

Writing Successful Technical Proposals



Getting Started: The Heilmeier Catechism + 2

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With thanks to the fabulous Physics faculty at Illinois!

Caveat lector!

1. I am not a scientist; I'm a science writer and technical editor.
2. All of my experience in proposal writing has been in nuclear engineering and physics (broadly defined), but I think the advice I offer transcends disciplinary boundaries. Your mileage may differ.
3. All of my experience has been at the University of Illinois. I know the rules for FFRDCs are different, and I may make stupid statements that have no relevance to your practices and constraints.
4. Anything I say today is trumped by an agency's general rules, specifics of an individual program announcement, and directions from the cognizant program officer.
5. The opinions expressed are solely my own and are not necessarily shared by the University of Illinois or federal funding agencies. But they should be.

Meet George Heilmeier: scientist, inventor, industry leader, government official

PhD in solid-state materials

Inventor of the LCD

**Member of the National
Academy of Engineering**

**National Medal of Science, IEEE Medal of
Honor, Kyoto Prize**

**White House Fellow, assistant to Secretary of
Defense, director of DARPA**

**VP & CTO, Texas Instruments; Pres & CEO,
Bellcore; Chairman & CEO, SAIC**



Credit: IEEE

The “Heilmeier catechism,” as it became known among DARPA employees (and remains an article of faith among some DARPA program managers), consists of a series of nine questions. Heilmeier insisted that every proposal to DARPA answer these nine questions.

Every one of your proposals should, too.

For a brief biography of Heilmeier, see
http://www.ieeeahn.org/wiki/index.php/George_H._Heilmeier.

Heilmeier photo is courtesy of The Institute of Electrical and Electronics Engineers, and is used under the terms of the GNU Free Documentation License, Version 1.2.

Here's how to use the questions to get started on a compelling proposal

Think about how each question relates to the project you have in mind

Write down answers to the questions in full sentences—*be explicit and specific*

Use the answers to #7 and #8 to put boundary conditions on your proposed project

Read the RFP and map your answers to mandatory sections of the proposal

Make an outline, with the mandatory sections first and in the order they're presented in the RFP

Put the rest of your answers to the Heilmeier questions in their own separate sections

Now you've got an outline and are ready to write

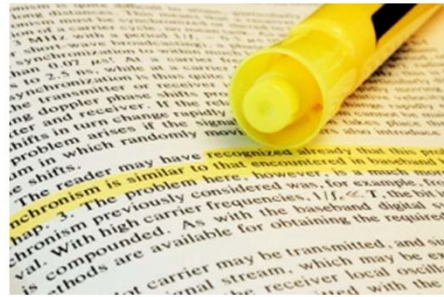
Thinking about the questions is a great way to get started in writing your proposal, the answers to the questions (particularly 7 & 8) will help you put necessary boundary conditions on your project before you get too far into the process, and incorporating the answers in your project narrative will help the reviewers positively assess your proposal.

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1. What are you trying to do?

State the goal of your project
using absolutely no jargon.



Federal funding agencies want to support hypothesis-driven research. Instead of saying “we will study this process” or “we will measure x ,” state the overall goal of your project in terms of a question to be answered or an hypothesis to be tested.

Make a distinction between “goals” (hypothesis to be tested) and “objectives” (intermediate steps along the path to answering the overarching question) and state them both.

NIH requires a “specific aims” section for every proposal submitted to it. I think adopting a “specific aims” section is a useful exercise for a proposer and reassures reviewers and program officers that you’ve thought carefully not only about what you want to do (goal), but specifically **how** you’re going to go about accomplishing it (objectives).

The “no jargon” rule is a good one. Not everybody who reads your proposal (and decides its fate) may be an expert in your narrow field.

If you have to use jargon, explain your terms. And never, **ever** use undefined acronyms. Ever.

2. How is it done today, and what are the limits of current practice?



Explicitly address this question in your “background and introduction” section. Cite freely.

3. What's new in your approach, and why do you think it will be successful?



Explicitly state why your approach is faster, better, cheaper—don't rely on the reviewers to intuit it.

Show how you've tested your approach and its promise; provide preliminary data.

Discuss your "Plan B." If your approach doesn't work, what is your alternative plan to save the project (and the funding agency's investment)?

4. Who cares?



Is the problem important to anybody besides your research group? Tell the program officer and reviewers who benefits.

5. If you're successful, what difference will it make?



What will your successful project mean for your research? For the infrastructure of your institution and future capabilities? For your discipline? For related disciplines? For society? For the ***funding agency***??

Will it create new knowledge?

Train the next generation of scientists and engineers?

Contribute to the nation's research infrastructure and technical capabilities?

Solve an important scientific, technological, or societal problem?

Contribute to economic development?

Why should a Congressman care?

6. What are the risks and the payoffs?



Candidly discuss risks, but use positive language. Don't ever **say** a proposal is "risky." (Funding agency employees tend to be risk averse.) "Speculative" or "promising" or "potential high-payoff" is okay—"risky" is the kiss of death.

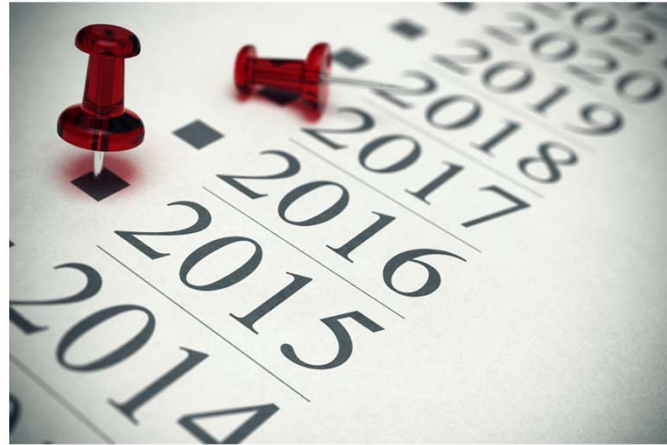
7. How much will it cost?



Think not only of dollars, but of time and resources (personnel and infrastructure). The program announcement will often specify the maximum funds that can be requested. Typically, if you exceed that limit, your proposal will be deemed “non-responsive” and will be returned without review.

If the program announcement does not specify a budget limit, it will often indicate how much money has been allocated for the program and how many awards the agency expects to make. Use that information to set boundary conditions for your budget.

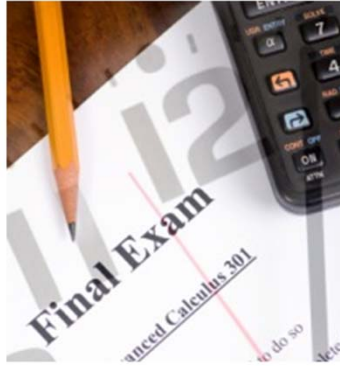
8. How long will it take?



Read the program announcement carefully and be sure your proposal fits the prescribed duration.

A great addition to any proposal is a narrative or figural timeline for the project.

9. What are the midterm and final “exams” to check for success?



How are you going to evaluate the project as it proceeds, so that you know when to make mid-course corrections?

What metrics will you use to evaluate progress?

How will you analyze and evaluate your data? How will you know when you're "done"?

C1. Why you?



With thanks to S. Lance Cooper, who suggested this addition.

Put a section in the project description titled “Qualifications of Key Personnel” and tell the reviewers why you and your team are uniquely positioned to succeed. Describe your expertise and success in related work. Mention the facilities you have at your disposal and your organization’s institutional strengths, including the availability of other experts to assist you.

Not every reviewer will look at the biosketches or the facilities description, but they will read the project description.

C2. Why now?



Talk about “opportunity costs.” “Opportunity cost” means what is the cost of not doing the project NOW? What will be lost if the agency decides “Not this year. Maybe next year.”?

To recap...

**Answer every question of the catechism
somewhere in your project description**

**Make it easy for a reviewer to pick out
the answers**

Make your answers as jargon-free as possible



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Notes: