2023 Mid-scale Research Infrastructure (RI) Webinars
NSF Key Messages

Dr. Roland Roberts, Deputy Chief Officer for Research Facilities (DCORF)

Mr. Matthew Hawkins, Head, Large Facilities Office (LFO)

Overview - Key Messages from NSF

- **RI awards are not the same as research grants:** RI constitutes a **fixed deliverable** that is expected **on-time and within budget** whereas research grants are less constrained
- **Build your team:** Project planning and management may require finding, gaining or hiring certain expertise > **These cost are allowable in the proposal budget!**
- **Start with scientific requirements & technical scope: NOT** a **preconceived budget** or an allowable **programmatic ceiling**
- **The solicitation governs proposal submission:** Proposers are advised to read all applicable guidance documents including relevant sections of the *Research Infrastructure Guide* (RIG)
- **Ask questions:** Program Officer on the solicitation & LFO on the RIG

Project Planning & Management - Key Messages from NSF

- **Every project benefits from some level of planning**
- **Management approach (people, processes, tools, etc.):** Should match the project and be articulated in the Project Execution Plan (PEP)
- **The PEP is YOUR document:** Minimum set of required components (See section 5 of the RIG) but tailored to the project > **If adequate for project management, the PEP should meet NSF's needs for oversight**
- **The PEP is a living document:** The level of information should mature with the project, be updated when beneficial, and only submitted to NSF upon request or per the terms & conditions of the award
- **Design proposals do not need a mature PEP at time of award:** Sufficient to carry out the design award **plus** include a plan to further mature the PEP to support a potential implementation award

NSF Mid-Scale Learning

Webinar #1 - Part 1

An Introduction to Projects, PEPs & the Research Infrastructure Guide (RIG)

Mark Warner, PE, PMP | Carol Wilkinson, PhD., SCPM

Class Overview

Learning Objectives:

- Describe what a Project Execution Plan (PEP) is and how it fits into the development of a Project
- Explain key documents & terminology used in creating PEP components
- Familiarize mid-scale proposers with some of the NSF's key requirements for creating a PEP
- Explain how to begin the development of *your* PEP

In This Presentation:

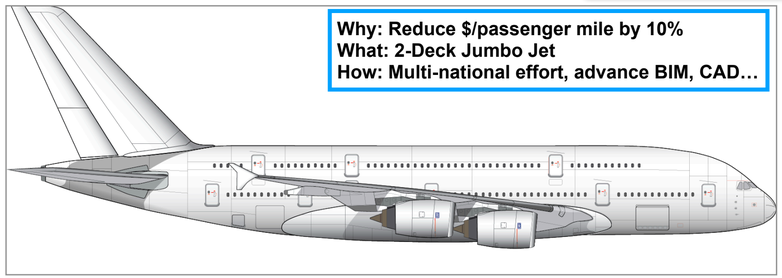
- What Is A Project—And What Is A Project Execution Plan (PEP)?
- PEPs As Defined By The Research Infrastructure Guide (RIG)
- "Tailored," Progressively-Elaborated PEPs For Mid-Scale Projects

What Is A Project?

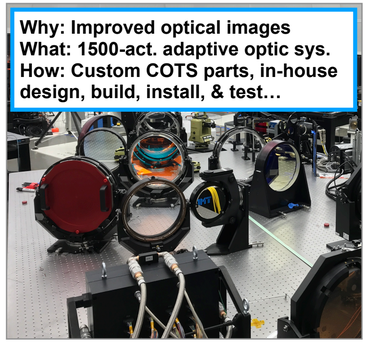
All projects are unique—but they all share common elements, starting with Why, What, & How?

Why: Cross body of water
What: Iconic Suspension Bridge
How: J. Strauss “safety first” A&E & Construction

Why: Need monument/burial tomb for Pharaoh
What: Giant stone-built pyramid
How: Quarried rock, slave labor, alien designs…



Why: Reduce $/passenger mile by 10%
What: 2-Deck Jumbo Jet
How: Multi-national effort, advance BIM, CAD…



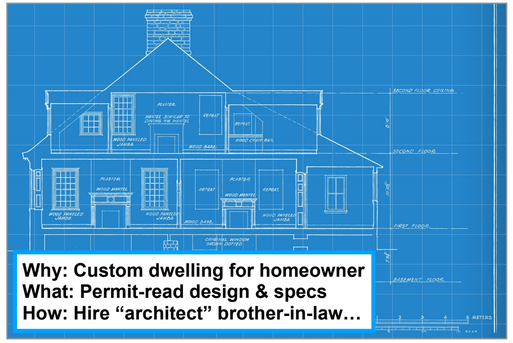
Why: Improved optical images
What: 1500-act. adaptive optic sys.
How: Custom COTS parts, in-house design, build, install, & test…

Why: Save lives from global pandemic
What: Mass-produced injectable vaccine
How: Employ MRNA technology, fast-track testing, govt. funded

Why?

What?

How?



Why: Custom dwelling for homeowner
What: Permit-read design & specs
How: Hire “architect” brother-in-law…

Why: Understand collected raw data
What: Peer-reviewed, published paper
How: Long, lonely nights, toiling in obscurity…

Why: Help customer use product
What: Printed instruction manual
How: Tech writer-led staff interviews…

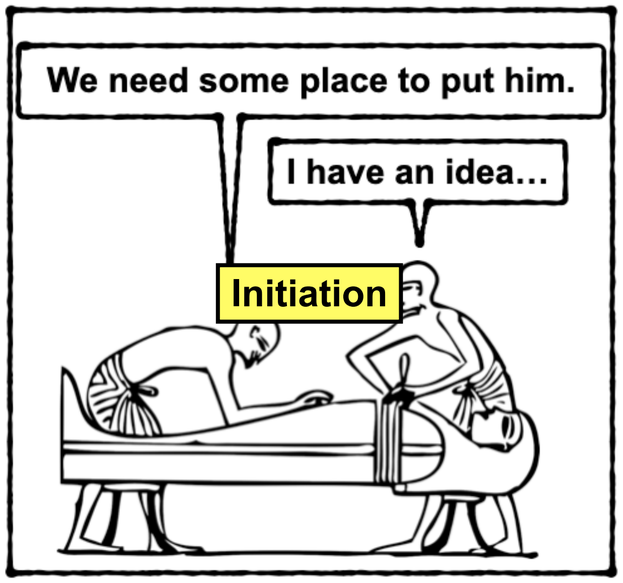
Why: Provide high resolution visible and IR stellar observations
What: Turn-key 8m-class observatory + instrument suite
How: In-house design, contracted construction, in-house testing

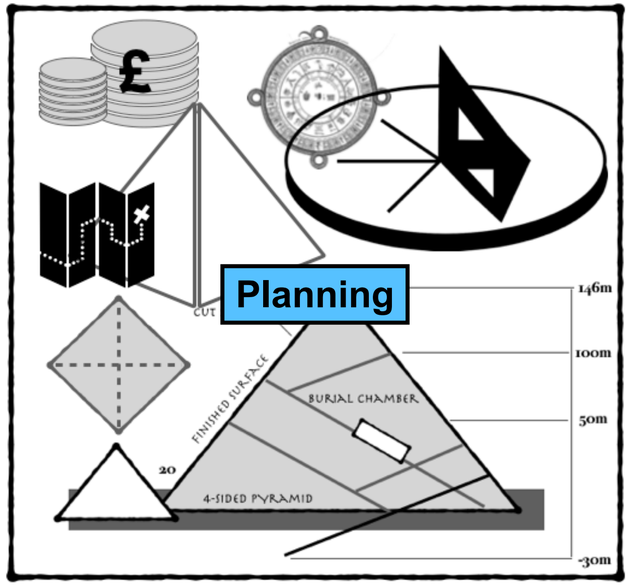
Why: Understand newly discovered single-cell organisms
What: Create a new SCO research facility
How: Partner with universities, public funding….

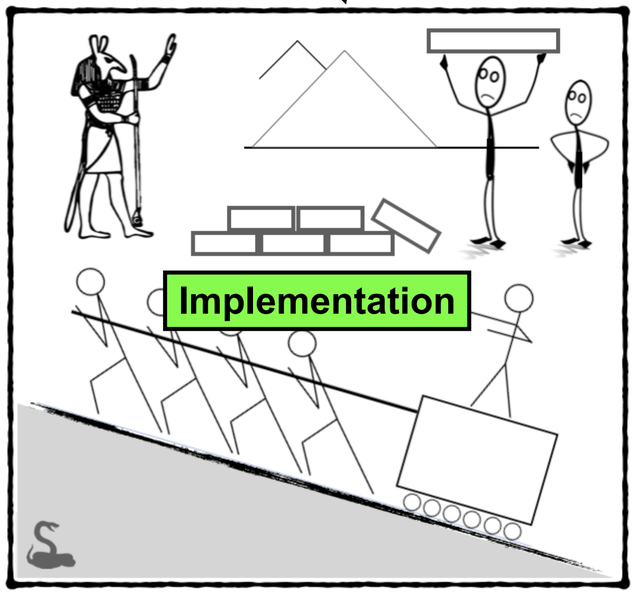
Why: Respond to user complaints
What: Improve reliability, speed of app
How: Hire software team and work through checklist of common issues

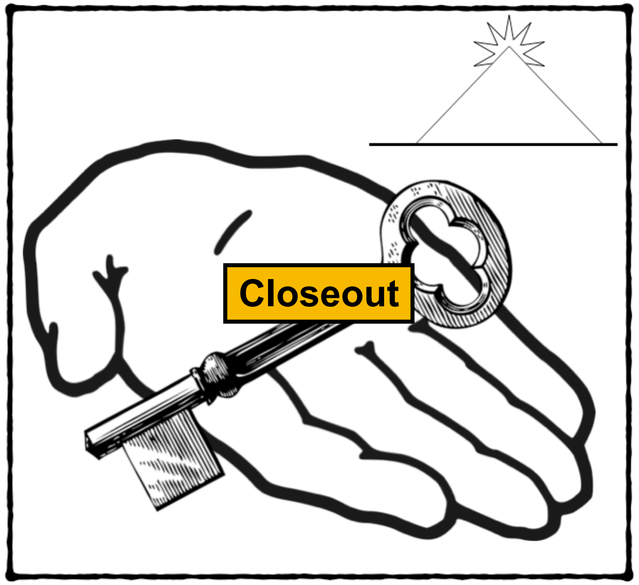
The 4 Major Phases of Every Project

…a need for something, a plan to create it, execution of that plan, and a plan to wrap it up…



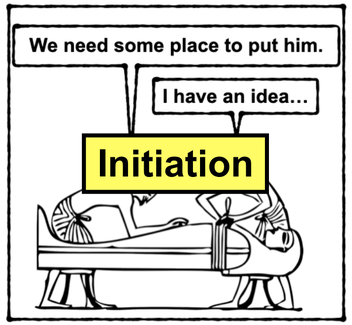




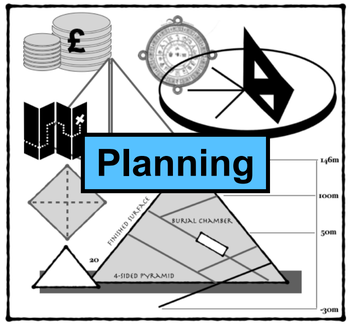


Someone Has Need For Something	A Detailed Plan Is Developed	Plan Is Implemented, Issues Solved	The Project Is Successfully Concluded
Why?	**What?**	**How?**	**How?**

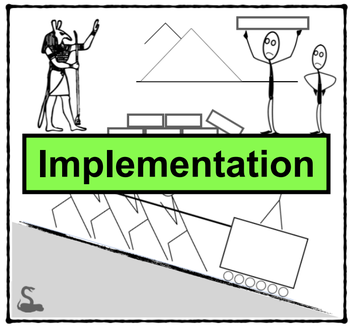
Every Project Addresses A Series Of Similar Questions



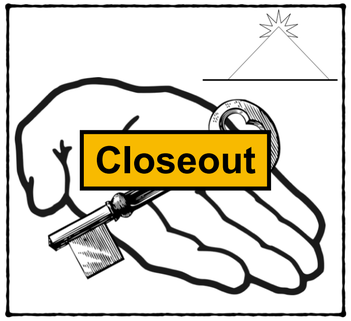
Why Is This Project Needed?
Who is asking for the project? What is the overall purpose?



What Will Be Created?
What is the deliverable & what constraints are placed on it and us?



How Will It Be Created?
"How are we going to efficiently acquire the deliverable within those constraints?"



How Will The Project End?
"What will happen at the end of the project—and after that, too?"

The Project Objectives

- **Who** Are The Main Parties Involved In This Project?
- **Why** Do They Want and/or Need This Project?
- **What** Do They Envision as The Solution to the Problem?

The Project Definition/Baseline

- **What** Are The Project Deliverable(s)?
- **What** Are The Acceptance Criteria For Deliverable(s)?
- **What** Is The Cost To Create The Deliverable(s)?
- **What** Is The Timeline To Create The Deliverable(s)?

Plans for Implementation

- **How** Will The Deliverable(s) Be Created?
- **How** Will Resources Be Organized & Managed?
- **How** Will Work Be Directed, Monitored, & Controlled?
- **How** Will Project Information Be Managed & Distributed?
- **How** Will Project Risks & Issues Be Managed?

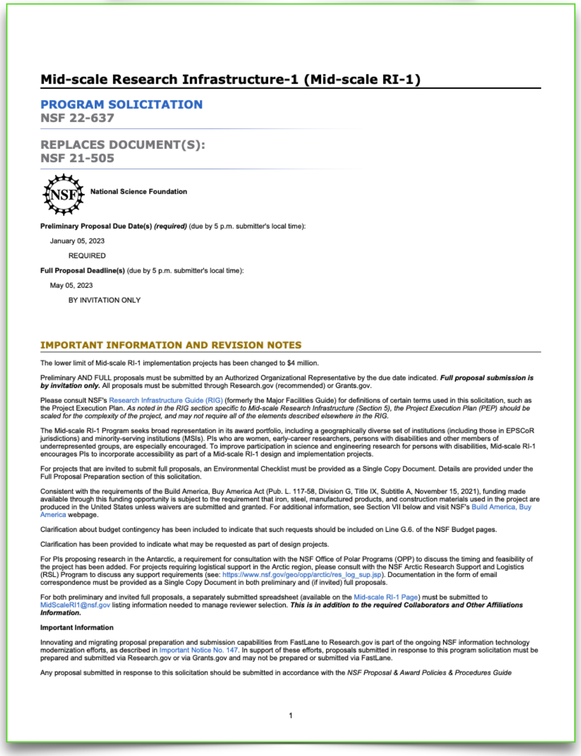
Plans for Completion

- **How** Will The Project Be Concluded?
- **How** Will The Deliverable Be Used After The Project?

Primary Inputs to a Project Execution Plan (PEP)

The NSF's Project/Solicitation Guidance Documents

Solicitation



Mid-scale Research Infrastructure-1 (Mid-scale RI-1)

PROGRAM SOLICITATION
NSF 22-637

REPLACES DOCUMENT(S):
NSF 21-505

National Science Foundation

Preliminary Proposal Due Date(s) *(required)* (due by 5 p.m. submitter's local time):

January 05, 2023

REQUIRED

Full Proposal Deadline(s) (due by 5 p.m. submitter's local time):

May 05, 2023

BY INVITATION ONLY

IMPORTANT INFORMATION AND REVISION NOTES

The lower limit of Mid-scale RI-1 implementation projects has been changed to $4 million.

Preliminary AND FULL proposals must be submitted by an Authorized Organizational Representative by the due date indicated. ***Full proposal submission is by invitation only.*** All proposals must be submitted through Research.gov (recommended) or Grants.gov.

Please consult NSF's Research Infrastructure Guide (RIG) (formerly the Major Facilities Guide) for definitions of certain terms used in this solicitation, such as the Project Execution Plan. *As noted in the RIG section specific to Mid-scale Research Infrastructure (Section 5), the Project Execution Plan (PEP) should be scaled for the complexity of the project, and may not require all of the elements described elsewhere in the RIG.*

The Mid-scale RI-1 Program seeks broad representation in its award portfolio, including a geographically diverse set of institutions (including those in EPSCoR jurisdictions) and minority-serving institutions (MSIs). PIs who are women, early-career researchers, persons with disabilities and other members of underrepresented groups, are especially encouraged. To improve participation in science and engineering research for persons with disabilities, Mid-scale RI-1 encourages PIs to incorporate accessibility as part of a Mid-scale RI-1 design and implementation projects.

For projects that are invited to submit full proposals, an Environmental Checklist must be provided as a Single Copy Document. Details are provided under the Full Proposal Preparation section of this solicitation.

Consistent with the requirements of the Build America, Buy America Act (Pub. L. 117-58, Division G, Title IX, Subtitle A, November 15, 2021), funding made available through this funding opportunity is subject to the requirement that iron, steel, manufactured products, and construction materials used in the project are produced in the United States unless waivers are submitted and granted. For additional information, see Section VII below and visit NSF's Build America, Buy America webpage.

Clarification about budget contingency has been included to indicate that such requests should be included on Line G.6. of the NSF Budget pages.

Clarification has been provided to indicate what may be requested as part of design projects.

For PIs proposing research in the Antarctic, a requirement for consultation with the NSF Office of Polar Programs (OPP) to discuss the timing and feasibility of the project has been added. For projects requiring logistical support in the Arctic region, please consult with the NSF Arctic Research Support and Logistics (RSL) Program to discuss any support requirements (see: https://www.nsf.gov/geo/opp/arctic/res_log_sup.jsp). Documentation in the form of email correspondence must be provided as a Single Copy Document in both preliminary and (if invited) full proposals.

For both preliminary and invited full proposals, a separately submitted spreadsheet (available on the Mid-scale RI-1 Page) must be submitted to MidScaleRI1@nsf.gov listing information needed to manage reviewer selection. ***This is in addition to the required Collaborators and Other Affiliations Information.***

Important Information

Innovating and migrating proposal preparation and submission capabilities from FastLane to Research.gov is part of the ongoing NSF information technology modernization efforts, as described in Important Notice No. 147. In support of these efforts, proposals submitted in response to this program solicitation must be prepared and submitted via Research.gov or via Grants.gov and may not be prepared or submitted via FastLane.

Any proposal submitted in response to this solicitation should be submitted in accordance with the *NSF Proposal & Award Policies & Procedures Guide*

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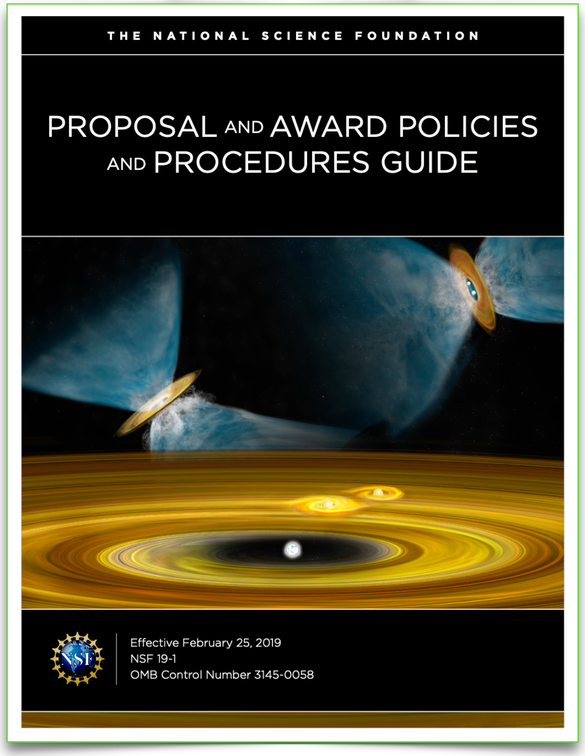
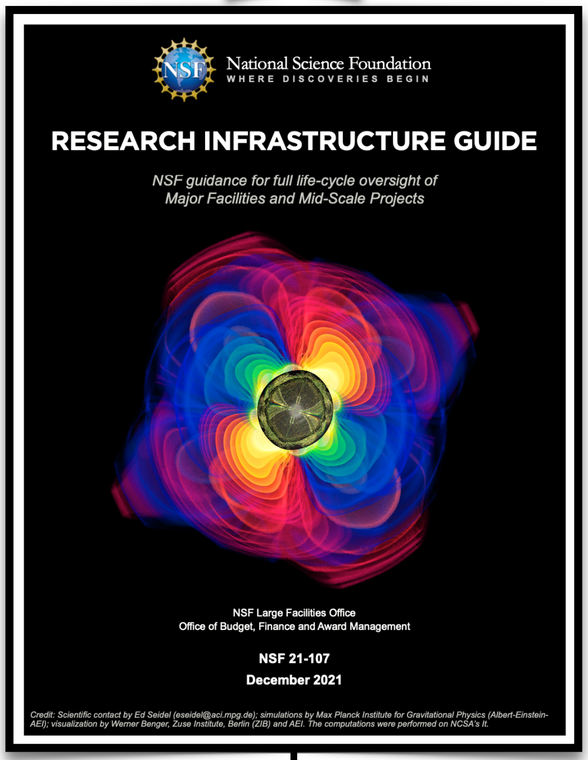
PAPPG



RIG



Project Execution Plan (PEP)

- **Section 3.4: Full MREFC PEP Definition**
- **Section 5: Mid-Scale PEP Requirements**

RIG Section 3.4 - Project Execution Plan

The sixteen (16) Project Execution Plan (PEP) components for Major Construction (>$100M)

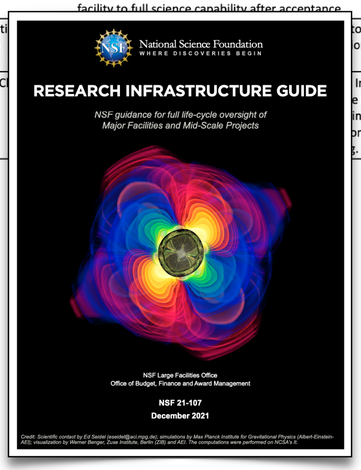
Component	Sub-Topics	Description of Sub-Section Requirements
1. Introduction	1.1 Scientific Objectives	Description of the research objectives motivating the facility proposal.
	1.2 Scientific Requirements	Comprehensive statement of the Requirements Matrix/ Key Science Requirements to be fulfilled by the proposed facility (to the extent possible identifying minimum essential as well as desirable quantitative requirements), which provide a basis for determining the scope of the associated infrastructure requirements.
	1.3 Facility / Infrastructure	Description of the infrastructure necessary to obtain the research and education objectives.
	1.4 Scientific & Broader Societal Impacts	Description of the Broader Societal Impacts associated with the purpose of the facility, including the scope of work, budget and schedule related to science community or society related actions or interactions.
	1.5 Facility Divestment Plan	Description of plans and estimate of divestment liabilities at the end of facility life for transfer, demolition, site remediation, decontamination, etc., where appropriate.
2. Organization	2.1 Internal Governance & Organization and Communication	Internal Project Governance and Organization Structure with clear lines of authority, responsibility, and communication between Internal and institutional governance and oversight and advisory committees.
	2.2 External Organization and Communication	External Project Organizational Structure and Governance, showing clear lines of authority, responsibility, and communication between NSF, any partners, and the Recipient.
	2.3 Partnerships	Role of interagency or international partners in future planning and development and/or construction. Plans, agreements, and commitments for interagency and international partnerships. Description of the project's stakeholders and their roles, responsibilities and meeting schedules.
	2.4 Roles and Responsibilities	Roles and Responsibilities of key project personnel and governance groups.
	2.5 Community Relations and Outreach	Community Relations and Outreach plans for building and maintaining effective relationships with the broader research community that will eventually utilize the facility to conduct research and with the public. Description of scientific and educational outreach programs.
3. Design and Development	3.1 Project Development Plan	Description of activities that will be undertaken in order to achieve readiness for construction, such as design, prototyping, manufacturing process validation, vendor qualification, modeling and simulation, creation of required project management plans, forming partnerships, etc.
	3.2 Development Budget and Funding Sources	Estimate of total budget required to perform Design and Development, including NSF funding and any contributions from partners and other outside sources.
	3.3 Development Schedule	Schedule of design and development activities and milestones, at a level of detail appropriate to the maturity and complexity of the work.

Component	Sub-Topics
4. Construction Project Definition	4.1 Summary c Project Definiti
	4.2 Work Breal Structure (WBS
	4.3 WBS Dictio
	4.4 Scope Man Plan and Scope Contingency
	4.5 Cost Estima Plan, Executive Summary, and Budget
	4.6 Budget Cor
	4.7 Cost Book, Model Data Se Basis of Estima
	4.8 Funding Pr
	4.9 Baseline Sc Basis Documer Integrated Sch
	4.10 Schedule Contingency

ion Requirements
SF and other project-specific job application of indirect cost rates must stimating Plan (CEP) and Basis of tion 4.2 of this Guide.
ents for hiring and training staff, ncreasing or decreasing staffing cations for key staff.
describes the methodology/process analyzing, tracking, controlling, and es both qualitative assessment and ethods.
tool that provides a ranked list of k impact analysis and prioritization, ion plans and opportunities of risk us over time. Documents data and k analysis.
ent plans and approval process using e NSF approval requirements per s (CAs).
anagement Plan; roles and
d technical feasibility study, including al requirements and major systems. lesign requirements, drawings, and
ces between major components or s for managing communication, actions. Interface Management Plan
quality control requirements and s.
lans.
manage accounting changes and or PMB plan: changes in scope, t or schedule, and movement of ut of the PMB. Includes approval and es plus roles and responsibilities.
for managing version control, access, t related documentation.
ns, processes, subawards, and cluding evolving technologies and definition. Provide a time-based list curement actions.
process for acquisitions (NSF, year by year Acquisition Plan of ted to require NSF approval.
ct management organization and
S plans, processes, software, and
and Business processes and controls.

Component	Sub-Topics	Description of Sub-Section Requirements
11. Site and Environment	11.1 Site Selection	Site selection criteria and description of selected site(s).
	11.2 Environmental Aspects	List need for any Environmental Impact Statements, permitting, site assessments, etc.
12. Cyber-Infrastructure	12.1 Cybersecurity Plan	Plan for protecting access, confidentiality, and integrity of key information assets of the facility.
	12.2 Code Development Plan	Plan to enable critical scientific/engineering capabilities and data flows within the facility as well as interoperability with key external collaborators or stakeholders.
	12.3 Data Management Plan	Plans for acquisition and integration of equipment or services from third parties.
13. Environmental, Safety and Health	13.1 Environmental, Safety and Health Plans	Environmental, Safety and Health plans (ES&H).
14. Review and Reporting	14.1 Reporting Requirements	Statement of reporting requirements, including notifications for specific events and periodic reports on progress and project technical and financial status per NSF contractual requirements or CAs.
	14.2 Audits and Reviews	Statement of the required and proposed reviews, audits, and assessments for progressing during project life cycle through project close-out.
15. Commissioning	15.1 Integration and Testing Plan	Describes the acceptance criteria and technical activities that should be completed as part of construction to transition the facility to operations.
	15.2 Operational Readiness Plan	Plan for determining operational readiness; includes administrative (non-technical) acceptance procedures to transition the facility from construction to operations such as conducting the operational readiness review and the authorities for making the determination(s).
	15.3 Concept of Operations Plan	Plans for, and estimate of, annual operations and maintenance costs (staffing, services, material/supplies, etc.) and funding sources that will be needed when the facility has completed construction and is transitioned to operations. This plan should include activities to bring the facility to full science capability after acceptance.
	15.4 Segregati Funding Plan	to on and
16. Project Close-out	16.1 Project Cl Plan	Includes e as well in the on for .

1. Introduction
2. Organization
3. Design & Development
4. Construction Project Definition
5. Staffing
6. Risk & Opportunity Management
7. Systems Engineering
8. Configuration Control
9. Acquisitions
10. Project Management Controls
11. Site & Environment
12. Cyber-Infrastructure
13. Environmental, Safety and Health
14. Review and Reporting
15. Commissioning
16. Project Close-out



RIG Section 3.4 - Project Execution Plan

The sixteen (16) components of a complete MREFC-type Project Execution Plan (PEP)…

Component	Sub-Topics	Description of Sub-Section Requirements
1. Introduction	1.1 Scientific Objectives	Description of the research objectives motivating the facility proposal.
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3. Design and Development	3.1 Project Development Plan	Description of activities that will be undertaken in order to achieve readiness for construction, such as design, prototyping, manufacturing process validation, vendor qualification, modeling and simulation, creation of required project management plans, forming partnerships, etc.
	3.2 Development Budget and Funding Sources	Estimate of total budget required to perform Design and Development, including NSF funding and any contributions from partners and other outside sources.
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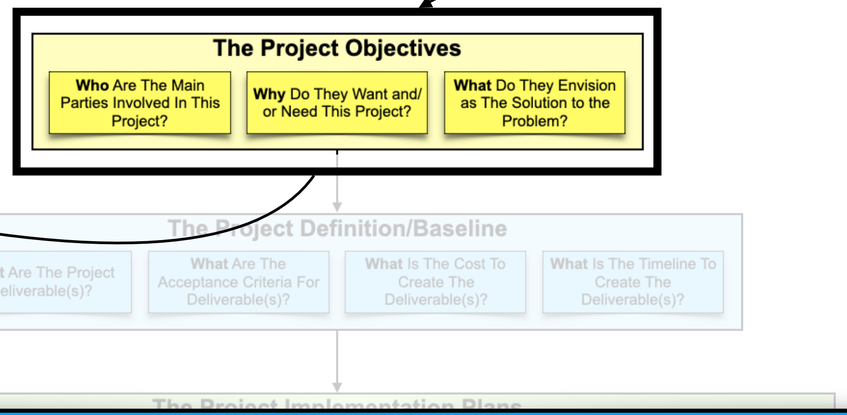


1. **Introduction**
2. **Organization**
3. **Design & Development**
4. **Construction Project Definition**
5. **Staffing**
6. **Risk & Opportunity Management**
7. **Systems Engineering**
8. **Configuration Control**
13. **Environmental, Safety and Health**
14. **Review and Reporting**
15. **Commissioning**
16. **Project Close-out**

A PEP serves two key purposes:

1. Helps you work through, understand, describe, and (ultimately) manage your project.
2. Demonstrates to the NSF that you have considered all relevant aspects of your project—and have a reasonable plan in place to carry it out within proposed budget and schedule.

Section 5 of the RIG: Guidance for Mid-Scale Projects

Reduced "Mid-Scale" PEP Requirements vs. Complete "MREFC" PEP Components

Section 5:
"Scaled" Mid-Scale Project PEP

Programmatic Deliverables: Mid-scale projects should be executed using well-established project management methodology. The specific project management approach used should be scaled to the needs of the project. For example, project management controls used to manage project resources and schedules, performance management, financial and progress reporting requirements, and risk management techniques should be carefully considered such that burden does not outweigh the benefit.

A Project Execution Plan (PEP) is required for all mid-scale projects in order to document the foundation for how the project will be managed by the Recipient during the construction stage (also referred to as implementation). Concurrence on an initial PEP must be reached between NSF and the proposing organization. It is reasonable to expect the PEP to evolve during the execution of the award.

The following list provides the minimum required components of the PEP for a mid-scale project as compared to Section 3.4.1 of this Guide. The contents of each PEP component should be tailored in both detail and scope to the specifics of the project. Refer to Section 3.4.1 of this Guide for descriptions of typical elements of each PEP component. Unless otherwise noted in the solicitation, the sub-topics within each PEP component should be included. Although, some of the material may also be included in the mid-scale proposal itself, inclusion in the PEP allows for completeness and reference in the award terms and conditions.

1. Introduction
2. Organization
4. Construction Project Definition
6. Risk and Opportunity Management
8. Configuration Control
9. Acquisitions
10. Project Management Controls. Describe the methods for performance measurement and management.
12. Cyber-Infrastructure
13. Commissioning, including Concept of Operations

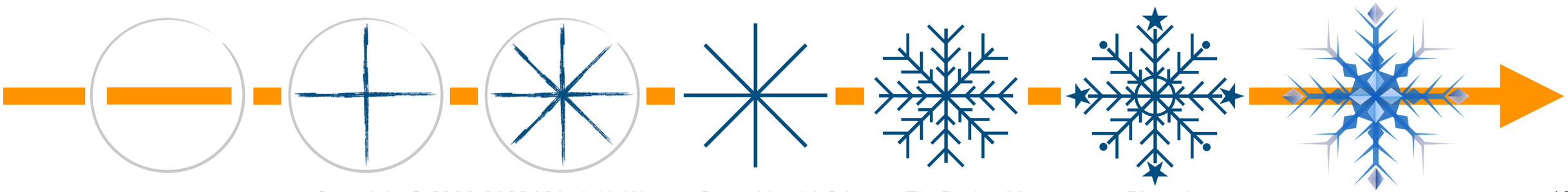
- **Every project is unique!**
- **The minimum required component list may *or may not* be sufficient to fully describe your specific mid-scale project.**
- **Your mid-scale project may need one or more of the non-mandatory sections included.**
- **E.g., Staffing, Review and Reporting, Project Close-out, etc…**

1. **Introduction**
2. **Organization**
3. **Design & Development**
4. **Construction Project Definition**
5. **Staffing**
6. **Risk & Opportunity Management**
7. **Systems Engineering**
8. **Configuration Control**
9. **Acquisitions**
10. **Project Management Controls**
11. **Site & Environment**
12. **Cyber-Infrastructure**
13. **Environmental, Safety and Health**
14. **Review and Reporting**
15. **Commissioning**
16. **Project Close-out**

The PEP is a “Living Document”

Your PEP should be progressively elaborated in a manner appropriate for the proposal stage…

- **Preliminary Proposal Submission**: Initial “working copy” of PEP
  - Rough outline draft with all of your specific project components included
  - Draft descriptions and placeholder sections are okay—provided they include explanations for ***your*** management approach and what will be included in a Full Proposal Submission
  - Justifications for any excluded mandatory components should be included.
- **Full Proposal Submission**: Updated & detailed version of PEP
  - All components developed and written in detail
  - Include details of how any incomplete sections will be matured.
- **Funding Award**: Fully mature, “ready to implement” version of PEP
  - Note: for design proposals, a fully mature PEP is not required at the time of award; the PEP may be updated after the award



The Key Takeaways

- **A well-considered/constructed PEP is a useful tool for both you & NSF:**
  - Helps you plan (and execute) a successful project:
    - ie., Deliver full scope within specifications, on time, and on budget
  - Helps NSF's understanding (and oversight) of your project
  - *Mid-scale projects are not the typical "best effort"-type research grant proposals*

- **Familiarize yourself with the RIG, as it's one of the key guides that mid-scale projects must adhere to.**
  - Section 3.4 and 5 in particular for PEP development

- **A mid-scale PEP should be tailored to *your* unique project needs**
  - Minimum PEP requirements spelled out in Section 5 of RIG….
  - …but every project is unique; you may need/want more than that minimum

- **Progressive Elaboration is key— you don't have to do it all at once!**

Next Up: A Deep Dive Into PEP Component 1

An introduction to the Introduction…

1. **Introduction**
2. **Organization**
3. **Design & Development**
4. **Construction Project Definition**
5. **Staffing**
6. **Risk & Opportunity Management**
7. **Systems Engineering**
8. **Configuration Control**
9. **Acquisitions**
10. **Project Management Controls**
11. **Site & Environment**
12. **Cyber-Infrastructure**
13. **Environmental, Safety and Health**
14. **Review and Reporting**
15. **Commissioning**
16. **Project Close-out**

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Questions?

NSF Mid-Scale Learning

Webinar #1 – Part 2

PEP Component 1: Introduction

Carol Wilkinson, PhD, SCPM and Mark Warner, PE, PMP

Presentation Overview

Webinar Series Goals

- Familiarize Midscale project leaders and key personnel with NSF minimum requirements for a Project Execution Plan (PEP)
  - Research Infrastructure Guide (RIG) Chapters 3 and 5
- Explain terms and language used in creating PEP components
- Provide examples for tailored, practical, and acceptable PEP component responses
- Present the practical application of the PEP management plans during implementation

In This Presentation

Cover the Introduction component of the PEP

- It focuses on the kernel of a project: the motivation, the needed infrastructure, and the people involved and benefitting
- It is high level - can be created early in the project when all details not yet worked out.
- It can be revised and updated as planning advances – progressive elaboration
- It promises to deliver a specific product well-defined in advance, unlike research projects which reach for goals or ”best effort” to advance knowledge

PEP 1. Introduction

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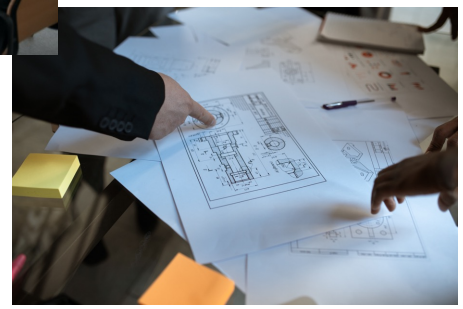
Researchers and technical leads need to understand the components of the Introduction, since they will be writing most of it.



High Level version of WHY, WHAT, HOW, and WHO BENEFITS

- WHY – motivation for the project
- WHAT - deliverables, requirements, and completion metrics
- HOW – methods of implementation
- WHO Benefits - besides you
  - Research community outside the project
  - Society at large
- And .. WHAT happens to the facility when it will no longer be used?

Required for Mid-scale projects – customized to each project

- Not just a repeat or condensed version of the proposal
  - Focus on project scope details and methods for implementation
  - Less background info, e.g., previous research/development or staff experience
- Not a sales pitch
  - Proposals are snapshots in time meant to sell and then be archived
  - PEP evolves as planning matures and then provides a roadmap during implementation

1.1 Scientific Objectives

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Scientific Objectives address WHY, WHAT, and WHO BENEFITS

- High level description of the problem, how you are addressing it, and why it is important
- Serves as a summary for the details that will be elaborated in later components of the PEP: WBS, cost, schedule, etc.

Example Objectives Statement for imaginary project:

Cargo Sand Bike (CASABI)

WHAT

Design a low cost, off-road, human-powered cycle that can operate in very sandy soils while carrying a few hundred pounds of load and/or people. The cycle must be sturdy and easily built using widely available materials and simple manufacturing methods.

More WHY

- Remote, sandy desert areas have high levels of poverty and limited access to resources due to a lack of roads and transportation
- Low-cost methods of transporting small cargo loads and people have proved effective in improving access to benefits and resources, reducing poverty
- Motorized and animal powered vehicles are not practical

WHY and WHO

1.2 Scientific Requirements

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Scientific Requirements

Need images of molecules with high resolution over 1 nanometer. Choice of atomic force microscope rather than x-ray diffraction or electron beam microscopes defines the key parameters.

Essential vs. Desirable Requirements

Three data storage sites (2 physical sites plus cloud storage) are desirable; two are the minimum essential

Further define the WHAT: more details

- Specific Key Science Requirements to be fulfilled by the proposed design/infrastructure
  - For design projects, make a clear distinction between requirements to do the design work versus requirements for a future infrastructure or product
- Performance Metrics, qualitative and quantitative
- Identify minimum essential as well as desirable quantitative requirements
- Requirements provide the basis for determining the scope of the associated design/infrastructure

Style Point: The PEP is a manual for implementation

- Be concise and precise - avoid wordiness and only include necessary detail
- Use diagrams, bulleted lists, tables, and graphics to supplement, summarize, and organize text sections

1.2 Requirements Example: (CASABI)

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STEM Learning Behavior Studies

Creation of Collaborative Data Bases

WHAT – requirements that describe and set high level bounds on the solution

- Design a human-powered cycle with cargo/passenger box
- Suitable for off-road use in sandy conditions
- Capable of carrying up to 405 lbs. of cargo or 3 local adults
- Cost of parts must be less than $1,000
- Maximum number of standardized and readily available commercial parts over custom parts
  - Minimum of 80% commercial parts
- Simplified assembly plan requiring low mechanical skills and common tools
  - Match capabilities at local sites in region of use

Note that the WHAT deliverable may not be a physical facility or piece of equipment

1.3 Facility / Infrastructure

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Audio/Visual Equipment and Teams

Facility Operators and Staff

"Scope Statement" – HOW you are going to do the WHAT

- Describe the method or solution you propose to meet the scientific and broader impact objectives.
  - Can be a combination of facilities, equipment, instrumentation, or computational hardware or software, and human resources
  - Could be intangibles like workforce training and education.
- List all key deliverables
  - Include metrics – quantitative and qualitative measures with descriptions of what constitutes successful completion
  - Combination of text explanation with summarized bulleted list helps to organize and present clearly
- Define the work necessary to achieve the deliverables
  - Include intermediate steps (e.g., prototypes, testing and trials, etc.)
  - What's not in the project, if relevant
- Describe all external facilities, resources, and infrastructure needed to complete the work
  - Lab space, classrooms, data storage, test facilities, audiovisual equipment, operators, etc.

1.3 Facility/Infrastructure Example: CASABI Scope

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CASABI Conceptual representation

- Solution Design
  - 3 wheeled bike with an open rear cargo box with single gear and back-pedal brake
  - Dirt bike tires to optimize flotation and grip in deep sand
  - Load capacity of 405 lbs./3 adults
  - Total cost of parts <$1K, with at least 80 % “off-the-shelf”
- Deliverables and metrics
  - Bike Design validated by with testing at 3 sites on appropriate terrain, using experienced testers
  - Manufacturing and assembly plan reviewed by experienced off-road builders, testers, and users
- Necessary Work
  - Market survey and parts procurement
  - Sequential design and build for 2 prototypes
  - Testing and review
- External Facilities/Resources
  - Partner bicycle assembly shop, staff, and tools
  - Testing sites at Great Sand Dunes National Park

1.4 Scientific & Broader Societal Impacts

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NSF core values:
NSF's strength is scientific leadership. We value diversity and inclusion, demonstrate integrity and excellence in our devotion to public service, and prioritize innovation and collaboration in our support of the work of the scientific community and of each other.

Web search on "NSF Broader Impacts" can bring up many useful tips and examples from NSF and other proposers.

One useful NSF link is:

- "NSF 101: Five Tips for your Broader Impacts statement"

WHO benefits?

How does the project affect the research community?

- Opportunities to use infrastructure or data for researchers outside the project
- Training of research workforce

How will the research/project will contribute to society?

- Improve quality of life
- Increase public appreciation of STEM benefits or advance literacy on STEM topics

Considerations

- Tailored to stakeholders and the project activities/results
- Should be specific, with planned resources to support activities
- Include an evaluation plan with metrics that indicate accomplishment
  - Number of grad students trained, production of videos, workshops attended, number of people on site tours, etc.

1.5 Facility Divestment Plan

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Transfer ownership?

Decommission/demolish?

What happens to the project deliverables when they are no longer needed or no longer functional?

- Divestment liability is part of the total cradle-to-grave project cost
- Not part of project scope under the proposed award
- Includes approximate cost to divest
- Describes any remedial work to address contamination or to restore environment
- Includes demolition, decommissioning, title/ownership transfers, etc.

Example : CASABI

- No facility or equipment to divest – belong to the bike shop and the sponsoring institution
- With NSF permission, transfer prototypes to World Relief Bicycles to be used as demonstrators
- Design and manufacturing plans are in the public domain

Summary: PEP1. Introduction

- Takeaways
  - Walked through the PEP 1. Introduction
    - Roadmap for project implementation – not a sales pitch
    - High-level description of the WHY, WHAT, HOW, and WHO Benefits
    - Lead-in for detailed project elements later in the PEP - reference for all decision-making during implementation
    - Good starting point for defining a project – can be refined and elaborated as planning matures
  - Each project has unique features – tailor your plan to fit your circumstances
  - Style point – practical document, not a literary masterpiece
  - Where to get help
    - Web searches can yield useful tips and examples for PEP writing
    - Consult the program officer for questions about the Solicitation or the LFO for the RIG
    - PM training programs run from overviews to in-depth certification courses

- Feeling overwhelmed and out of your depth? Project management requires specific expertise
  - Bring professional Project Management/Controls experts into planning in the proposal stage
  - After award, paying for PM/PC expertise is an allowable cost for NSF projects
  - Science and technical leaders should be familiar with PM terms and expectations – seek training opportunities