National Science Foundation
WHERE DISCOVERIES BEGIN

NSF Merit Review Process and Research Proposal Preparation

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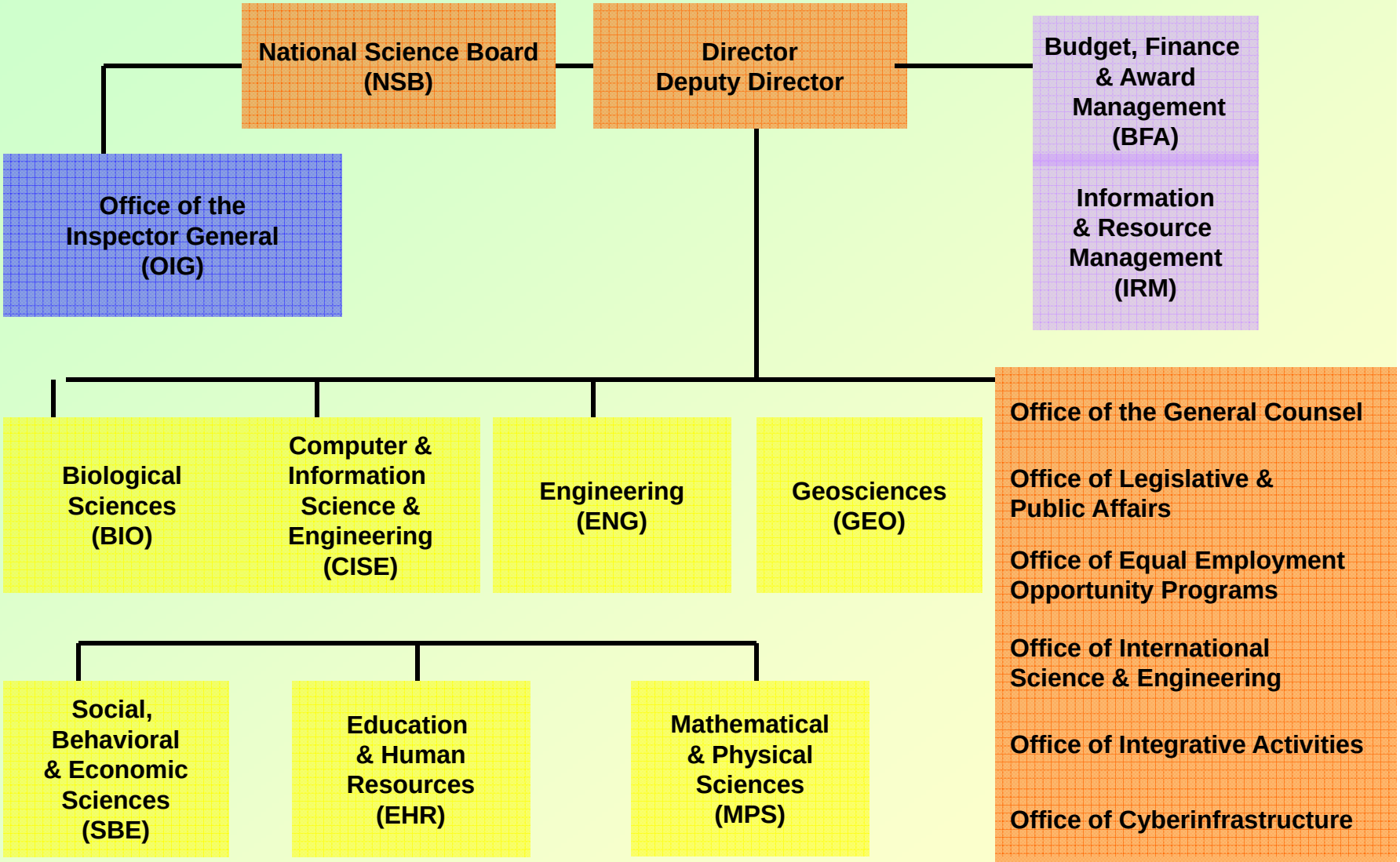
Outline

- Background: About NSF & me
- Mechanics of proposal process
- Proposal review
  - Submission
  - Review
  - Decision
- Scholarly interlude on merit review
- Proposal preparation specifics & advice

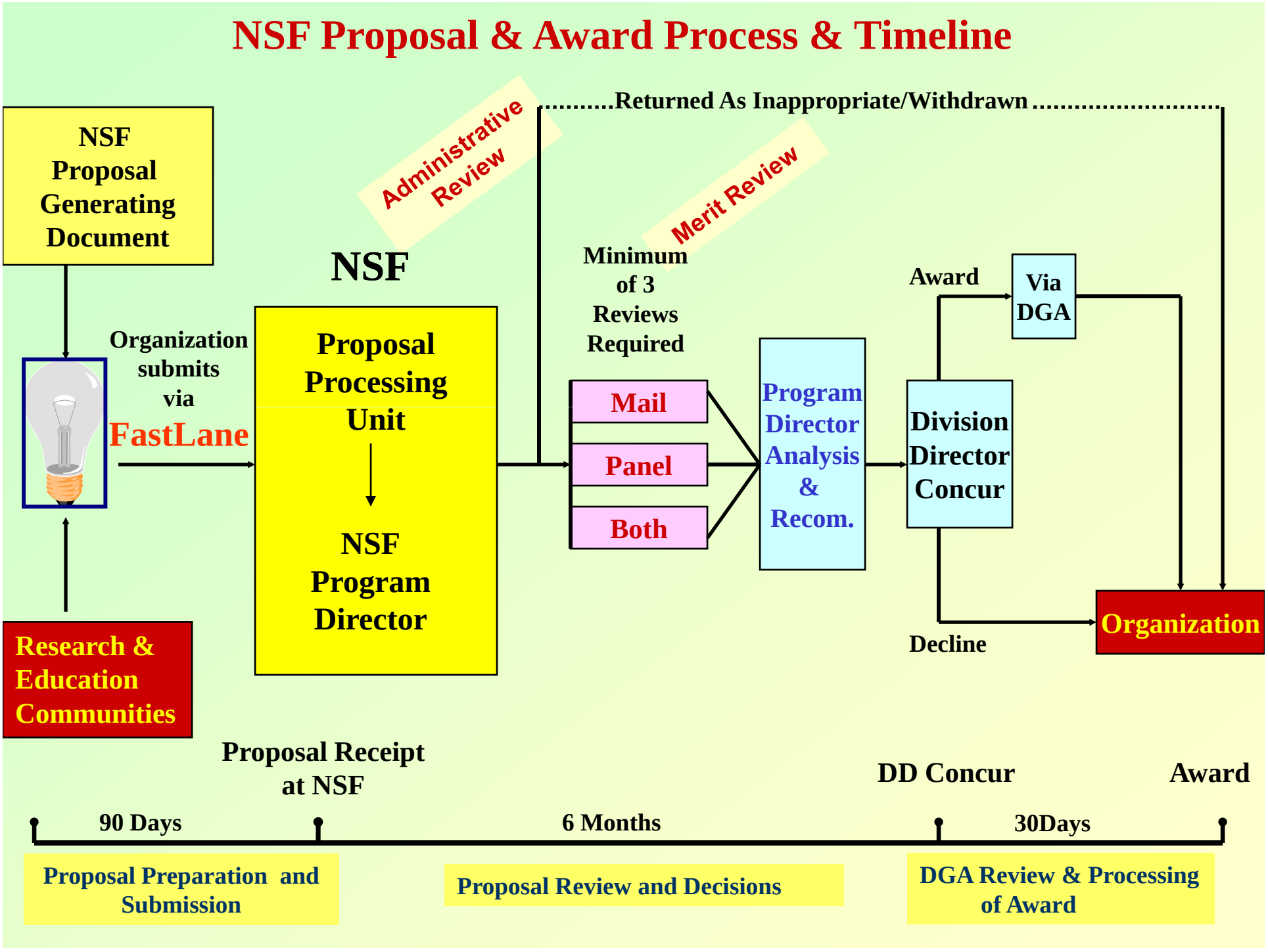
National Science Foundation

- Not a foundation
- Established by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare…"
- Independent agency—outside Cabinet
- Guided by National Science Board
- Merit review (from ONR) & COV (since mid-1970s) to award grants & evaluate process
- Permeable—borrows university faculty
- Translator and transducer

NSF Organizational Chart



NSF Proposal & Award Process & Timeline



Proposal Submission

- How?
  - Via FastLane (https://www.fastlane.nsf.gov) *or* Grants.gov (http://www.grants.gov)
- Who?
  - Universities and colleges
  - Non-profit, non-academic organizations
  - For-profit organizations
  - State and local governments
- To whom?
  - Categories of Funding Opportunities
- What?
  - Basics of Proposal Types
- When?
  - Target date, deadline and window

Proposal Submission - Categories of Funding Opportunities

- Program Description (or Announcement)
  - broad, general descriptions of programs
  - accepts investigator-initiated proposals
- Dear Colleague Letter
  - general information; clarifies or amends existing policy or document; announces opportunities or special competitions for supplements to existing awards
- Program Solicitation
  - encourage submission of proposals in specific program areas of interest to NSF
  - more focused; normally limited-time request
  - may include additional review criteria and reporting requirements, budgetary and eligibility limits, require letters of intent or pre-proposals, etc.

Proposal Submission - What?

- Letters of Intent
  - Only if required by the program
    - Intent: to help NSF gauge size and range of competition
    - Content: PI's and co-PI's names, proposed title, list of possible participating organizations, and synopsis
    - Not externally evaluated or used to decide on funding
- Preliminary Proposal
  - Only if required by the program
    - Intent: reduce proposal preparation effort, increase quality of full proposals, inform review process
    - Contents: based on the program
    - Review and decisions: merit review to aid decisions
      - Invite or not; Encourage or not
- Full Proposal
  - Typical submission to NSF

Proposal Submission - When?

Published in program descriptions and solicitations

- Target dates
  - dates after which proposals still accepted, but may miss a particular panel
- Deadline dates
  - dates after which proposals will not be accepted for review
- Submission Windows
  - designated periods of time during which proposals accepted for review
- Accepted any time – After speaking with a Program Director
  - e.g. SGER (Small Grants for Exploratory Research), conference/workshop proposals, supplements

Words of Caution

- Plan Ahead!!
  - Don't wait until the last minute.
  - Don't count on getting a time extension
- Submission
  - Check before you submit
    - Print out from FastLane to ensure pdf conversion is correct
  - Work with your Sponsored Projects Office
- After submission
  - Acknowledgment and FastLane proposal status page
  - FastLane Proposal File Update module
    - Parts of a proposal *may* be replaced after submission
    - Don't count on this, the word is *may*, not *can*.

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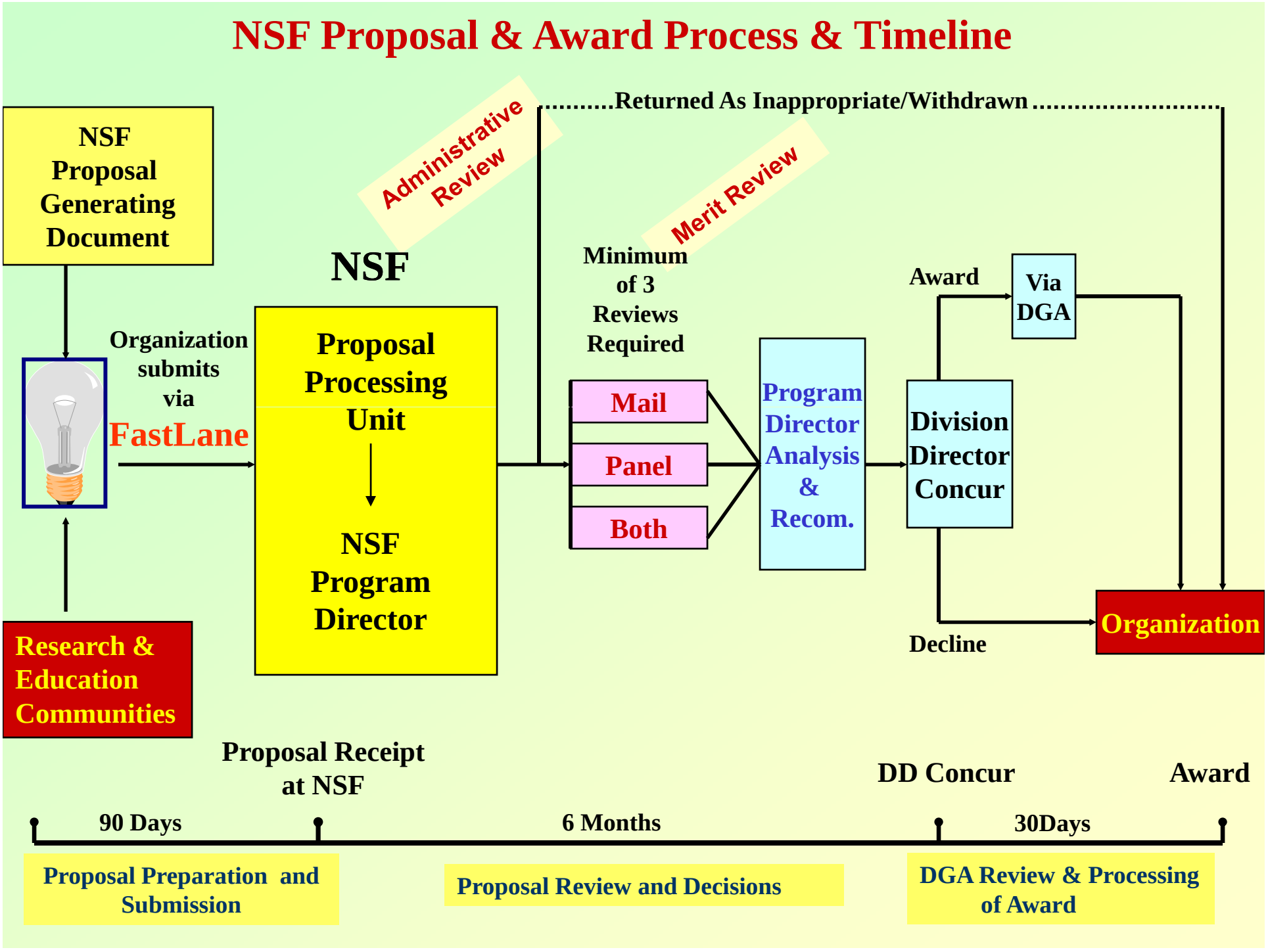

Proposal review process

- Administrative Review
  - Printed, checked, transferred to Division/Office
  - Assigned to program, cluster, section, etc.
  - Checked for compliance
    - Both review criteria
    - Format
    - Appropriateness
- Merit Review
  - *Ad Hoc* (email) reviews
  - Panel review
- Decisions
  - Award or decline recommendation by Program Director
  - Concurrence by Division Director
  - Non-award notifications by Division/Office
  - Award notifications by Division of Grants and Agreements

Administrative Review

- **Compliance Check**
  - Print problems, format, page limits, etc.
  - Return without review
    - FAILS TO ADDRESS BOTH CRITERIA IN PROJECT SUMMARY
    - inappropriate for funding by NSF
    - insufficient lead-time before the activity's start
    - received after announced proposal deadline date
    - full proposal submitted when preliminary proposal "not invited"
    - duplicate of, or substantially similar to, proposal already under consideration by NSF from same submitter
    - does not meet NSF proposal preparation requirements
    - not responsive to GPG (Grant Proposal Guide) or program announcement/solicitation
    - previously reviewed & declined; not substantially revised
    - duplicates another proposal already funded

NSF Merit Review

NSF invests in the best ideas from the most capable people, as determined by competitive merit review.

Merit Review Criteria

- **Intellectual merit**
  - Creativity and originality and *transformative potential*
  - Potential to advance knowledge
  - Conceptualization and organization
  - Qualifications of investigators
  - Access to resources
- **Broader impacts**
  - Promotes teaching, training and learning
  - Participation of underrepresented groups
  - Enhancement of infrastructure
  - Dissemination of results
  - Benefits to society

A scholarly interlude on merit review

- Describe the context of merit review
- Provide an institutional analysis of merit review
  - What does it do?
    - Manifest and latent functions
  - What values or principles guide it?
    - Values compete: ambivalence
  - … Let's set the stage with some alternatives to merit review….

Ways To Allocate Funds For Science

- Legislators may allocate funds
  - Earmarking and Pork Barrelling
  - + Democratic
  - + Legitimate
  - + Distributional fairness
  - - "Political"
  - - Inexpert
  - - Culturally corrosive
  - ... More than $4.5B (est.) spent by earmark

Another Way To Allocate

- Strong Manager (DARPA)
  - + Flexible and responsive
  - 0 Assumes clear objectives and standards
  - 0 Requires outcome accountability
  - 0 May not work for all aims or fields
  - - Projects have defined objectives, programs sustain fields
  - - Must seek out failure, cut losses, redirect effort

One Final Option...

- Formula funding
  - $$= $\alpha\xi + \beta\psi + \chi\zeta + \delta\iota\zeta\zeta\psi$
  - Who writes the formula, in what terms?
  - $$ to states or institutions or departments?
    - Then merit review? Another formula?
  - Will it encourage creativity and responsiveness?
  - How will it start young careers and finish "old" careers?
  - Gaming and unintended outcomes

So….

- Merit review is a choice…
  - There are alternatives.
- NSF made its choice at "birth," has adapted over the decades, and thrived through merit review
- Merit review informs and guides POs, who are active scientific decision makers—a mixed model
- And some purposes of merit review are subtle ….

Merit review in principle…

- A process for "grading the grain" and allocating scarce resources, of course.
  - NIH: reviewers are asked to evaluate the science, the whole science, and nothing but the science of a proposal
- But it is also much more…

A Source of Expert Advice

- To NSF and to the proposal author
- Improves science through wise allocations of resources and identifying new opportunities
- Cumulatively, it shapes the research area and the agency research program

A Flywheel

- Lends stability
- Embodies the "essential tension" of science between tradition and originality
- Helps researchers "stay the course" through obstacles of research

Mode of Scholarly Communication

- Original ideas circulate among influential scientists, which helps prepare the field to accept them
- People may become aware of or involved in activities (workshops, meetings, panels, publications) that are in formation
- Stream of proposals represents new intellectual growth of a field, shaped through merit review

Enactment of Professional Authority

- Distinguishes science from other endeavors (we don't use merit review to make most allocation decisions!)
  - Symbolic importance as a badge of cultural distinctiveness and professional autonomy
- Creates a "preserve" for evaluation and decision making that is relatively free of other considerations (e.g., politics, fads).

Entry Point for Social Considerations

- Currently formalized in the broader impacts criteria at NIH and NSF—which have different weight in different decisions
- Program officer balancing portfolio (gender, ethnicity, geography, undergrad institutions)
- NIH Advisory Councils and "specials"
- Is greater citizen participation possible?

Competing Values

- Social values are the standards of goodness, truth, beauty and such that a society shares—the principles of evaluation
- Values may be unitary or coherent, or they may be organized in pairs that are in tension with one another—"ambivalence"
- Criticisms of merit review often overlook the variety and inconsistency of the values it is asked to serve

Competing Values

- Openness-Secrecy
- Effectiveness-Efficiency
- Sensitivity-Selectivity
- Innovative (transformative)-Inertial
- Meritocratic-Fair
- Rigorous-Responsive
- Reliable-Valid

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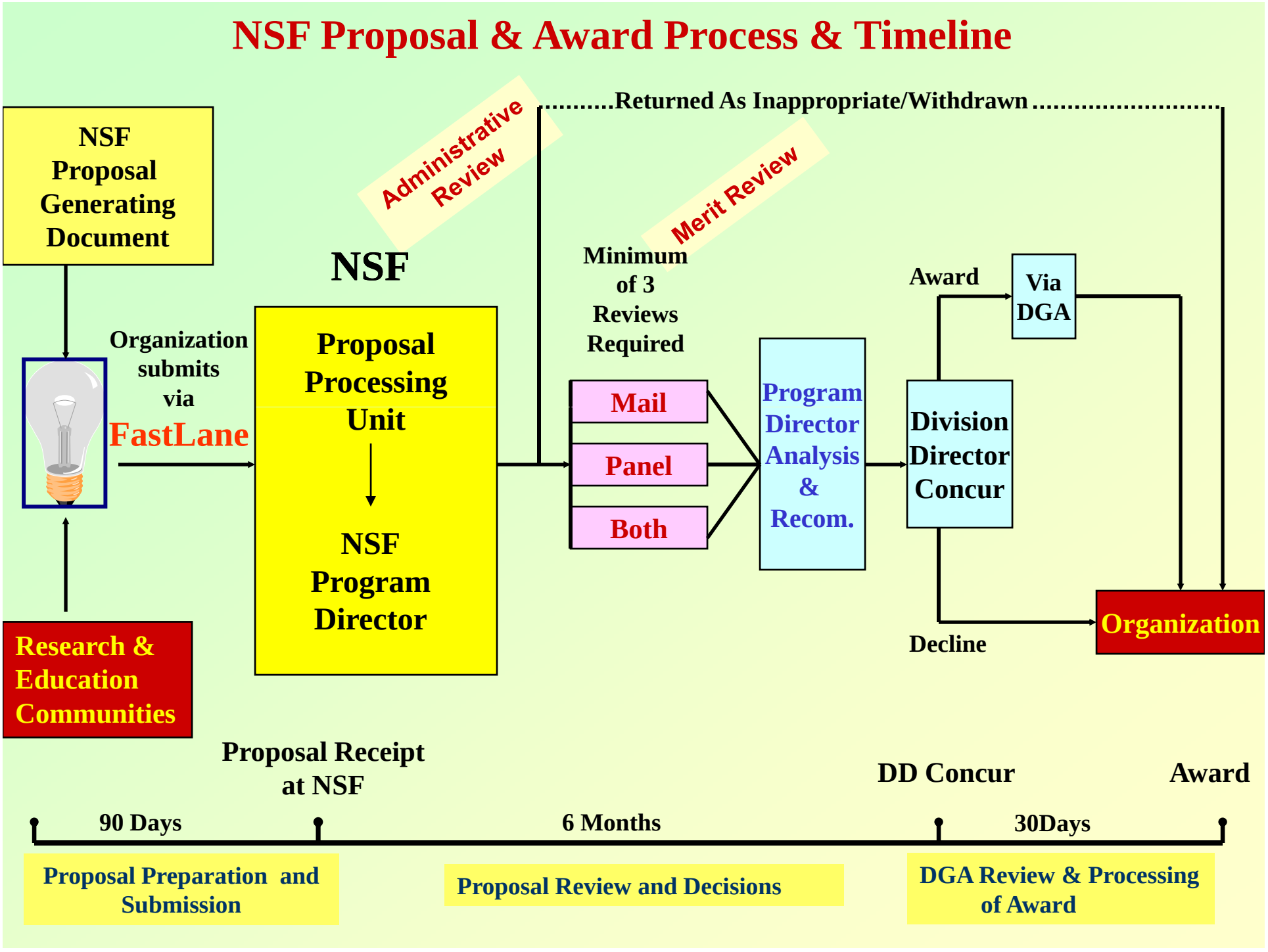

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Merit Review

- Mail Reviews
  - Identifying reviewers:
    - Reviewer suggestions by the PI
    - Program Director's knowledge of the research area
    - References listed in proposal
    - Recent meeting programs of professional societies
    - Recent authors in scientific and engineering journals
    - Reviewer recommendations
    - Google and the web
- Panel Reviews
  - At least two panelists provide written reviews
  - All are expected to contribute to the discussion of the proposal and its panel rating

Reviewer Conflicts of Interest

- Remove or limit influence of ties to an applicant institution or investigator that could affect reviewer advice
- Preserve trust of scientific community, Congress, and general public in integrity, effectiveness, and fairness of review
- Types of COIs:
  - Affiliations with applicant institutions
  - Relationships with investigator or project director (personal and/or professional)

Basis for decisions: Reviews

- Written Reviews
  - Substance of the review is more important than the rating.
  - Program Director analyzes reviews.
    - Fairness
    - Substance of the reviews
    - Technical problems raised in the reviews
    - Reasons for the reviewer concerns or enthusiasm
    - Information not available to the reviewer (e.g. updates)
  - Program Director sometimes obtains additional reviews or comments from the PI
- Panel Advice—substance and priority

Basis for Decisions: A Balanced Portfolio

- Innovation and Creativity
  - **Potentially transformative proposals**
- Breadth of research areas
- Priority areas and systems
- Demographics and Diversity
- Broadening participation
- Institutional impact- RUI, EPSCOR, etc.
- Integration of research & education
- International collaborations

Outline

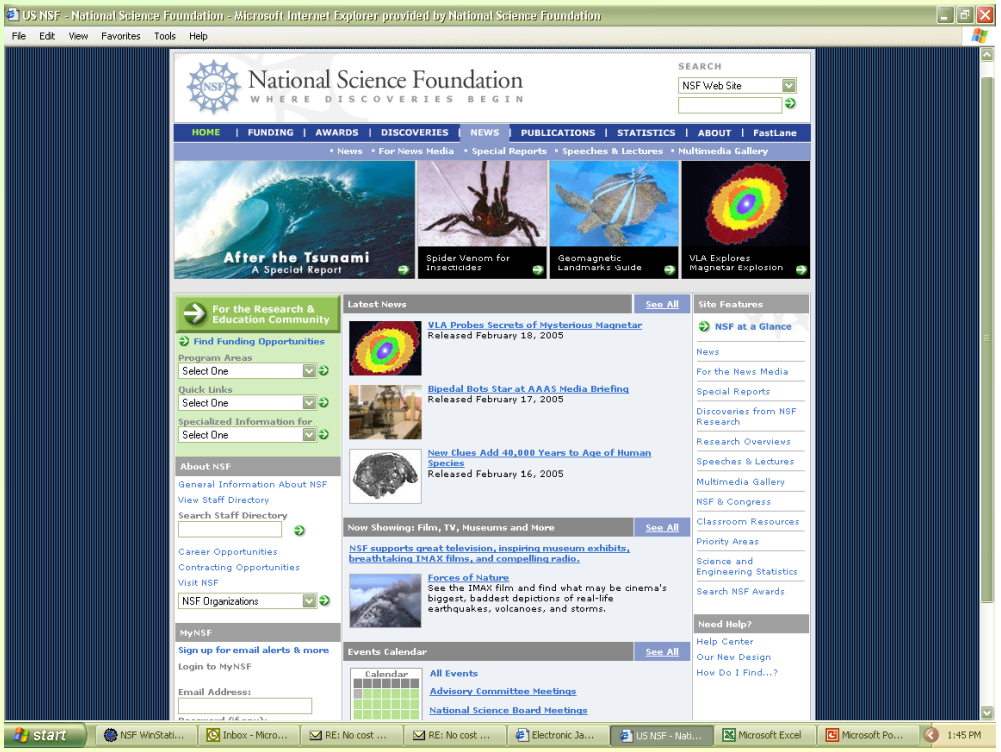
- You now have an expert's understanding of the proposal review and decision processes
- Research proposal preparation
  - Getting started
  - The proposal & proposal writing tips

Research proposal preparation

A good proposal is a good idea, well expressed, with a clear indication of methods for pursuing the idea, evaluating the findings, making them known to all who need to know, and indicating the broader impacts of the activity.

Step 1: Getting started

- There is no substitute for a good idea!
- Find the right program early!
  - It's better to do this well before you write, than after you get your reviews back.



Develop your brilliant idea

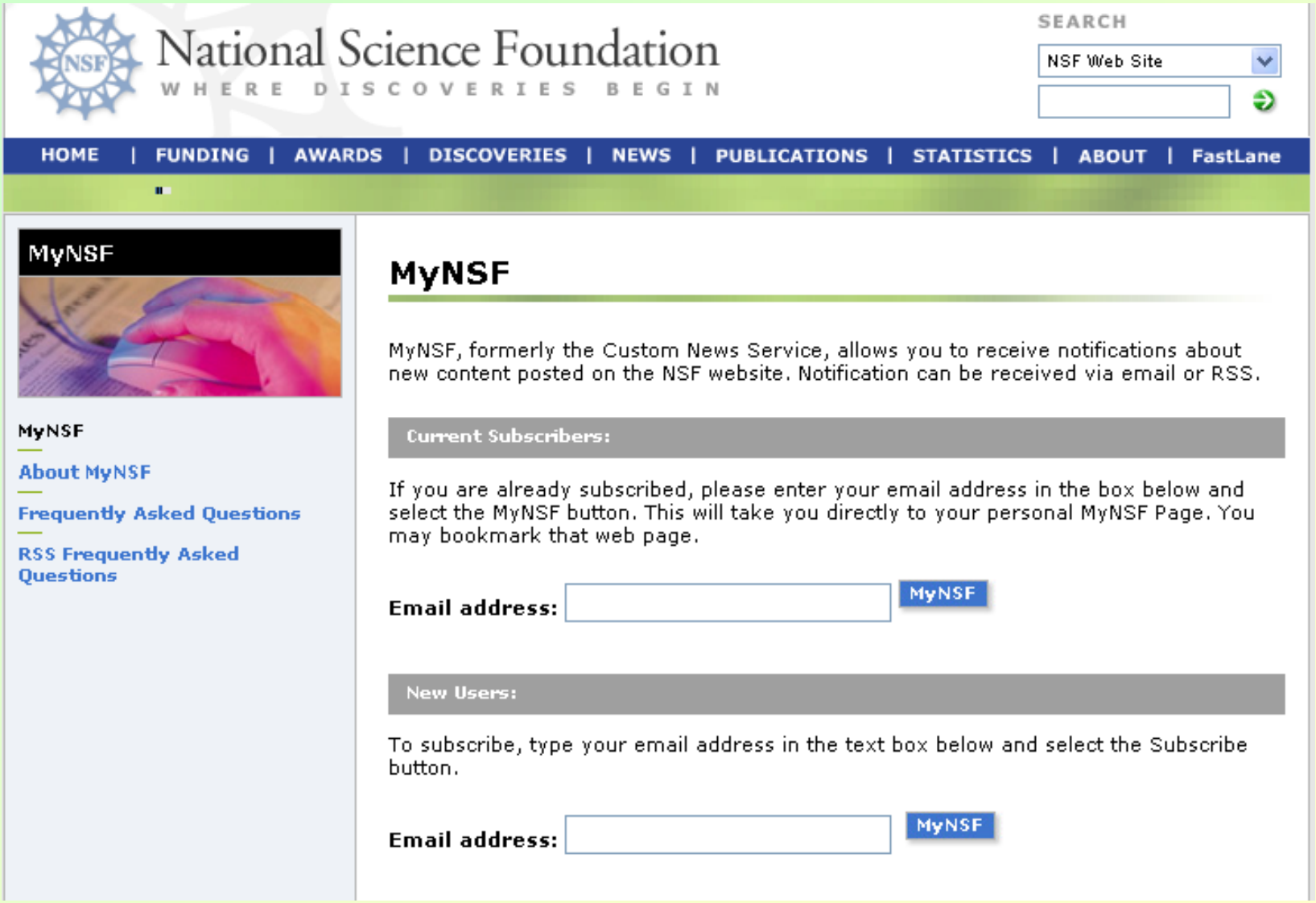
- Key Questions
  - What do you intend to do?
  - Why is the work important?
  - What does the literature provide?
  - How are you going to do the work?
- Make sure it is original and exciting
  - Survey the literature
  - Talk with others in the field
- Convince people that you can do it
  - Obtain preliminary data
  - Develop arguments to support feasibility
  - Determine available facilities and resources
    - What you have
    - What collaborators can help with

Finding the right program

- What to look for:
  - Goal of program or announcement
  - Eligibility
  - Special requirements
  - Deadlines or target dates
- Where:
  - www.nsf.gov
  - Program Directors (phone, email)
  - MyNSF

Read the program description or solicitation carefully.

MyNSF
http://www.nsf.gov/mynsf/



Step 2: The Proposal

The Grant Proposal Guide

- Get it - Read it - Follow it
- Proposal preparation and submission
- Submission of collaborative proposals via
  - Subaward
  - Separate, yet linked, proposals
- Review criteria and process
- Return-without-review criteria
- Withdrawal, declination, and award processes
- Significant award administration procedures

Parts of a Proposal

- Cover sheet and certifications
- Project summary
  - Both intellectual merit and broader impacts described
- Table of contents
- Project description
- References cited
- Biographical sketches
- Budgets and justification
- Current and pending support
- Facilities, equipment and other resources
- Special information/documentation
  - NO reprints, preprints, letters of endorsement
- Single Copy Documents
  - Reviewer suggestions, deviation authority, confidential information, etc.

Project Summary

- This page is critical:
  - It influences which program or panel will review your proposal.
  - It must address both review criteria
    - If not, then returned without review.
- Intellectual Merit
  - Describe the research problem & its importance
  - State the overall goal and specific aims
  - Describe how the aims will be achieved
- Broader Impacts
  - Educational & outreach activities; infrastructure; dissemination of results; underrepresented groups; benefit to society

Project Description

- The key to a strong proposal
- Overall concept / rationale
- Hypothesis-driven or Data-driven or Innovation-driven
- Execution
  - Careful
  - Thorough
  - Appropriate

Project Description

15 pages to cover:

- Objectives and expected significance
- Relation to present state of knowledge
- Methods and procedures
- Results from prior NSF support (required if applicable)
- Relation to your longer term goals
- Optional sections:
  - preface, background, preliminary studies, specific objectives

Advice: Project Description

- A proposal is not a linear document
- Original, subtle, complicated ideas demand clear, careful, lucid explanation
- Writing = thinking; rewrite for clarity and impact
- Simplify and streamline:
  - Make sure you get your overall idea across!
- Sweat the small stuff:
  - Spell check and proof-read
  - Prepare clear photos, graphs, etc.
  - Readable font and font-size

Advice: The reader over your shoulder

- The reviewer may not be an expert in your specific field
- Make it easy for reviewers to like your proposal—show you're committed, engaged
- Lost on page one is lost forever
- Figures and tables get your point across clearly
- You cannot predict what a reviewer will notice

Advice: Be reasonable

- Be aware of the scope:
  - "Too ambitious" vs. "Too narrow"
- Be honest and up-front:
  - Address issues, don't try to hide them
  - Acknowledge possible research complications problems and have alternatives
- Explain what the literature provides and why research is needed

Biographical Sketch

- Professional Preparation
- Appointments
- Publications
  - 5 closely related
  - 5 other significant publications
- Synergistic activities
- Collaborators & other affiliations
  - Collaborators (last 4 yrs) & co-editors (last 2yrs)
  - Graduate and Postdoctoral Advisors
  - Thesis Advisor and Postgraduate-Scholar Sponsor

Budget

- Budgets should be
  - reasonable, but ask for what you need
  - for personnel, equipment, travel, participant support, & other direct costs (subaward, consultant, computer services, publication costs)
  - for cost of educational activities associated with research, where appropriate
- Unless solicitation specifies otherwise, do not:
  - include cost-sharing on Line M in budget
  - exceed cost-sharing level or amount specified in solicitation
- Justification

Current and Pending Support

- List everything
  - current, pending, and anticipated
- Be careful of overlap
  - Perception of overlap could be detrimental in the review.
- Dual submissions
  - Only when they are allowed

Why do some proposals fail?

- Absence of original ideas or hypotheses
  - Incremental
  - Not exciting or original
- Errors
  - Unclear or incomplete expression of aims
  - Faulty logic or experimental design
  - Less than rigorous presentation
- Unrealistic, sloppy or incomplete
- Resources and facilities not in place
  - PI qualifications/expertise not evident
  - Necessary collaborations not documented

If you have to resubmit…

- Stay calm!
  - Take ten… breaths, hours, days
  - Examine the criticisms carefully
- Get in touch:
  - Call, email or visit your program director
- Think carefully about rapid resubmission:
  - Take time to evaluate the proposal and the project

Funding and afterwards

- Funding
  - Budget and scope may be negotiated before award
  - Funding may be as a standard grant (all $ at once) or continuing grant ($ released annually).
- Afterwards
  - Do what you promised (*pretty much*)
  - Notifications & Requests via FastLane
  - Supplement opportunities
    - REU - Research Experience for Undergraduates
    - ROA - Research Opportunity Awards
    - RET - Research Experience for Teachers
  - Submit annual and final reports

Getting Support in Proposal Writing

- NSF Publications
  - Program Solicitations
  - Grant Proposal Guide
  - Web Pages
  - Funded Project Abstracts
  - Reports, Special Publications
- Program Directors
  - Incumbent
  - Former "Rotators"
- Mentors on Campus
- Previous Panelists
- Serving As A Reviewer
- Sponsored Research Office
- Successful Proposals

NSF on the web- An indispensable resource

www.nsf.gov