Writing a Great Telescope Proposal

Telescope time can be quite competitive, with oversubscription ratios of 2-10 or even higher. **Because of this, a lot of meritorious science will not get the time requested.**

This means that TAC members will select proposals not just based on their technical feasibility and scientific importance but on how well justified the science is, whether they are personally excited about the science, how well the proposal is written, and harder to define subjective criteria. Writing a winning proposal is not, then, just a matter of describing your science well, but of conveying to the committee your own sense of excitement and importance of the work. Doing this well is an art.

To illustrate this: consider two proposals, **both alike in worthiness**, in the fair conference room where we lay our scene of the TAC deliberations. Forced to choose between them for the last 2 nights of time, the committee cannot help but consider these factors:

1. **Following the directions**:
   One proposal has 12 point font throughout, 1 page of figures and references, and all the text stays in the box, just as the instructions required.

   The other has target tables with illegibly small entries, violates the page limits, and has text bleeding outside of the boxes. The TAC gets the sense that the proposers are trying to unfairly include more information than other proposers were allowed to include, and also that the proposers are not giving the proposal process its due attention.
2. **Justifying the request for time**:
   Telescope time is precious, and the TAC needs to know how much you really need to succeed.

   One proposal has a signal to noise calculation rooted in the underlying science. The TAC has a good sense of where the number comes from. The contingency section has a careful description of what would happen if the proposal got, say, half the time requested.

   The other is requesting visits to ten targets with no prioritization, with exposure times calculated for SNR of 100, with no justification for that number.

   One proposal notes that the time previously awarded for the project by the TAC resulted in data that has been reduced; shows a figure illustrating how the data can be translated into compelling science; and explains why additional observations are needed in order to publish. The other proposal notes that it was awarded time previously, but does not mention whether it was reduced or not, or why they need additional time.
3. **Justifying the request for queue priority / temporal restrictions:**
   One proposal has calculated the number of nights in the semester during which the observations could be made, justifying its cuts on airmass and moonlight contamination.

   The other proposal has a brief statement that they need the tight constraint because their "observations are time sensitive."

4. **Having a compelling figure:**
   One proposal synthesizes what makes the science so compelling in an easy to read figure. It has large font, is not too busy, uses multiple, redundant point/line properties to clearly illustrate a third dimension, and conveys a few key ideas. From the figure the TAC quickly understands (for instance) the strength of the signal expected by the proposed observations, the new physical parameter space explored by them, or the factor by which the number of such detections will increase if the time is awarded. The caption text explains exactly what the TAC members should understand by looking at the figure, and connects it to the proposal text.

   The other proposal has a very hard to read and interpret figure filled with extraneous information, perhaps because the figure was taken from another context with little or no modification. The colorblind TAC member cannot distinguish the points and so needs it explained to them by the other members. The TAC members spend a lot of time arguing about what it is trying to convey because the caption, while technically accurate, does not interpret the figure in the context of the underlying science.
5. **Showing a clear path to an important result**:
   One proposal shows that these observations will triple the number of examples of a newly appreciated phenomenon. It connects this phenomenon to an important question in astrophysics, and illustrates how this is a result that the community will be excited to see, regardless of the outcome. The proposal explains the reasons this exciting science has not been done before, emphasizing the competitive advantage this telescope offers the TAC host institution in answering the question, so the TAC understands why this is an excellent use of the telescope.

   The other proposal is to observe a few more examples of a phenomenon that, as far as the TAC can tell, has been observed dozens of times before with other instruments. The proposal argues simply that the observations "will inform studies" of the phenomenon.
6. **Arguing with strong prose**:
   One proposal is easy to read, written in the active voice with tight, forthright prose that has been proofread and polished by the co-authors. The scientific justification lays out the problem being addressed clearly, emphasizing the place of these observations in the broader scientific landscape. The TAC members finish reading it quickly, with a good sense of the nature and importance of the work. A small number of key messages are in boldface or italics, so the TAC can quickly find them when deliberating.

   The other proposal was written in a single draft a few hours before the deadline. It is written in dense, highly technical prose in the passive voice, and filled with technical hedging, irrelevant qualifications, and unnecessary verbiage. Some references are malformed, some words are misspelled, and there are many run-on sentences. The TAC members have to reread sections of it multiple times before they can quite parse what is being conveyed. The TAC members finish reviewing the proposal with a vague sense of the importance of the science and the way the observations fit in. During deliberation, there are long pauses while TAC members hunt for a key piece of information they think they remember reading.

Clearly, the first proposal will (and should!) get the time, and the second will not. This is because even though **the actual merit of the science is identical for both proposals**, the first proposal makes that merit easy to see, and the second does not. So make sure you are writing the first proposal, not the second one!

From:

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