

DOE Early Career Research Program Application Experience and Tips

Kavin Ammigan 2023 All Engineers' Retreat 20 February 2023

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...

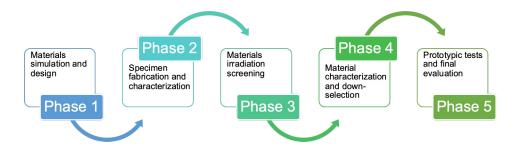
- Check your eligibility
- Plan your submission
 - How to expand your research portfolio? Existing LDRD?
 - You have 3 chances. Plan which years you want to submit
 - Discuss with your supervisor, department head and division head
- Articulate your story
 - What will you do and what key problem are you 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...

- Have a clear timeline of your research project
 - Yearly key deliverables
 - Personnel needs with roles and responsibilities
 - Detailed budget and cost estimates
- 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
- Speak with your **HEP program manager**
- Start working with your division financial manager as early as possible to obtain guidance on **budget preparation**
- Identify **potential risks** with your proposed research methods and **mitigation plans**



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More advice...

- 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

Do Follow Instructions

Read the current FOA thoroughly, as well as any supporting materials, e.g. FAO

SC rules & procedures and Program Office requirements are regularly updated

Do seek out advice & support from trusted colleagues & mentors

Your institution has invested a lot of time and money hiring you. They want you to succeed. Let them help you

Request a review of the proposal. There are resources at most institutions

Do learn the rules, regulations, and costs of vour institution

Funds are awarded to the institution. Understand direct and indirect rates, benefits, and restrictions

Establish a relationship with your budget office or sponsored research office

Do follow through on reviewer feedback

Give weight to the critical reviews

Arguing with a program officer that 3 out of 5 reviewers thought your proposal was excellent does not address the 2 reviewers who had a different opinion

Do follow proper English grammar and composition

Careless editing will annoy or confuse reviewers

Hire someone to proof-read your proposal

Do ask for what you reasonably need

Standard research reauests

- · Salary and travel
- Other Personnel including post-docs, students, Engineer, etc.
- · Equipment, M&S, Tuition remission

Realistic funding expectations

- Early Career >\$150k Univ & >\$500k Lab
- 50% FTE to proposal
- Stagger personnel

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



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Summary of what **NOT** to do

Do Not submit a proposal late

You should assume that applications received after the deadline will not be reviewed or considered for award

Use the weeks or months after the FOA is made public to prepare and then submit your proposal early Do Not brag or exaggerate

Be professional and objective.

Fully list your accomplishments in the bio. Include your mentoring.

Accurately and reasonably describe research plan

Do Not bury the message

The narrative should be accessible to a review panel with a wide range of expertise

Avoid jargon when possible. Same with acronyms.

Describe in clear and concise language. Tell a story. Do Not dwell on the past

General rule of thumb (1/3:2/3).

No more than one-third of proposal devoted to past

efforts

Majority of proposal narrative should be forward looking Do Not submit a sloppy budget

The budget sheets and justification should be prepared with the same care as the narrative

Reviewers will call out any:

- Excessive or inappropriate requests
- Arithmetic errors
- Poorly justified expenses

Do Not be discouraged

Competition is strong.

Some very good proposals are declined due to limited resources.

That first feedback is so valuable.

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/

