

PMT Transition Meeting

July 17, 2007

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With contributions from Bob Carman and Aaron Falk

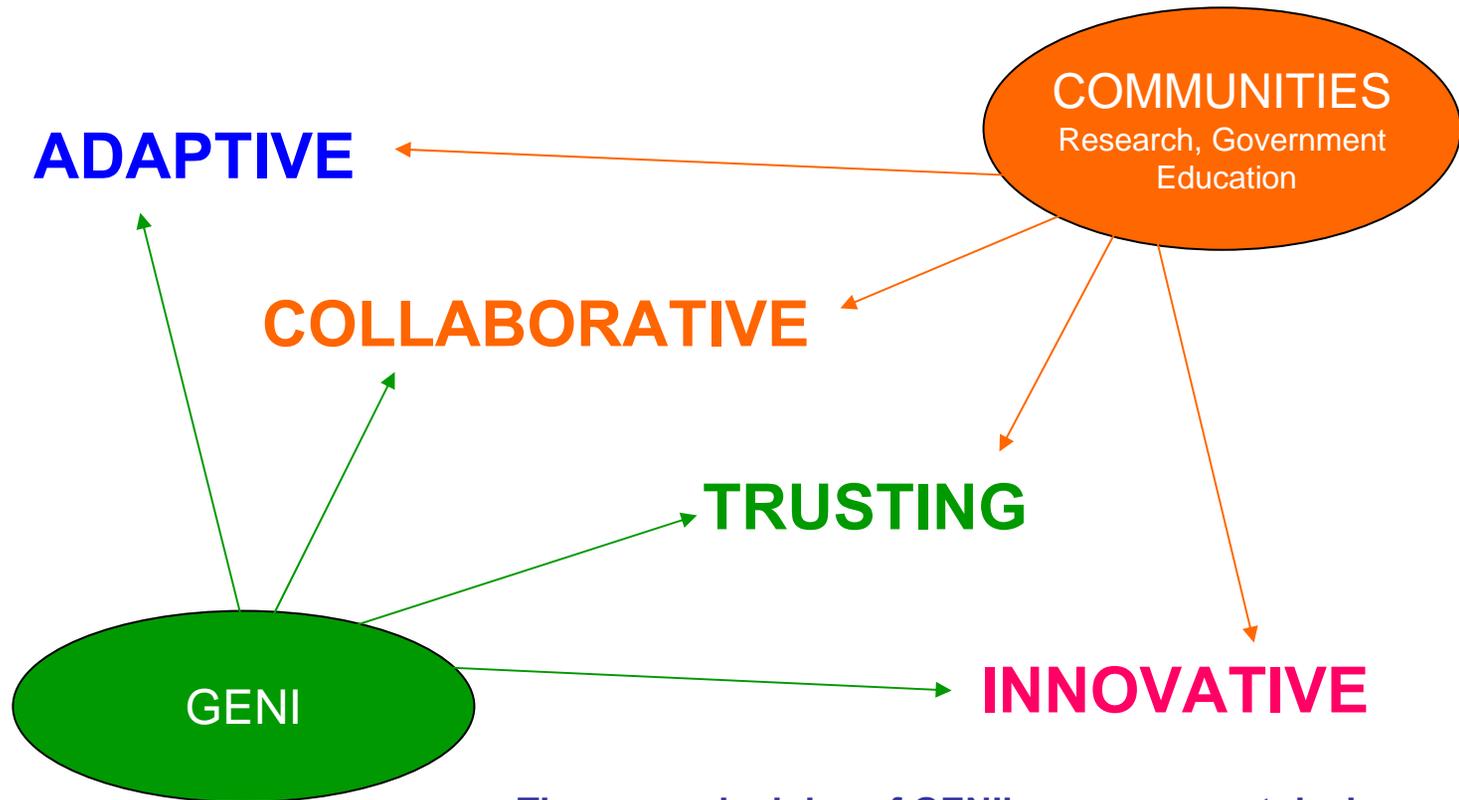
Topics

- Quick Review of PMT Activities
- Risk as an Opportunity
 - Identification and Analysis
 - WBS Method Limitations
- Timeframes to FDR
- Interaction with Communities
- META Issues
 - Completeness
 - 2nd Thoughts
 - Open issues/problems Recommendations

Background and Motivation

- Early 2006 apparent that innovation required in process as well as architecture
- Potential for disconnects between evolving MREFC process and project
- PG desire to do more than meet the check boxes in the MREFC process but rather define processes that made sense in the Global *Environment for Innovation*
- Created team including access to experts in emergent management

PM Core Principles



The core principles of GENI's management design evolve naturally from the concepts of the GENI project itself and the goals of the communities it will serve

PM Core Principles

- **Adaptive**
 - Project Management must promote and be adaptable to continuous change – in GENI design, budget, staffing, schedules... Learning will occur incrementally as GENI is built; change is integral to GENI and essential to its success.
- **Collaborative**
 - Project Management must be committed to collaboration and shared responsibility at all levels – even to the sharing of failure. No soloists allowed!
- **Trusting**
 - Project Management must promote trust throughout the project organization – in the NSF, among contractors, within the research community, and with supporters.
- **Innovative**
 - Project Management must develop strategies, policies, procedures, and interfaces that encourage innovation within GENI – in the Facility design, in technologies selected, in research use, and in project management itself.

PMT Activities

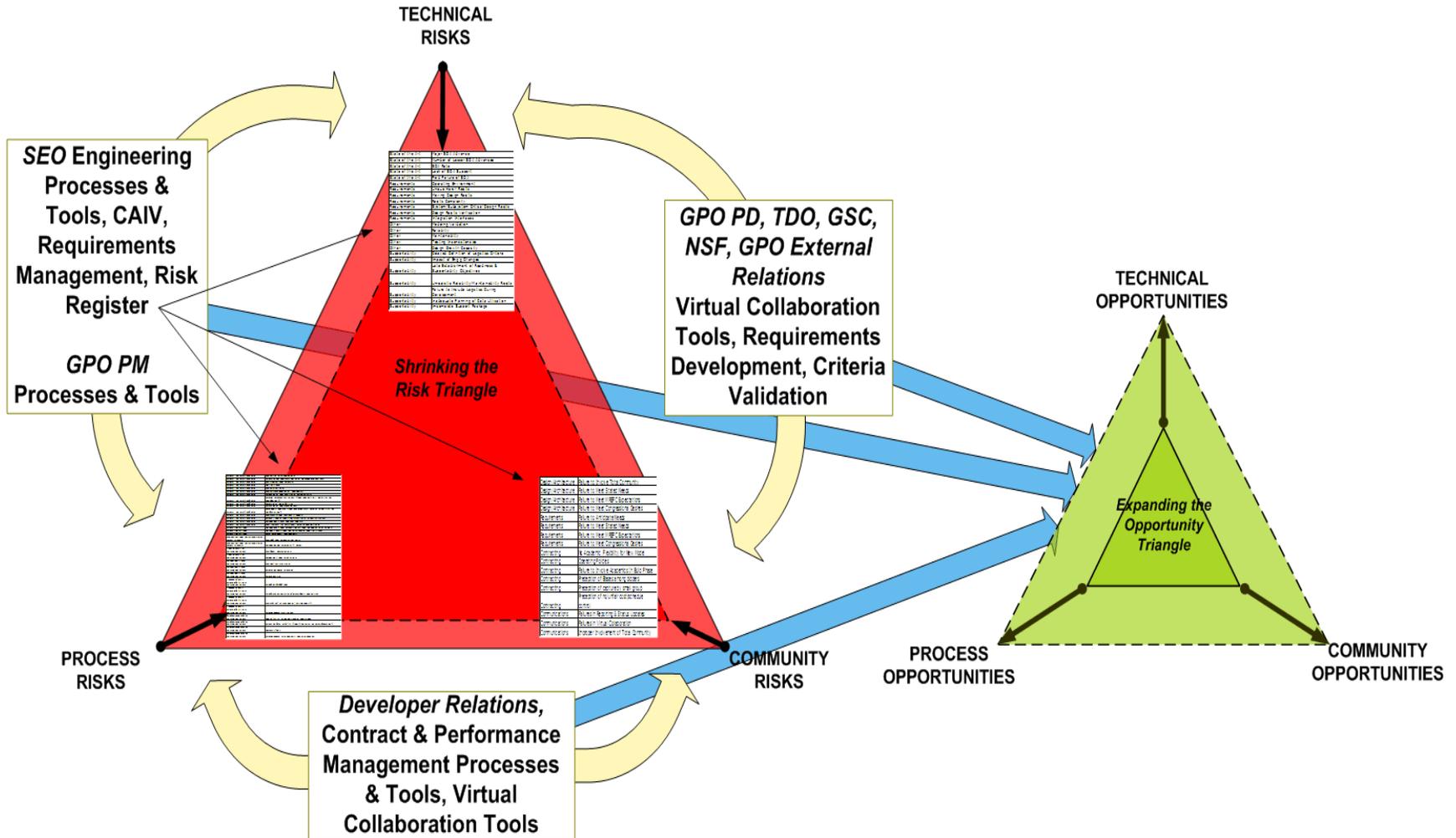
2006 - Present

- Principles realized in set of plans
 - GPO Reference Design
 - Risk Management Plan
 - WBS Guide
 - WBS
 - Facility Construction Plan
- Transition Activities

Large Facility Construction Processes Requirements

- Budgeting for Facility Construction
 - Baseline and contingency budgeting
 - Risk mitigation strategies
 - Spending Plan development
- Work Breakdown Structure Development
 - Overall process and interactions with WGs
 - Basis of Cost and Cost Detail Spreadsheets
- Risk Management
 - Risk Events and Categorization strategy
 - Risk Factor calculation process
 - Relationship to the contingency budget
- Change Control Management
 - For distributed projects dynamic, real-time process
- Project Management Control System

Risk/Opportunity Triad



Risk Management Plan Development

Identification and Categorization of Risks

- Identification

- Usually carried out by “area experts” who understand the risk elements particular to their specialties (e.g., software, hardware, networking,...) –
- In pre-CDR planning the PMT used a set of very simple risks of a somewhat generic character (later slide)

- Categorization

- Following risk identification, the risks are grouped into just a few classes, such as the following:
 - **Technical Risk:** Linked to use of new designs
 - **Cost Risk:** Associated with project budget issues
 - **Schedule Risk:** Linked to potential project delays
 - **Programmatic Risk:** Outside the control of project management

- **NOTE – this focuses on contingency calculation and only examines risks associated with producing an artifact.**

Risk Management Plan Development

Risk Quantification and Mitigation

- Following identification of the risk elements and their categorization, it is necessary to quantify the risk, select risk mitigation methods, and develop a management structure to implement the risk management plan
- Risk quantification is a simple process that involves calculation of a Risk Factor, which is the product of a risk “weight” (C) and a probability of occurrence (p) of the risk, summed over all risk categories (i)

$$RF = \sum (p \times C)_i$$

- For pre-CDR planning the PMT has used a simple calculation process accepted by the MREFC
- At this stage of planning, risk mitigation strategies have not yet been quantified or incorporated in the construction budget development process.

Risk Management Plan Development

Chart Summary of Results

GENI RISK FACTORS AND MULTIPLIERS	
Risk Factors Multipliers	Risk Factor Descriptions
Technical Risk Category	
1	Existing design and COTS hardware
2	Minor modifications to an existing design
3	Extensive modifications to an existing design
4	New design within established product line
6	New design different from established product line. Existing technology.
8	New design. Requires some R&D development but does not advance the SOA
10	New design. New development of new technology which advances the SOA
15	New design way beyond the current SOA
<i>Multipliers</i>	
2%	Design or manufacturing concerns only
4%	Design and manufacturing concerns
Cost Risk Category	
1	COTS or catalog item
2	Vendor quote from established drawings
3	Vendor quote with some design sketches
4	In-house estimate for item within current production line
6	In-house estimate for item with minimal company experience but related to existing capabilities
8	In-house estimate for item with minimal company experience and minimal in-house capability
10	Top-down estimate from analogous programs
15	Engineering judgment
<i>Multipliers</i>	
1%	Material cost or labor rate concern
2%	Material and labor rate concerns
Schedule Risk Category	
2	No schedule impact on any other item
4	Delays completion of non-critical path subsystem item
8	Delays completion of critical path subsystem item
<i>Multiplier</i>	
1%	Used for each of the three risk factors in the Schedule category

WBS Detail: BoE Template

GENI WBS Dictionary - Basis of Cost Rates - Risk Factors			
Task Name:	Hardware (of PEC)		Date: 3/6/2007
WBS No.:	1.2.1.1.1		Revision: 1.3
Stage:	5 years		
Estimator:	Larry / CK		
WBS Dictionary Entry/Definition of Scope:			
Programmable Edge Cluster Hardware. They consist of a rack or chassis populated with commodity processors, interconnected by a switch, augmented with significant storage capacity, and attached to the local network infrastructure. (Labor cost is not included here, refer to the Software section under 1.2.1.1.2)			
Deliverables, Sub-Tasks, & Dependencies:			
Deliverables: (1) Install 8-node blade servers on 97 sites, for both year 1 and 2, to be renewed in both year 4 and 5. (2) Install 1000-node clusters on 3 sites, for both year 1 and 2, to be renewed in both year 4 and 5; Sub-tasks: None; Dependencies: None.			
Labor Basis:			
Labor Categories: 1) GENI Project Director/Project Manager (250,000); 2) Senior Project Scientist (175,000); 3) Task Manager or Technical Leader (125,000); 4) Software or Hardware Engineer (100,000); Junior Engineer or Technician (80,000), 5) Executive Assistant (70,000); 6) Administrative Assistant (50,000). These labor rates are unloaded; loading occurs automatically on the Cost Estimate Detail spreadsheet. The Cost Basis on the Cost Estimate Detail spreadsheet should be entered as "Engineering Estimate" = EE for all labor categories.			
Non Labor Basis:			
8-node blade server (30,000)			
1000-node cluster (1,250,000)			
\$500K for 256 HP DL320gX where X is the latest version in '08 quad-core Intel Xeon processors, 4GB RAM, 4TB storage			
Travel Basis:			
1) Domestic: Hotel = 125/night; Meals = 55/day; Car/Taxi = 55/day; Other. = 25/day. Total: 260/day + 500 airfare			
2) International: Hotel = 160/night; Meals = 75/day; Car/Taxi = 70/day; Other. = 60/day. Total: 365/day + 800 airfare			
3) Domestic Day Trip: Hotel = 0; Meals = 55; Car/Taxi = 55/day; Other: = 50/day. Total: 160/1-day + 500 airfare			
Risk Factors			
	Factor	%	Basis
Technical:			Provide a brief explanation for your choice of Factor
Cost:	2	1	Factor of 2: Vendor quote from established drawings. (Multiplier of 1% for material concern)
Schedule:			Provide a brief explanation for your choice of Factor
Misc Comments:			
Facilities cost calculation for clusters: Same cost as hardware. E.g. a \$10000 machine costs \$10000 to run per year (including power, cabling, network, etc). Assumption: free hosting for the blade servers on the 194 sites.			
Scoping Options:			
Describe mitigation method planned and estimated cost savings in percent of task total cost estimate.			

INSTRUCTIONS FOR COMPLETING THIS WBS WORKSHEET

- **Task Name:** Enter the name of this WBS Element (as it appears in the WBS Outline).
- **Date:** Enter the date for this cost estimate or cost estimate revision.
- **WBS:** Enter the WBS Element (or task/subtask) identification number (same as the line number in the WBS Outline).
- **Revision:** Indicate the revision number of this estimate; first estimate performed is revision 0.0.
- **Stage:** Indicate construction stage (or stages) during which this cost will be incurred.
- **Estimator:** Person performing the estimate of this task.
- **WBS Dictionary:** Description of what this WBS element/task is about; also say what the element/task does not include.
- **Deliverables, Sub-Tasks, Dependencies:** List the principal deliverables for this task. Also, the sub-tasks that directly support this task (from WBS Outline). List dependencies by WBS Outline level number.
- **Labor Basis:** Please use these rates for labor categories on the Cost Estimate Detail spreadsheet that accompanies this WBS Dictionary page.
- **Non-Labor Basis:** Several categories have been provided. If you need additional categories of non-labor cost, please specify the rates here. These will be carried over to the Cost Estimate Detail spreadsheet. Please provide a reference to your sources for any other categories/rates used.
- **Travel Basis:** The rates shown on this WBS Dictionary page are similar to those used in other MREFC projects and have been accepted by MREFC in prior reviews.
- **Risk:** Included on a separate page.

WBS Detail: CED Spreadsheet Template

Cost Estimate Detail																																												
WBS Number		1.3.4.1																																										
WBS Element/Task		Hardware (of Data Repository)																																										
Construction Stage		5 years																																										
Description		End Date																																										
Estimated By		Larry Peterson / CK																																										
Last Modified On		3/6/2007																																										
Cost Category	Description	Estimator Comments or Vendor	Cost Basis	Qty.	Direct Labor		Capital Equipment		Travel		Materials & Expenses		Recurring Expenses		Total Cost (\$)	Reference/Comments																												
					Unit Cost	Total (\$)	Unit Cost	Total (\$)	Unit Cost	Total (\$)	Unit Cost	Total (\$)	Unit Cost	Total (\$)																														
Capital Equipment																																												
Equip.	High end Storage Server		EE	1			3,000,000	3,000,000							3,000,000																													
Equip.			EE	0			-	-							-																													
Equip.			EE				-	-							-																													
Equip.			EE				-	-							-																													
Equip.			EE				-	-							-																													
Recurring Expenses																																												
					Period																																							
Recurring Expenses	Facilities costs (including power, cabling, network, etc) from year 1		EE	5									600,000	3,000,000	3,000,000																													
Recurring Expenses	Facilities costs (including power, cabling, network, etc) from year 2		EE	4									600,000	2,400,000	2,400,000																													
Recurring Expenses	Facilities costs (including power, cabling, network, etc) from year 3		EE	3									600,000	1,800,000	1,800,000																													
Recurring Expenses	Facilities costs (including power, cabling, network, etc) from year 4		EE	2									600,000	1,200,000	1,200,000																													
Recurring Expenses	Facilities costs (including power, cabling, network, etc) from year 5		EE	1									600,000	600,000	600,000																													
Direct Labor																																												
					FTE-Years																																							
Labor			EE	0		-	-								-																													
Labor			EE	0		-	-								-																													
Labor			EE			-	-								-																													
Labor			EE			-	-								-																													
Labor			EE			-	-								-																													
Travel																																												
					Per Stage																																							
Travel	Multi-Day Domestic Travel (2 trips per year)	260/day + 500 (airfare)	EE	0					-	-					-																													
Travel	Single-Day Domestic Travel	660 per day	EE						-	-					-																													
Travel	International Travel	365/day + 800 (airfare)	EE						-	-					-																													
Blank Field																																												
Materials & Supplies																																												
					Quantity																																							
Materials & Supplies			VQ										-	-	-																													
Materials & Supplies			VQ										-	-	-																													
Materials & Supplies			VQ										-	-	-																													
Materials & Supplies			VQ										-	-	-																													
Materials & Supplies			EE										-	-	-																													
					Category Totals		-	3,000,000		-				9,000,000																														
														Sub Total Sheet	12,000,000																													
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Work Breakdown Structure Development

- Construction of the WBS has been a team activity, with leadership from the PMT
- The overall content of the WBS is based on numerous discussions, meetings, and reviews with CISE and MREFC
- Individual GENI Working Groups were established to develop designs, requirements, tasks, and budgets for the WBS Elements
- Cost estimates were based on the requirements for completion of tasks and subtasks – including staffing, capital equipment, recurring expenses, etc.
- Each WG completed BoE and CED pages for each WBS Element and relevant tasks or subtasks and submitted these to the PMT

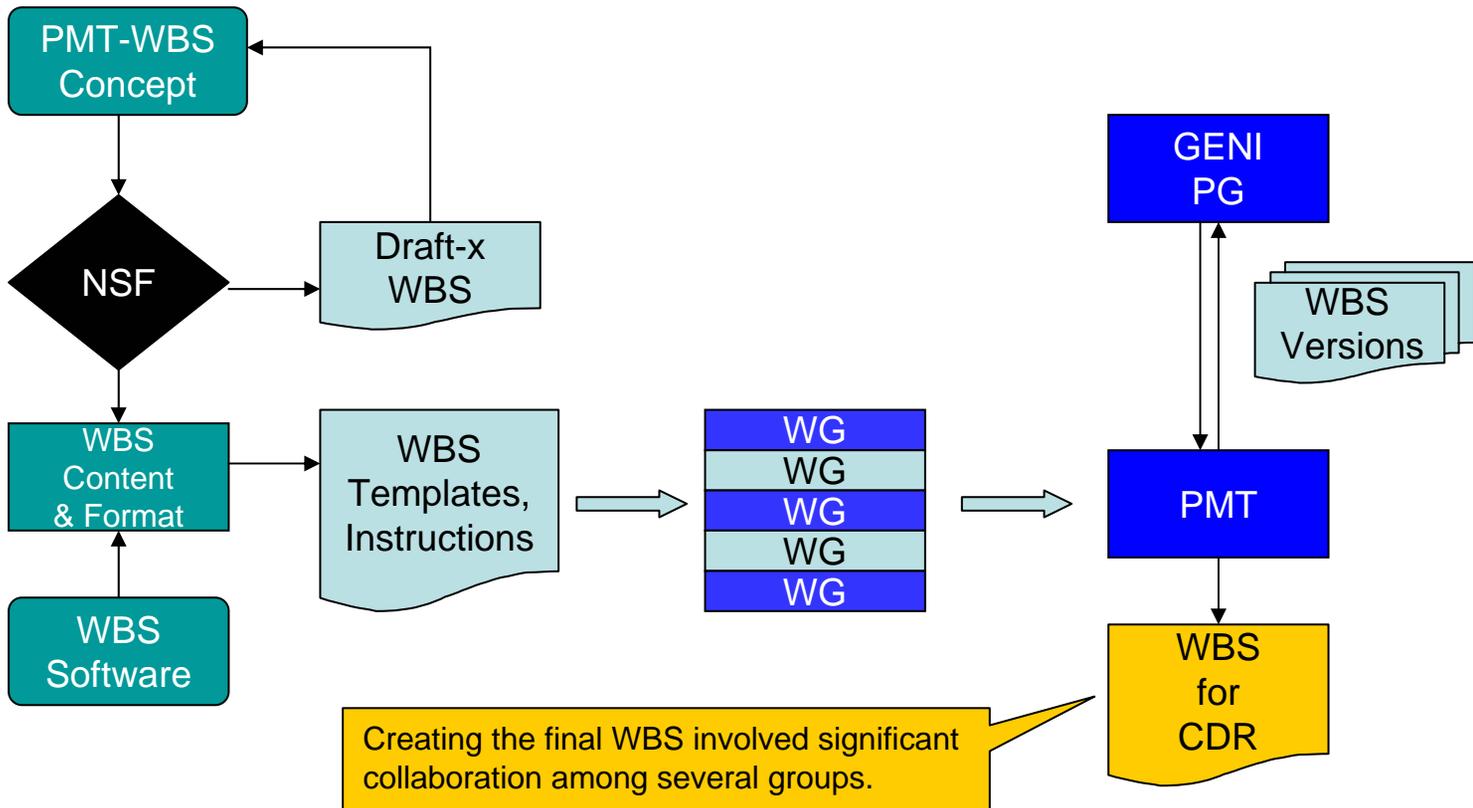
Work Breakdown Structure

Principal Components

- **WBS Outline:** A detailed outline of key project tasks – viewed from the Conceptual Design Planning Stage – that will be required to construct the GENI Facility.
- **BoE Pages:** Single-page summaries that include: task definitions; deliverables for each task/subtask; names of supporting tasks; assumptions related to task costs; risk/contingency assignments for budgeting; mitigation plans
- **CED Spreadsheets:** Single-page spreadsheets that provide detailed presentations of WBS Element/Task cost components, including direct labor, capital equipment, recurring expenses, benefits and overhead, contingency budget (from risk management plan)
- **Project Schedule:** Presented at a very high level. Needs more thought before the CDR to align costs, deliverables, dependencies, and relationship to construction stages

Work Breakdown Structure

WBS Development Flow



Project Management Control Systems

- Goals: Project Management information for *everyone* not just the high priests of project management
- Explore new dynamic ways of representing information
- PMCS becomes central to project principles
 - Adaptive
 - Collaborative
 - Trusting
 - Innovative
- Requires open platform, back-end database, multi-vendor
- Project Science reports showed programmable database approaches
- PMCS Approach during Planning
 - The PMT used elements of PMCS during planning, but no integrated system established
 - Performed informal market survey
 - Probably no commercial system that will meet all of GENI's needs, so development will have to be a part of the next phases of planning

Timeframes to FDR

- Multi-dimensional
- Schedule vs. Results vs. Continuity
- What is the goal?
 - Deliver useful artifact
 - Reduce risk
 - Preserve momentum
- Extensive discussion of NSF schedule driven vs. community readiness
- Pros and Cons on both sides, but risk too
- Rapid pace leaving community behind?
- Stagnation, lack of momentum?
- Risk reduction through forward progress
- Important questions around criteria for investment

All of this Requires **BALANCE**



Key PMT Interactions During Management Planning

CISE and MREFC
Research Community

Project Management Team Interactions

CISE and MREFC Interactions

- First 6 months held regular meetings with CISE and MREFC office
- Open dialog on process approach
- Examples of key documents from other MREFC projects
- Guidance on meeting MREFC requirements
- PMT provided references and input on emergent processes and open methods
- Jointly evolved potential new approaches

Project Management Team Interactions

Research Community Interactions

- Working groups active participant in developing budget and WBS
- Research community generally lacking experience in project management process
 - Required training and coaching
- Wide variations in practice of developing budget and WBS
- Staffing considerations should be reviewed
 - Use of grad students or department assistants not effective

Meta Issues

- Completeness
 - Risk Management Plan not really that
 - PMCS needs careful thought
- Only cursory work on
 - Change Control Management
 - Construction Plan - *Staging open issue*
 - Operational planning and budget
- 2nd Thoughts
- Open issues, problems

Summary of Recommendations to the GPO and CISE/MREFC

Recommendations to GENI Project Office

From Dean Casey Experience

- **Work Breakdown Structure**

- Ideally, the Research Plan, Facility Design Plan, and Construction Plan should be in place before a final WBS is developed;
- Practically, work on the WBS by the WGs assigned specific responsibilities for Facility Design and Facility Construction will help guide the development of these plans (e.g., by keeping facility design/construction within a doable build schedule and budget);
- Establish a mechanism from the start for WGs to communicate effectively among themselves so that conflicts are resolved early.

- **Construction Budget Development**

- Use the basic format provided by the PMT for Basis of Cost and Cost Detail; these forms contain all required MREFC information; a simple budget roll-up script is available;
- Use the *contingency override* feature sparingly; it should be possible to project a good zero-order contingency budget based on the simple risk management strategy used by the PMT;
- If refinements to Contingency Budget calculations are made, they should be easy to use by technical Working Groups (otherwise, the GPO will have to do all the work);
- The construction budget must include a spending plan (what will be spent and when) for GENI construction.

- **Project Management Control System**

- Select a PMCS as soon as possible;
- Design management processes so that they can be seen and administered through the PMCS.

Recommendations to CISE/MREFC

From Dean Casey Experience

- **CISE/MREFC-Project Planning Group Interaction**
 - The Project Management Team found the support provided by CISE and the MREFC very helpful as early basic project management documents were being prepared;
 - Regular meetings of CISE/MREFC and a pro-temp management team for a new MREFC project should be continued through CDR;
 - Not all MREFC projects will fit into the MREFC “plan-design-construct-use” mold; flexibility in MREFC processes is essential for the success of future projects (one size does not fit all);
 - Relationship between MREFC and new MREFC Project planners needs to be more open and collaborative;