

Project Management Team *Update Report*

October 24, 2006

National Science Foundation

Arlington, VA

Note: These slides have been updated since the October NSF Review in order to address issues brought to the attention of the PMT by NSF during the Review.

GENI Project Management

Agenda: *NSF Review & Update*

- **Review & Update**
 - Project Development Plan – Project Management (CDR'/PDR)
 - Work Breakdown Structure Review
 - Development of the WBS Format and Content
 - WBS Teams Progress (Wireless, Backbone)
 - WBS-PM Progress (PMT)
 - GPO Reference Design & Requirements
 - Risk Management Plan Update
- **Next Steps Discussion**
 - WBS Completion
 - Change Control Management Plan
 - Management Transition Plan (PMT/GPO/Operations)
 - Multi-Stage Facility Commissioning Plan
 - Continuing Operations Budget Plan
 - Others TBD?

Project Development Plan - 1

Project Management - GPO

- GPO Reference Design & Requirements
 - Overall recommendation for the design of the GPO and the basic requirements for each of its principal functions
- WBS Construction Budget Process
 - Bottom-up budget with contingency and mitigation elements
- Transition to GPO Support Plan
 - Getting from the PMT to the newly established GPO
- Risk Management Plan
 - Way that risk will be managed during Facility construction
- PMCS and Critical Path Plan
 - Reveals critical path, including dependencies and implications of schedule slippages

Project Development Plan - 2

Project Management - GPO

- Change Control Management
 - Details processes and procedures to be used by project management when significant changes to original schedule, technology, budget, etc., occur
- Industry Participation Plan
 - Determination of how industry will participate in GENI
- Operations during Construction
 - Establishes requirements and specifications for full operation of GENI after construction
- Commissioning and Post-Construction Operations Plan
 - Describes processes required during commissioning, including development of Facility test plans, acceptance criteria, text exit reports, and similar

Status of PMT Work

- **GPO Reference Design developed**
 - Design shows GPO structure, interfaces, functional offices, communications links, ...
- **GPO Office Requirements Documents completed**
 - Four offices described in detail
 - Chart of roles and responsibilities completed
- **WBS refinements in progress**
 - Updates to WBS content by WGs
 - Effort to make it easier for WGs to complete the WBS by use of MS Project (detailed example of FMO today)
- **WBS Working Teams established**
 - WBS Guideline document [GDD-06-30] distributed; slide set distributed; weekly conference calls in progress; periodic face-to-face meetings on WBS-related issues
- **Risk Management Plan draft nearly complete**
 - Text and slide set versions

GPO Reference Design

October 24, 2006

Project Management Team

GPO Reference Design

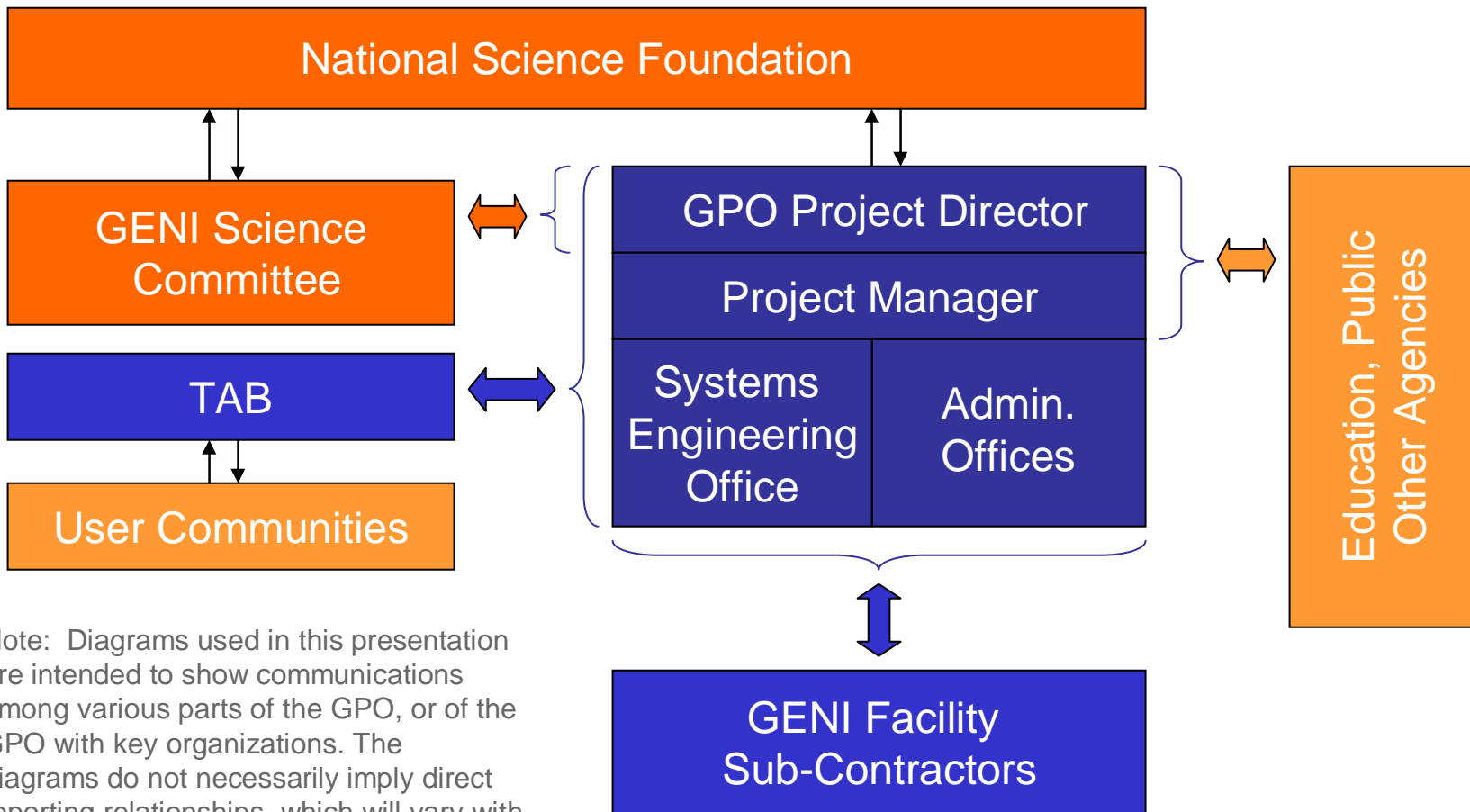
This document presents a Reference Design for the GENI Project Office, showing the functional requirements for the office and the relationships of these functional components to one another. The design includes presentations – text or drawings – of each of the topics below

GPO General Requirements
GPO Functional Requirements
GENI PM Core Principles
GENI PM Design Concept
GENI Project Office Model
GPO Structural Organization
GPO Offices & Processes
Financial Management & Control
Contracts, Legal, and Administration
Systems Engineering & Operations
External Liaison

GPO General Requirements

- **Effective Outward-Facing Organization**
 - Connections to all critical organizations and people, including:
 - NSF, GSC, CCC, and others as appropriate
 - Federated networks, and
 - Research and educational user communities
- **A Well-Defined Functional Structure**
 - Complete set of offices meeting all functional requirements
 - Well-developed policies that reflect the strategic approach of the management design
 - Thoughtful processes and procedures that enable the office to function effectively, and
 - A communications structure that ensures no part of the internal or external organization is ever isolated
- **Appropriate Overall Management Concept and Design**

Key Relationships of GPO



Note: Diagrams used in this presentation are intended to show communications among various parts of the GPO, or of the GPO with key organizations. The diagrams do not necessarily imply direct reporting relationships, which will vary with the specific implementations of the GPO.

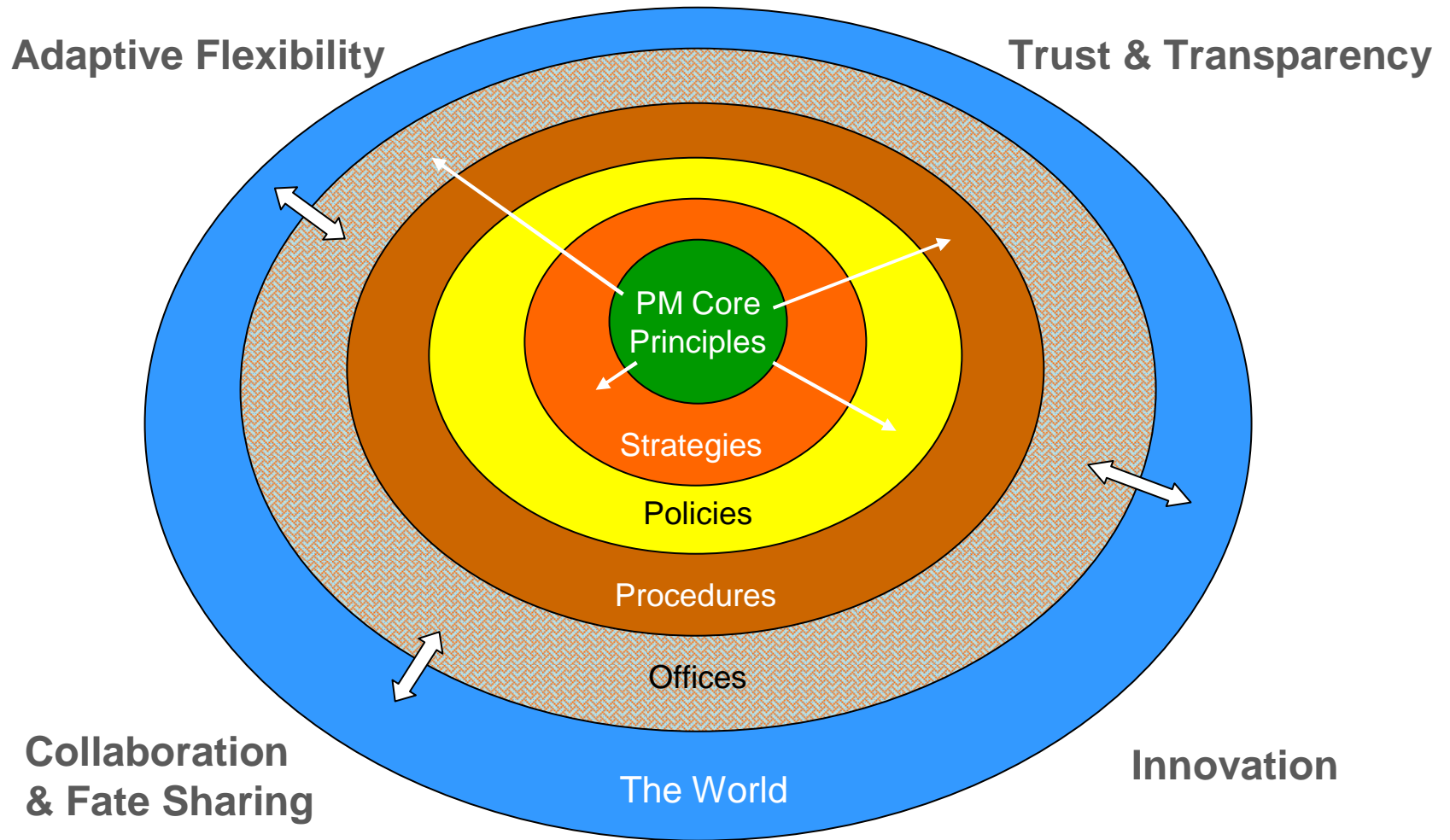
GPO Basic Organizational Needs - 1

- **Core Principles**
 - A guiding doctrine for the operation of the GPO based on the special character of the GENI project and its management requirements
- **Operating Strategy**
 - A well-conceived operating method that reflects the core principles of the organization and ensures best possible operation during GENI construction
 - Implement effective communications and project tracking systems; IMS/IMP, EVMS, PMCS are cornerstone elements
- **Policies**
 - Supporting practices for GENI management during construction, including: personnel, communications, IP, safety, and environment ...
- **Processes and Procedures**
 - Basic methods by which the project is managed, including budgeting, reporting, project tracking, risk management, change control, research during construction
- **Organized Functional Structure**
 - Organization of fundamental office functions into an GPO management structure that will ensure that all functional requirements of the office are met in the most appropriate manner possible
 - Create a lean, cost-effective GPO office structure by combining office functions where appropriate to reduce staffing and duplication of efforts

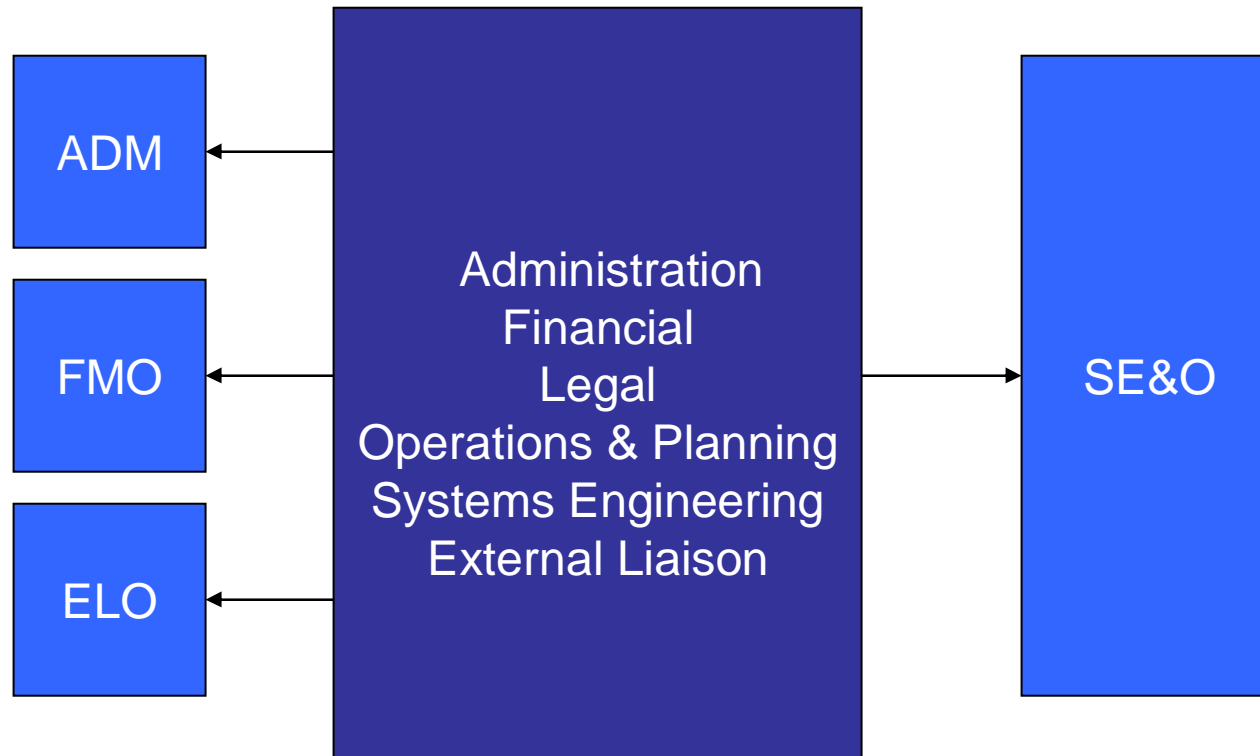
GPO Basic Organizational Needs - 2

- **Administration**
 - Provides services, including human resources, payroll, salary administration ...
- **Financial Management & Control**
 - Is the central function that manages financial obligations of the GENI project, including financial planning, recurring budgeting, accounting, bookkeeping, reporting ...
- **Legal**
 - Provides the legal advice and counsel required to generate contracts, develops IP policies, protect assets ...
- **Operations & Planning**
 - Directs the operation of the project and the GENI Facility, providing overall project tracking, management of the Facility, maintenance ...
- **Systems Engineering**
 - Responsible for ensuring that the GENI Facility is properly engineered, requirements and standards met, tested executed, elements deployed ...
- **External Liaison**
 - Ensures timely and appropriate contact with the computer science and networking communities, research and education communities, the general public, federated networks, and others as appropriate. This is the formal communications arm of the GENI project and is guided by the Project Director.

GENI PM Design Concept



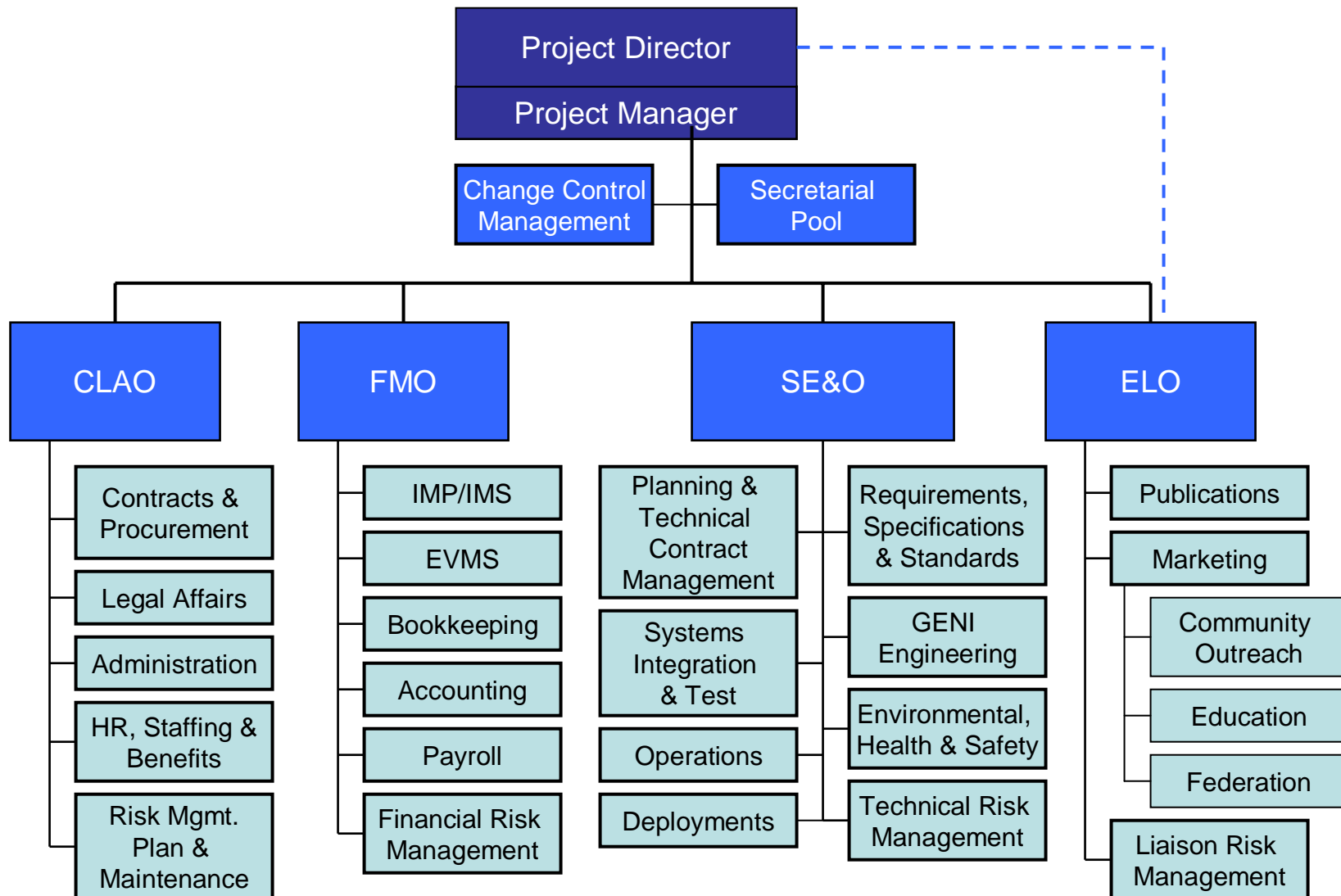
Mapping Functions to Offices



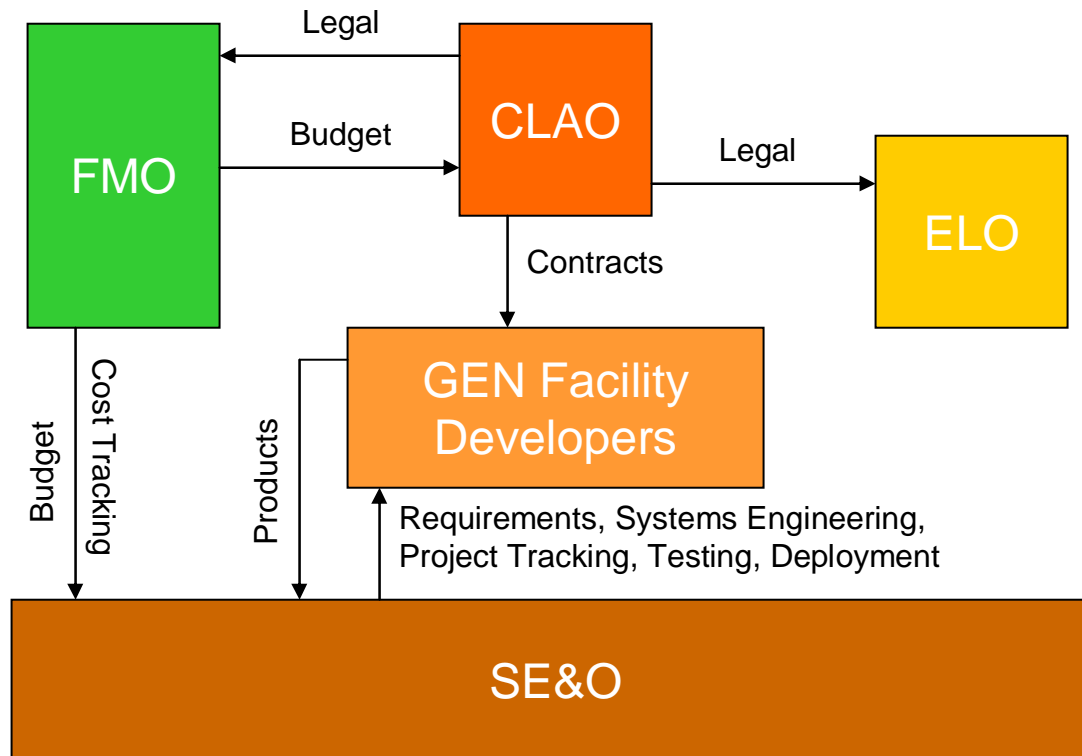
GENI Project Office Model

- **Contracts, Legal, Administration (CLAO)**
 - CLAO is the lead office for the initiation of GENI Facility construction, releasing RFPs, awarding construction contracts, providing legal support to GENI management, and administrative support to the GPO
- **Financial Management & Control (FMO)**
 - FMO is the office responsible for all financial functions related to GENI construction, including financial planning, financial tracking of the project, accounting, archiving, and financial reports
- **Systems Engineering & Operations (SE&O)**
 - The SE&O is responsible for all engineering requirements, designs of offices and plant, modeling, lab- and in-field testing, deployments, all commissioning stages, and operations/management of the Facility (including ownership of the PMCS)
- **External Liaison (ELO)**
 - The ELO maintains contact with external organizations and the public related to GENI construction. This office is closely tied to the Project Director (shown as a dotted line relationship in organizational diagrams)

GPO Structural Organization



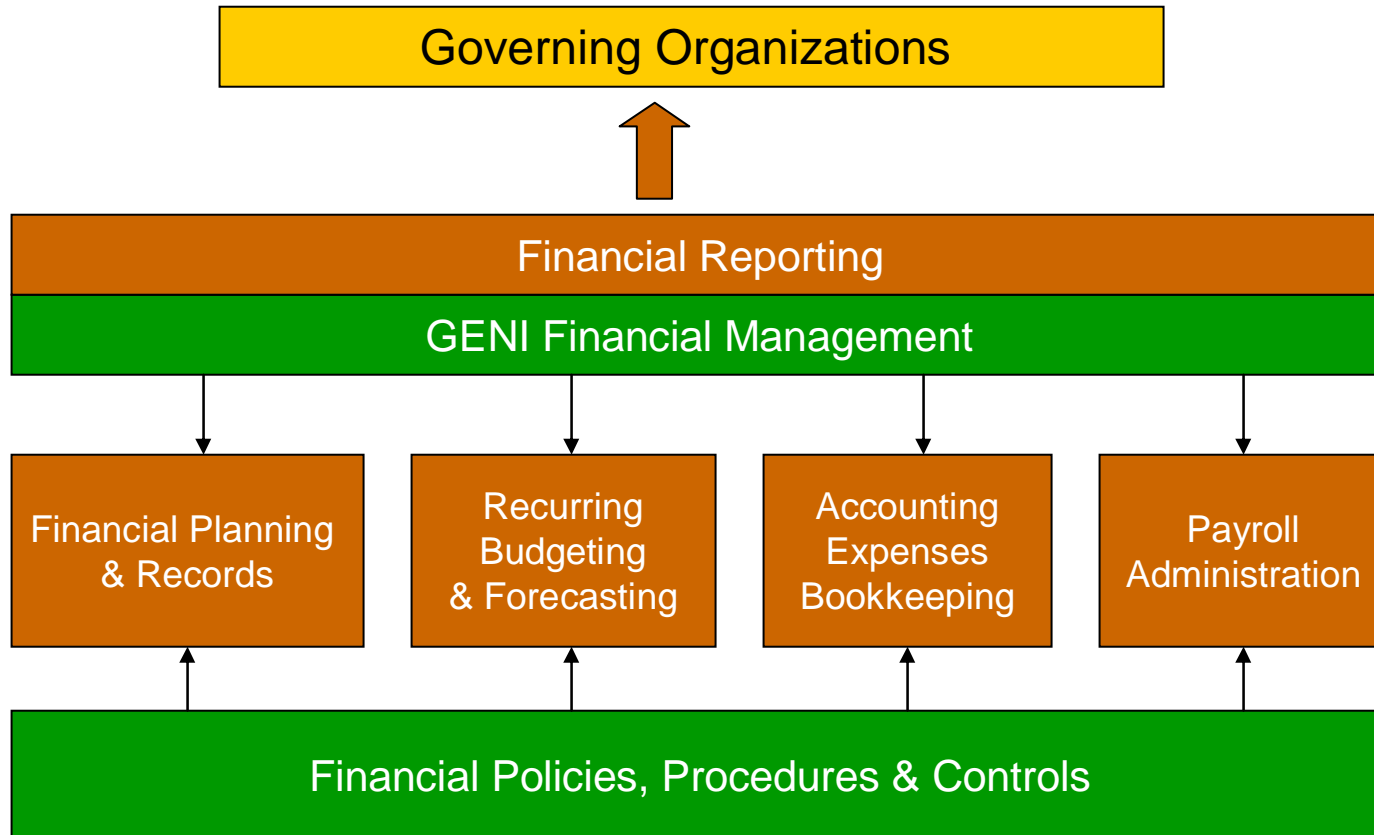
GPO Offices Association



FMO: Lead Responsibilities

Budget Forecasting
Accounting
Bookkeeping
Capital Planning
EVMS Maintenance, Planning
Financial Policies & Procedures
FMO Risk Management
GPO Cash Flow Analysis
IMP/IMS Maintenance
Financial Reports
Resource Tracking
Financial Transition Planning
And More

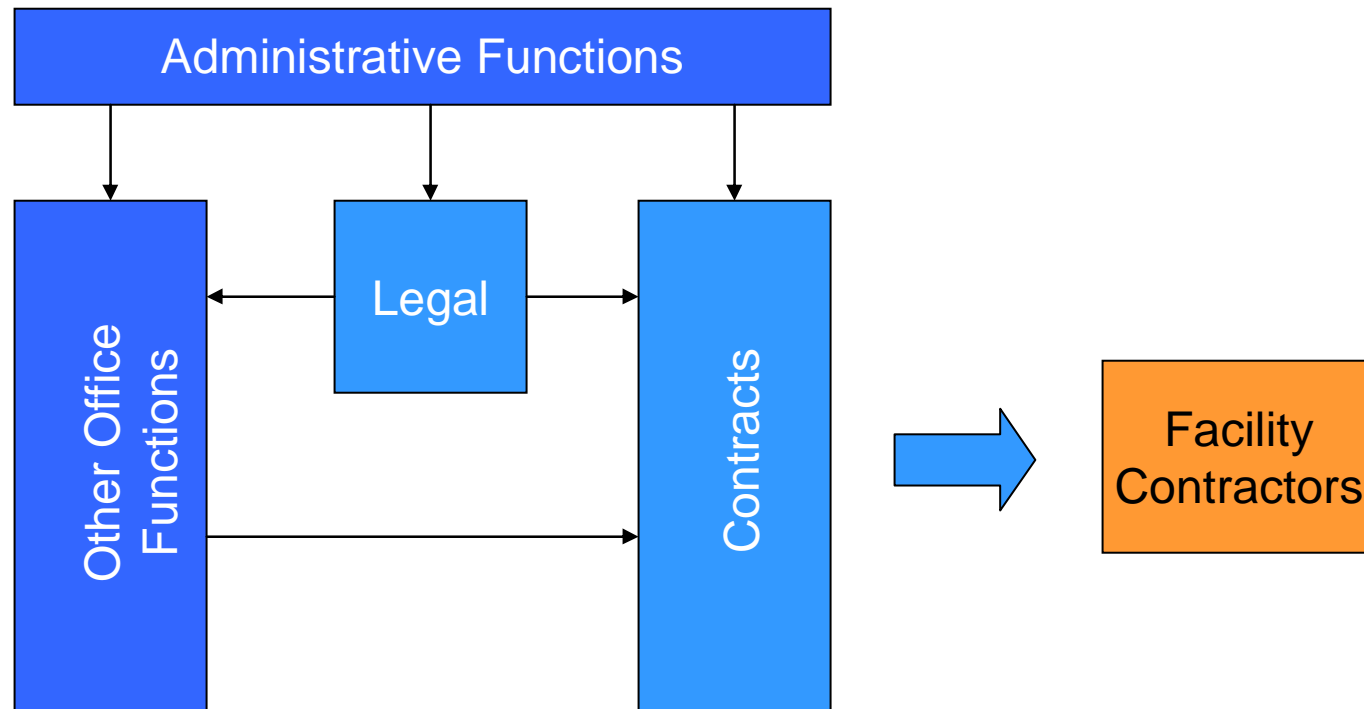
Financial Management & Control



CLAO: Lead Responsibilities

Administrative Policies & Procedures
Contractual Compliance
Organizational Conflict of Interest
Procurement/Contract Policies & Procedures
Cooperative Agreements
Employee Benefits
Facility Use Agreements
Human Resources
Intellectual Property Policies
Licensing Agreements
Physical Security
CLAO Risk Management
Staffing & Hiring
Timecards
And More

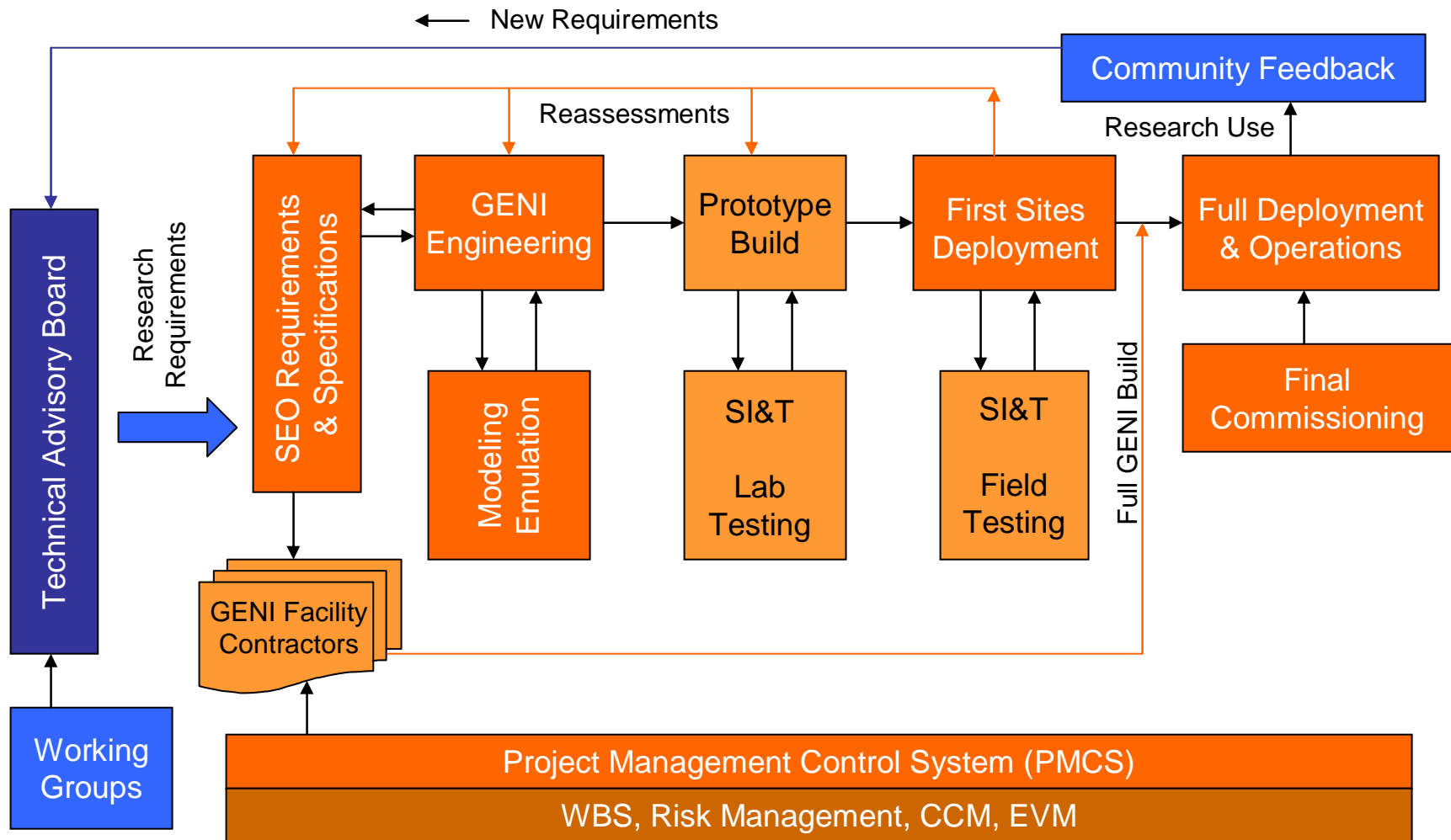
Contracts, Legal, and Administration



SE&O: Lead Responsibilities

Engineering Requirements
Systems Engineering
PMCS Tool Ownership
Technical Project Tracking
Scheduling & Planning
SEO Risk Management
Lab & Field Testing
Engineering Reviews
Outside Plan Engineering
All Network Deployments & Commissioning
Maintenance & Upgrades of Network
Network Operations & Management
Security Incidence Handling
And More

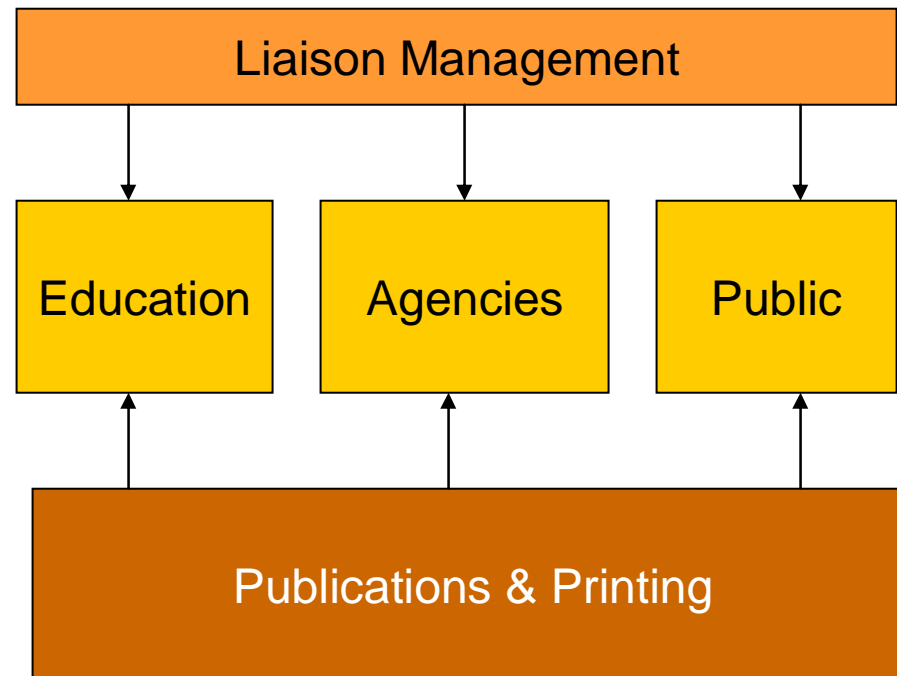
Systems Engineering & Operations



ELO: Lead Responsibilities

Public Communications
Government Liaison
Research User Training
Educational Institutions Liaison
Community Outreach
Industrial Relationships
Uses of GENI for Education
Risk Management in Communications
Publications Distribution
Documentation & Report Printing
Press Releases
And More

External Liaison



GENI Risk Management Plan

October 24, 2006

GENI Project Management Team
National Science Foundation

GENI & Risk

- GENI is one of most innovative computing and networking projects to be undertaken by the computer sciences research community in a long time
- It will establish a major global research and education facility that will enable work to be conducted simultaneously by hundreds (even thousands) of computer and networking scientists working to develop the architecture and related services that will make the future Internet possible
- The GENI deployment methodology requires that GENI be constructed and used simultaneously and that – through research use – new design concepts, technologies, and services be continuously built into GENI
- Although the element of risk to the GENI methodology may be higher than that of other MREFC-funded projects, these risks are manageable and the worldwide opportunities to be created by GENI are well worth the risks involved

GENI Risk Management

- Objectives
 - Effective administration of the RMP should enable the GENI team to meet or beat planned project cost, schedule, and technical objectives
- Risk Perspectives
 - Risk is essential to the success of GENI; acceptance of it will create significant opportunities for innovation as GENI is constructed
 - Thus, the development of a well-conceived Risk Management Plan is essential to the GENI project
 - Risk management must be built into all project elements, especially the PM structure, from the very beginning
 - *In many ways, risk management is the domain of all project participants. Risk management is not a spectator sport.*

RMP Development: Key Steps

- Identify the risk elements most likely to be associated with project tasks. Starts at the lowest level of the WBS
- Organize these risk elements into simple categories so that they can be applied appropriately to different parts of the project
- Assess the potential impact (consequences) of risks on project tasks and their probability (likelihood) of occurrence
- Develop a formula that will result in the quantification of risk elements in a Risk Factor (e.g., $RF = p \times C$)
- Establish a procedure by which the Risk Factor (RF) is applied to the cost estimate budget and schedule in order to develop contingencies for both
- Decide upon the mitigation strategies that will be applied (at the top level of the WBS) to reduce risk to an acceptable level and apply these to the contingency budget and schedule
- Develop a RM organizational structure with the necessary tools to track risks and to respond to risk events when they occur

Approach to Risk Management - 1

- Risk Element Identification

- To be identified by staff most familiar with risks to task completion
- Likely to depend on the nature of the task to be performed
- Reviewed by PMT to establish validity and sort out redundancies
 - *This will add time to the process, but is essential to getting the WGs to think about risk and its management*

- Risk Element Categorization

- Technical: Risk linked to the development and deployment of new designs. Also includes network deployment.
- Cost: Risk associated with possibility of budget overruns
- Schedule: Risk connected with possible schedule delays
- Programmatic: Risk generally outside the control of PM, but must be accounted for in the RMP with a strategy for mitigation

Approach to Risk Management - 2

- **Risk Assessment Process**

- Risk assessment is based on expertise and prior experience of technical staff responsible for each project task (for GENI, this is the WG participants)
- Each risk element is assigned an experience-based “weight” based upon potential project cost and/or schedule impact if the risk event occurs
 - Weights are usually just unitless numbers (e.g., 1-15) that represent project impact. It will be necessary to tell WGs what the numbers mean (e.g., chart)

- **Strategies for Risk Mitigation**

- **Risk Avoidance:** Risk reduction through modification or elimination of processes, requirements, or activities that cause risks (e.g., build only what you know will work from past experience, but consequences...)
- **Risk Control:** GPO takes active steps to reduce the likelihood of a risk event occurring (through mitigation strategy) and/or to reduce the potential impact of the risk on project (don't put on critical path)
- **Risk Assumption:** Conscious decision to accept the consequences of a risk; potential benefits justify the risk
- **Risk Transfer:** Process of sharing a risk with another party; could involve agreements to cost-share consequences of risk

Approach to Risk Management - 3

- **Risk Monitoring**

- Involves systematic tracking and evaluation of the effectiveness of risk mitigation actions against established metrics
- Uses Risk Registers and Watch Lists to anticipate and follow expected risk events
- Involves the establishment of responsibility for tracking and the development of policies for reporting and responding to risk events
- Requires the selection of project management tools that allow for tracking of project progress and visibility of progress among project participants

- **Risk Reporting**

- Development of real-time reporting processes and procedures
- Documentation of deviation from planned budget, schedule, or product design (e.g., functionality, features, or performance)

Managing Risk in GENI - 1

Steps 1-3: Risk Identification, Categorization, Assessment

- Using a template supplied by the PMT, a list of risk elements – inclusive of all project components (i.e., architecture, services, backbone, NM software, wireless subnets) – will be assembled by the WGs. Supporting materials to the WG will include:
 - A list of example recognized risk types by category
 - A Risk Event Rating chart
- Using these materials, the WGs will generate Risk Identity charts for their WBS Elements and tasks. The risk element will have associated with them an impact weight and a probability of occurrence
- This list of risk elements will be assessed, reduced, prioritized, and assignments made to risk categories by the PMT

Steps 4: Risk Factor Calculation

- Using the weightings and probabilities received from each of the WGs, an RF column will be added to each of the WG spreadsheets (by the PMT staff based on calculations using an appropriate risk model)
- The process for RF calculation will follow the simple $RF = p \times C$ formula, with RF factors normalized to so that they fall in the range of 0 - 1.
- The Risk Factors will be used by the WGs – starting at the WBS “work package” level – to establish a contingency budget for each element of the WBS
- The “roll-up” process for the contingency budget will be the same as for the baseline budget

Risk Event Rating Chart

Table 4-2. Consequence Criteria

Level	Technical	Program Schedule	Program End Cost	Operational	Programmatic
1	Minimal Impact	Minimal impact	Minimal impact	Minimal Impact	Minimal Impact
2	Acceptable with some reduction in capability	Additional resources required; able to meet need dates	< 1%	Small increase in operational costs	Small impact on cost, schedule or technical baselines
3	Acceptable with significant reduction in capability	Moderate slip in key milestones; not able to meet need dates	1 - 5%	Moderate increase in operational costs	Moderate impact on cost, schedule or technical baselines
4	Marginally Acceptable, barely able to perform needed science	Major slip in key milestone or critical path impacted	5 - 10%	Significant increase in operational costs	Significant impact on cost, schedule or technical baselines
5	Unacceptable	Cannot achieve key team or major program milestone	>10%	Unacceptable increase in operational costs	Unacceptable impact on cost, schedule or technical baselines

Figure 4-2 shows the simple method that the OOI program uses for rating risk events. The matrix shows how the Risk Manager has defined levels as high, moderate, and low for the various combinations of likelihood and consequences. A high (H) rating means that a major disruption to the program is likely. A moderate (M) rating means that some disruption will likely occur. A low (L) rating means that the risk, if realized, will have a minimum impact on the program.

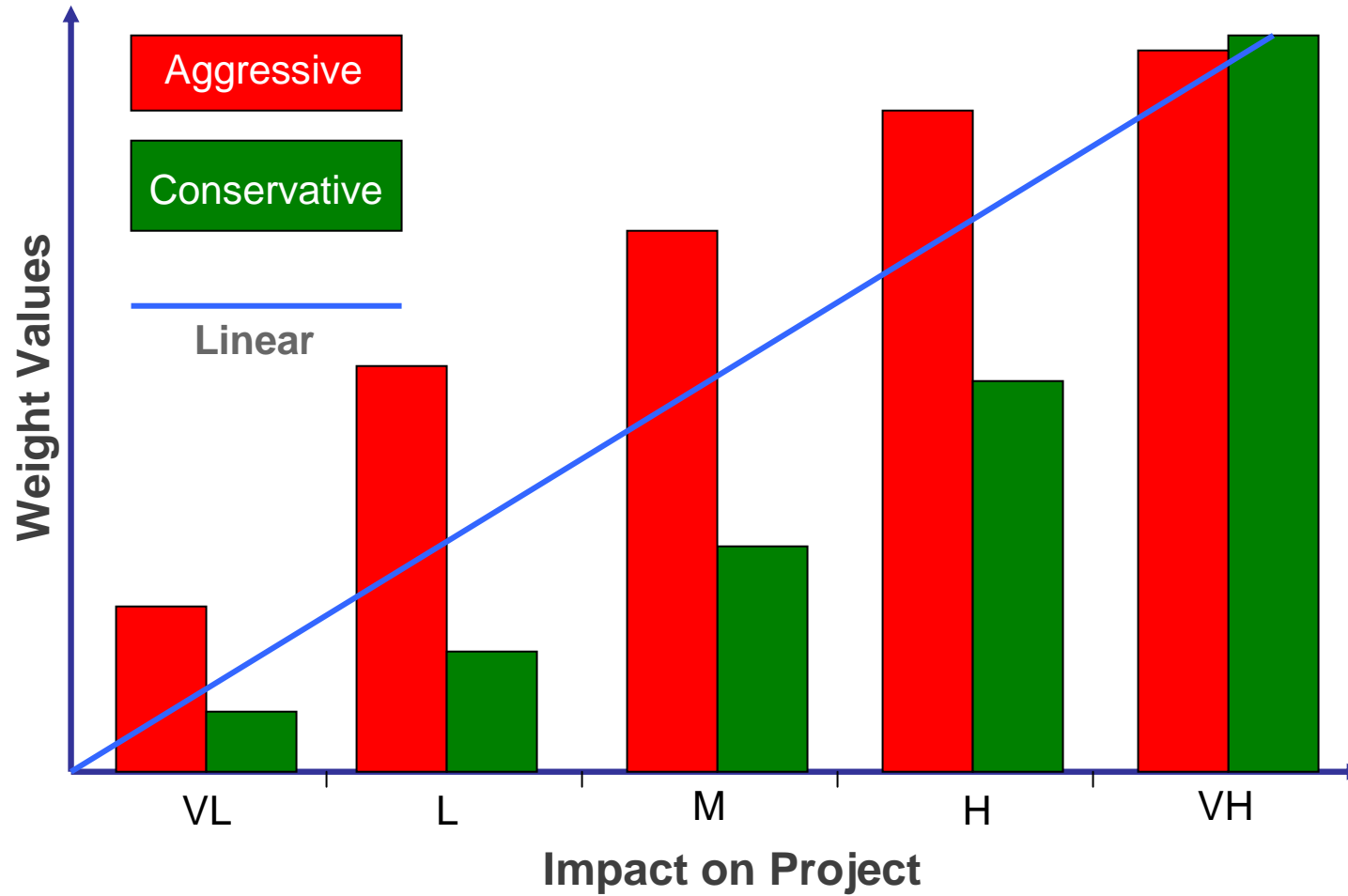
Work Group Risk Identification

Work Sheet Example

Risk Category	Risk Description	Impact (C) (1 to 5)	Likelihood (1-5)*	RFs
Technical				
BBWG 1	Short description of the specific risk. Identify 5-6 of these for each Risk Category	Rate Impact (5 = highest)	Rate the Likelihood (5 = highest)	TBD
Cost				
BBWG1-N				
Schedule				
BBWG 1-N				
Programmatic				
BBWG 1				
BBWG 2, etc.				

*Likelihood weighting factors: 1 (p < 0.1); 2 (p = 0.1-0.4); 3 (p = 0.4-0.7); 4 (p = 0.7-0.9); 5 (p > 0.9)

Risk Weight Models



Risk Factors: Linear Model

Before Normalization

Wt./p	<0.1	0.1-0.4	0.4-0.7	0.7-0.9	>0.9
14	1.4	5.6	9.8	12.6	14
12	1.2	4.8	8.4	10.8	12
10	1.0	4.0	7.0	9.0	10
8	0.8	3.2	5.6	7.2	8
6	0.6	2.4	4.2	5.4	6
4	0.4	1.6	2.8	3.6	4
2	0.2	0.8	1.4	1.8	2

Risk Factors: Linear Model

Normalized Risk Factors

Wt./p	<0.1	0.1-0.4	0.4-0.7	0.7-0.9	>0.9
14	0.1	0.4	0.7	0.9	1.0
12	0.086	0.34	0.6	0.77	0.86
10	0.071	0.28	0.5	0.64	0.71
8	0.057	0.22	0.4	0.51	0.57
6	0.043	0.17	0.3	0.38	0.43
4	0.028	0.11	0.2	0.26	0.28
2	0.014	0.06	0.1	0.13	0.14

Risk Factors and Contingency

- **Contingency Budgeting: Task/Activity Levels**
 - Risk Factors (RF), calculated by the generally accepted method of multiplying a weighting factor based on the the project consequence (C) of a risk by its probability of occurrence (p), will be used to calculate task and activity contingency budgets
 - This process will begin at the lowest level task or activity (i.e., the “work package” level) in a WBS Element and be rolled up to the highest level of the same WBS Element to arrive at a contingency budget number
 - The baseline budget for each WBS task – previously calculated – will be the basis for each task-level contingency budget calculation
 - This same strategy will be used both for cost and schedule contingency calculations, although the weight models may be different for each

Managing Risk in GENI - 2

- **Organizational Responsibilities**
 - The Project Director has the final responsibility for Risk Management
 - The Project Manager (personally) has the day-to-day responsibility, as do all other project participants – a critical concept from day-one
 - The PM is responsible for implementing the RMP, and is first in line for response to risk events
 - All policies, procedures, contracts, ... developed during the course of the project will incorporate risk management components
 - Regular Risk Management Meetings will be held to review and update the RM Plan, identify new risks, and to discuss strategies for mitigating risks deemed to be imminent

Managing Risk in GENI - 3

- **Risk Mitigation**

The GENI project will employ all four risk mitigation strategies to reduce the impact of risk on the GENI budget, schedule, and technical elements of the GENI Facility

- **Risk Avoidance:** When possible, GENI will achieve required Facility features, functionality, and performance by using existing designs and technology. This will greatly reduce the probability of risk events and their impact on the project
- **Risk Control:** Through a well-defined Risk Management organizational structure, clearly defined levels of responsibility related to risk management, and through well-defined risk response, documentation, and reporting processes, GENI will control necessary project risks
- **Risk Acceptance:** It is necessary to accept some risk as integral to a project such as GENI that attempts to innovate in such a substantial way in order to give birth to the ideas, designs, and technologies that will make a future Internet possible.
- **Risk Transfer:** Within the GENI project, risk transfer means risk sharing – and the PMT sees risk sharing as central to the policies, processes, procedures, organizational structure that will be GENI. Risk is seen as the business of all who will participate in the project, from contractors to research users, and the risk management plan will reflect this perspective.

Managing Risk in GENI - 4

- **Monitoring Risk**

- The Project Management Control System (PMCS) for the project will integrate risk management into it so that emerging risks are visible to all project personnel
- A risk register will be developed and regularly updated to ensure that all knowable risks are monitored
- A Watch List of the potentially most significant risks will be created and monitored by the Project Manager, who will have the principal responsibility for risk management in the project
- Based on the observance of emerging risk events, impact models will be developed for the potentially most harmful in order to address mitigation at the earliest time possible

Managing Risk in GENI - 5

- **Responding to Risk Events**

- In the GENI project, a system of electronic reporting processes – based on the use of a suitable PMCS tool – will be used to enable broad participation in the risk management process by all project staff
- The reporting processes will include the possibility of flagging emerging risks according to their potential impact on the project cost and schedule, and will highlight the timeframe for such impact
- A response plan will be developed according to the level of flagging
 - Low-level impact events, or events that are some distance in the future, will be addressed at regular Risk Management meetings of the Project Manager
 - Medium-level impact events, or events that are likely to occur within a month or two, will be taken up at weekly staff meetings of the Project Director
 - High-level impact events, or events likely to occur in the very near future, will be taken up at emergency Risk Management meetings to be called by the Project Director and Project Manager

Managing Risk in GENI - 6

- **Risk Documentation**

- Emerging risks will be documented by users, contractors, and others associated with the project as they arise
- Information related to risks and the actions taken to mitigate them will be stored on line as part of the capability of the PMCS system
- A Risk Management page will be developed and maintained on the GENI Project Management web site. The purpose of this page will be for project personnel to report potential risks to the PM as they are observed

- **Risk Reporting**

- Quarterly Risk Reports, authored by the Project Manager, will be circulated electronically to all project participants
- A Risk Register and Watch List will be maintained by the PM, with monthly updates