



DOE Early Career Research Program Application Experience and Tips

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My background

- Senior Engineer in Target Systems Department, AD
 - PhD in Mechanical and Aerospace Engineering (2012)
 - Joined Fermilab in 2012 through the Bardeen Engineering Leadership Program
- High-Power Targetry R&D
 - Material behavior under high-intensity proton irradiation
 - Beam windows, secondary particle production targets (eg. neutrino targets)
 - Radiation damage and thermal shock effects
 - In-beam irradiation and material characterization
 - Calculation/simulation of thermomechanical response
- Current grants
 - DOE U.S.-Japan Science and Technology Cooperative Program in High Energy Physics (PI, 2020-)
 - DOE Early Career Research Program, HEP (PI, 2022-2027)

DOE Early Career Research Program

- ECRP is open to laboratory scientists and engineers who are within 10 years of receiving their PhD (12 years for next two years due to COVID-19 pandemic)
 - Supports development of **individual research programs of early career scientists/engineers**
 - Proposed research topics must be **within the programmatic priorities of the DOE's SC**
 - **High Energy Physics (HEP) research areas:** energy frontier, intensity frontier, cosmic frontier, theoretical high energy physics research, accelerator science and technology R&D, detector research and development
 - **Awards aligned with ongoing or future work at the lab**
 - **Five-year program**
 - **\$500k/year, \$2.5M total**
 - Can submit up to 3 times
 - Many of Fermilab's awards were on 2nd or 3rd attempts

Merit Review Criteria

- 1) Scientific and/or Technical Merit of the Project
- 2) Appropriateness of the Proposed Method or Approach
- 3) Competency of Applicant's Personnel and Adequacy of the Proposed Resources
- 4) Reasonableness and Appropriateness of the Proposed Budget
- 5) Quality and Efficacy of the Promoting Inclusive and Equitable Research (PIER) Plan
- 6) Relevance to the mission of the specific program
- 7) Potential for leadership within the scientific community

→ More details on the criteria are provided in the Funding Opportunity Announcement (FOA)

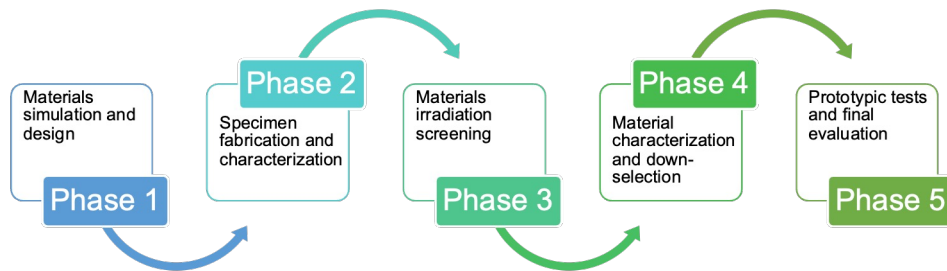
Getting started...

- Check your eligibility
- Plan your submission
 - How to expand your research portfolio? Existing LDRD?
 - You have 3 chances. Plan which years you want to submit
 - Discuss with your supervisor, department head and division head
- Articulate your story
 - **What** will you do and what key problem are you solving?
 - **Why** is this important? Impact and benefits
 - **How** will you do this?
 - **When** is this effort needed?
 - **Who** should you do this and why you?
 - **Where** will this work be done and why there?
 - Fermilab and collaborators?
 - Relevance to DOE mission and Fermilab



1st ECRP application (2021)

- **HEP research area:** Accelerator Science and Technology R&D
- **What?** Develop novel High-Entropy Alloys and Electrospun Nanofiber materials that are more resistant to radiation damage and thermal shock
- **Why?** Advance state-of-the-art in targetry materials to enable next-generation multi-MW accelerator target facilities (eg. LBNF 2.4 MW)
- **How?** Experimental program coupled with complementary simulations



1st attempt unsuccessful!

- **Who?** Me/Fermilab and collaborators
- **When?** Now to address future challenges
- **Where?** Fermilab and user facilities. Supports LBNF/DUNE and reference to P5/HEPAP reports

Some reviewers' comments (negative ones)...

1. Scientific and/or technical merit of the proposed research

...I personally consider this research as 'valuable' while *not rising to 'innovative'*...

...the PI *does not comment much on the qualification criteria*

2. Appropriateness of the proposed research or approach

...the applicant *does not analyze problems or risks*. The procedures all seem guaranteed to produce a publishable result.

...*not clear what mechanical/thermal properties test equipment are applicable to nanofibers*

...author *not very specific about criteria for down-selection* of materials for the final stage.

3. Reasonableness and appropriateness of the proposed budget

...*materials support seems light*, in particular regarding the cost of doing beam tests and analyzing activated samples, etc.

...author is *not specific on quantity of samples* at each stage of the research program

Summary from review panel: The proposal is *light on analysis of potential problems and risks* and would benefit from *more detail on how results will be quantified*. The proposal would have been *stronger if examples of candidate materials had already been identified for testing*.

2nd ECRP application (2022)

- **Successful**
- Same title and proposed work as in the 1st application
 - “Advanced Materials to Enable Next-Generation High-Power Accelerators”
 - Topic Area: Accelerator Science and Technology Research & Development
- **Revised proposal by addressing all the reviewers’ comments**
- Asked a lot more people to review and proofread my proposal
- Reviewer scores (out of 6): 4, 6, 5, 5 - same as 1st attempt

Some general advice...

1) Make your proposal easy to read

- **Reviewers will come from many disciplines.** Narrate a story that people from various backgrounds can easily read and understand your proposal
- **Get the reader's attention** in the first couple of paragraphs. Start with the **What** and **Why**
- Include **graphics and figures** to illustrate and explain concepts
- **Avoid ambiguous descriptions** (narrative, table, figures, budget request)
- Always **define jargons and acronyms**
- Say that you **WILL** do something. Avoid words such as can, could, may, might

2) **Support your proposal** with preliminary work, simulations, LDRDs, letters of support and collaboration, your past experience, concerns/recommendations highlighted in the P5 and/or HEPAP reports

- Emphasize unique facilities, capabilities, expertise at Fermilab that would support the proposal

3) Emphasize **why your proposal should this be funded** under the ECRP

- Proposal is beyond currently supported effort
- Or is not supported by project

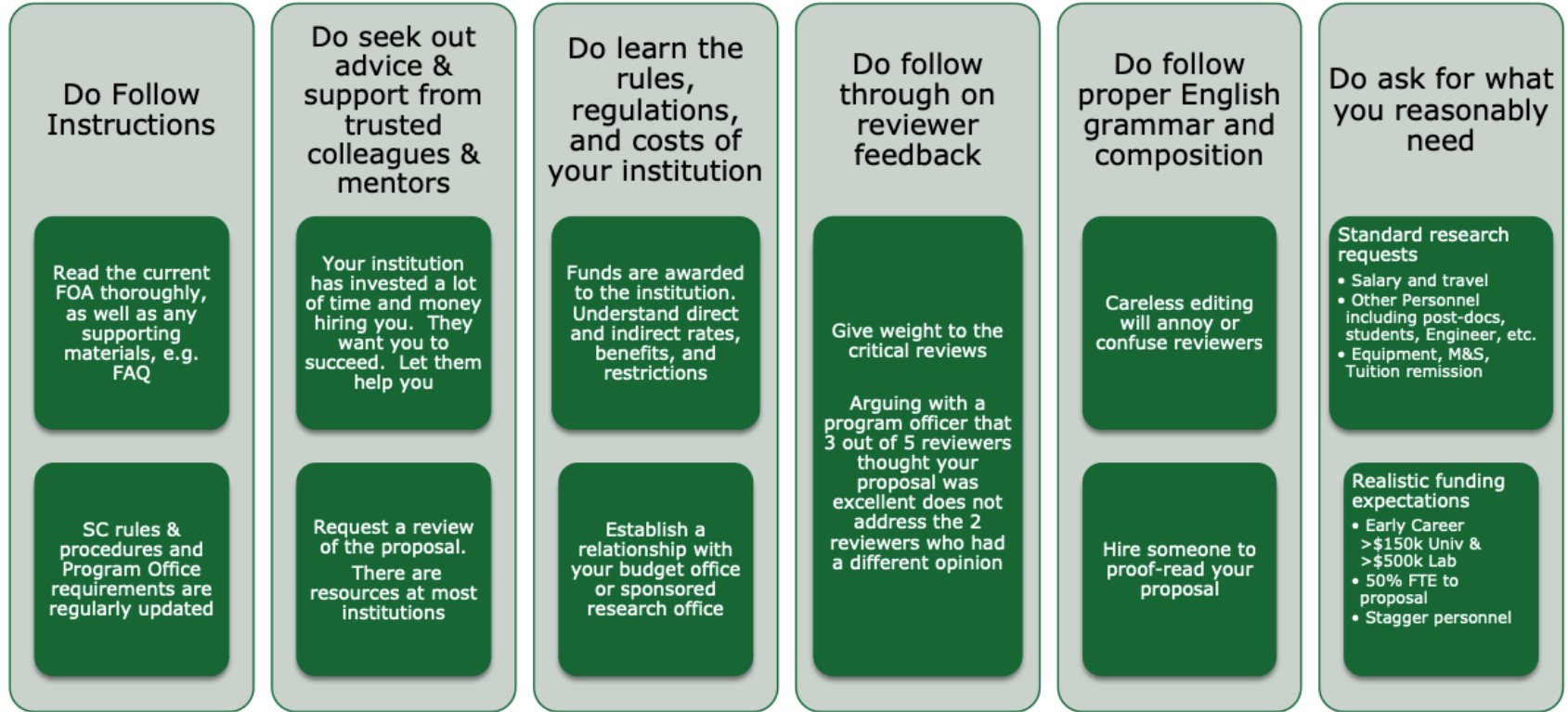
More advice...

- 4) Have a **clear timeline of your research project**
 - Yearly key deliverables
 - Personnel needs with roles and responsibilities
 - Detailed budget and cost estimates
- 5) Highlight your **qualification and leadership**. What makes you the right person to perform the proposed work?
 - Involvement in your research/engineering community (attendance and participation at conferences, reviewer, publication list, collaborations, invited talks, presentations, recognitions)
 - Can include in the narrative and/or in your biosketch
- 6) Speak with your **HEP program manager**
- 7) Start working with your division financial manager as early as possible to obtain guidance on **budget preparation**
- 8) Identify **potential risks** with your proposed research methods and **mitigation plans**

More advice...

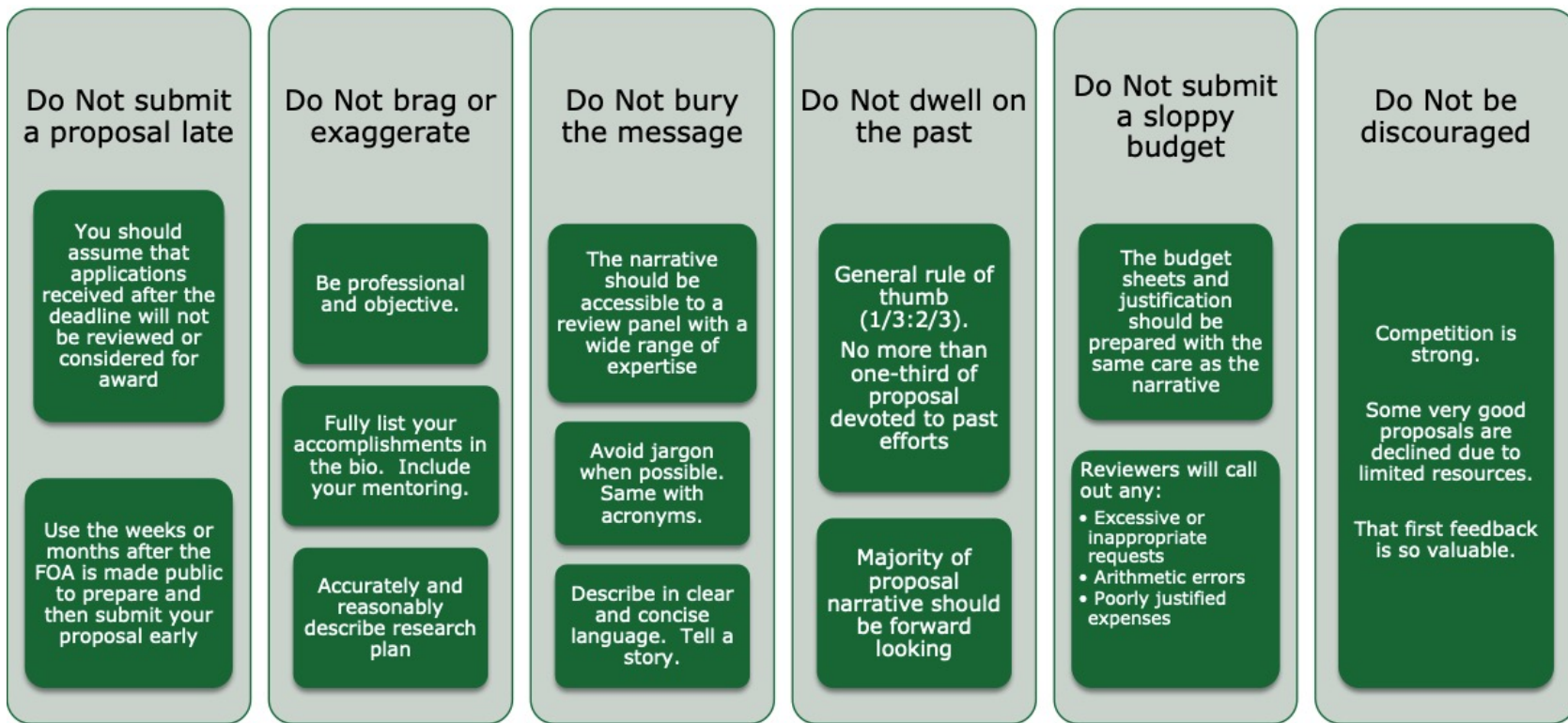
- 9) Ask many **people to read your proposal** (experts and non-experts), and read other people's proposals
 - Talk to your supervisors, mentors and others who have gone through the process, previous awardees
 - Read successful and unsuccessful proposals written by others
- 10) Start **writing as early as possible**. It is a lot of work!
 - Write a little bit every day

Summary of what to do



Slide from A. Stone, "Early Career Primer", 2020

Summary of what **NOT** to do



Slide from A. Stone, "Early Career Primer", 2020

Resources

- DOE ECRP website
 - <https://science.osti.gov/early-career>
- Funding Opportunity Announcement (FOA)
 - https://science.osti.gov/-/media/grants/pdf/foas/2023/SC_FOA_0002821.pdf
- Frequently Asked Questions (FAQ)
 - <https://science.osti.gov/-/media/early-career/pdf/Early-Career-FAQ-FY-2023-final.pdf>
- Fermilab holds weekly meeting to advise and help with ECRP application, including talks from past awardees
 - <https://fermipoint.fnal.gov/org/ood/dir/eca/>