Research: Start to Finish Writing NASA Proposals

♦ Basics
♦ NASA’s Structure and Research & Analysis Programs
♦ Parts of NASA proposals: NSPIRES, NOIs, & Proposal Formats
♦ Proposal budgets
♦ Reviewing NASA proposals: From External Reviews to Review Panel
♦ References
♦ Q&A
Basics: Funding Your Research Career

All non-industry, PhD-level research scientists will need to fund their careers with research grants.

University | Gov’t Research Lab. | Industry

Programmatic goals

Freedom (YOU decide what to work on) | Independence from vagaries of funding $

Tips:

- During your postdoc (if not as a grad student), you should get experience writing research proposals!
### Funding Sources

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<th>Geosciences</th>
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**Tips:**
- Choose funding source appropriate for size and scope of project
- Your department (SESE), or ASU office of sponsored projects, or ASU Foundation, will have information on funding opportunities
**Tips:**

- Where ever you go, familiarize yourself with the *infrastructure* to submit proposals.
- At ASU, postdocs can be Co-Is, but CANNOT PI proposals to NASA or NSF – must be promoted to Faculty Research Associate first!
- Be sure to get help writing your first proposal from your advisor or SESE Research Staff!!
What Constitutes a Good Research Topic?

Topic is studiable

- Scientific methods & analyses can be applied
- Technology & resources exist to study the subject
  - People are trained and are available
  - Geographical (physical) facilities are available to do the research
  - Material & supplies (hardware, software, communication equipment) available
- Funding available
- Security can be maintained (if necessary) for ongoing research
- Research conforms to rules & guidelines of authorizing body

Topic is relevant to modern scientific study

- Research topic can be related to current problems needing a solution
- Will fill a void in the database of field
- Will provide useful information for future after other research is completed
- Potential to provide more funding to field over extended period
- Has potential to make money for the private sector
What Constitutes a Good Research Topic?

- **Scientifically significant**
  - "Ivory Tower" (Impact to 1 person)
  - Scientific "Fad" (Hot topic, scientific opportunism)
  - Impact (major/minor) on the scientific community

- **Should be achievable**
  - In general – resources, people, materials
  - YOU as the researcher

- **Topic should be “supportable”** – funding, equipment, etc.
Types of Proposals

Proposals are Solicited or Unsolicited

♦ Solicited Proposals
  ● Funding agency comes to you and asks for a proposal
  ● Very rare!

♦ Unsolicited Proposals
  ● Funding agency releases a call for proposals
  ● If you are interested, you may apply

Most Proposals provide funding as either Grants or Contracts

♦ Grants
  ● “Gift” (at least in 1st year), but need to show progress to receive next year’s funding via Annual Progress Reports

♦ Contracts
  ● “Deliverables” required at end of project: Report or hardware
NASA’s Structure

- **NASA has FOUR Mission Directorates**
  - Aeronautics Research (Air transportation system)
  - Space Technology
  - Human Exploration and Operations (ISS, and Beyond)
  - Science

- **NASA’s Science Mission Directorate splits the Cosmos into FOUR Divisions**
  - Earth Science
  - Heliophysics (The Sun)
  - Planetary Science (Everything in SS except above)
  - Astrophysics (Everything outside the SS)
Funding can come from NASA Missions

- Discovery-class (Small, PI-led, Cost cap $450M: Dawn, MESSENGER, GRAIL, InSIGHT)
- New Frontiers-class (Medium, PI-led, Cost cap $750M: New Horizons, Juno, OSIRIS-REx)
- Flagship-class (Large, Center-led, Cost cap $Multi B: Cassini, MSL, Europa Clipper)
- Other, Programmatic (LRO-Lunar Exp., MAVEN-Mars Scout)

NASA’s Research & Analysis (R&A) Program: ROSES 2015 AO (AO = Announcement of Opportunity = Annual Call for Proposals)

- Earth Science: ROSES Appendix A
- Heliophysics: ROSES Appendix B
- Planetary Science: ROSES Appendix C
- Astrophysics: ROSES Appendix D
Funding to the Missions’ Science Teams

- Usually written into initial proposal for mission or instrument
- PIs and Co-Is can receive large block of funding for postdocs, grad students, and staff scientists
- Proposal more complex than typical R&A proposals (many NASA Programmatic requirements)
- Usually done by mid-career or senior scientists w/prior mission experience

Funding to New Science Team Members (After Launch)

- Proposal calls prior to start of or during Prime Mission
- Participating Scientists, Guest Investigators, Guest Observers, Interdisciplinary Scientists

Tips:

- PS, GI, GO, and IDS programs are great way for early career scientists to break into field!!
Funding from NASA R&A Program: Examples

♦ Astrophysics
  ● Astrophysics Data Analysis, Astrophysics Research & Analysis, Astrophysics Theory, Kepler Guest Investigator, Swift Guest Observer

♦ Planetary Science
  ● Solar System Workings, Habitable Worlds, Emerging Worlds, Lunar Data Analysis, Mars Data Analysis, Cassini Data Analysis & Participating Scientists, Maturation of Instruments for SS Exploration

♦ Earth Science
  ● Land Cover/Land Use Change, Ocean Biology & Geochemistry, Biodiversity, Cryospheric Science, Interdisciplinary Research in Earth Science, Science of Terra and Aqua

Tips:
♦ Always read the AOs of the programs in your discipline to find the correct program(s) for your research!
Key Points:

- Scope, length, and amount of funding quite variable
  - DAPs are 3-year length, SSW can run up to 4 years
  - Facility proposals run 5 years; some research (geologic mapping) run longer than 3 years, so have to split work between two proposals
  - Most full time soft money scientists ideally fund themselves from 3-4 concurrent proposals, each covering 25% to 33% of their salaries. Better than smaller fractions from many projects!
  - A typical 3-yr, R&A grant covering 1/4 to 1/3 of your salary, with ‘normal’ ops, travel, and publications costs averages ~$80K-$100K, with no subcontracts (including overhead) or major equipment required

Tips: Starting your career, if you can get funding from mission work, you should!

- This business is very opportunistic!
Who Can Be Funded On Proposals?

The Principal Investigator, PI, leads a proposal effort

- The PI assembles the team to conduct proposed tasks
  - Co-Investigators participate in the work & receive funding
  - Collaborators contribute expertise to the proposal, but do not receive funding. Can be at same institution or different institution
  - Staff contribute specific expertise and can receive funding
  - Postdocs and Graduate Students are scientists in training, and can receive funding
  - Contractors can provide a specific product or service for a fee

TIPS

- Choose your funded Co-Is carefully – don’t let the proposal get more expensive than it needs to be!
- If a Co-I is too expensive, can compensate with a lower %FTE (Full Time Equivalent)
The first step in submission of a proposal is submission of an NOI or Step-1 Proposal

- NOI = Notice of Intent (to propose)
  - ≤1 page summary of proposal
  - No budget or list of Co-Is required, but sent by ASU!
  - Submitted electronically via NASA’s NSPIRES website (see next)
  - NASA uses NOIs to determine expertise required for Review Panel

- Step-1 Proposal
  - NASA Program Officers use these for new programs, to determine if proposal within scope of program
  - Proposals are either Encouraged or Discouraged to proceed to full regular proposal (Step-2 proposal)
  - No budget required, but list or funded Co-Is required!
Tips:

- New postdocs should register w/NSPIRES if you plan to be involved w/proposal writing or reviewing
Tips:

- Explore your NSPIRES account to locate solicitations, links to create NOIs and proposals, and review assignments
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Parts of a NASA R&A Proposal

- NASA proposals are submitted as PDFs via the **NSPIRES website** (NASA Solicitation & Proposal Integrated Review & Evaluation System)
  - NSPIRES pages
  - Table of Contents (pages as needed)
  - **Scientific/Technical/Management Section** (15 single-spaced pages)
  - References (pages as needed)
  - PI’s CV (2 pages)
  - Co-I’s CVs (1 page each)
  - PI’s list of Current & Pending funded research projects (pages as needed)
  - Co-I’s Current & Pending (pages as needed)
  - Facilities and Equipment list (pages as needed)
  - Budget Justification and Table of Work Efforts (pages as needed)
  - Detailed Budget (pages as needed)
Title: Geologic Mapping of Arsia and Pavonis Montes, Mars

Proposal No.: 09-MDAP09-0020
PI: Dr. David Williams
Submit Type: Electronic Submissions Only
Proposal Due: 08/21/2009, 11:59PM EDT
Status: Selected

Proposal Cover Page

Element | Updated | Status
--- | --- | ---
Proposal Summary | Last updated: 07/17/2009, Dr. David Allen Williams | ✓
Business Data | Last updated: 07/17/2009, Dr. David Allen Williams | ✓
Budget | Last updated: 08/13/2009, Dr. David Allen Williams | ✓
Program Specific Data | Last updated: 07/17/2009, Dr. David Allen Williams | ✓
Proposal Team | Last updated: 08/19/2009, Dr. David Allen Williams | ✓

* Status denotes if the minimum requirements have been met for each element. It is the responsibility of the PI/organization to determine if each element is completed for submission.

Proposal Attachments

* At least one document of this type is required for submission.
(1) Only one of this document type can be attached to a Proposal/NOI.
(M) Multiple files for this document type can be attached to a Proposal/NOI.

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Complete Proposal

* 09-MDAP09-0020.pdf

PI Selection Information Package (05/17/2010)

Type

- Notification Letter
- Panel Evaluation
Writing the Scientific/Technical/Management Section is the most time-consuming part of the process. ~15 pages long. Typical sub-sections:

- Introduction and/or Statement of Objectives of Proposal
- Approach & Methodology
  - Background (Previous work, similar ongoing work, etc.)
  - Description of Tasks
- Statement of Data Availability
- Data Management Plan (New in 2014)
- Statement of Perceived Impact on community
- Statement of Relevance to Program Objectives
- Work Plan, Management, and Schedule (table)

See example proposal!
Tips on Proposal Writing

♦ Writing proposals is learned from experience, and the best way to learn what to do and what NOT to do is to serve on a NASA Review Panel and experience it for yourself!

♦ These opportunities come when you start submitting proposals. In the meantime, some TIPS:

- Start working on research BEFORE you begin writing proposal, if you can – establish some credibility – you know the topic well!

- In each task, include proof-of-concept examples that demonstrate you know how to do what you propose to do

- Use figures appropriately; “Picture worth a thousand words!”

- Strengthen your proposals through a good publication record
  - PhD students should have 3-4 lead-authored publications from dissertation research (Get papers in review before you graduate!!)
  - Postdocs should strive for 2 lead-authored AND 2 co-authored publications every year of your postdoc – PUBLISH! PUBLISH! PUBLISH!
Proposal Budgets

Two Cost categories:

♦ Direct costs (DC)
  ● Salaries of researchers in terms of %FTE, employee-related expenses (ERE: health & retirement benefits)
  ● Operations: Research materials, hardware, software, laboratory equipment, field work expenses, publication costs, etc.
  ● Tuition for Graduate Students (does not contribute to IDC)
  ● Domestic & international travel expenses (Conference registration, air fares, mileage, lodging, rental cars, taxi/shuttle/train, per diem for food)
  ● Subcontracts: All of the above, but for funded colleagues at other institutions

♦ Indirect costs (IDC, or overhead – tax on proposals to pay for infrastructure at institution: Buildings, AC, lights, admin assist)
  ● Varies widely: ASU – 54.5%; JPL – ~150%
  ● Varies also for on-campus vs. off-campus research
Sample Budget

Key Points:

- Most Direct costs are in salaries
- Include money to present results at one conference/year
- Money for 1 new computer in 1st year -- $3-3.5K
- Money for one publication per year
- Two subcontracts
  - ~45% of whole proposal
  - Beware double overhead – ASU charges IDC on first $20K of subcontracts
Submitting your Proposal

Proposals are submitted by sponsoring institution, not by PI

- Once proposal is ready, upload to NSPIRES website
  - PI creates a webpage for proposal on NSPIRES cite
  - Sections for Proposal Summary (4000 characters), Business Data (Sponsoring org, start-end dates, environmental impact, point of contact), Budget, Program Specific Data, and Proposal Team (PI, Co-Is, Collaborators, Staff, Students)
  - Budget pages here MUST match budget page within proposal!! NASA goes by these budgets when awarding money
  - Upload proposal document as a PDF to site

- PI “Releases Proposal to Sponsoring Org”
  - They review the proposal PDF according to their guidelines, either ask for changes, or release it to NASA
  - Sponsoring org usually requires 2-5 days to review proposal!
View Proposal

Title: Geologic Mapping of Arsia and Pavonis Montes, Mars

Solicitation Announcement: NNX09ZDA001N-MDAP: Mars Data Analysis

Proposal No.: 09-MDAP09-0020
PI: Dr. David Williams
Submitter Type: Electronic Submissions Only
Proposal Due: 08/21/2009, 11:59PM EDT
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PI Selection Information Package (05/17/2010)

- Notification Letter
- Panel Evaluation
How NASA Proposals Are Evaluated

All NASA proposals are evaluated by a Review Panel within 3-6 months after submission

- Review Panels are composed of the NASA Program Officer and a group of scientists with expertise in subject & no conflicts of interest (not at same institution or on a competing proposal)
  - Panel divided into Groups (e.g., Geology, Geophysics, Remote Sensing, etc.) of ~6-8 reviewers
  - Each proposal is reviewed by 2-3 panelists and (ideally) 2-3 external reviewers (community members not on panel)
  - Each proposal is assigned a Chief Reviewer & Associate Reviewer, who’ve (ideally) submitted a review prior to arriving at the panel
  - One by one, each proposal is discussed: Chief’s review, associate’s review, external reviews. Then the proposal is scored.
  - Chief Reviewer writes the Consensus Review, which will be sent to PI
How NASA Proposals Are Scored

Proposals evaluations are scored in a standard format

- Reviewers and panelists score each proposal with 4 metrics:
  - Intrinsic Merit: Balance of Major and Minor Strengths and Weaknesses regarding proposed tasks, experience of the PI + team, methodology, etc.
  - Relevance to the NASA Program: Is the proposed work relevant to the goals of the NASA Program (Yes/No)
  - Cost Realism/Reasonableness: Does the proposal request appropriate funds (%FTE, operations, travel, etc.) to accomplish the proposed work?
  - Overall Grade: Overall quality of the proposal

- Scores:
  - Excellent-5, Excellent/Very Good-4.5, Very Good-4, Very Good/Good-3.5, Good-3, Good/Fair-2.5, Fair-2, Fair/Poor-1.5, Poor-1

- IM & Cost dominates the Overall Score

- After all proposals are scored, they ordered highest to lowest
Which NASA Proposals Are Funded?

Program Officer used Review Panel scores to fund the best proposals each year

- Review Panel uses scored proposal in their Group to determine the “waterline” (WL)
  - Proposals above WL can be funded if there are enough funds
  - Proposals below WL will not be funded
  - If more money may come available later in the FY, fundable proposals can be listed as “Selectable”

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Notification of Proposal Reviews

Soon after Review Panel (ideally within 120 days after submission), NASA notifies PI of results by email

- **Selected:** Proposal will be funded immediately *(fully or partially)*
- **Selectable:** Proposal MAY BE funded before end of Federal FY if more money comes available
- **Not Selected:** Proposal will not be funded this year

- Notification letter comes with Consensus Review, both downloadable from NSPIRES

**TIPS:**

- Often it takes about 9 months - 1 year from submission to receipt of funding
- Most 1st-time proposals are rejected. BE PERSISTENT!!
- If not selected, ALWAYS review Panel comments, and revise proposal for submission next year
References


