO, there is approximately the same amount of writing per finding, but, with time, the focus of findings on Form C is shifting towards instrumentation. It is somewhat unclear if the quality

of proposals, as judged by the evaluation process, is changing temporally.

A compelling concern about proposal evaluations is that, given the assumption of two major findings in each subcategory on each form, the average proposal ends with roughly 30 major findings. Are 30 data points enough to choose a mission? Is that amount of data worth the money put into proposal evaluation?

**Future Work:** This project was part of a summer internship, so not all related work could be completed. Future work on this topic could determine if NASA has been doing a "better" job picking proposals with time, defining what "better" actually means in this context. It may also be beneficial to combine these findings with other similar projects across NASA Headquarters to provide a larger picture of trends within the agency. It is recommended that this data be updated in future years to establish longer-lasting trends.