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# NSF Review

## April 13, 1997

### LIGO Project Cost/Schedule Status

Phil Lindquist



# NSF Review - April 13, 1997

## LIGO Project Cost/Schedule Status

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- Overview
- Actual Costs and Commitments
- Schedules
- Cost Schedule Status Report
- Performance Graphs
- Change Control and Contingency
- Staffing

# Overview

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- Facilities were replanned for the April 1996 NSF Review
- Since the last Semi Annual Review (October 1996)
  - ›› Livingston, Louisiana construction contracts issued to Hensel-Phelps and Woodrow Wilson
  - ›› Construction started in Livingston in January (last of the major Facilities contracts)
  - ›› Detector in process of replanning \*
- \* Replanning is defined as adjustments to the baseline to reflect
  - Approved Change Requests (Change Control Board Actions)
  - Time-phasing of the detailed budget to reflect subcontractor planning

# Actual Costs and Commitments

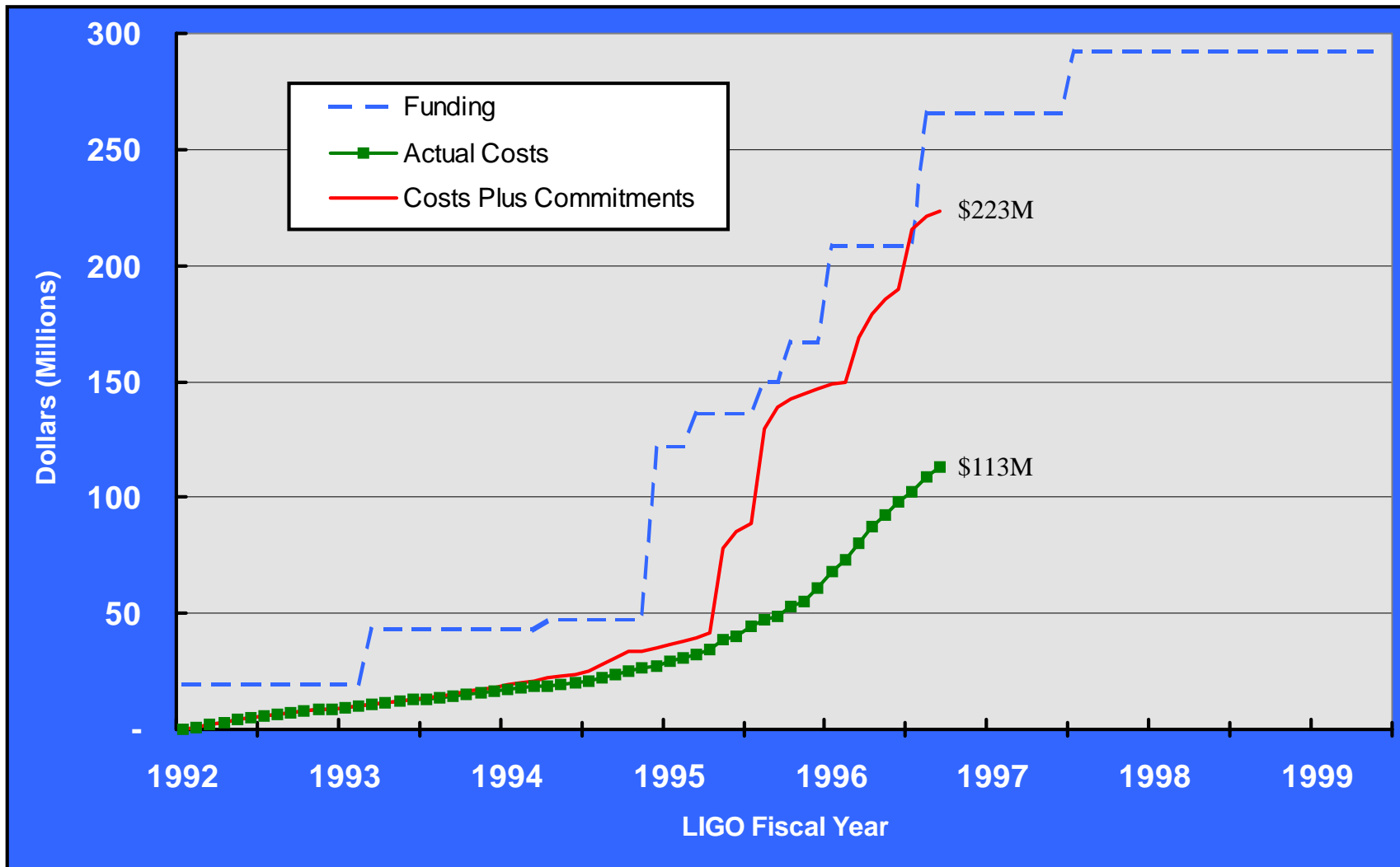
## (End of February 1997 Data)

- All subcontracts have been awarded for Facilities

WBS	Description	Costs				Cumulative Costs	Open Commitments	Total Cost Plus Commitments
		Thru Nov 1996	Dec-96	Jan-97	Feb-97			
1.1.1	Vacuum Equipment	21,254	869	43	44	22,210	22,662	44,872
1.1.2	Beam Tube	17,262	107	3,427	1,260	22,057	35,292	57,349
1.1.3	Beam Tube Enclosure	6,237	251	459	247	7,195	12,269	19,465
1.1.4	Civil Construction	14,117	1,665	1,567	1,474	18,822	30,239	49,061
1.2	Detector	6,270	478	281	762	7,791	6,014	13,805
1.3	R&D	16,816	272	153	420	17,661	1,229	18,890
1.4	Project Management	16,288	457	411	583	17,740	1,964	19,704
	Unassigned (See Note)	2	(1)	-	1	2	131	132
<b>TOTAL</b>		<b>98,246</b>	<b>4,098</b>	<b>6,342</b>	<b>4,791</b>	<b>113,477</b>	<b>109,800</b>	<b>223,277</b>
Cumulative Actual Costs		98,246	102,344	108,686	113,477			
Open Commitments		91,492	113,149	112,583	109,800			
Total Costs Plus Commitments		189,738	215,493	221,269	223,277			
NSF Funding		208,468	208,468	265,389	265,389			

# Actual Costs and Commitments

(End of February 1997 Data)



# Project Mgmt Plan Milestones

## (Hanford, WA Facilities)

Milestone Description	Project Mgmt Plan	Baseline Dates	Current Status
Beam Tube Final Design Review	Apr-94	Complete	Complete
Select A&E Contractor	Nov-94	Complete	Complete
Complete BT Qual Test	Feb-95	Complete	Complete
Select VE Contractor	Mar-95	Complete	Complete
Initiate Site Development	Aug-95	Complete	Complete
Initiate Beam Tube Fabrication	Oct-95	Complete	Complete
Initiate Slab Construction	Oct-95	2/14/96	2/14/96 (A)
Initiate Building Construction	Jun-96	8/8/96	8/8/96 (A)
Joint Occupancy	Sep-97	8/5/97	9/5/97
Accept Tubes and Covers	Mar-98	11/6/97 *	1/5/98 *
Accept Vacuum Equipment	Mar-98	4/6/98	4/6/98
Beneficial Occupancy	Mar-98	9/2/97	10/6/97
Initiate Facility Shakedown	Mar-98	4/7/98	4/7/98

\* Beam Tube Bake is planned after Beam Tube Acceptance



# Project Mgmt Plan Milestones

## (Livingston, LA Facilities)

Milestone Description	Project Mgmt Plan	Baseline Dates	Current Status
Beam Tube Final Design Review	Apr-94	Complete	Complete
Select VE Contractor	Nov-94	Complete	Complete
Select A&E Contractor	Nov-94	Complete	Complete
Complete BT Qual Test	Feb-95	Complete	Complete
Initiate Site Development	Aug-95	Complete	Complete
Initiate Beam Tube Fabrication	Oct-95	Complete	Complete
Initiate Slab Construction	Jan-97	1/10/97	12/17/96 (A)
Initiate Building Construction	Jan-97	10/10/96	12/12/96 (A)
Joint Occupancy	Mar-98	2/2/98	2/23/98
Accept Vacuum Equipment	Sep-98	10/28/98	10/28/98
Accept Tubes and Covers	Sep-98	12/10/98 *	12/23/98 *
Beneficial Occupancy	Sep-98	4/13/98	6/9/98
Initiate Facility Shakedown	Sep-98	3/3/99	12/28/98

\* Beam Tube Bake is planned after Beam Tube Acceptance



# PMP Milestones (Detector)

Milestone Description	Project Mgmt Plan	Baseline	Current Status
Core Optics Support FDR	4/30/97	3/7/97	12/9/97
Core Optics Components FDR	7/30/97	7/21/97	10/27/97
BSC Stack Final Design Review	7/30/97	7/30/97	9/19/97
HAM Stack Final Design Review	7/30/97	7/30/97	9/19/97
WA Cntl Area/Net Sys Ready To Install	9/30/97	9/10/97	9/29/97
Detector System Prelim Design Review	12/30/97	12/30/97	4/3/98
Input/Output Optics FDR	4/30/98	2/10/98	5/19/98
Wavefront FDR	4/30/98	10/8/97	2/13/98
Control Data System DAQ FDR	4/30/98	3/26/98	5/28/98
Length Sensing Control FDR	5/30/98	6/17/97	12/15/97
Physics Environ Monitoring FDR	6/30/98	4/28/97	8/6/97
Begin WA IFO Installation	7/30/98	7/30/98	7/30/98
Pre-Stabilized Laser FDR	8/30/98	3/6/98	7/30/98
Begin LA IFO Installation	1/30/99	1/30/99	1/30/99
Begin COINCIDENCE TEST	12/31/00	12/31/00	12/31/00



# Cost Schedule Status Report

## (End of February 1997)

Run Date: 26MAR97		COST / SCHEDULE STATUS REPORT (CSSR)				Page 1		
CONTRACTOR: Caltech		CONTRACT NUMBER:	CONTRACT BUDGET	REPORTING PERIOD:	PROJECT FILE NAME:			
LOCATION: Pasadena, CA		PHY-9210038	BASELINE	31JAN97-28FEB97	LIGO Master Merged PMB - WBS 1.0			
PERFORMANCE DATA ( K\$ )								
REPORTING LEVEL	CUMULATIVE TO DATE					AT COMPLETION		
MPR LEVEL	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGET (BAC)	ESTIMATE (EAC)	VARIANCE (6-7)
	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE (2-1)	COST (2-3)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.1.1 : Vacuum Equipment	23580	23423	22210	(157)	1213	42113	42113	0
1.1.2 : Beam Tubes	20527	22282	22057	1755	226	47298	47298	0
1.1.3 : Beam Tube Enclosure	8641	8151	7195	(490)	956	19384	19384	0
1.1.4 : Facility Design &	18548	19589	18822	1042	767	48311	48311	0
1.2 : Detector	10327	8928	7753	(1399)	1175	52567	53336	(769)
1.3 : Research & Developme	18429	18121	17661	(309)	460	23490	23490	0
1.4 : Project Office	17844	17844	17740	0	104	27074	27074	0
<b>SUBTOTAL</b>	<b>117896</b>	<b>118338</b>	<b>113437</b>	<b>441</b>	<b>4901</b>	<b>260238</b>	<b>261007</b>	<b>(769)</b>
CONTINGENCY	////	////	////	////	////	0	31087	(31087)
MANAGEMENT RESERVE	////	////	////	////	////	0	0	0
<b>TOTAL</b>	<b>117896</b>	<b>118338</b>	<b>113437</b>	<b>441</b>	<b>4901</b>	<b>260238</b>	<b>292094</b>	<b>(31856)</b>

\$117.9M
\$118.3M
\$113.4M
\$0.4M
\$4.9M

COBRA (R) by WST Corp.



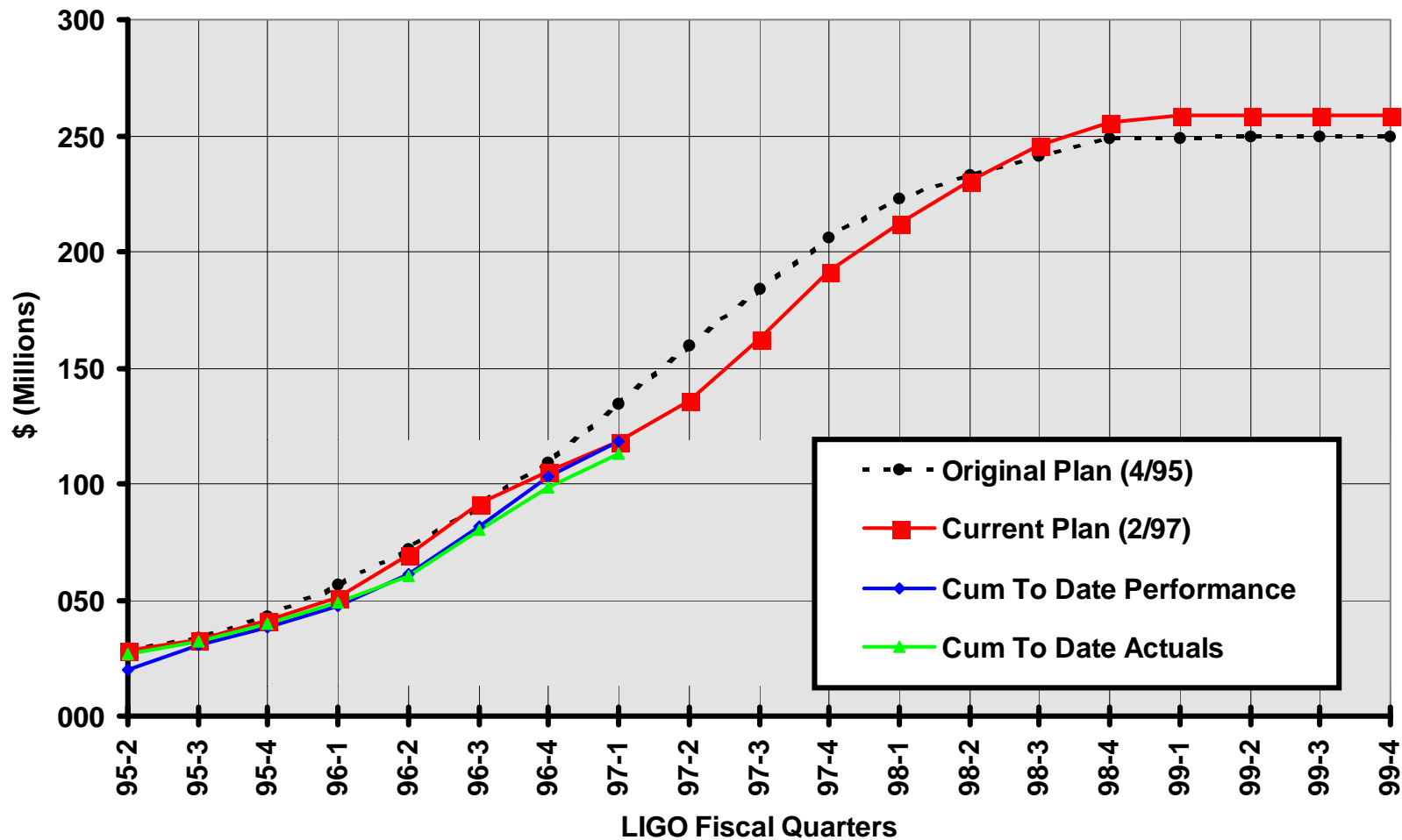
# Cost Schedule Status Report

## (End of February 1997)

Work Breakdown Structure	Cumulative to Date						
	Budgeted Cost		Actual Cost Work Performed	Schedule Variance		Cost Variance	
	Work Scheduled	Work Performed		\$Ks	%	\$Ks	%
1.1.1 - Vacuum Equipment	\$ 23,580	\$ 23,423	\$ 22,210	\$ (157)	(1%)	\$ 1,213	5%
1.1.2 - Beam Tubes	\$ 20,527	\$ 22,282	\$ 22,057	\$ 1,755	9%	\$ 226	1%
1.1.3 - BT Enclosures	\$ 8,641	\$ 8,151	\$ 7,195	\$ (490)	(6%)	\$ 956	12%
1.1.4 - Facility Design & Construction	\$ 18,548	\$ 19,589	\$ 18,822	\$ 1,042	6%	\$ 767	4%
1.2 - Detector	\$ 10,327	\$ 8,928	\$ 7,753	\$ (1,399)	(14%)	\$ 1,175	13%
1.3 - Research & Development	\$ 18,429	\$ 18,121	\$ 17,661	\$ (309)	(2%)	\$ 460	3%
1.4 - Project Office	\$ 17,844	\$ 17,844	\$ 17,740	\$ -	0%	\$ 104	1%
<b>TOTAL</b>	<b>\$ 117,896</b>	<b>\$ 118,338</b>	<b>\$ 113,437</b>	<b>\$ 441</b>	<b>0%</b>	<b>\$ 4,901</b>	<b>4%</b>

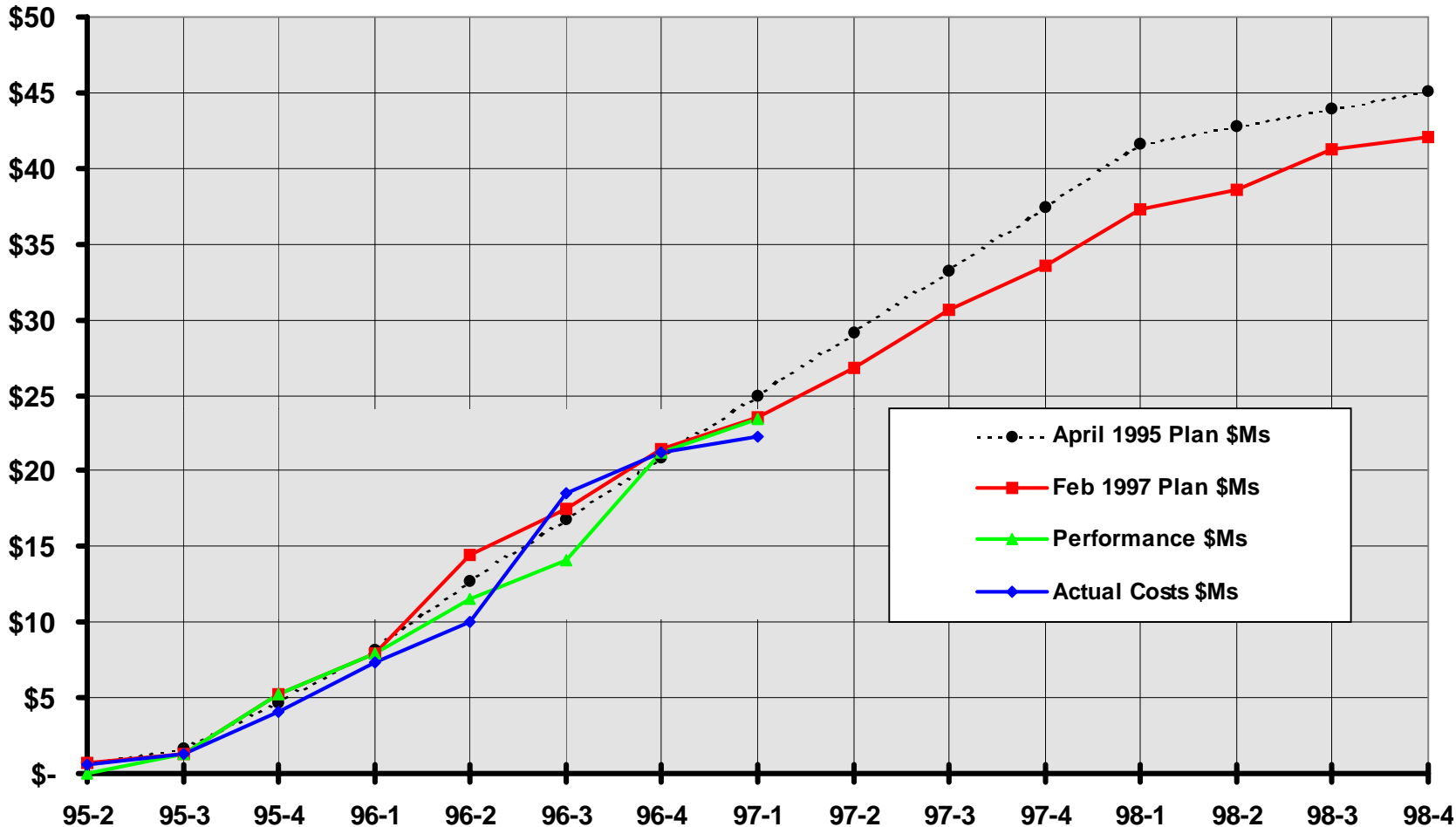
# Performance Graphs

## (LIGO Construction Project Total)



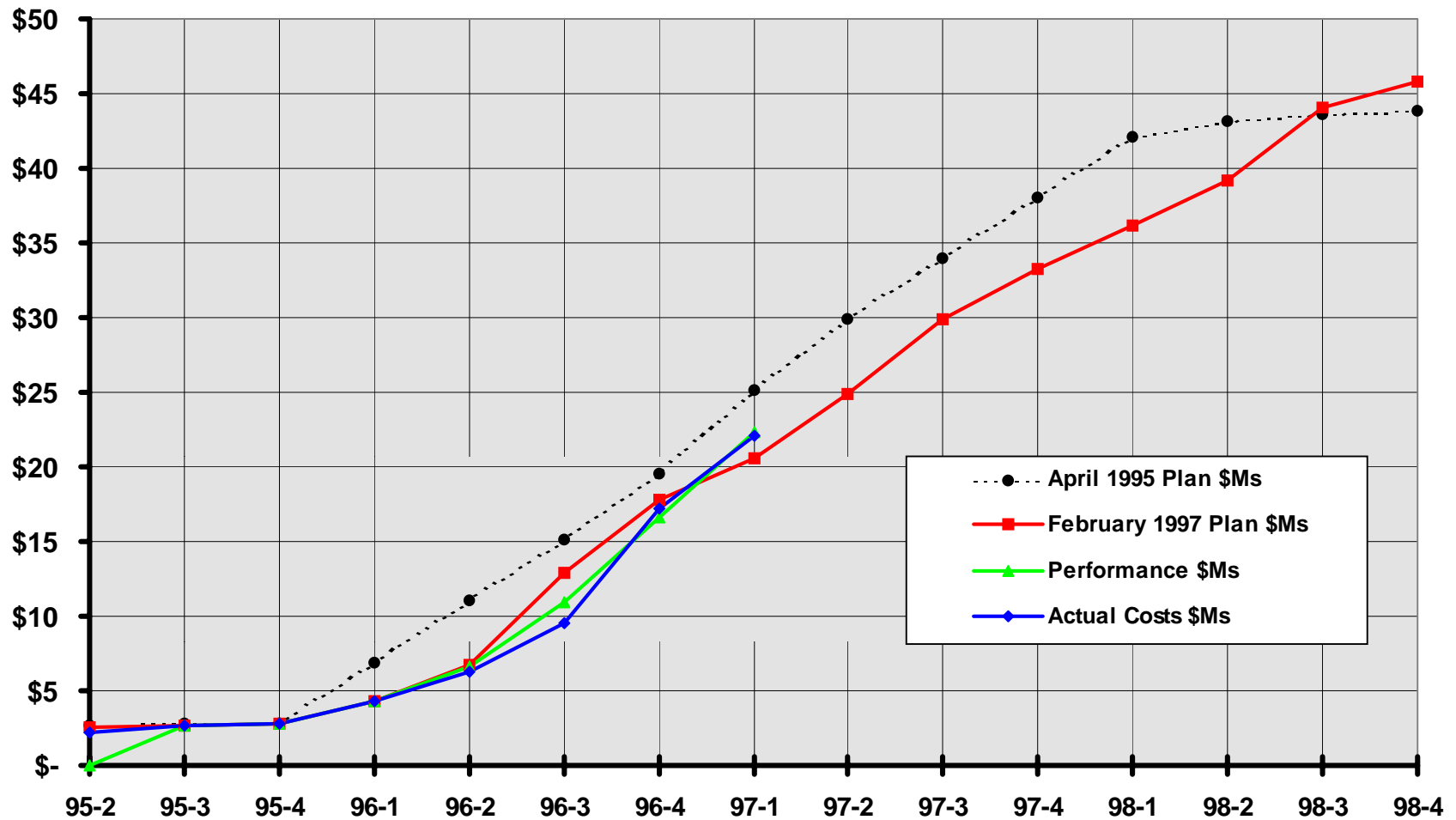
# Performance Graphs

## (WBS 1.1.1 - Vacuum Equipment)



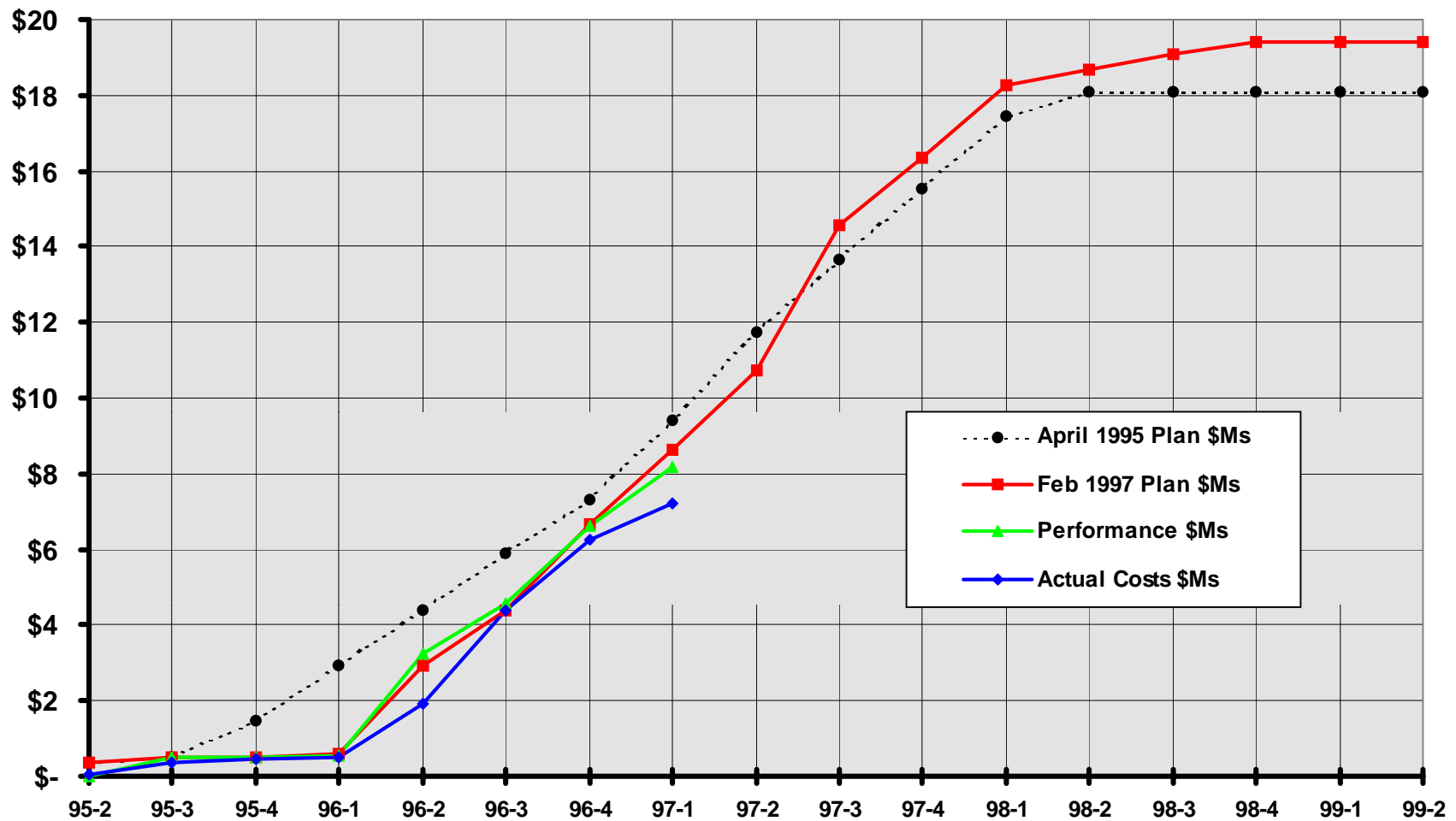
# Performance Graphs

## (WBS 1.1.2 - Beam Tube)



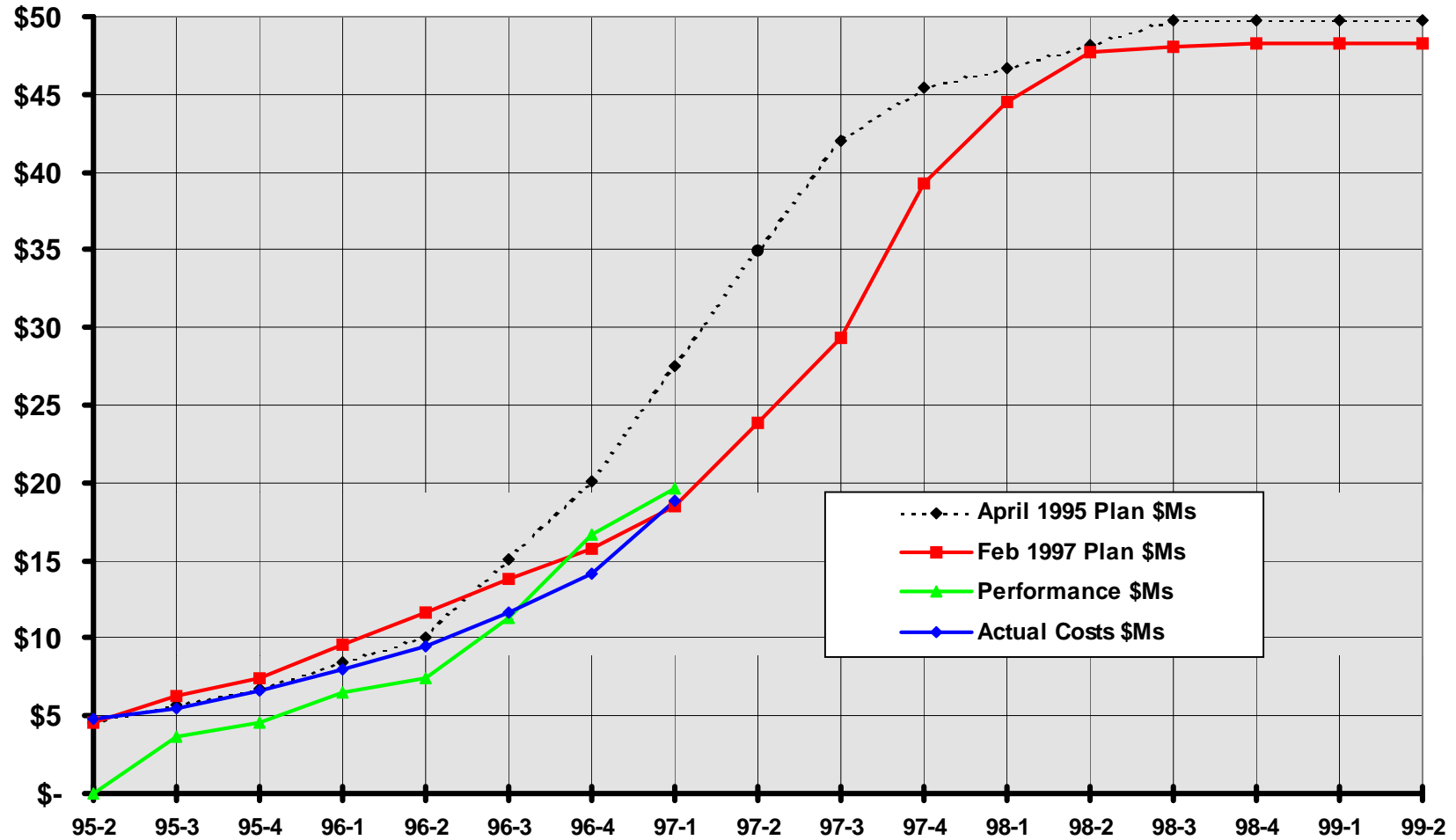
# Performance Graphs

## (WBS 1.1.3 - Beam Tube Enclosure)



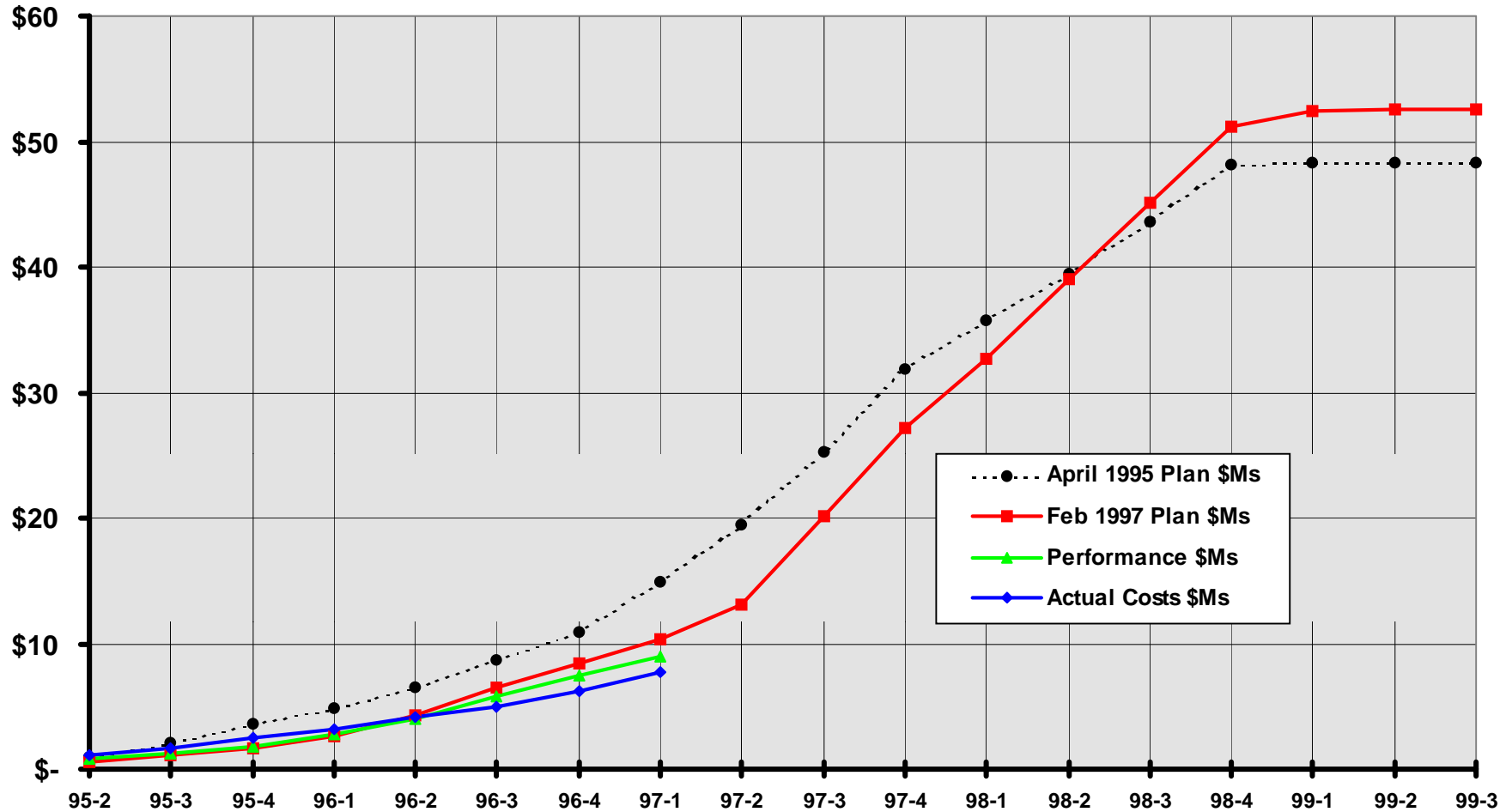
# Performance Graphs

## (WBS 1.1.4 - Civil Construction)



# Performance Graphs

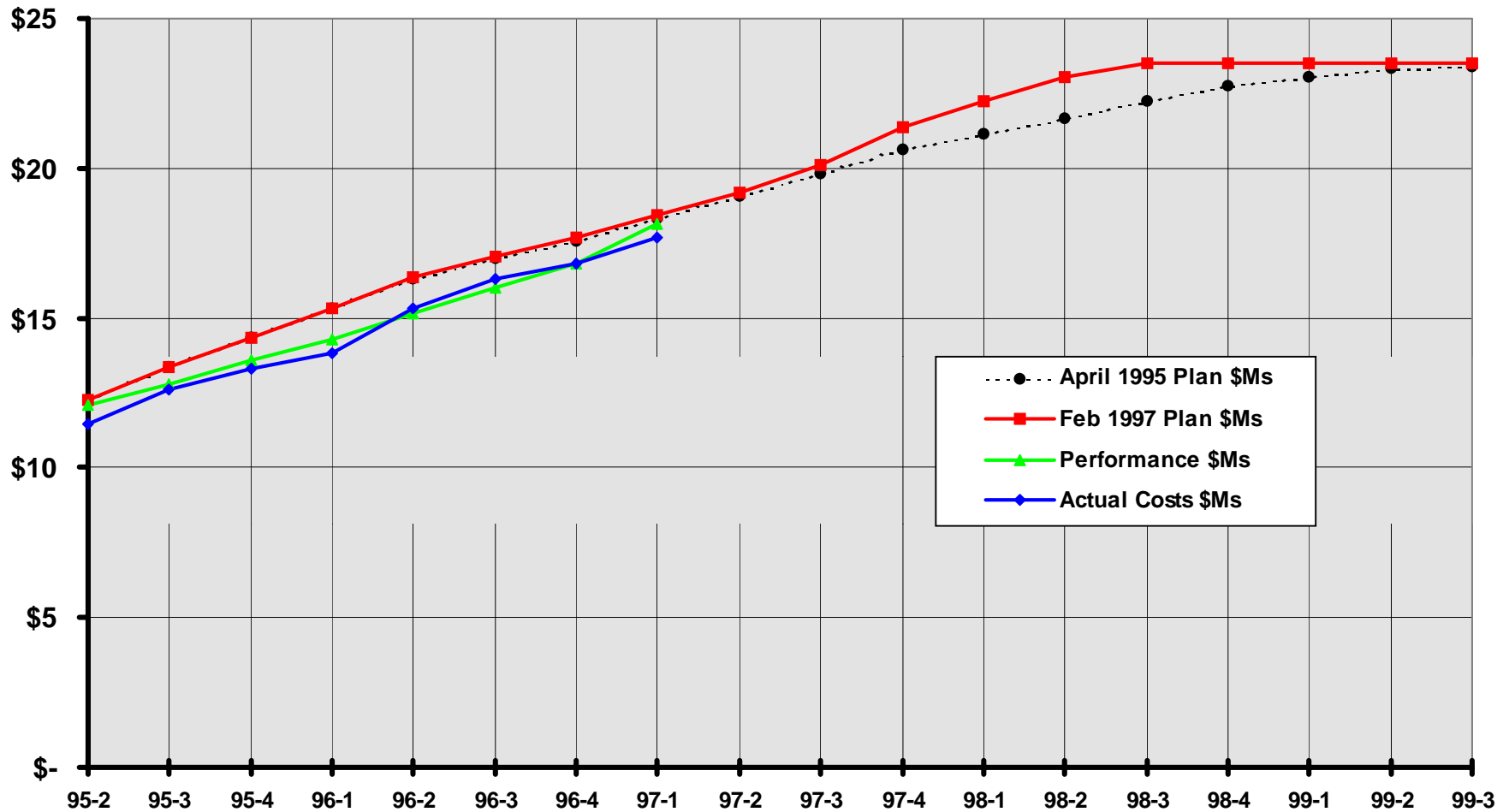
## (WBS 1.2 - Detector)





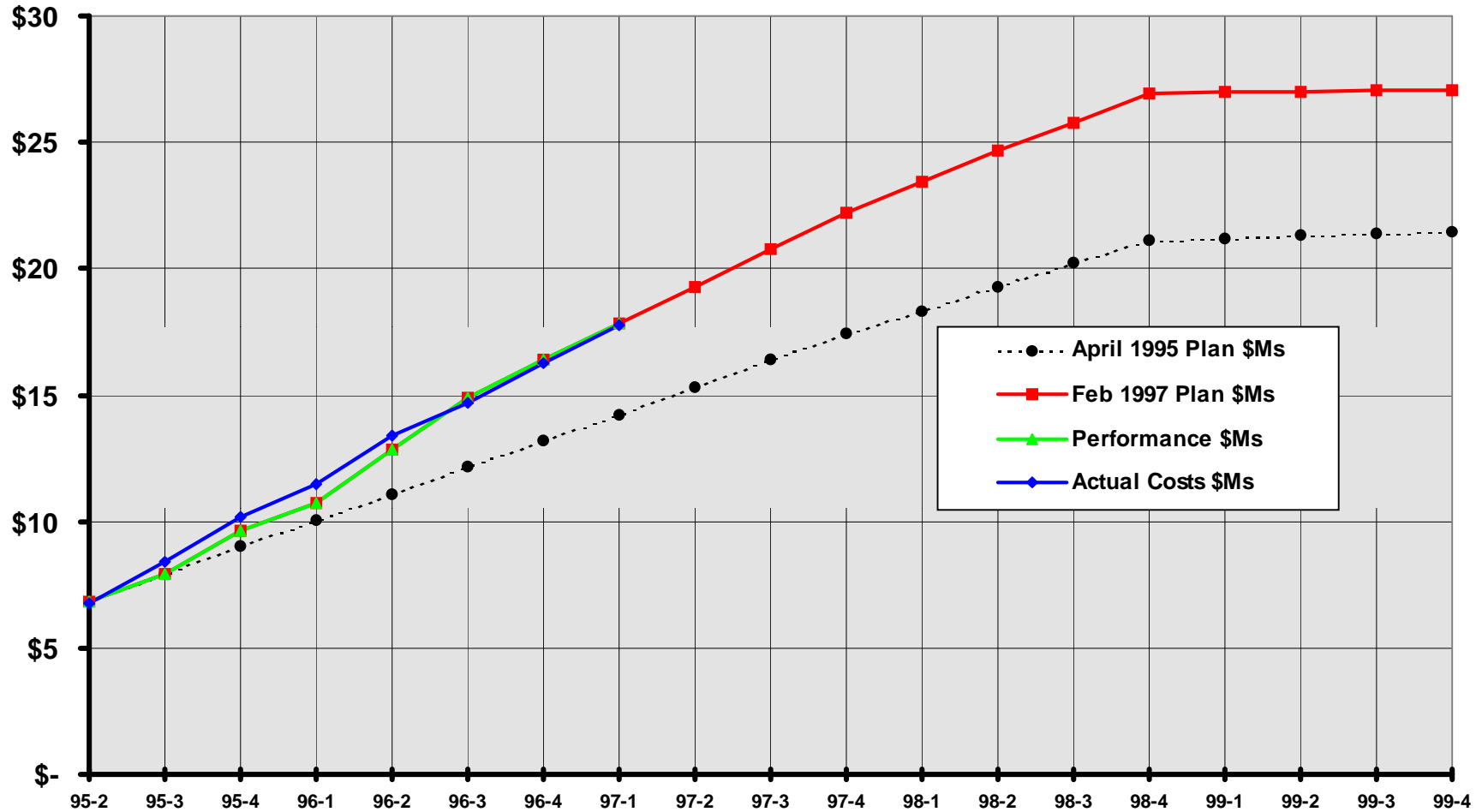
# Performance Graphs

## (WBS 1.3 - Research and Development)



# Performance Graphs

## (WBS 1.4 - Project Office)



# Change Control Log

## (Since last NSF Review)

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Change Request No.	Description	Submitted By	Submittal Date	Current Status	Disposition Date
CR-970001	WBS 1.1.1 Vacuum Equipment - Replacement of one BSC with proto-type	J. Worden 372-1788	February 7, 1997	Not Approved	March 25, 1997
CR-970002	WBS 1.1.1 Vacuum Equipment - Metal Seal Test	J. Worden 372-1788	February 7, 1997	Approved \$21,000	Information only
CR-970003	WBS 1.1.4 Facilities - Air Handling Ducts cleaning procedures and specifications	O. Matherny 372-1788	February 12, 1997	Approved \$150,000 NTE	February 13 1996
CR-970004	WBS 1.1.2 - Beam Tube, Transformers	L. Jones	March 12, 1995	Approved (\$44,110)	March 25, 1997
CR-970005	WBS 1.1.2 - Beam Tube Miscellaneous	L. Jones	March 12, 1995	Approved \$51,200	March 25, 1997

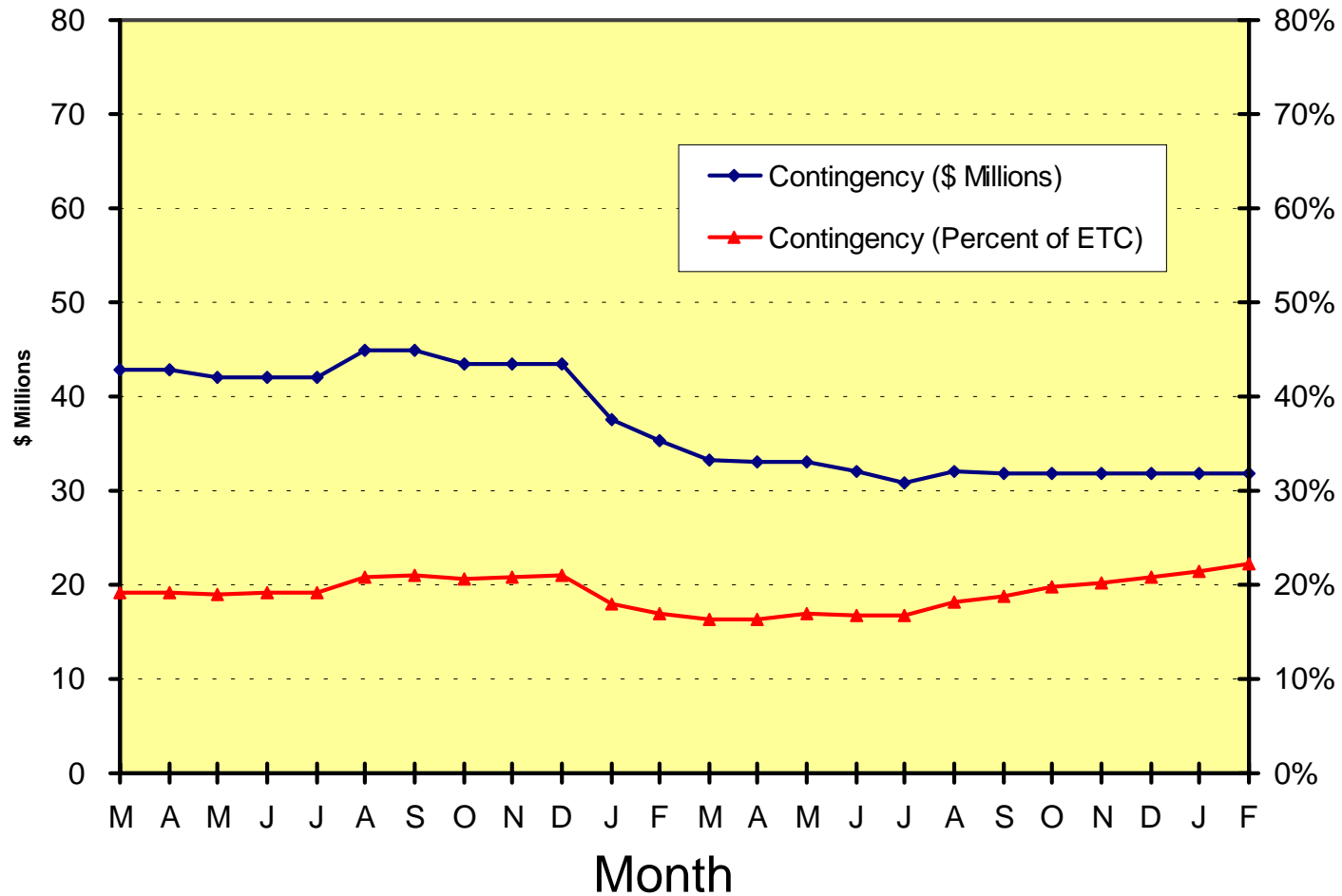
# Change Control Log - continued

(Since last NSF Review)

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Change Request No.	Description	Submitted By	Submittal Date	Current Status	Disposition Date
CR-970006	WBS 1.1.2 - Beam Tube, BDF Air Monitoring	L. Jones	March 12, 1995	Approved \$46,130	March 25, 1997
CR-970007	WBS 1.1.2 - Beam Tube, Hanford Labor Rates	L. Jones	March 19, 1995	Approved \$61,316	March 25, 1997
CR-970008	WBS 1.1.4 - Cement Treatment of Berm, Livingston, Louisiana Site	F. Asiri	March 21, 1997	Approved Pending Additional Information \$900,000	March 25, 1997
CR-970009	WBS 1.2 - Core Optics Components, Reduced Quantity/Unit Price	G. Billingsley	March 20, 1997	Approved (\$881,636)	March 25, 1997
CR-970010	WBS 1.2 - Input/Output Optics, Delete Output Mode Cleaners	J. Camp	March 21, 1997	Approved (\$471,000)	March 25, 1997

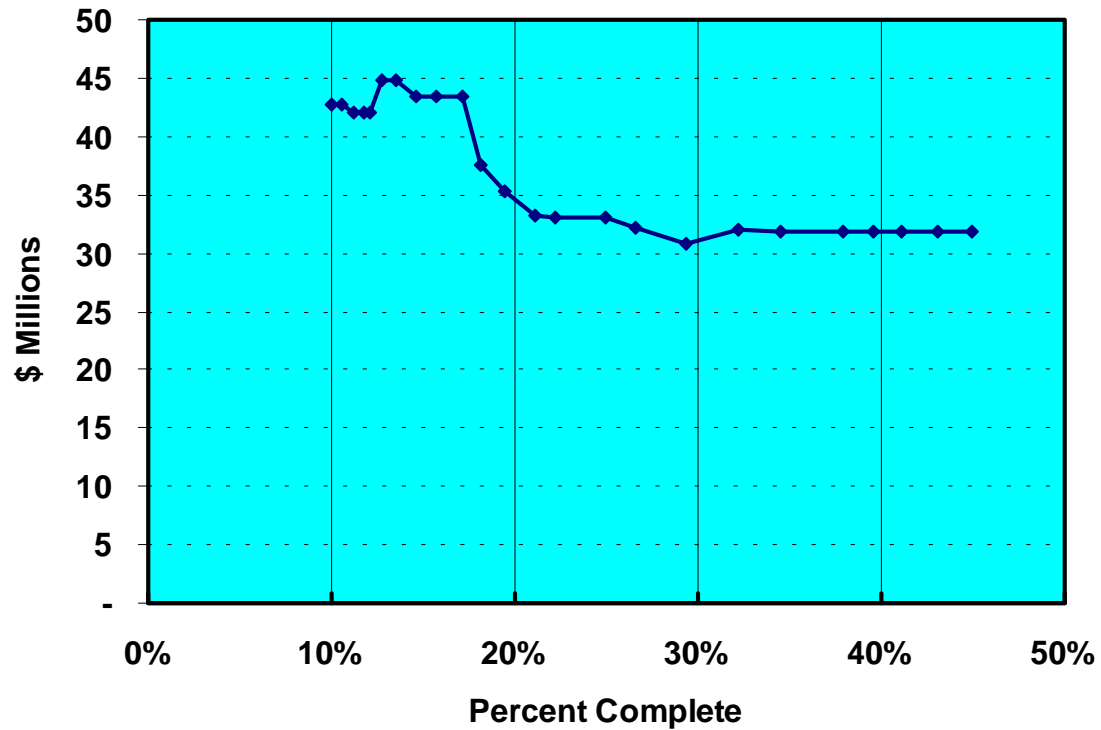
# Project Contingency (As a function of Time)



# Project Contingency

(As a function of Percent Complete)

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# LIGO Staffing History

(Since January 1995)

