

---

# Project Control Systems

Phil Lindquist  
LIGO Project Controls Manager  
April 9, 1996

- Cost Schedule Control Systems
- Change Control and Contingency Management

LIGO Project

1

LIGO-G960062-00-P

## Project Control Systems - Overview

---

- **Introduction**
- Rebaselining
- Integrated Project Schedule
- Budget Baseline
- Change and Contingency
- Actual Costs, Commitments, Funding
- Cost Schedule Status Report
- Conclusions

LIGO Project

2

LIGO-G960062-00-P

## Cost Schedule Control Systems

---

### Brief History

Cost Estimate Review	September 1994
Cost Estimate Approved by NSB	November 1994
Performance Measurement Baseline (PMB) Established	April 1995
NSF Review of PMB	May 1995
Revised Integrated Schedule, Baseline, Estimate	February 1996

### Description of Cost Schedule Control System

---

- All subsystems tied to Work Breakdown Structure
- Integrated Project Schedule (IPS) - Maintained in **OpenPlan**
- Budget Baseline - **COBRA**
  - » Timephased based on IPS
  - » Budget allocated to Measurement Milestones
- Earned Value - **COBRA**
  - » Based on time-phased budget established for completed work
- Actual Costs - Data imported electronically from Caltech General Ledger
- Cost Estimate - maintained in **COBRA**  
(9/94 data was SUCCESS database)

## Definition of WBS Levels

1	LIGO Construction		B. Barish/G. Sanders	
1.1	Facilities and Vacuum System		M. Coles/G. Stapfer	
1.1.1	Vacuum Equipment	Control Account	J. Worden	5A5
1.1.1.1	Vacuum Equipment Design			
1.1.1.1.1	In-house Engineering and Contract Management	Work Package	J. Worden	5A511
1.1.1.1.2	Contracted Design Competition	Work Package	J. Worden	5A512
1.1.1.1.3	Contracted Design (Phase B)	Work Package	J. Worden	5A513
1.1.1.1.4	VE Control and Data Systems	Work Package	J. Worden	5A514
1.1.1.2	Washington VE Construction			
1.1.1.2.1	In House Labor and Equipment	Work Package	J. Worden	5A521

LIGO Project

5

LIGO-G960062-00-P

## Organization

### LIGO Project Responsibility Assignment Matrix

WBS	Account Code	Description	Account Manager	Baseline (KS)
1.1		Facilities	Coles/Stapfer	159,650
1.1.1	5A5	Vacuum Equipment	J. Worden	42,210
1.1.2	5B5	Beam Tubes	L. Jones	48,653
1.1.3	5C5	Beam Tube Enclosures	F. Asiri	19,687
1.1.4	5D5	Facility Design and Construction	F. Asiri	49,100
1.2		Detector Systems	Whitcomb/Shoemaker	50,945
1.2.1	5E5	Interferometer Design/Fabrication	Whitcomb/Shoemaker	34,137
1.2.2	5J5	CDS	R. Bork	12,292
1.2.3	5K5	Physics Monitoring	TBD	2,952
1.2.4	5L5	Support Equipment	TBD	1,564
1.3	5M5	Research and Development	Whitcomb/Shoemaker	23,490
1.3.1		Lab Operations	Whitcomb/Shoemaker	6,880
1.3.2		R & D Tasks	Whitcomb/Shoemaker	16,610
1.4	5N5	Project Office	G. Sanders	22,791
1.4.1		Project Management	G. Sanders	11,142
1.4.2		Support Services	G. Sanders	848
1.4.3		System Integration	A. Lazzarini	4,613
1.4.4		Administration	B. Moore	6,188

LIGO Project

6

LIGO-G960062-00-P

## LIGO Monthly Cost Schedule Reporting Process

---

- Performance data collected 1st day of month  
(Direct interface between Project Controls and Group/Task Leaders)
- Financial reports received - 10th day  
(Floppy disk provided for entering data directly into COBRA)
- Performance reports prepared and distributed - 15th day  
(Project Controls)
- Project Controls Meeting dedicated to Cost Schedule Review - 20th day  
(Status presented by responsible Group and Task Leaders)
- Issue Monthly, Quarterly, Annual Reports - 25th day  
(Project Controls)

## Project Control Systems - Overview

---

- Introduction
- **Rebaselining**
- Integrated Project Schedule
- Budget Baseline
- Change and Contingency
- Actual Costs, Commitments, Funding
- Cost Schedule Status Report
- Conclusions

## Rebaseline - Purpose and Approach

---

- **Purpose: to reflect**
  - » Negotiated Contract Milestones
  - » Coordination of Facility Construction Tasks
  - » Switch to Nd:YAG Laser
  - » Reorganization of Detector/R&D Groups
  - » Experience
- **Approach**
  - » All changes submitted to Change Control Board (CCB)
  - » Facilities (schedule variances for in-process work retained; cost variances reduced to reflect scope changes and negotiated contract prices)
  - » Detector (schedule variances eliminated; cost variances at end of FY 1995 were carried into the new baseline)

## Project Control Systems - Overview

---

- Introduction
- Rebaselining
- **Integrated Project Schedule**
- Budget Baseline
- Change and Contingency
- Actual Costs, Commitments, Funding
- Cost Schedule Status Report
- Conclusions

## Integrated Project Schedule (IPS)

---

- Work scope organized and planned by WBS
- Tasks, durations and logic provided by Control Account Managers (Task and Group Leaders)
- Activities cover the lifetime of the project through 2000
- Detailed schedules merged into one logic network, horizontal integration provided by interface milestones
- IPS reviewed and approved by the Control Account Managers, the Group Leaders, and the Project Manager
- Changes to PMP Reporting Milestones submitted to Change Control Board (CR-960017A)
- Status reported monthly by Control Account Manager at Project Controls Meeting

## NSF Reporting Milestones (Hanford, WA)

---

Milestone Description	Current Project Management Plan Dates	Proposed Project Management Plan Dates	Change
Final Site Construction	Mar 97	Complete	
Begin Main Building Renovation	Apr 97	Complete	
Seismic Mitigation	Nov 97	Complete	
Complete Structural Test	Feb 98	Complete	
Seismic Contract	Mar 98	Complete	
Initial Beam Tube Installation	Oct 98	Complete	
Initial Sub Construction	Oct 98	Complete	
Initial Top Construction	Jan 99	No Change	
Top Completion	Sept 99	No Change	
Aspen Vacuum Equipment	Mar 99	No Change	
Aspen Vacuum Control (P&ID)	Mar 99	No Change	
Beamline Commissioning	Mar 99	No Change	
Final Facility Shakedown	Mar 99	No Change	

## NSF Reporting Milestones (Livingston, LA)

Milestone Description	Project Management Plan Dates	Proposed Project Management Plan Dates	Change
Baseline for the LIGO Livingston	Apr 03	Apr 03	
Setup of the Livingston	Nov 03	Apr 04	
Complete Livingston	Feb 05	Apr 04	
Setup of Livingston	Mar 05	Apr 04	
Final Livingston	Aug 05	Apr 04	
Final Livingston	Dec 05	Apr 04	
Final Livingston	Jan 07	Nov 04	
Final Livingston	Jan 07	Apr 04	
Final Livingston	Mar 08	Apr 04	
Final Livingston	May 08	Nov 04	
Final Livingston	Sep 08	Nov 04	
Final Livingston	Jan 09	Apr 04	(1)
Final Livingston	Jan 09	Mar 09	(1)

LIGO Project

13

LIGO-G960062-00-P

## NSF Reporting Milestones (Detector)

Milestone Description	Project Management Plan Dates	Proposed Project Management Plan Dates	Change
Baseline for the Livingston	Apr 03	Apr 03	(1)
Setup of the Livingston	Nov 03	Apr 04	(1)
Complete Livingston	Feb 05	Apr 04	(1)
Setup of Livingston	Mar 05	Apr 04	(1)
Final Livingston	Aug 05	Apr 04	(2)
Final Livingston	Dec 05	Apr 04	(1)
Final Livingston	Jan 07	Nov 04	(1)
Final Livingston	Jan 07	Apr 04	(1)
Final Livingston	Mar 08	Apr 04	(1)
Final Livingston	May 08	Nov 04	(1)
Final Livingston	Sep 08	Nov 04	(1)
Final Livingston	Jan 09	Apr 04	(1)
Final Livingston	Jan 09	Mar 09	(1)

LIGO Project

14

LIGO-G960062-00-P

## Project Control Systems - Overview

---

- Introduction
- Rebaselining
- Integrated Project Schedule
- **Budget Baseline**
- Change and Contingency
- Actual Costs, Commitments, Funding
- Cost Schedule Status Report
- Conclusions

## New LIGO Construction Budget Baseline

---

### Approach

- Existing budget was spread to new Integrated Project Schedule (IPS)
- All increases (and decreases) to budget were submitted to and reviewed by Change Control Board (CCB)
- All budget was assigned to the new milestones for performance measurement

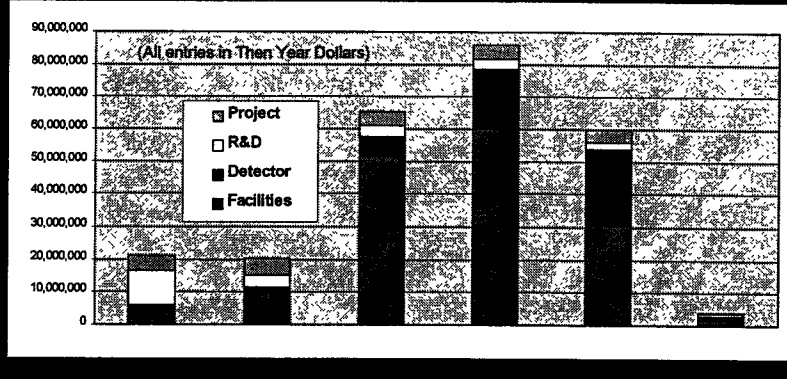
### Result

<b>Total Budget-at-Completion (escalated)</b>	<b>\$256.9 million</b>
<b>Contingency</b>	<b>\$35.2 million</b>
<b>Project Total Cost</b>	<b>\$292.1 million</b>



## New LIGO Construction Budget Baseline

Subsystem	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999
Facilities	6,195,000	9,721,000	51,120,000	60,380,000	30,689,000	1,545,000
Detector	0	1,679,000	6,513,000	18,085,000	23,119,000	1,549,000
R&D	10,407,000	3,919,000	3,353,000	3,005,000	2,162,000	644,000
Project	4,729,000	4,905,000	4,380,000	4,491,000	3,931,000	355,000
Total	21,331,000	20,224,000	65,366,000	85,961,000	59,901,000	4,093,000

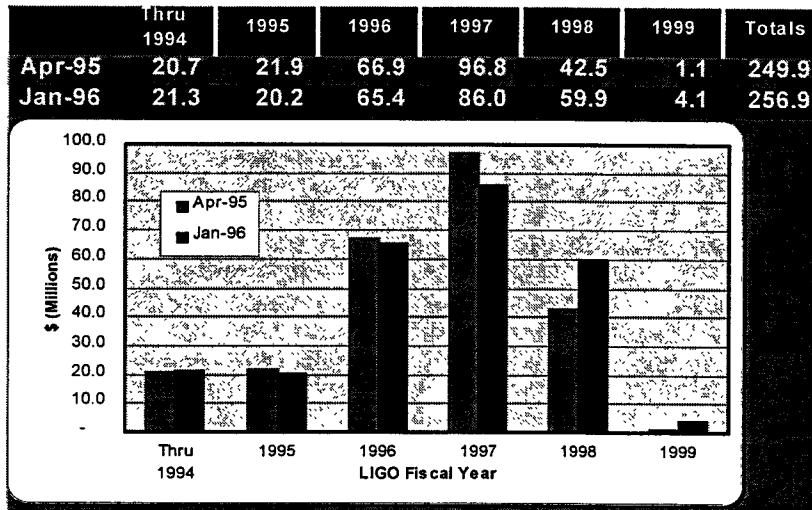


LIGO Project

17

LIGO-G960062-00-P

## Budget Baseline Changes (Apr 95 - Feb 96)

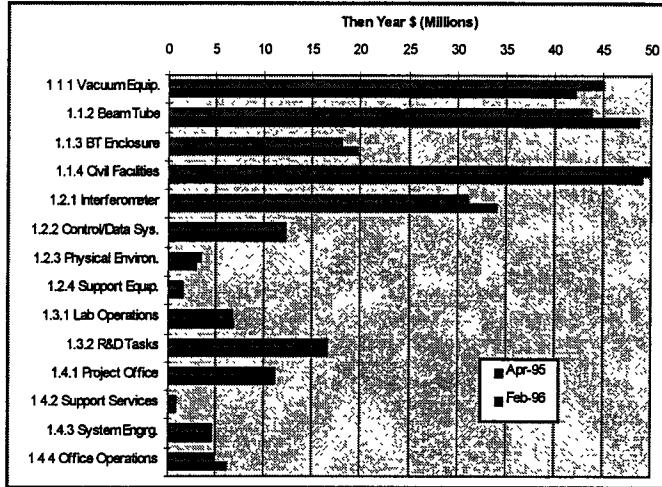


LIGO Project

18

LIGO-G960062-00-P

## Budget Baseline Changes by WBS

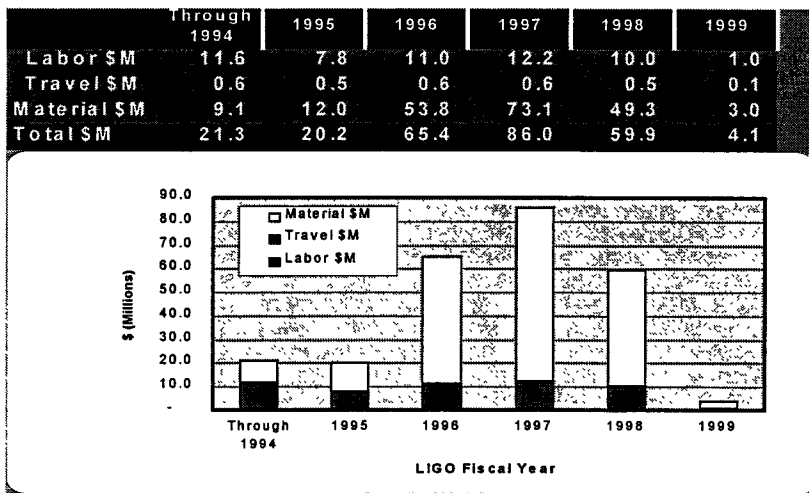


LIGO Project

19

LIGO-G960062-00-P

## Budget Baseline (Labor, Travel, Materials)



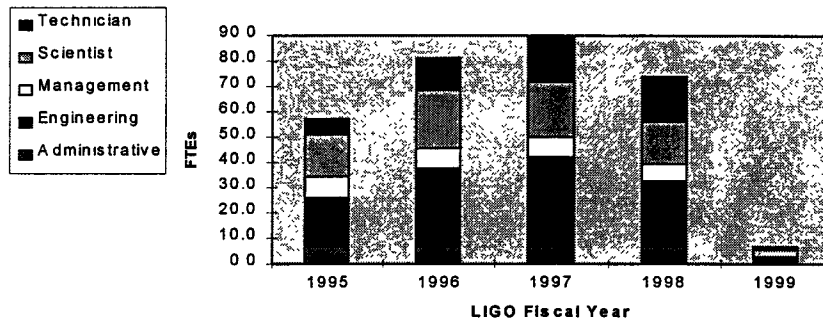
LIGO Project

20

LIGO-G960062-00-P

## Budget Baseline (Labor by Category)

Labor Category	1995	1996	1997	1998	1999
Administrative	6.7	6.7	6.7	6.7	
Engineering	19.5	30.9	35.4	26.1	1.4
Management	8.0	8.0	8.0	6.5	1.5
Scientist	17.0	22.8	21.7	16.8	2.5
Technician	6.0	12.7	17.7	17.6	1.3



LIGO Project

21

LIGO-G960062-00-P

## Project Control Systems - Overview

- Introduction
- Rebaselining
- Integrated Project Schedule
- Budget Baseline
- **Change Control and Contingency**
- Actual Costs, Commitments, Funding
- Cost Schedule Status Report
- Conclusions

LIGO Project

22

LIGO-G960062-00-P

# LIGO Construction Change Request Log

## Section of the LIGO Change Control Log

Change Request No.	Description	Submitted By	Submittal Date	Current Status	Disposition Date	Baseline Date	Net Contingency
CR-960014	1.1.1 Vacuum Equipment - BTD Pump Cart modifications	J. Worden x4438	March 4, 1996	Approved \$40,031	March 4, 1996		\$35,184,697
CR-960015	1.1.1 Vacuum Equipment - Annulus Conductance Specification	J. Worden x4438	March 4, 1996	Approved (\$41,427)	March 4, 1996		\$35,226,124
CR-960016	WBS 1.1.3 Beam Tube Enclosure, Hanford - shift Access Module centerline	D. Coyne	March 4, 1996	Approved \$5200	March 4, 1996		35,220,924
CR-960017A	WBS 1.4.1.1 Project Management Plan - NSF Reporting Milestones	P. Lindquist	March 18, 1996	Approved No Cost	April 3, 1996		\$33,270,924
CR-960018	WBS 1.1.2 Beam Tubes - reduced cost beam tube supports	L. Jones	April 2, 1996	Approved (\$206,955)	April 3, 1996		\$33,477,879
CR-960019	WBS 1.1.1 Vacuum Equipment - deplete 30 inch flanges from Mode Cleaner	J. Worden	March 22, 1996	Notification Only (\$35,298)	April 1, 1996		\$33,513,177

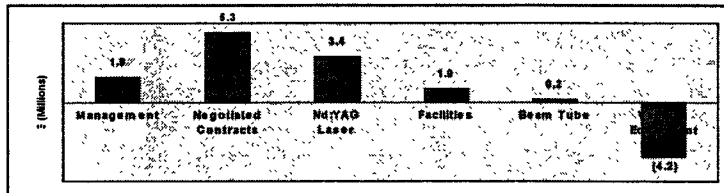
LIGO Project

23

LIGO-G960062-00-P

## LIGO Change Request Activity

September 1994 Cost Estimate		\$42,816,000
Total Submitted (through March 1996)	45	
Approved	26	7,612,421
Notification Only	2	-17,345
March 30, 1996 Baseline		\$35,220,942



LIGO Project

24

LIGO-G960062-00-P

## LIGO Contingency Log (1995)

Item No.	Change Request	Approved Date	WBS No.	System	Description	Contingency Debit	Contingency Credit	Contingency Balance
					Initial Balance			\$ 42,816,000
1	CR950010	May-95	1.4	Project Office	Allocations of Actual Costs thru FY 1994	\$ 584,000		\$ 42,232,000
2	CR950001	May-95	1.1.2	Beam Tube	Improved Beam Tube Cleaning Process	\$ 137,000		\$ 42,095,000
3	CR950005B	May-95	1.1.4	Civil	Contract for Clearing Livingston Site	\$ 135,735		\$ 41,959,265
4	CR950008	May-95	1.1.1	Vacuum Equip	Remove Getter Pumps		\$ 1,685,000	\$ 43,644,265
5	CR950014	Jul-95	1.1.1	Vacuum Equip	Remove TMC Chambers		\$ 1,420,000	\$ 45,064,265
6		Jul-95	1.2.1	Detector	Remove TMC Chambers		\$ 257,000	\$ 45,321,265
7	CR950016	Aug-95	1.1.4	Civil	Rough Grading/Pipeline Crossing	\$ 520,000		\$ 44,801,265
8	CR950019	Sep-95	1.1.1	Vacuum Equip	Adjustment to negotiated contract price	\$ 1,003,000		\$ 43,798,265
9	CR950022	Oct-95	1.4.4	General Computing	Increase budget to cover increased scope	\$ 1,318,782		\$ 42,479,483
10	CR950024	Nov-95	1.1.2	Beam Tubes	Adjustment to negotiated contract price	\$ 4,257,000		\$ 38,222,483
11	CR950025	Nov-95	1.1.4	Civil	Expand End Station to accommodate two interferometers	\$ 200,000		\$ 38,022,483
12	CR950027	Dec-95	1.1.4	Civil	Incorporate Observation Deck Design	\$ 15,731		\$ 38,006,752
13	CR950028	Dec-95	1.1.4	Civil	Increase LVEA area to accommodate three interferometers	\$ 150,067		\$ 37,856,685

LIGO Project

25

LIGO-G960062-00-P

## LIGO Contingency Log (1996)

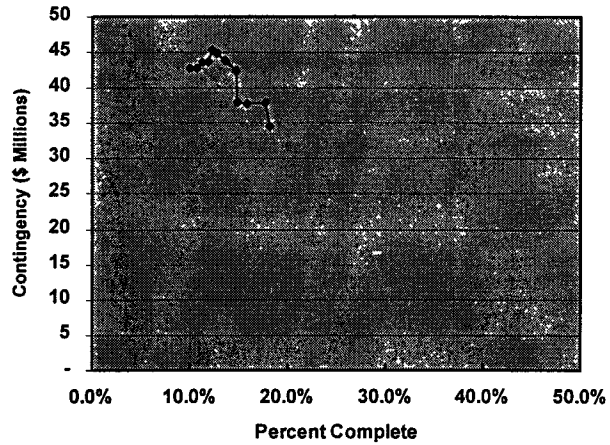
Item No.	Change Request	Approved Date	WBS No.	System	Description	Contingency Debit	Contingency Credit	Contingency Balance
14	CR960002	Jan-96	1.1.1	Vacuum Equip	WA Beam Manifold		\$ 200,557	\$ 38,057,242
15	CR960005	Jan-96	1.1.1	Vacuum Equip	Main Ion Pumps Auxiliary Ports	\$ 9,854		\$ 38,047,388
16	CR960008	Feb-96	1.1.1	Vacuum Equip	Gate Valve Weld Stub	\$ 17,953		\$ 38,029,435
17	CR960006	Feb-96	1.1.2	Beam Tubes	Beam Tube & BT Enclosure Model	\$ 40,600		\$ 37,988,835
18	CR960007	Feb-96	1.2	Detector	Increase due to conversion to Nd:YAG Laser	\$ 3,390,000		\$ 34,598,835
19	CR960011	Mar-96	1.1.1	Vacuum Equip	BSC Floors (reduced number / increased loading)	\$ 11,962		\$ 34,586,873
20	CR960012	Mar-96	1.1.1	Vacuum Equip	Chillers for Deliverable Carts	\$ 62,145		\$ 34,524,728
21	CR960013	Mar-96	1.1.1	Vacuum Equip	Reduce Miscellaneous Hardware budget		\$ 700,000	\$ 35,224,728
22	CR960014	Mar-96	1.1.1	Vacuum Equip	BTD Pump Cart modifications	\$ 40,031		\$ 35,184,697
23	CR960015	Mar-96	1.1.1	Vacuum Equip	Annulus Conductance specification		\$ 41,427	\$ 35,226,124
24	CR960016	Mar-96	1.1.3	BT Enclosures	Shift Access Module centerline	\$ 5,200		\$ 35,220,924
	Totals					\$ 11,895,060	\$ 4,303,984	

LIGO Project

26

LIGO-G960062-00-P

## Contingency Vs. Percent Complete

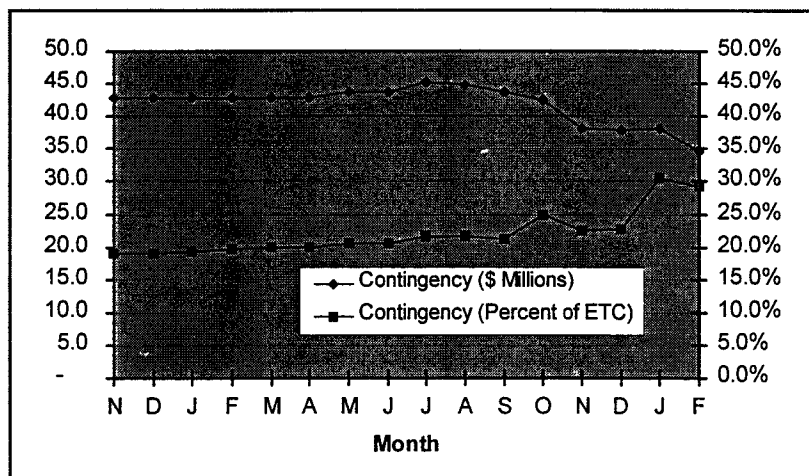


LIGO Project

27

LIGO-G960062-00-P

## LIGO Contingency Vs. Time



LIGO Project

28

LIGO-G960062-00-P

## Project Control Systems - Overview

- Introduction
- Rebaselining
- Integrated Project Schedule
- Budget Baseline
- Change Control and Contingency
- **Actual Costs, Commitments, Funding**
- Cost Schedule Status Report
- Conclusions

LIGO Project

29

LIGO-G960062-00-P

## Costs and Commitments (End of February 1996)

WBS	Description	Allocation of Costs through Nov. 1994	LFY 1995 (Dec. 1 - Nov. 30)	December 1995	January 1996	February 1996	Cumulative Costs	Open Commitments	Total Costs Plus Commitments
1.1.1	Vacuum Equipment	\$487,273	\$3,593,563	\$2,775,108	\$406,653	\$60,104	\$7,322,701	\$33,473,767	\$40,796,468
1.1.2	Beam Tubes	\$1,339,077	\$1,396,960	\$52,858	\$1,533,855	\$32,807	\$4,355,587	\$38,195,883	\$42,551,470
1.1.3	Beam Tube Enclosures	\$8,149	\$459,408	\$9,712	\$6,217	\$8,806	\$492,293	\$7,615,257	\$8,107,550
1.1.4	Facility Design and Construction	\$3,238,405	\$3,438,684	\$544,111	\$343,580	\$477,532	\$8,042,313	\$6,150,625	\$14,192,938
1.2	Detector	--	\$2,429,521	\$172,425	\$218,599	\$398,028	\$3,218,572	\$895,302	\$4,113,874
1.3	R&D	\$10,407,161	\$2,914,107	\$105,788	\$115,733	\$302,550	\$13,845,339	\$2,220,883	\$16,066,222
1.4	Project Office	\$4,716,180	\$5,435,300	\$484,504	\$396,503	\$473,529	\$11,506,016	\$1,299,390	\$12,805,406
	Unassigned	\$1,670	\$77,160	\$5,432	(\$8,215)	(\$120,922)	(\$44,845)	\$82,739	\$37,894
1.0	Total Project Costs	\$20,197,916	\$19,744,702	\$4,149,939	\$3,012,957	\$1,632,434	\$48,737,976	\$89,933,846	\$138,671,822
	Cumulative Project Costs	\$20,197,916	\$39,942,647	\$44,092,587	\$47,105,543	\$48,737,977			
	Open Commitments	\$3,531,398	\$44,992,602	\$44,350,451	\$82,584,663	\$89,933,846			
	Costs Plus Commitments	\$23,729,314	\$84,935,250	\$88,443,038	\$129,690,206	\$138,671,822			
	NSF Funding	\$47,088,935	\$136,088,935	\$136,088,935	\$149,888,935	\$149,888,935			

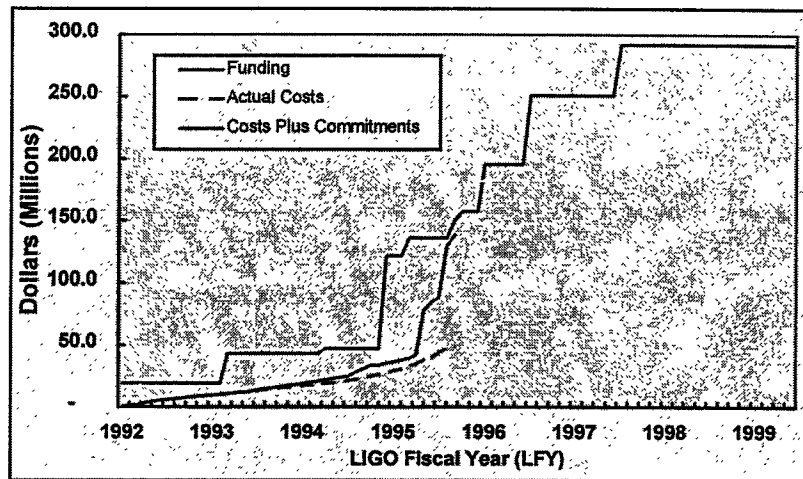
LIGO Project

30

LIGO-G960062-00-P

## LIGO Actual Costs and Commitments

---



LIGO Project

31

LIGO-G960062-00-P

## Project Control Systems - Overview

---

- Introduction
- Rebaselining
- Integrated Project Schedule
- Budget Baseline
- Change Control and Contingency
- Actual Costs, Commitments, Funding
- **Cost Schedule Status Report**
- Conclusions

LIGO Project

32

LIGO-G960062-00-P



# Cost Schedule Status Report

Cost Schedule Status Report prepared monthly

CONTRACTOR		CONTRACT TYPE/NO		PROJECT NAME/NO.		REPORT PERIOD		SIGNATURE	
Caltech Pasadena CA		PHY-921003B		LIGO Mirror Upgrade Phase - WB 1.0		31JAN96-29FEB96		TITLE / DATE	
CONTRACT DATA									
ORIGINAL CONTRACT TARGET COST		NEGOTIATED CONTRACT CHANGES		CURRENT TARGET COST		ESTIMATED COST OF AUTHORIZED UNPRICED WORK		CONTRACT SUBJECT BASELINE	
		292,100,000		292,100,000				292,100,000	
PERFORMANCE DATA									
WPR Level	CUMULATIVE TO DATE					AT COMPLETION			
	(1) WORK SCHEDULED	(2) WORK PERFORMED	(3) ACTUAL COST WORK PERFORMED	(4) SCHEDULE VARIANCE (2-1)	(5) COST VARIANCE (3-2)	(6) BUDGETED	(7) ESTIMATE AT COMPLETION	(8) VARIANCE AT COMPLETION (8-7)	
1.1.1	Value Equipment	7925	7925	7323	10	619	42810	42810	0
1.1.2	Beam Tubes	434	434	4355	(7)	(29)	48833	48833	0
1.1.3	Beam Tube Enclosure	608	628	492	(80)	36	19887	19887	0
1.1.4	Facility Design &	8009	9390	8042	(811)	1348	49100	49100	0
1.2	Director	2607	2758	3219	152	(480)	30946	31714	(768)
1.3	Research & Developme	15346	14008	13840	(1048)	436	23490	23490	0
1.4	Project Office	10725	10725	11506	0	(781)	22791	22791	0
SUBTOTAL		51147	49962	48777	(1185)	1184	256877	257646	(769)
CONTINGENCY							0	34452	(34452)
MANAGEMENT RESERVE							35221	0	35221
TOTAL		51147	49962	48777	(1185)	1184	292098	292098	0

29MAR96 11:29:45

Thousands of \$

CDRA (R) by WST Corp

LIGO Project

33

LIGO-G960062-00-P

# Cost Schedule Status Report

Explanation of data on Cost Schedule Status Report (CSSR)

BCWS (Budgeted Cost of Work Scheduled)	55.1M
BCWP (Budget Cost of Work Performed)	50.0M
ACWP (Actual Cost of Work Performed)	49.8M
Schedule Variance (BCWP-BCWS)	(5.1M)
Cost Variance (BCWP-ACWP)	0.2M
BAC (Budget at Completion)	256.9M
EAC (Estimate at Completion)	257.6M
At Completion Variance (BAC-EAC)	(0.8M)

LIGO Project

34

LIGO-G960062-00-P

CONTRACTOR: Caltech LOCATION: Pasadena, CA	CONTRACT TYPE/NO: PHY-9210038	PROJECT NAME/NO: LIGO Master Merged PMB - WBS 1.0	REPORT PERIOD: 31JAN96-29FEB96	SIGNATURE: TITLE / DATE:
---	----------------------------------	---	-----------------------------------	-----------------------------

CONTRACT DATA

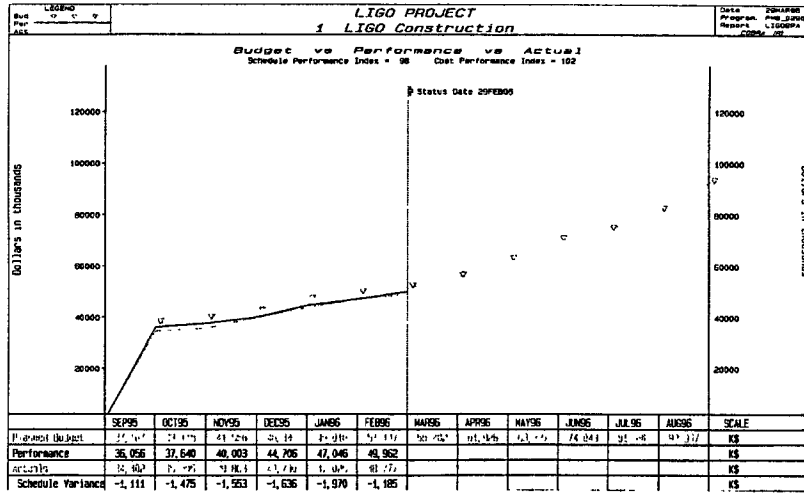
ORIGINAL CONTRACT TARGET COST	NEGOTIATED CONTRACT CHANGES 292,100,000	CURRENT TARGET COST 292,100,000	ESTIMATED COST OF AUTHORIZED UNPRICED WORK	CONTRACT BUDGET BASELINE 292,100,000
-------------------------------	--	------------------------------------	--	---

PERFORMANCE DATA

MPR Level	CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		(3) ACTUAL COST WORK PERFORMED	VARIANCE		(6) BUDGETED	(7) ESTIMATE AT COMPLETE	(8) VARIANCE (6-7)
	(1) WORK SCHEDULED	(2) WORK PERFORMED		(4) SCHEDULE (2-1)	(5) COST (2-3)			
1.1.1 : Vacuum Equipment	7925	7935	7323	10	612	42210	42210	0
1.1.2 : Beam Tubes	4334	4326	4356	(7)	(29)	48653	48653	0
1.1.3 : Beam Tube Enclosur	608	528	492	(80)	36	19687	19687	0
1.1.4 : Facility Design &	9602	9390	8042	(211)	1348	49100	49100	0
1.2 : Detector	2607	2759	3219	152	(460)	50946	51714	(769)
1.3 : Research & Developme	15346	14298	13840	(1048)	458	23490	23490	0
1.4 : Project Office	10725	10725	11506	0	(781)	22791	22791	0
<b>SUBTOTAL</b>	<b>51147</b>	<b>49962</b>	<b>48777</b>	<b>(1185)</b>	<b>1184</b>	<b>256877</b>	<b>257646</b>	<b>(769)</b>
CONTINGENCY	////	////	////	////	////	0	34452	(34452)
MANAGEMENT RESERVE	////	////	////	////	////	35221	0	35221
<b>TOTAL</b>	<b>51147</b>	<b>49962</b>	<b>48777</b>	<b>(1185)</b>	<b>1184</b>	<b>292098</b>	<b>292098</b>	<b>0</b>

# COBRA Performance Measurement Report

Performance Reports are used internally to review status at all levels

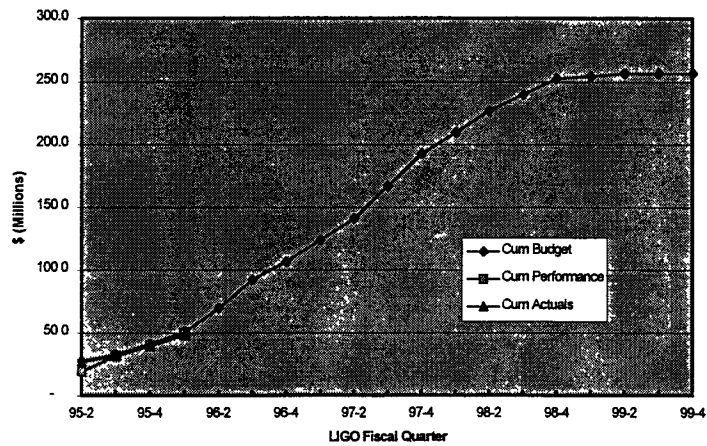


LIGO Project

35

LIGO-G960062-00-P

## Performance Status Relative to the Total Baseline



LIGO Project

36

LIGO-G960062-00-P



## September 1994 Construction Cost Estimate

---

WBS	Cost Estimate	Basis
1.1 Facilities	\$ 148.0 M	FY 1994 \$
1.2 Detector	45.0 M	FY 1994 \$
1.3 R&D	22.7 M	FY 1994 \$
1.4 Project Office	20.6 M	FY 1994 \$
Subtotal	<b>\$ 235.7 M</b>	FY 1994 \$
Escalation	13.5 M	
Contingency	42.8 M	Then Year \$
Project Target Cost	<b>\$ 292.1 M</b>	Then Year \$

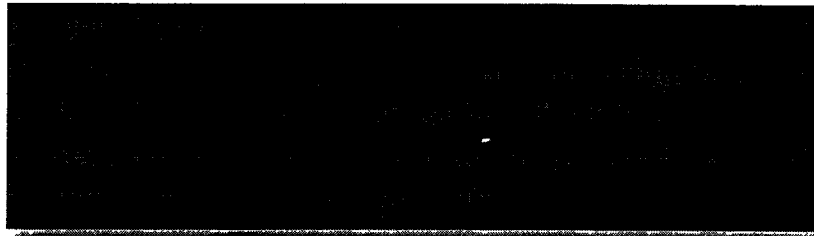
## February 1996 Construction Cost Estimate

---

WBS	Description	Cost Estimate (\$ Millions)
1.1	Facilities	150.4
1.2	Detector	48.0
1.3	R&D	22.8
1.4	Project Office	21.8
	Subtotal	243.0
	Escalation	14.6
	Contingency	34.5
	<b>Project Target Cost</b>	<b>292.1</b>

# Conclusions

---



# Current LIGO Staffing

---

