

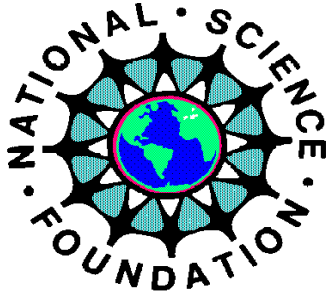
Research Program Development Workshop

Orono, Maine
September 2008

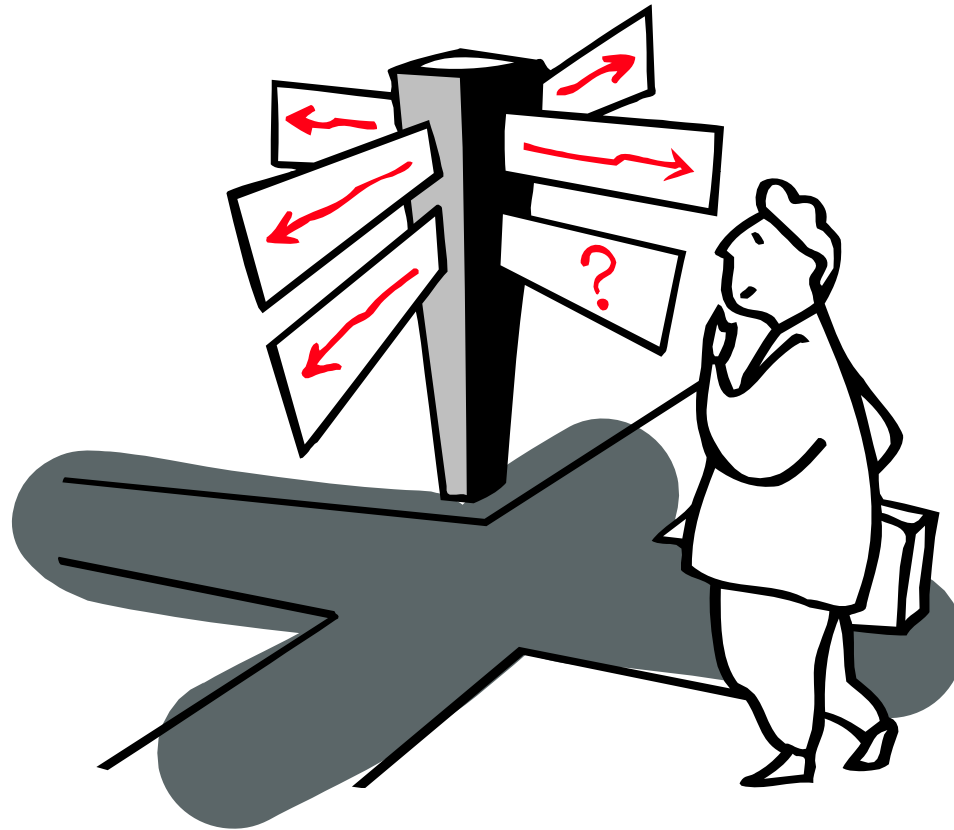


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The Larger Context





NSF

-
- The NSF **Mission** is
 - To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense (NSF Act of 1950)
 - The NSF strategic goals are related to:
 - Discovery - advance frontiers of knowledge
 - Learning - cultivate an inclusive S&E workforce
 - Research infrastructure - investment in advanced instrumentation, cyberinfrastructure, tools, etc.
 - Stewardship - support excellence in S&E research and education

NSF funds fundamental research and education



NSF

-
- We look for research proposals that
 - Are innovative and push the frontiers of knowledge
 - Contribute to national needs and priorities
 - Go beyond marginalia
 - Integrate well with educational goals
 - Involve research
 - We do not support (except as incidental to the research goals of the research)
 - Developmental efforts
 - Computer programming
 - Design of...
 - Commercialization



CAREER Award

-
- Funds the academic career development of new faculty (it is not a research award)
 - Is based on a development plan –“well argued specific proposal for activities that will build a firm foundation for a **lifetime** of **integrated** contributions to research and education”
 - Duration: 5 years
 - Min (in most programs, it's also a Max.) amount: \$400,000
 - Deadline: July each year



You

-
- **Who are you?**
 - Your expertise/interests
 - Your career/life goals
 - Your position/resources
 - **Your proposal should fit into your life plan**

What is your life plan?
Do you need to develop a
strategic plan?



Your Strategic Plan

- A strategic plan has three parts:
 - Where are you today?
 - Where do you want to be in the future (5, 10, 20 years from now)?
 - How do you get from here to there?

A strategic plan is a
roadmap for your life



Your Proposal

- Should advance you toward your life goals
 - Should be a stepping stone to the next thing
- Should be compatible with your institution's goals
- Should represent a contribution to society at large

Test: If you accomplish your research objectives, are you better off for the effort?



Initiatives

- NSF is backing off on initiatives
- An initiative is right for you if:
 - It's your topic
 - You are already working in the field
 - It fits with your strategic plan
 - You contribute through your collaboration

Be sure to read the announcement for what it says, not what you want it to say



Your Funding Base

- NSF should not be the sole source of funding for your research
 - Internal support
 - State support
 - Industry support
 - Other Federal agency support

List the potential funding sources for your research area



DOs

-
- Have a strategic plan
 - Build on your strengths
 - Differentiate this proposal from your Ph.D. thesis work and other sponsored work
 - Perform thorough literature search and exploratory research before writing the proposal
 - Journal articles (update with personal contact)
 - Read the NSF Grant Proposal Guide (GPG)
 - Establish and keep your contacts



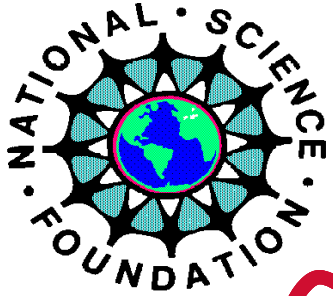
DON'Ts

- Rush
- Wait until last minute (1 month) to contact program directors
- Make the proposed work (research and education) too broad
- Make the proposed work too narrow
- Ask for too much (or too little) money
- Ignore rules (Grant Proposal Guide) and misc. items

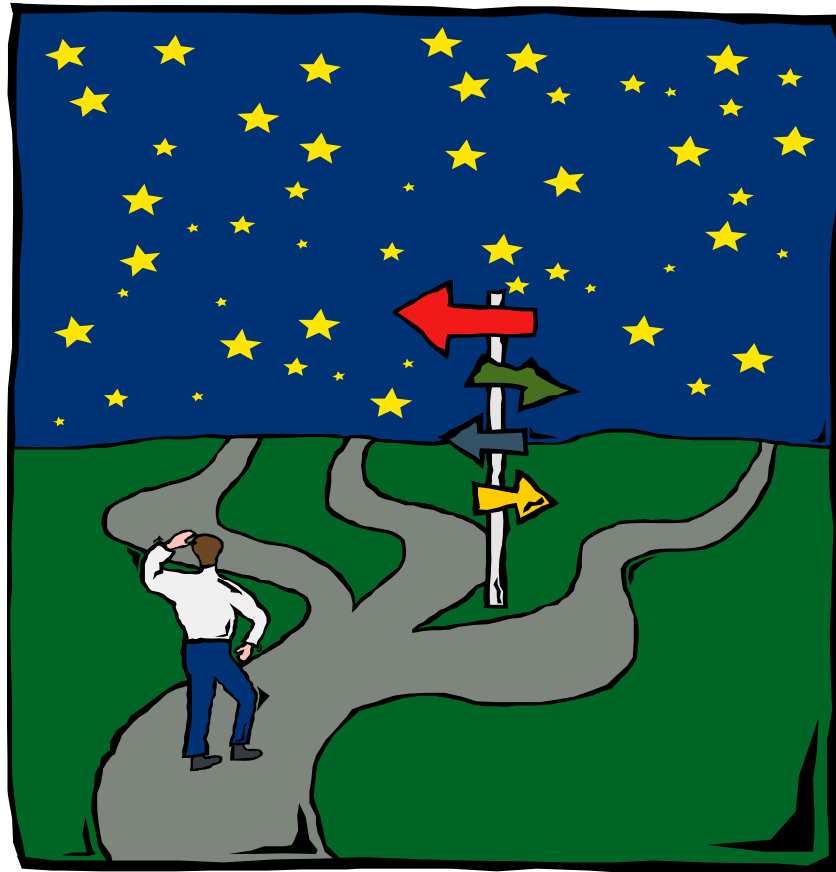


Proposal Basics

- Write to the reviewers (not to me and not to yourself)
- Your proposal will be judged by the reviewers
- Reviewers want to know four things:
 - What is it about (the research objective)?
 - How will you do it (the technical approach)?
 - Can you do it (you and your facilities)?
 - Is it worth doing (intellectual merit and broader impact)?
- This is, basically, all the proposal needs to convey - but it needs to convey this



Getting a Research Topic





The Research Topic

- It must be research
- It must not have been done before
- It must be significant
- There must be higher than probability zero that you can do it
- It must lend itself to a viable research plan
- You must have the facilities to accomplish the research
- It should fit into your strategic plan



Groundwork

- Do you know in your field:
 - What is the current state-of-the-art
 - Who are the top ten researchers
 - What they are doing right now
 - Where they get their funding
 - What they consider to be the key research issues
 - Who would likely review your proposal
 - How much money is available for a grant/what the grant opportunities are



The CAREER Research Topic

-
- The CAREER proposal is *not* a research proposal
 - The CAREER proposal is a proposal detailing how you will spend \$400,000 to enhance your career development
 - Your career involves a research *path*, not a research project
 - Determine your research path—your lifelong research goals—and then identify milestones toward your goals
 - Detail the first one or two as the research projects for your CAREER proposal



What is Research?

- Research is the process of finding out something that we (everyone) don't already know
- Scientific research builds upon the extant knowledge base and it is methodical, repeatable and verifiable
 - Methodical means that you can specify, in advance, a procedure to accomplish your stated objective

Question: Exactly what will your research contribute to the knowledge base?



The Research Objective

The research objective is a concise statement of what you intend to find out that we don't already know



The Research Objective

- This is probably the hardest part of the proposal
- Examples of how not to do it:
 - The objective of my research is to provide a quantum leap in the design of anti-gravity boots.
 - The goal of this project is to develop an integrated modeling tool for the hardening process.
 - The goal of this project is to develop innovative advances to enhance wire sawing processes.
 - Rapid prototyping machines are an important part of the vast array of tools. This research will bridge the accuracy gap in these processes by developing theoretical and technological means to implement significant gains in accuracy.



The Research Objective

- Four acceptable ways to do it right:
 - The research objective of this proposal is to test the hypothesis H .
 - The research objective of this proposal is to measure parameter P with accuracy A .
 - The research objective of this proposal is to prove conjecture C .
 - The research objective of this proposal is to apply method M from field Q to solve problem X in field R .



The Research Objective

- How to do it right:
 - The research objective of this project is to measure the cross-section of the muon-neutrino interaction at 5 GeV accurate to 10%.
 - The research objective of this proposal is to test the hypothesis that chip formation in high-speed machining of brittle materials is determined by parameters x , y and z .
 - The research objective of this project is to account for uncertainty in engineering design decision making through the application of utility theory.



The Research Objective

- How to do it wrong (“actual” submissions):
 - This project aims to advance the research in predictive modeling for manufacturing process optimization.
 - The proposed study will significantly advance the theory of random fields.
 - This study will develop modeling and simulation-based technologies for building construction.
 - New methods in robust optimization are proposed for optimizing complex models under uncertainty.



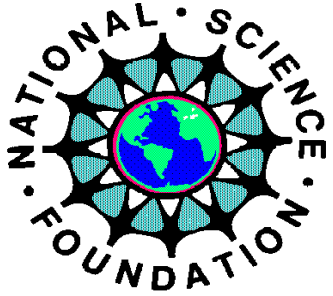
The Research Objective

- Doing it right:
 - Begin: "The research objective of this project is..."
 - Limit: 25 words or less
 - Be specific about what you intend to find out
 - Be specific about what you intend to find out
 - Be sure your statement is comprehensible
 - Be sure your objective leads directly to a research procedure to accomplish the objective
 - Put it up front—sentence one, paragraph one, page one
 - Do not give a weather report or state-of-the-union address



The Research Objective

- Do not use words that mean “not research”
 - Develop
 - Design
 - Optimize
 - Control
 - Manage
- Use of words such as these gives the reviewers the impression that you are not doing research, there is no innovation, nothing is new, etc. - your ratings *will* be lower



Finding a Home





Questions

- Is your “research” research?
 - If it isn't, it doesn't belong at NSF
- If the answer is “no,” skip to the end, look for support from other sources
- If the answer is “yes,” what is your research objective?
 - The right NSF home for your research depends on your research objective, not on the application of your research

NSF does not support applications studies



Step Two

-
- Look up NSF's web site: www.nsf.gov
 - Read the current Grant Proposal Guide
 - Specifically, look at the research programs, read what research topics they support
 - Look up new initiatives, read the current announcements
 - Then call the appropriate program officers
 - Be prepared to answer the question: "What is your research objective?" (25 words or less)

NSF does not support applications studies



Important Questions

- Does my research topic fit well with your program?
- Does your program have funds to support my research if my proposal reviews well?
- What size grant is pushing the limits of your funding ability?
- What are your proposal submission deadlines?
- How are proposals submitted to your program reviewed?



Questions You Shouldn't Ask

- So, will you fund my research?
- Is this a good research topic?
- What research topic do you think I should work on?
- What are my odds?
- If I send a copy of my proposal to you, will you help me edit it? Will you tell me what you think of it?
- My proposal wasn't funded, so can I resubmit it as a SGER?



Catch 22

-
- My research doesn't fit in any single NSF program, how about joint submission/review?
 - Did you formulate a clear research objective?
 - Is your research objective too broad?
 - Do you want to consider focusing your scope?
 - Suppose my research really does span multiple programs?
 - Contact all relevant program directors



Should I Meet My Program Officer?

- Why? What do you intend to gain?
- Or is your goal to schmooze? (It doesn't help)
 - Don't even think about taking your program officer to lunch
- If you decide to meet:
 - Be prepared to listen (you don't learn by talking)
 - Be prepared with questions
 - Remember, the program officer is not the panel
 - You can get a free trip to NSF (more later)



How Could a Meeting Help?

- Your program director can:
 - Give advice on proposal submission
 - Help you understand a review of a previous proposal
 - Point you to resources you can use to help write a better proposal next time
 - Give general guidance on good proposal writing
 - Give you ideas for collaborations

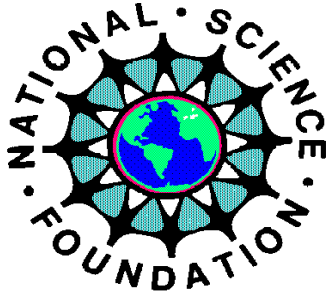
Program officers look forward to constructive meetings with PIs



How Could a Meeting Help?

Note—you learn by listening, not by talking. So shut up and listen.





Writing the Summary





Writing the Summary

- The most important statement is your statement of the research objective
 - It should be sentence 1 of paragraph 1
 - Do not begin with a weather report: "The sky is falling. Tools are breaking. Designs are failing..."
 - Do not begin with a state-of-the-union address: "Business is moving off shore. Manufacturing is going to the ..."
- Remember, this is not a tech paper, it is not a murder mystery (where we find out what the objective is on page 15)
- Don't forget the Intellectual Merit and Broader Impact statements



What We Want to Know

- What is your research objective?
 - This is what directs your proposal to the appropriate program
- What is your approach?
 - Outline — just two or three sentences
- Why is your contribution important to your research community (the intellectual merit)?
- If successful, what will be the benefit to society (the broader impact)? Why is your project important to society?



Summary Template

The objective of this research project is to test the hypothesis that too many monkeys in a tree will cause the tree to break. The approach will be to take a sample of ten trees and load them with monkeys until they break...

Intellectual Merit - It is important that we know how many monkeys can climb a tree before it breaks because this affects our perceptions of monkey procreation and... The Snerd Theory holds that tree size limits monkey procreation. This study challenges that theory with the notion that... If the objective hypothesis is correct therefore, it will transform our approach to...

Broader Impact - Monkeys are used in medical research. By knowing how many monkeys can fit in a tree, we will be able to provide more monkeys for such research thereby advancing medical science more quickly and improving the quality of life. Also, by watching the monkeys get hurt when the tree breaks, graduate students will be less likely to climb trees, thereby increasing their probability of graduating.



Remember

-
- Your proposal may (will) be returned without review if:
 - You fail to include explicit statements of intellectual merit and broader impact (entitle them Intellectual Merit, Broader Impact)
 - You use the wrong font or it is too small
 - The margins are too narrow
 - Your bio is incorrectly formatted
 - You have an unauthorized attachment
 - We have been lenient in the past, we will not be permitted such lenience in the future, and you anger the reviewers anyway



The Rest of Your Proposal

- The next 15 pages of your proposal give backup and detail to your summary
- Start with a restatement of your research objective, clarify it, and provide a research plan to accomplish it
- Provide a convincing argument that you can carry out your proposed plan
- Restate and provide detail on your intellectual merit and broader impact

This is a good time to put forth your best effort



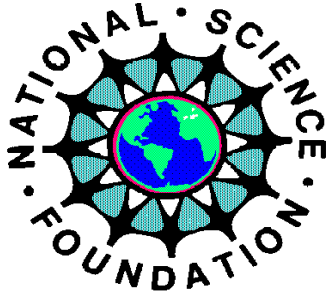
Tips on Proposal Writing

- Use only 12 point type
- Do not use figures or tables as filler—everything should contribute
- Everything should be legible—do not use 2 point type on figures or tables
- Be sure to include a clearly stated research objective
- Use only the required format
- Be sure to include intellectual merit and broader impact statements in the body of the proposal



Tips on Proposal Writing

- Don't include letters of support from industry if
 - They aren't very supportive
 - Letters from several companies are identical
 - They are letters from previous proposals
 - You don't have them before the submission deadline
- Don't cut and paste together new proposals from old declined proposals
- Proofread your proposal before you submit it (and after you submit it)



Intellectual Merit and Broader Impact Statements





IM and BI Statements

- They are required
- Your proposal will be rated based on them
- But:
 - What are they?
 - What should you include?
 - How should they shape your proposal?



Intellectual Merit

- The Intellectual Merit is the contribution that your research makes to the knowledge base and how that impacts the field
- Questions:
 - What is already known?
 - What will your research add?
 - What will this do to enhance or enable research in your or other fields?
 - Why is your contribution important to your research community?
 - How will your results be “transformative”?



Broader Impact

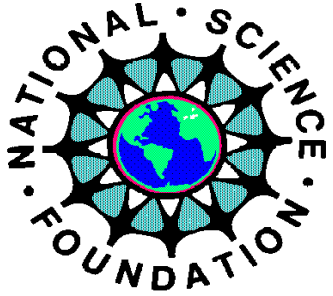
- The Broader Impact focuses on the benefit to society at large as a result of your research result
- Means to benefit society include:
 - Economic/environment/energy/health/safety
 - Education and training
 - Providing opportunities for underrepresented groups
 - Improving research and education infrastructure

The key issue is how your research results will be applied — why would the general public care?



Caution

Your research goals and approach should determine the intellectual merit and appropriate broader impact



Ethics





Breach of Ethics

- People who submit proposals to the Federal Government (e.g., to NSF) are held to high standards
- A breach of ethics can lead to
 - Being barred from submitting proposals
 - Fines
 - Jail time
 - Really being on the outs with your institution - getting fired, losing tenure
- Violation of some ethics laws is a felony



Forms of Misconduct

- Plagiarism—material copied without citation and quotation—if you copy it, cite it and off-set it; if you accept an award based on a proposal that includes plagiarism, you may have committed a felony
- Charge for work already done—can be a felony, do not charge twice for the same work
- Falsification of data and reports—changing data or results—be honest in all your annual and final reports and papers
- Fabrication—making stuff up—report only what is real



Actual PI Responses

- "It's only a proposal. It's not like it's a publication."
- "The reviewers are smart enough to know what is my work and what is someone else's."
- "My English teacher told me it's not plagiarism if I change every seventh word."
- "It's not plagiarism; it's just bad citation."
- "It got funded before."
- "I didn't have space for all the citations."
- "I didn't do it. My grad student/undergraduate/ postdoc/grant writer/faculty colleague/secretary/ Co-PI/SRO/AOR/VP of Research/Dean/spouse wrote that section."
- "It was 'an act of lamentable carelessness' and therefore not misconduct."
- "Severe acid reflux."





Examples

- False charges
 - Never pad travel
 - Never commingle funds
 - » Don't mix business and pleasure expenses
 - » Don't mix grant funds and personal business expenses
 - Never charge for time not spent on a grant
 - Never bill items to your grant that shouldn't be billed to the grant
 - Never bill alcohol or entertainment to a grant
 - Never charge give-aways to a grant



Examples, continued

-
- **Breach of confidentiality—never divulge confidential information**
 - Ideas conveyed in proposals
 - Names of panelists
 - Names of PIs
 - Never use information that you received in confidence

Plagiarism is bad, plagiarism from a proposal you reviewed is a breach of confidence—much worse



Recommendation Letters

- It is against the law for an employee of the Federal Government to represent a third party to the Government
- That means it is illegal for a Government employee to write a letter of recommendation for you
- Don't ask - many Government employees don't know this law, you can get them into a lot of trouble



Multiple Proposal Submissions

- It is permissible to submit multiple proposals to do the same thing
 - But it is not permissible to submit the same proposal to multiple NSF units
- It is not legal to accept more than one
- If you submit multiple proposals for the same or similar work, be careful to distinguish the uniqueness of each and, if appropriate, note that you will only accept one (or possibly turn one back if you get a better one)



Ethics Training

- It is highly recommended that you give your student researchers training in ethics—this protects you in an event of their indiscretion
- Do it with all your students
- Do it before they have a chance to do something bad
- Ask them to sign a letter of recognition that you have provided ethics training, that it covers specific elements of ethics, and that they know that you expect appropriate behavior



Sticky Issues

- You collaborate with a senior faculty person to write a proposal
- You get an award
- You later find that your collaborator plagiarized materials that are in the proposal
- You should
 - Consult with your institutional ethics person
 - Report the matter to the NSF Inspector General
 - Continue to work on the grant
- You will not be held accountable for another faculty member's bad behavior



Reference

- OMB Circular A-110

**CIRCULAR A-110
REVISED 11/19/93
As Further Amended 9/30/99**

TO THE HEADS OF EXECUTIVE DEPARTMENTS AND ESTABLISHMENTS

SUBJECT: Uniform Administrative Requirements for Grants and Agreements With Institutions of Higher Education, Hospitals, and Other Non-Profit Organizations

1. Purpose. This Circular sets forth standards for obtaining consistency and uniformity among Federal agencies in the administration of grants to and agreements with institutions of higher education, hospitals, and other non-profit organizations.

2. Authority. Circular A-110 is issued under the authority of 31 U.S.C. 503 (the Chief Financial Officers Act), 31 U.S.C. 1111, 41 U.S.C. 405 (the Office of Federal Procurement Policy Act), Reorganization Plan No. 2 of 1970, and E.O. 11541 ("Prescribing the Duties of the Office of Management and Budget and the Domestic Policy Council in the Executive Office of the President").

3. Policy. Except as provided herein, the standards set forth in this Circular are applicable to all Federal agencies. If any statute specifically prescribes policies or specific requirements that differ from the standards provided herein, the provisions of the statute shall govern.

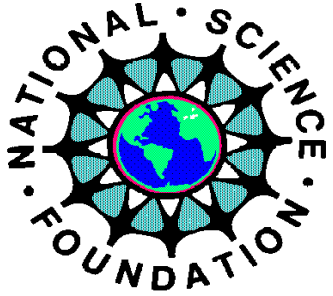
The provisions of the sections of this Circular shall be applied by Federal agencies to recipients. Recipients shall apply the provisions of this Circular to subrecipients performing substantive work under grants and agreements that are passed through or awarded by the primary recipient, if such subrecipients are organizations described in paragraph 1.



Parting Thoughts

Remember, if your grad student writes your proposals, you are responsible for their content, and you are the person in trouble if there is a breach of ethics

You have worked hard to establish your career, don't ruin it by a breach of ethics



Supplements





Beyond the Award

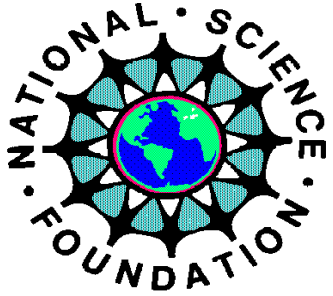
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- Beyond the award there are supplements
 - REU (Research Experience for Undergraduates): \$6,000 per year per student, nominally one student per award (two, provided one is from an under-represented group), does NOT include equipment
 - RET (Research Experience for Teachers): \$10,000 to involve a K-12 teacher in your research
 - IREE (International Research and Education in Engineering)
 - Initiating international collaborations (Office of International Science and Eng.)
 - Informal education (EHR)



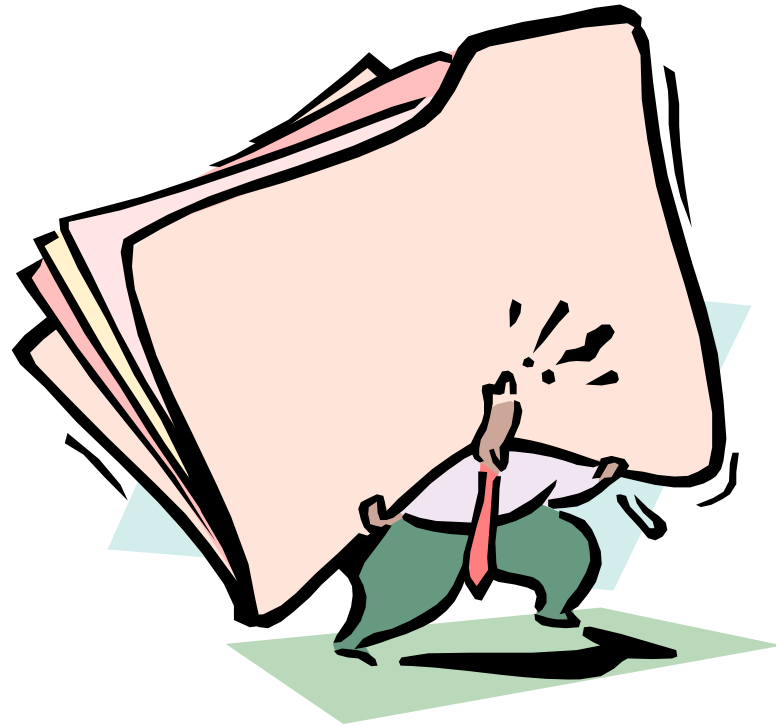
Supplemental Requests

- Contact your program director first!
- Must be submitted via FastLane
- Must include a budget
- Should be submitted early in the fiscal year (while we still have money) or to meet announcement deadlines

Don't even think about asking for a supplement if you're not up to date on your progress reports



Progress/Final Reports





Annual Reports

- Annual reports are required for ALL grants (standard or continuing)
 - This includes: unsolicited, CAREER, MRI, special initiatives, ...
 - This includes grants that are beyond their initial active period, i.e., grants that are in a no-cost extension period
- Annual reports must be submitted via FastLane 90 days PRIOR to anniversary (or by May 1st, whichever is sooner, for continuing grants)
- Annual reports **MUST** be submitted in the order in which they are due as they build upon previous report(s)



Annual Reports

- No annual report = no increments, no supplements, no no-cost extensions
- Be sure to use FastLane format — pdf attachments are ok, but you must also have filled in FastLane items first
- REU supplement during reporting period
- make sure to report activity under role of Research Experience for Undergraduates in PARTICIPANT section (this is different than role of undergraduate student)



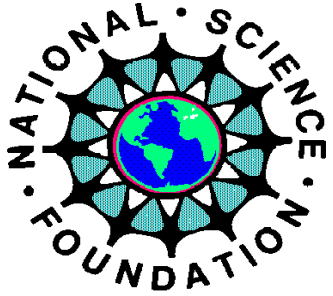
Final Reports

- All grants require a final report
- All final reports must be filed using FastLane
- Final reports are due not later than 90 days after the expiration date of the grant
- You must use the FastLane format
- **PENALTY!!!** You cannot get another grant or a supplement if you or a co-PI have an overdue final report
- Warning - the grant is over when the final report is approved

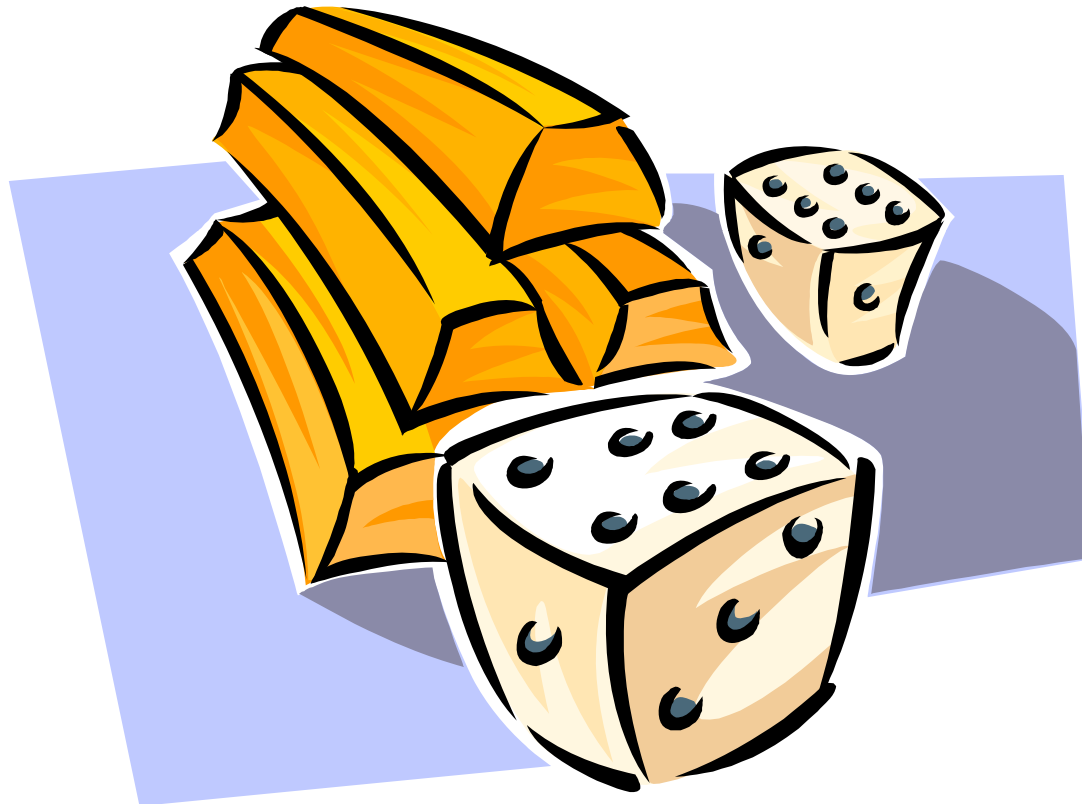


Warning!!!

NSF money is good for six years. After that, it turns into a pumpkin - plan to spend all money within six years.



Highlights (Nuggets)





Talk to Us

- We need to know about your progress, especially about the great things you do
 - Bragging rights
 - Demonstrates progress in the field
 - Justifies our budget
 - Helps make the case for increased budgets
 - Needed to fulfill our GPRA reporting requirements
- Report your significant progress as highlights
- Submit highlights any time of year



Highlights

-
- Highlights are for public consumption
 - Readable at the 8th grade level
 - Convey the excitement of discovery
 - Instill a sense of purpose — why this stuff was funded — and what does it mean to the general public (the broader impact)

To be usable, highlights must be well written

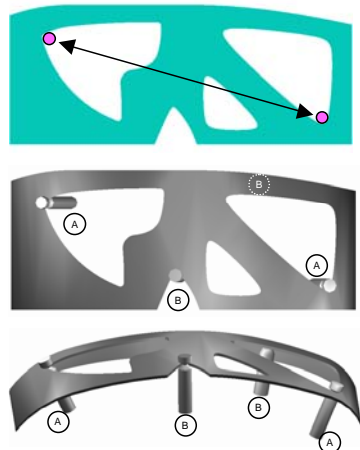


An Example Highlight

NSF Grant Number: DMI- 0010069

PI: Ken Goldberg Institution: U.C. Berkeley

Title: Self Aligning Grippers and Fixtures

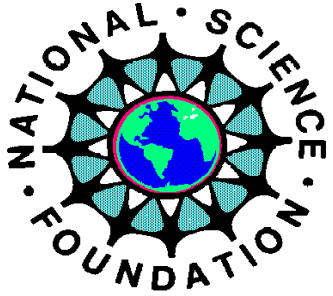
<p>•Research Objectives:</p> <p>New theoretical models of the mechanics of part acquisition, new data structures, and new hardware configurations that will improve the reliability of automated industrial manufacturing systems.</p>	<p>•Significant Results:</p> <p>We propose “unilateral fixtures” that are modular and compact and give algorithms for locating fixture contacts and bounds on design of the contacts. The repeatability of fixture’s precision in locating the part was experimentally verified.</p>
<p>•Approach</p> <p>We use modular cylindrical jaws with v-shaped notches to fixture sheet metal parts. First, we use a fast geometric algorithm to find fixtures for a rigid approximation of the part. We then give an algorithm to add more contacts to limit the deformation of the part due to external forces to within tolerance limits using FEM analysis.</p>	<p>•Graphic:</p> 
<p>•Broader Impact:</p> <p>The results from this research can be used to make the automotive assembly industry very flexible in terms of capacity and range of models manufactured. It also speeds up the design and implementation of newer models on the assembly line.</p>	



Highlight Enhancement

- Expand on your highlight by including a supporting write-up
- Be sure to include the topics on the example—don't change the format
- Be sure to include a graphic, and be sure it has broad appeal

And keep the highlights coming



Getting Involved





Be A Reviewer

-
- Proposal review is an important service to your community
 - There's no better way to see how the system works
 - There's no better way to understand what makes a winning proposal
 - If you think the system is unfair, try being part of it



How to Volunteer

- Contact your program director
- E-mail a brief (1-page) bio to your program director
- Be sure to include your contact information
- Indicate your areas of expertise

This will get you an expense-paid trip to visit your program director



Other Forms of Involvement

- Participation in NSF-sponsored workshops
- Service on advisory committees
- Service to your research community
 - Journal paper review/editing/etc.
 - Committee work



Questions

- It's always better to ask before you submit a proposal than after you get the reviews
- Remember, we're from the government, and we're here to help

www.nsf.gov