

**LIGO**  
**Interim Cost Review**  
**June 9, 1994**  
**B. Barish**

**NATIONAL SCIENCE FOUNDATION  
REVIEW OF THE COSTS OF THE  
LASER INTERFEROMETER GRAVITATIONAL-WAVE OBSERVATORY**

**AGENDA**

Thursday, June 9, 1994

8:30	Barish	Welcome	114 E. Bridge
8:45	Barish	Revised Organization	
9:00	Whitcomb	Revised WBS	
9:15	Stapfer	Revised Milestones/Obligation Plan	
9:30	Aguirre	Cost Estimating Plan	
10:00		Break	
10:15	Schmidt	CDS System Design	
10:45	Bork	CDS Cost Analysis	
11:00	Canizares	MIT/CIT Relationship	
11:30	Fritschel	MIT Program	
12:00		Lunch	
13:00	Raab	40-m Update	22 Bridge Annex
13:15	Asiri	Louisiana Site Status	
13:30	Jones	CBI Final Design Review	
13:45	Stapfer	A&E Solicitation	
14:00	NSF	Executive Session	
15:00		Discussion with LIGO Staff	
16:00		Report Writing	

## **Issues raised in the Committee Report for the April review.**

- 1. Revise and update the LIGO Project Management Plan. (p.p. 3-4)**  
*(Updated PM plan - September 16, 1994)*
  
- 2. A fundamental misunderstanding of the definition of "cost estimate" (p6-7)**  
*(Agreed! New cost estimate in the 'conventional interpretation)*
  
- 3. Incorporate configuration management into the Project Management Plan. (p. 8)**  
*(Yes! It will be in PM plan - Sept 16, 1994)*
  
- 4. An A&E firm should be on board as soon as possible.**  
*(Underway! to be presented by Asiri)*
  
- 5. Re-analyze and examine the labor cost, in view of Davies-Bacon rates, union labor agreements and the no longer generic, but actual selected sites. (p. 9)**  
*(To be done by U.S. Cost)*
  
- 6. Include the concept of "off site, pre-fabricated assemblies"**  
*(Will be part of value engineering studies by A&E)*
  
- 7. Evaluate the concept and needs for facility fire protection, particularly for the Washington site.(p.9)**  
*(JPL + A&E F. Asiri presentation)*
  
- 8. Re-evaluate the 23.8% burden rates used for construction contracts in view of current rates and geographic location. (p. 10)**  
*(To be done by U.S. Cost)*
  
- 9. Consider the appointment of a Washington Facility Project Manager. (p. 10)**  
*(We will consider it and other options for Washington management)*

**10. Assign a specific person to "move out" on the Louisiana site land acquisition. (p. 10)**

*(Ned Goldwasser assigned -- report by F. Asiri)*

**11. Engage the pipe line companies to resolve the LIGO crossing issues at the Louisiana site. (p,p, 10-11)**

*(report by Asiri)*

**12. Revise the schedule sequence, in view of the 404 application process and FONSI for the Louisiana site, (p.11)**

*(report by Asiri)*

**13. Include the cost uncertainty, due to the lack of geotechnical soil reports for the Livingston site. (p, 11)**

*(OK - report by Asiri)*

**14. Consider the appointment of a Louisiana Facility Project Manager to work interface problems. (p, 11)**

*(We will consider)*

**15. Conduct a cost update for the beam tube (now that the design is frozen). Consider schedule impact to qualify a new contractor. (p.12)**

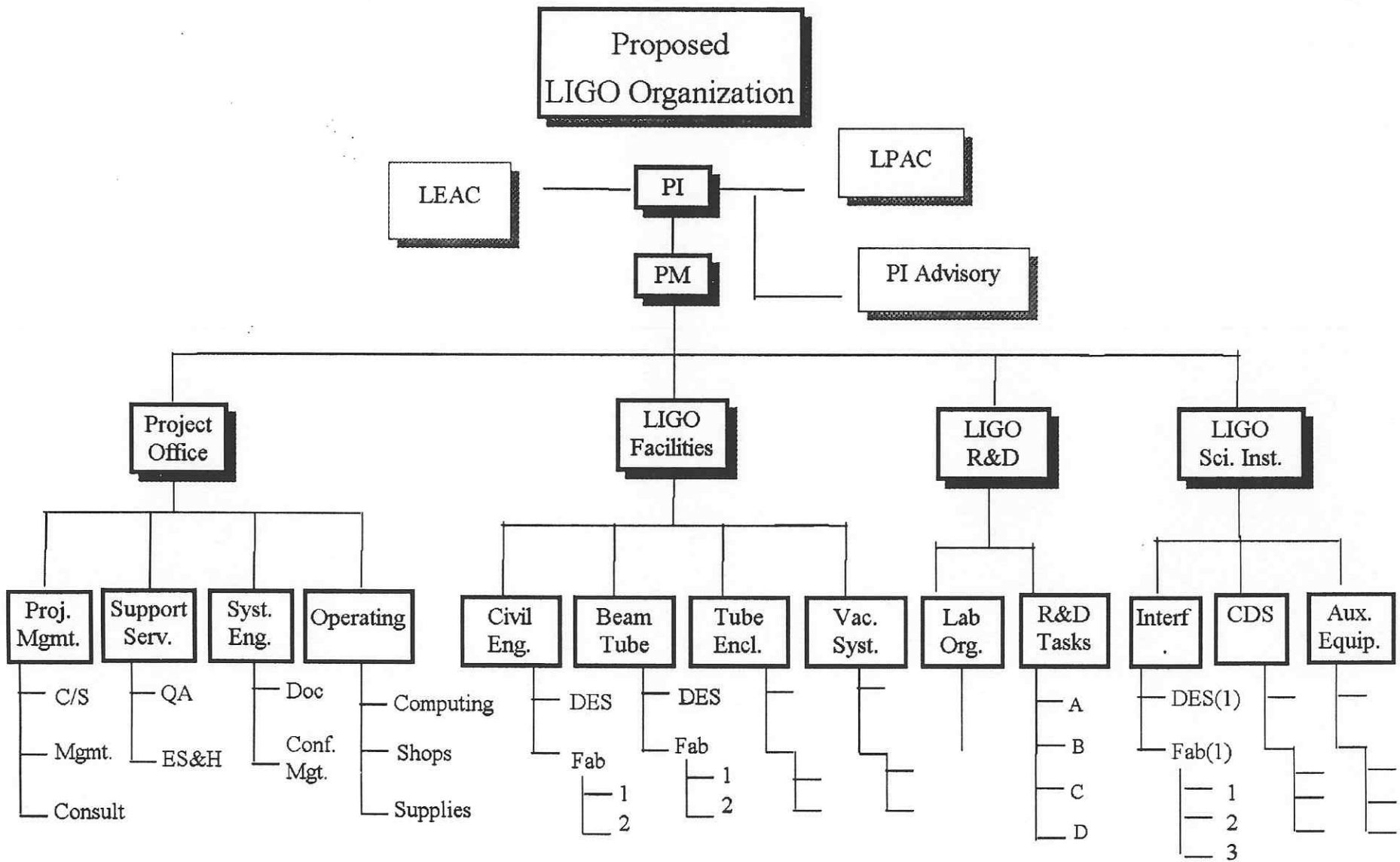
*(Will do - report by L. Jones)*

**16. Address the collaborative aspects of MIT-based LIGO work. (p. 13)**

*(reports by Canizares and Fritchel)*

**17. Consider floating the long structure in buoyant equilibrium (p 11)**

*(Yes - part of value engineering)*



Note: Interferometer is by subsystems at lowest level.

OVERALL PLAN:

*Phase I:*      Key Management Positions Filled:    September 1994

*Phase II:*     Complete Organization in Place:    February 1995

**Project Manager**

*Leading Candidate:*            Gary Sanders (LANL)  
   Informal offer made, which he is considering.

*Alternate Candidates:*        Being pursued with JPL.

**Chief Financial Officer**

*Leading Candidate:*            Offer made to R. Fischer which he declined.

*Alternate Candidates:*        Short list of 6 applicants being interviewed.

**Chief of System Engineering/Integration**

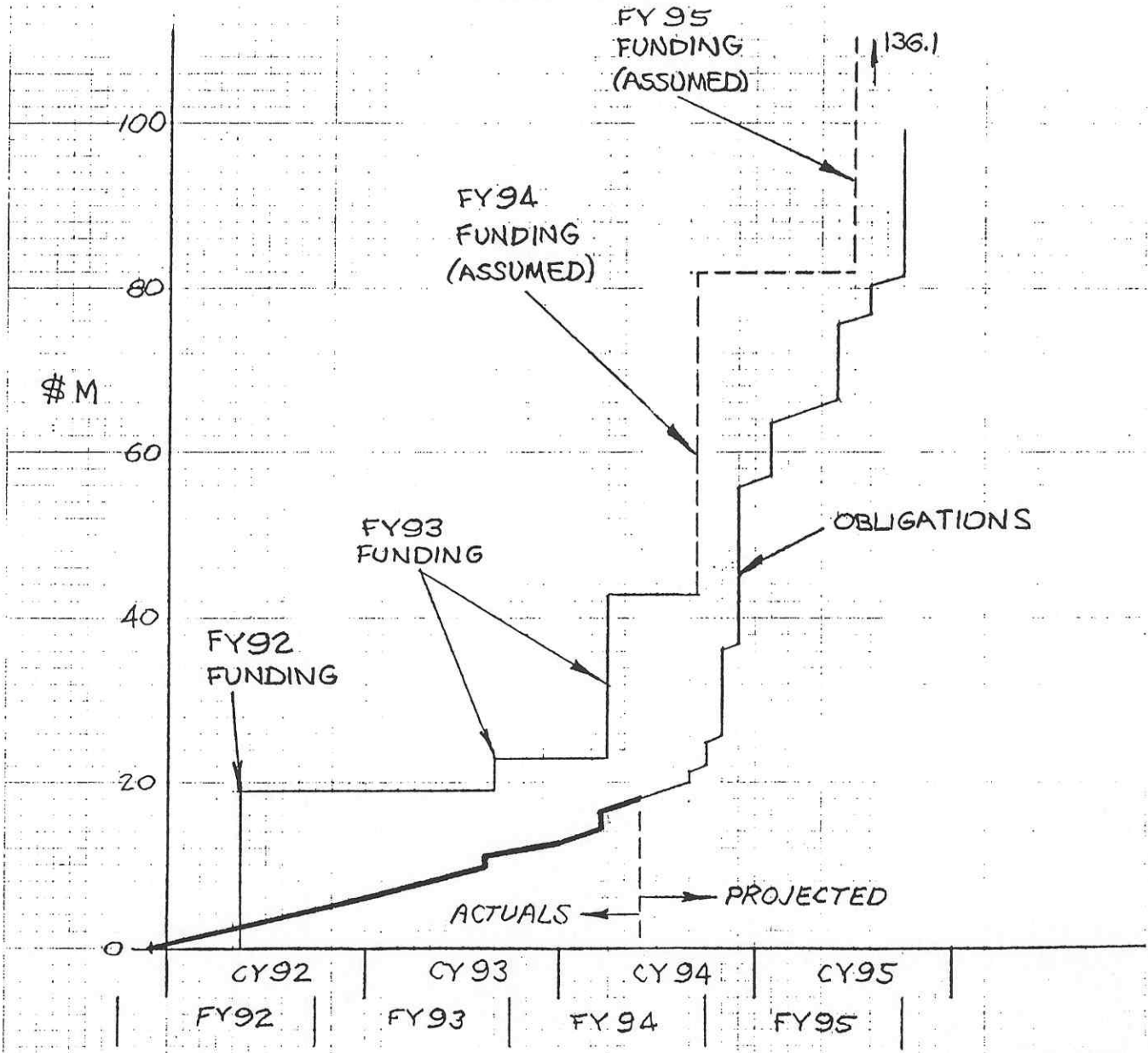
Candidates are being identified and interviewed at JPL.

These three positions, plus existing LIGO management will represent the key personnel from which we will fill out the rest of the organization. We expect to fill these three positions, plus others within the augmented organization by September 1994. The augmented organization will be in place in February 1995.

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APR 22 10:00 AM '94

### PLANNED CONSTRUCTION-PHASE FUNDING AND OBLIGATIONS



6/8/94

LIGO - Total Expended  
(new WBS)

			1992	1993
1.0	LIGO	13105.05		
1.1	Facilities and Vacuum Systems			
1.1.1	Beam Tubes			
1.1.1.1	Design	2382.65	338.52	2044.13
	Contracts			1548.8
	Scientist		6 50.65	6 50.65
	Engineer		18 219.15	12 146.1
	Technician		6 39.5	0 0
	Travel		0.3 29.22	0.32 42.752
	Consultants			23.508
	Contingency			232.32
1.1.1.2	Fab/Install			
1.1.1.2.1	Washington	0		
	Contracts			
	Scientist			
	Engineer			
	Technician			
	Travel			
	Consultants			
	Contingency			
1.1.1.2.2	Louisiana	0		
	Contracts			
	Scientist			
	Engineer			
	Technician			
	Travel			
	Consultants			
	Contingency			
1.1.2	Beam Tube Enclosures			
1.1.2.1	Design	0		
	Contracts			
	Scientist			
	Engineer			
	Technician			
	Travel			
	Consultants			
	Contingency			
1.1.2.2	Construction			
1.1.2.2.1	Washington	0		
	Contract			
	Scientist			



LIGO -- Total Costs (PMP)  
(new WBS)

		1992	1993	1994	1995	1996	1997
0	LIGO	237101.7					
1	Facilities and Vacuum Systems						
1.1	Beam Tubes						
1.1.1	Design	2720.685	338.52	2044.13	338.0347		
	Contracts			1548.8			
	Scientist	6	50.65	6	50.65		
	Engineer	18	219.15	12	146.1		
	Technician	6	39.5	0	0		
	Travel	0.3	29.22	0.32	42.752		
	Consultants				23.508		
	Contingency				232.32		
1.1.2	Fab/Install						
1.1.2.1	Washington	19226.07			19162.11	63.96887	
	Contracts				17124.1		
	Scientist			3	25.325	1	8.441667
	Engineer			12	146.1	3	36.525
	Technician			2	13.16667	0	0
	Travel			0.2	69.74	0.05	17.435
	Consultants				7.836		1.5672
	Contingency				1775.838		
1.1.2.2	Louisiana	19226.07				19096.57	129.5049
	Contracts					17124.1	
	Scientist					2	16.88333
	Engineer					9	109.575
	Technician					2	13.16667
	Travel					0.15	52.305
	Consultants						4.7016
	Contingency						1775.838
1.1.2	Beam Tube Enclosures						
1.1.2.1	Design	632.6127			632.6127		
	Contracts				458.5		
	Scientist				1	8.441667	
	Engineer				4	48.7	
	Technician						
	Travel				0.05	17.435	
	Consultants					7.836	
	Contingency					91.7	
1.1.2.2	Construction						
1.1.2.2.1	Washington	10001.68			9974.439	27.23807	
	Contract				7946.1		
	Scientist				0	1	8.441667

## COST IMPACTS

	COST 93 \$M	TOTAL COST 93 \$M	TOTAL COST RUNOUT \$M
COOPERATIVE AGREEMENT	222.8	222.8	232.2
SALES TAX	8.1	230.9	241.0
5 YR → 6 YR STRETCHOUT	7.6	238.5	
UNIMPLEMENTED SCOPE REDUCTIONS	8.4	246.9	
SITE-RELATED CHANGES	2.4	249.3	
WBS 4 ADJUSTMENTS	0.7	250.0	
CONTINGENCY RE-ALLOCATION	-2.7	247.3	
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PROJECT MANAGEMENT PLAN	239.2		
+ SALES TAXES	8.1	247.3	266.6
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<b><u>REVISED PROJECT PLANS:</u></b>			
REMOTE SITE COSTS TO PRE-OPS	-2.1	245.2	
AUGMENTED STAFFING	14.2	259.4	
<b>SCHEDULE SLIPS FORCED BY FUNDING CAP:</b>			
• AUGMENTED STAFFING	3.4		
• FY 94 FUNDING = \$39M	1.9	264.7	291.1
<b>POTENTIAL COST INCREASES:</b>			
• LA SITE DEVELOPMENT	2.6		
• SCHEDULE SLIP TO ACCOMMODATE FUNDING FOR COMMUNITY PROGRAM	2.9	270.2	296.9

Activity Description	Early Finish	Resp. Party	1994												1995	
			A	M	J	J	A	S	O	N	D	J	F	M	A	M
<b>LIGO PMCS Implementation Schedule</b>																
Restructure LIGO WBS	09JUN94	B. Barish/S. Whitcom														
Develop Re-Cost Estimating Methodology	09JUN94	U.S. Cost Inc.														
Write New WBS Dictionary	11JUL94	LIGO Engrs w/US Cost														
Re-Estimate LIGO Project Costs	23SEP94	U.S. Cost w/Engrs														
Define NSF Requirements for a PMCS System	23SEP94	Proj Mgr/Bus. Mgr														
NSF Cost Estimate Review	23SEP94	NSF Review Committee														
Evaluate and Purchase PMCS Software	21NOV94	Bus Mgr/Eval Board														
Develop LIGO Scheduling Methodology	30SEP94	Bus Mgr/Staff														
Develop Detailed System Schedules against WBS	30DEC94	PMCS Staff w/Engrs														
Integrate System schedules into IPS	20JAN95	PMCS Staff w/Engrs														
Reconcile Top Down/Bottoms up schedules	10FEB95	Meet w/Mgnt & Engrs														
Resource Load Schedules from WBS Cost Estimate	15MAR95	PMCS Staff w/US Cost														
Develop Cost Accounts and Work Packages	03APR95	PMCS Staff														
Prepare PMCS Documentation and CAM Training	03APR95	David Pells														
Internal LIGO Review	14APR95	Mgnt & Engrs														
Mock CAM Interviews	21APR95	Mgnt & CAMS														
NSF Review of Project Management Control System	28APR95	Mgnt & CAMS														

Project Start 03MAY94  
Project Finish 28APR96  
Data Date 31MAY94  
Plot Date 03JUN94

Sheet 1 of 1

**LIGO  
PMCS Implementation Schedule**

## Steps For LIGO PMCS Development

<u>Task Description</u>	<u>Responsible Party</u>	<u>Finish Date</u>
1. Restructure LIGO WBS	B. Barish/S. Whitcomb	June 9, 1994
2. Develop Re-Cost Estimating Methodology	U.S. Cost Inc.	June 9, 1994
3. Write New WBS Dictionary	LIGO Engrs w/U.S. Cost	July 11, 1994
4. Re-Estimate LIGO Project Costs	U.S. Cost w/Engrs	Sept 23, 1994
5. Define NSF Requirements for a PMCS System	Proj Mgr/Bus. Mgr	Sept 23, 1994
6. Evaluate and Purchase PMCS Software	Bus Mgr/Eval Board	Nov 21, 1994
7. Develop LIGO Scheduling Methodology	Bus. Mgr/Staff	Sept 30, 1994
8. Develop Detailed System Schedules Against the WBS (Scheduled Work Scope Must Match Scope Defined in WBS)	PMCS Staff Meet w/Engrs	Dec. 30, 1994
9. Integrate All System Schedules into Integrated Proj Schedule	PMCS Staff Meet w/ Engrs	Jan 20, 1995
10. Reconcile Top Down Milestones and Bottoms Up Schedule	Meet w/ Mgnt & Engrs	Feb 10, 1995
11. Resource Load Schedules from WBS Cost Estimate	PMCS Staff w/ U.S. Cost	Mar 15, 1995
12. Develop Cost Accounts and Work Packages	PMCS Staff	April 1, 1995
13. Prepare PMCS Documentation and CAM Training	David Pells(Consultant)	April 1, 1995
14. Internal LIGO Review	Mgnt & Engrs	April 14, 1995
15. Mock CAM Interviews	Mgnt & CAMs	April 20-21, 1995
16. NSF Review of Project Management Control System	Mgnt & CAMs	April 28, 1995