

QUARTERLY REVIEW

September 3, 2002

GNIRS Quarterly Review

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Introduction

- This is the 9th GNIRS Quarterly Review
- GNIRS is in the assembly and integration phase
 - All mechanism testing complete
 - OIWFS prism integration complete
 - Dewar wiring and assembly completes early September
- Delivery is now scheduled for March of 2003
 - Warm testing with mux in September
 - 1st cold test with engineering array in September
 - Flexure testing late September – early October

Progress Overview

- The project is currently 92% complete overall
- We have completed 206 of 227 total project milestones
- Major activities over this quarter:
 - Slit mechanism testing
 - Shield fabrication and rework
 - Bench assembly and wiring
 - Software manual

Technical Progress/Issues

Subsystem	Description	Solution and Status
Slit Slide	1. Bearing failures	Replaced bearings with commercial product for vacuum/cryo use. <i>Solved</i>
	2. Track wear	Anodized tracks. <i>Solved</i>
Short Red Camera	1. Incorrect material for lens 4	Fast-track replacement; Gemini allowed performance degradation. <i>Solved</i> .
	2. Spontaneous fracture in lens 1	Janos grinding out fracture in both damaged versions of lens 1; will use best one (mechanically) after test. <i>Cooldown pending.</i>
Grating Turret	Gratings incorrectly replicated	Replicated rulings on correct blanks. <i>Solved.</i>

Slit Slide

- Bearing wear - addressing the problem
 - Required life $>10^7$ revolutions; repeated failures observed
 - Set up separate investigative team
 - Investigate alternative solutions
 - Test motor drive + bearings in CROC
 - Evaluated two commercial solutions (MoS_2 and WS_2 coating)
 - Gold coating potential backup, not evaluated

Slit Slide

- Bearing wear - the solution
 - Both types passed CROC tests
 - Larger order of WS_2 bearings had QC problems
 - Larger order of MoS_2 bearings delivered with acceptable performance; these were used
 - WS_2 bearing problems were corrected in the end
 - Retrofit commercially-prepared bearings to all mechanisms
 - Recommended solution for future instruments

Slit Slide

- Track wear
 - Anodize tracks
 - Loss of thermal conductivity acceptable
- Slit slide test
 - Final cold test of actual mechanism
 - Passed with no bearing failure, no track wear
- Detailed report on web (SDN0022)

Short Red Camera

- Lens 1 - the problem
 - Found to have developed surface fracture when installing lens 4.
 - Apparently spontaneous
 - Outside clear aperture

Short Red Camera

- Lens 1 - the solution
 - Remove fracture and test
 - Janos agreed to attempt to grind out
 - Janos also grinding out previous lens 1 which was chipped (by Janos)
 - Will try lens Janos considers “best” (TBD)
 - Will probably thermal cycle lens separately first
 - Lens failure then poses no risk to other optics
 - But, adds up to a week to schedule

Short Red Camera

- Lens 4
 - Original drawings called out wrong material (BaF_2)
 - Re-ordered as CaF_2
 - Choose fastest delivery time (also cheapest)
 - Lens delivered out of spec on surface error
 - Overall effect on image quality 1% at 10th percentile seeing
 - Performance loss accepted by Gemini

Gratings

- Gratings replicated incorrectly
 - Wrong replicas on 2 blanks
 - Sent back for correct replication
 - Gratings received, checked, installed in turret

Technical Progress - Integration

- Status
 - Shield fit check and rework complete
 - Cold wiring complete
 - Wiring to dewar shell (bulkhead) completing
 - Cooling system completing
 - Copper straps sized and installed
 - Cryocoolers tested; fit check to “distribution system”

Technical Progress - Integration

- Status (2)
 - OIWFS Shack-Hartmann prism retrofit
 - Prism cold-cycled by Gemini
 - Warm test not possible as MUX is at ANU
 - Integration is nearly complete

Technical Progress - Integration

- Flexure test facility
 - Flexure rig installed
 - Additional work required
 - Cryocooler compressors (w/ spare) to be installed
 - Compressor rack being painted
 - Installation will take place afterwards, as looby work permits
 - Chiller shared with “blue room”
 - Computers not yet installed

Technical Progress - Integration

- Flexure test facility (2)
 - Additional work (2)
 - Stay bar required for safe horizontal installation
 - Needs ~1 day Ed H design time
 - Other minor action items (e.g., N2 gas)
 - *Coordination meeting needed (later this week?)*
 - Exploring option for 50 Hz power
 - Uses surplus GONG equipment
 - Would offer use of facility to Solar
 - Availability later in year

Technical Progress - Integration

- Flexure test facility (3)
 - Telescope simulator nearly complete
 - Optics installation will be done prior to need date
 - Focus check and adjustment required

Technical Progress - Integration

- Test plans
 - Warm test with MUX and complete optics
 - Test with blue cameras only (red camera focus shift into bench)
 - First cool-down with engineering array
 - If cool-down successful, proceed with functional tests, otherwise diagnose and abort
 - If functional tests OK, proceed to flexure testing
 - General plan unchanged since 7/99

Technical Progress - Integration

- Test plans (2)
 - Should be at end of second cold cycle at next QR
 - Will be starting 3rd cycle if prior cycles cut short
 - Will know whether contingency cycle(s) needed

Project Management

- Summary Overview
- Last QR response
- Schedule update
- Current integration plan
- Cost and Schedule
 - Current progress
 - WBS report
 - Work/FTE projections
 - Capital
 - Cost to complete projection
 - Milestones
 - Deliverables projections
 - Gemini payments summary
- Work still outstanding
 - Telescope simulator
 - Flexure testing
 - Integration and test
- Problems and Concerns
- Plans for Next Review

Response to May QR

- Items to be completed by this QR
 - Flexure testing
 - Electrical wiring and cabling
 - Mechanism testing
 - Parts cleaning
 - Manual outlines
 - Draft manuals
 - Deliver design documentation
 - Shipping container design
 - Grating replacement
 - CaF_2 lens replacement

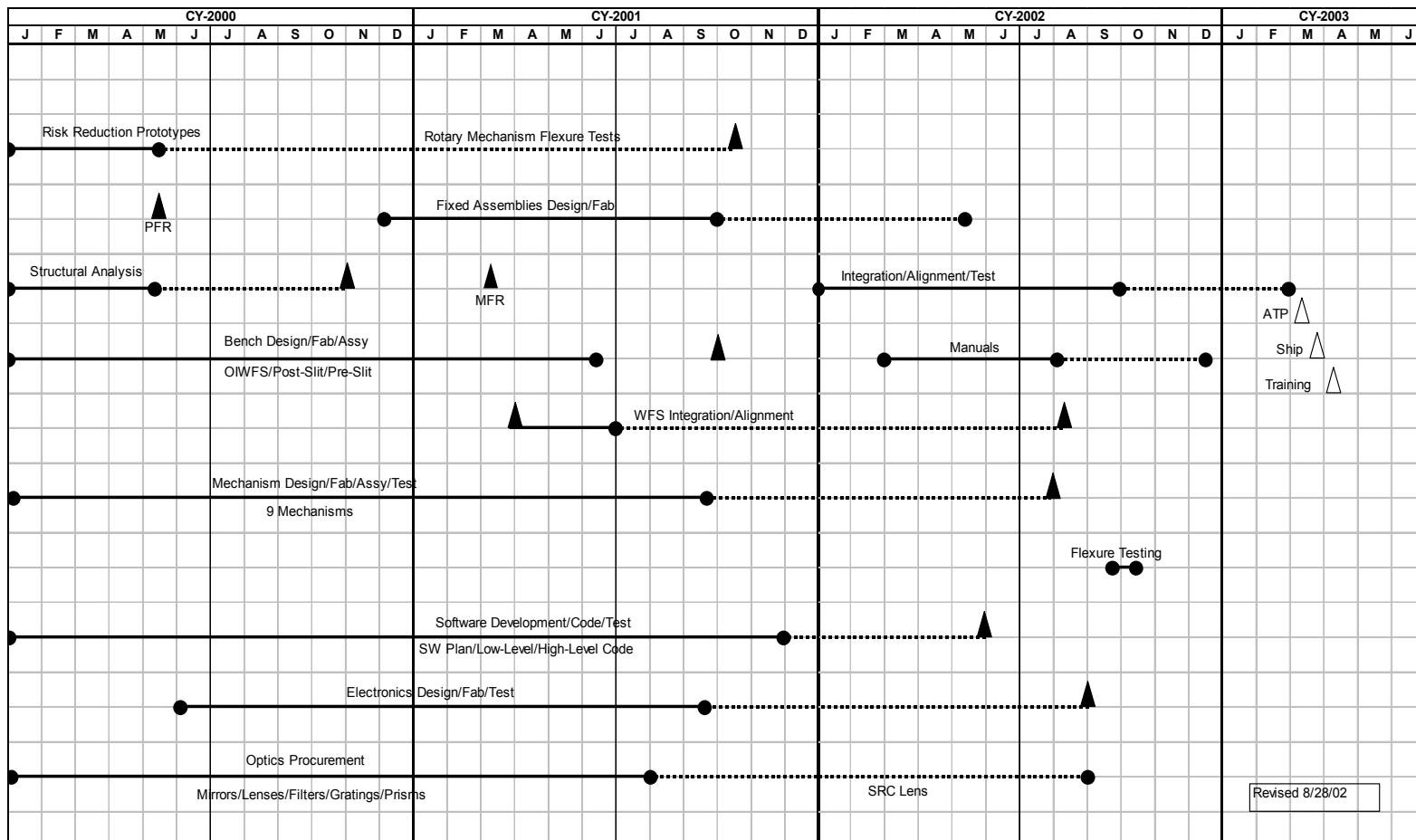
May QR Response

ITEM	STATUS	COMMENT
Flexure testing	Not Complete	Now scheduled for September-October
Electrical wiring and cabling	Complete	
Mechanism testing	Complete	
Parts cleaning	Complete	
Manual outlines	Complete	
Draft manuals	Complete	
Deliver design documentation	Not Complete	As-built drawings are near complete
Shipping container design	Complete	
Grating replacement	Complete	
CaF ₂ lens replacement	Complete	

Schedule Update

- Instrument will ship in March 2003 if all cold cycles needed
- Critical path:
 - Instrument assembly
 - Warm testing
 - Flexure testing
 - Cold testing
- Top Assembly Integration completes early September
- Flexure testing last week of September, 1st week of October
- Warm testing and characterization September
- 1st cold test in September
- Documentation deliverables should finish by December
 - Software maintenance manual delivered
 - Hardware maintenance manual in process
 - Operations manual in process

Summary Project Plan



Focus of Last Quarter of Work

- Fabrication/test activity concentrated on
 - Radiation shield fabrication/rework
 - Slit Mechanism testing, rework
 - Wiring
 - Mechanical fabrication cleanup
 - Telescope simulator fabrication
- Procurement
 - Mechanical piece parts
 - SRC lens
- Integration
 - OIWFS prism installation
 - Fit checks
 - Bench assembly

WBS Report - % Complete since MFR Mar '01

WBS Element	Mar	Jun	Oct	Jan	May	Sept
5.0 Overall Project	53%	66%	80%	86%	91%	92%
5.1 Mgmt & Reporting	51%	61%	71%	80%	89%	88%
5.2 Systems Engineering	100%	100%	100%	100%	100%	100%
5.3 Mechanical	52%	70%	87%	94%	94%	96%
5.3.1 Mechanisms	66%	84%	92%	97%	98%	100%
5.3.2 Benches	55%	70%	100%	96%	100%	100%
5.3.3 Fixed Assemblies	16%	36%	62%	84%	91%	93%
5.4 Electronics	63%	59%	86%	71%	76%	87%
5.5 Software	49%	63%	85%	86%	100%	100%
5.6 Integration	0%	0%	2%	23%	39%	57%
5.7 Deliverables	0%	0%	0%	45%	48%	54%
5.8 Procurement	54%	67%	77%	86%	99%	97%

Budget and Expenditures

Baseline Estimate (Jan '99 to Completion)						
Labor	\$3,391,232					
Capital	\$836,462					
Total	\$4,227,694					
Current Forecast (Jan '99 to Completion)						
	Mar '01	Jun '01	Oct '01	Jan '02	May '02	Sep '02
Labor	\$2,866,775	\$3,002,938	\$2,957,389	\$2,986,915	\$2,956,461	\$2,998,245
Capital	\$1,074,798	\$1,181,900	\$1,138,285	\$1,384,670	\$1,486,726	\$1,502,306
Total	\$3,941,573	\$4,184,838	\$4,095,674	\$4,371,585	\$4,443,187	\$4,500,551
Performance Ratios						
	Mar '01	Jun '01	Oct '01	Jan '02	May '02	Sep '02
BCWS	\$1,754,979	\$2,863,855	\$3,085,811	\$3,263,216	\$3,462,160	\$3,572,138
BCWP	\$1,611,542	\$2,011,383	\$2,526,319	\$2,899,362	\$3,035,216	\$3,186,692
ACWP	\$1,742,651	\$2,113,212	\$2,762,963	\$3,339,222	\$3,756,257	\$4,137,200
CPI	0.92	0.95	0.91	0.89	0.88	0.89
SPI	0.92	0.70	0.82	0.87	0.81	0.77

Project Status – WBS 5.3 Mechanical

<u>Mechanism</u>	<u>%</u>
Camera	100
Detector Focus	100
Environ Cover	100
Acquisition Mirror	100
Slit	100
Decker	100
Filter Wheel	100
Grating Turret	100
Gratings	100
Prism Turret	100
Prisms	100
Motor Drives	100
<u>Bench</u>	<u>%</u>
Post-Slit	100
OIWFS	100
Collimator	100
POM/Offner	100

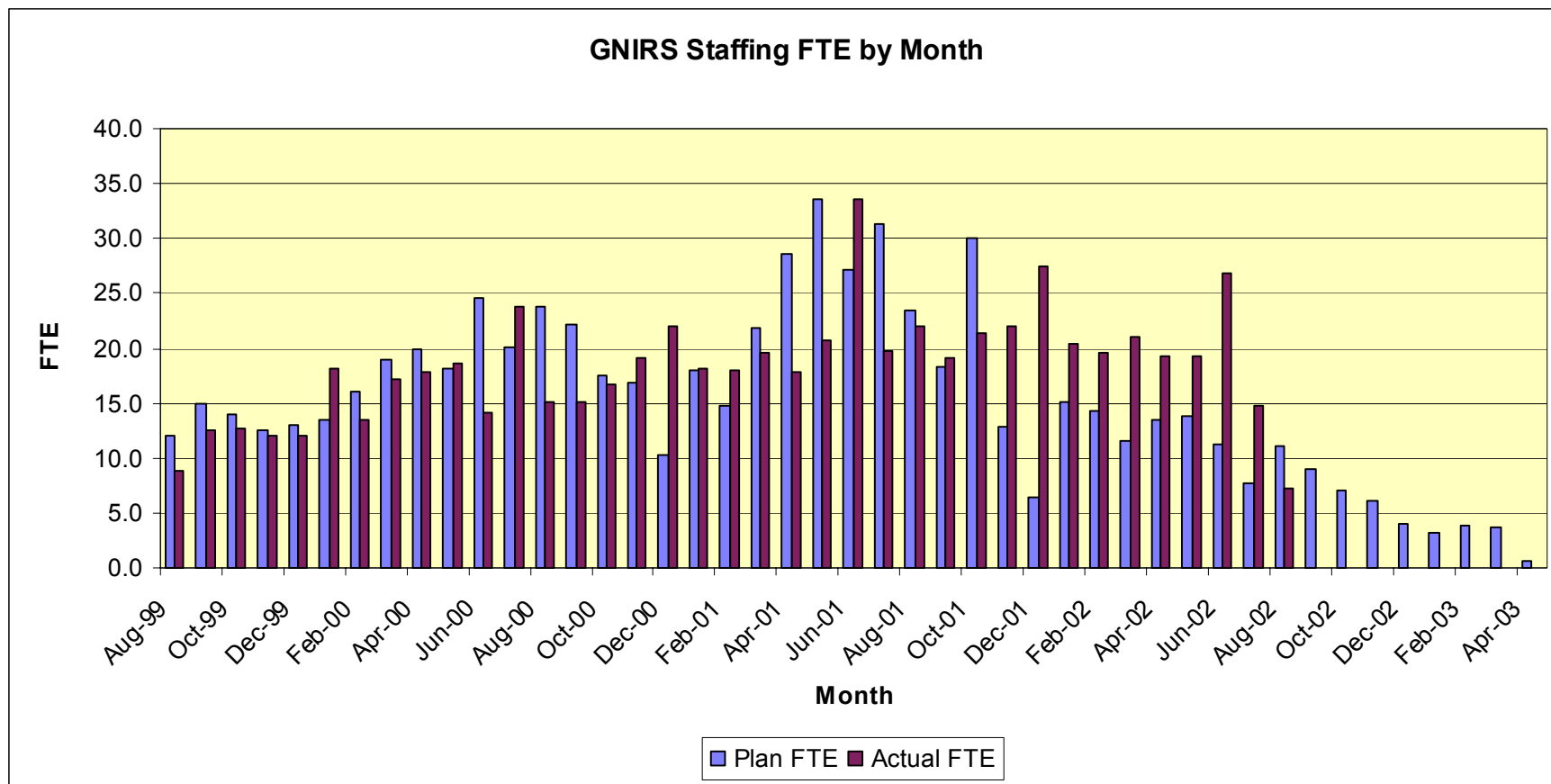
<u>Fixed Assembly</u>	<u>%</u>
Entrance Window	100
Cryo-cooler	100
Molecular Sieve	100
Thermal Dist.	100
LN ₂ Pre-Cool	100
Opt Bench Mount	100
Environ Cover Filter	100
Bulkhead	100
Passive Rad Shield	100
Active Rad Shield	100
Front Dewar Shell	100
Rear dewar Shell	100
Vert Inst Frame	100
Horiz Inst Frame	100
Dewar Mount Truss	100
TE Mount Truss	100
Shipping Container	51
Handling Fixture	100
Ballast Weights	100

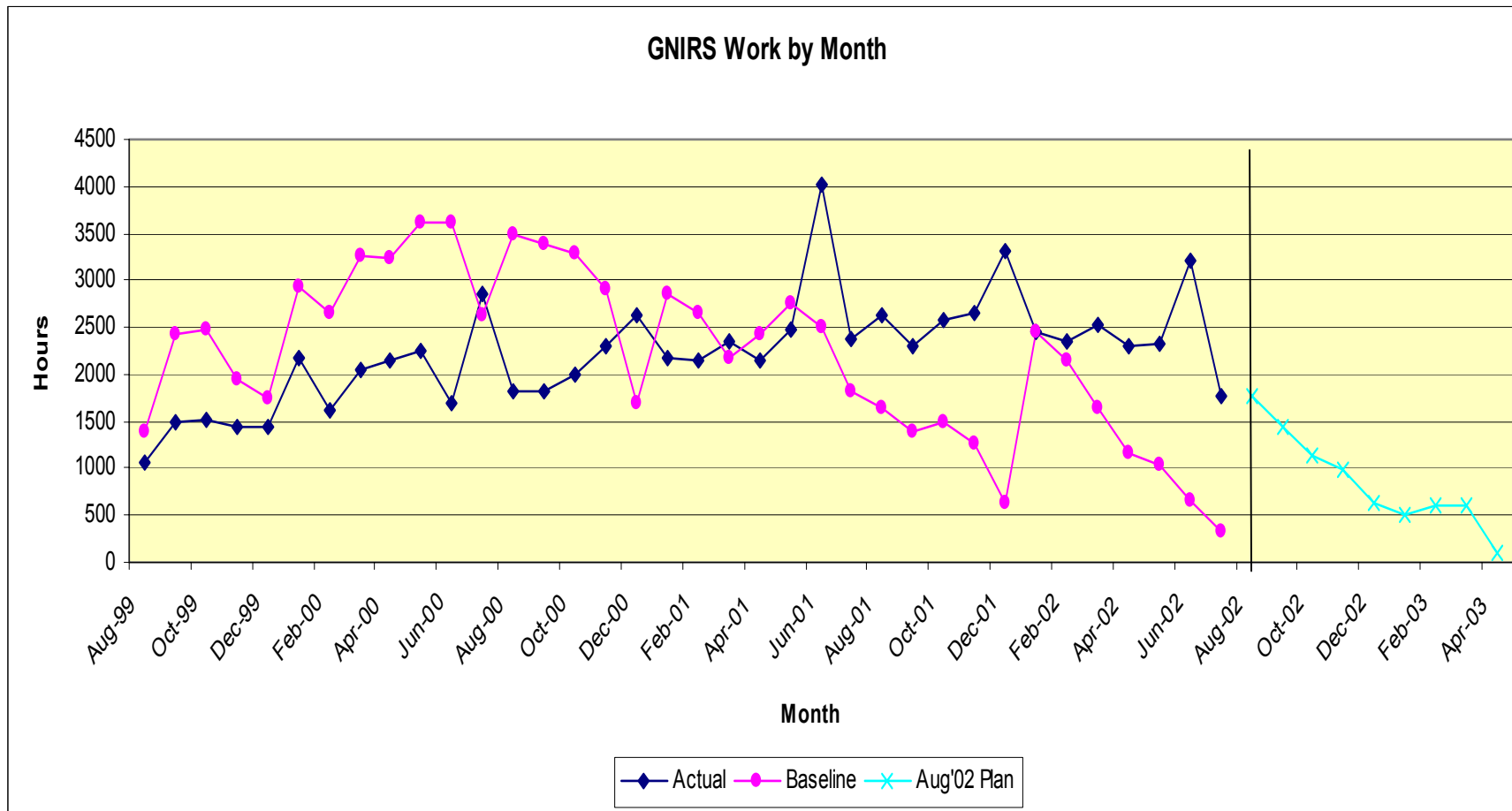
Project Status

- WBS 5.2 Systems Engineering
 - Activities over this quarter
 - Slit mechanism testing
 - Bearing test/evaluation
 - OIWFS prism integration
 - Work left
 - Oversee instrument assembly
 - System alignment
 - Warm testing
 - Flexure testing
 - Cold testing
 - Contribute to the Hardware Maintenance Manual
 - Write the Operations Manual

Project Status

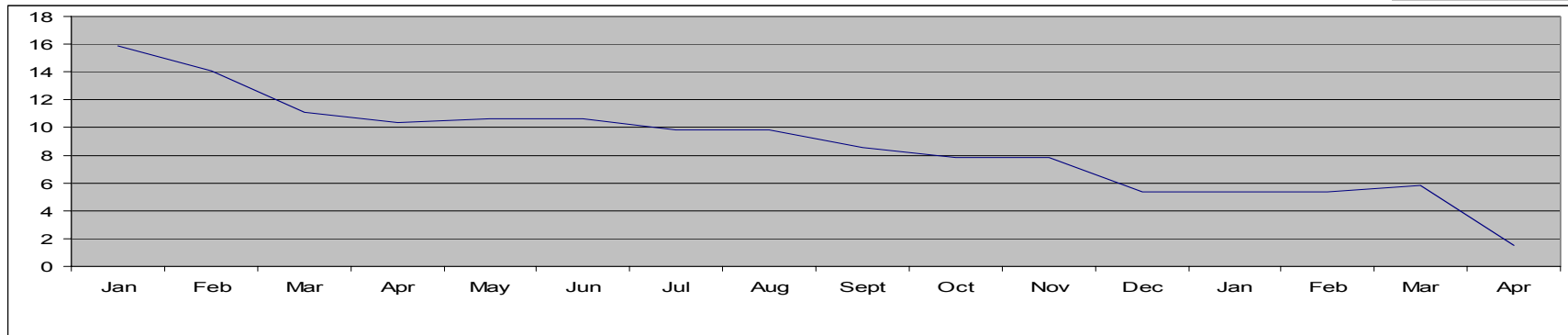
- WBS 5.3 Mechanical
 - All fabrication complete
 - Fixtures
 - Documentation cleanup
- WBS 5.4 Electrical
 - Complete dewar wiring
 - Assist in instrument assembly
- WBS 5.5 Software
 - Participate in instrument assembly and checkout
 - Finalize code
- WBS 5.8 Procurement
 - SRC lens
 - Miscellaneous mechanical items



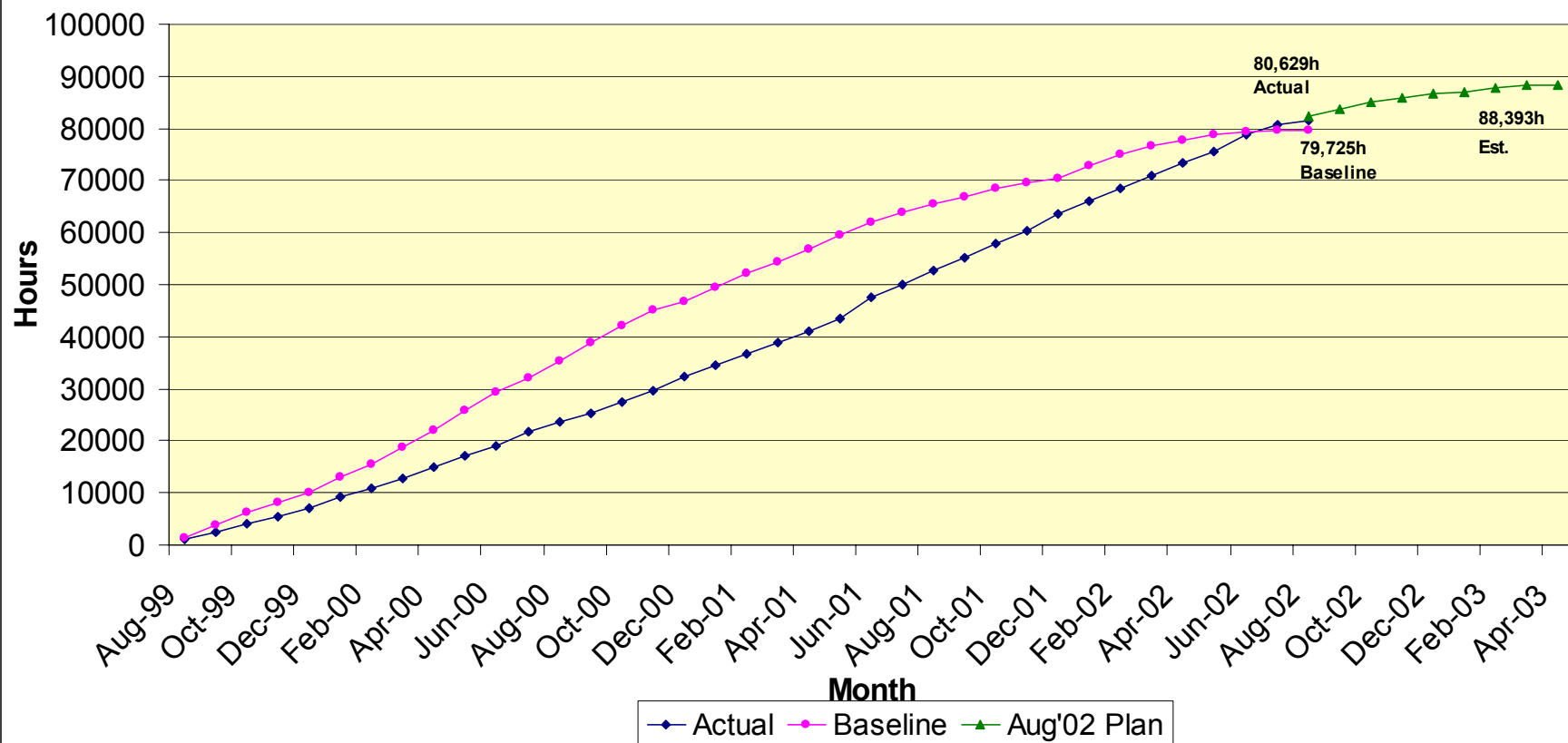


Planned FTE Projection

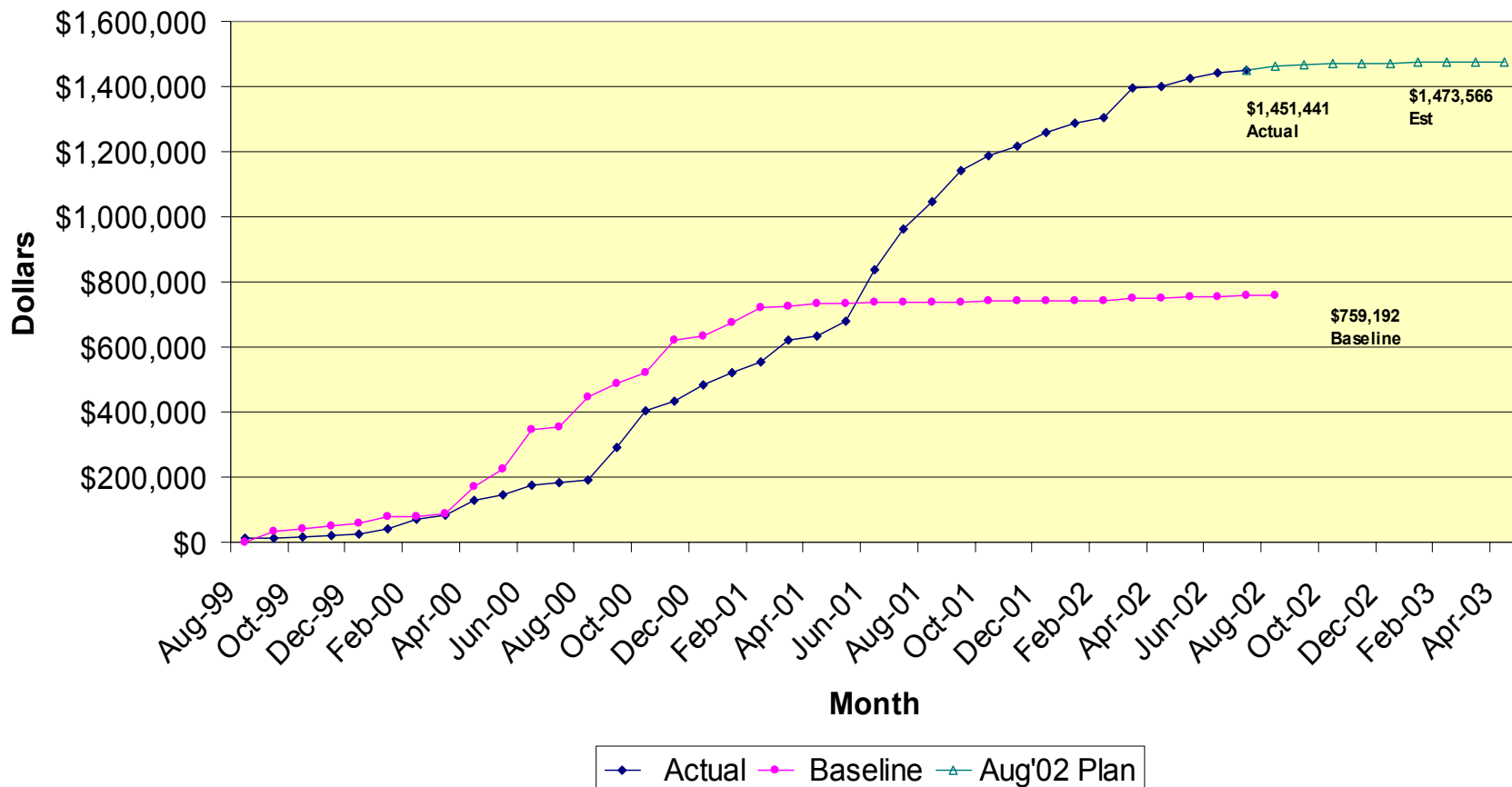
FTE Type	Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr
ME	Muller	1	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
ME	Hileman																
MD	Andrew	0.75	1	1	1	1	1	1	0.5	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
MD	Downey	1	1														
MD	Rosin	1	1														
MD	Circle																
EE	Penegor	0.25	0.25	0.25	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
ET	Schmitt								0.5	0.5	0.5	0.5	0.5				
ET	George	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	1	1	1	0.5	1	1	1	
IM	Stein	1	1	1	1	1	1	1	1	1	1	1					
IM	Bennett	1															
IM	Harris	1	1	1	1	1	1	0.5	0.5								
IM	Lederer	1															
OPT	Camacho	1	1														
P	Wolff	0.1	0.1	0.1													
P	Ruckle	1	1	1	1	1	1	1	1	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5
OE	Ming	0.25	0.25	0.25						0.25							
GT	Pina/Sillman	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
ENG	Distler	0.5	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25							
PA	Eklund	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
AA	Bowersock	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
PE	Davis	0.75	1	1	1	1	1	1	1	1	1	1					
PS	Elias	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	1
PSS	Joyce	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
PM	Gaughan	0.75	1	1	0.75	1	1	0.75	0.75	0.75	0.5	0.5	0.5	0.5	0.5	0.5	
	Total	15.85	14.1	11.1	10.35	10.6	10.6	9.85	9.85	8.6	7.85	7.85	5.35	5.35	5.35	5.85	1.5
		2536	2256	1776	1656	1696	1696	1576	1576	1376	1256	1256	856	856	856	936	240
Spend Rate (\$/mo)		\$95,328	\$84,688	\$66,448	\$61,888	\$63,408	\$63,408	\$58,848	\$58,848	\$51,248	\$46,688	\$46,688	\$31,488	\$31,488	\$31,488	\$34,528	\$8,080
Total \$ to go from September 2002		\$281,696	7632														



GNIRS Cumulative Work



GNIRS Capital Spend Plan



Project Milestones by Quarter

Calendar Year	Quarter	Number of Milestones Due	Running Total	Number of Milestones Comp	Running Total
1999	4th	1	1	1	1
2000	1st	15	16	15	16
2000	2nd	13	29	13	29
2000	3rd	8	37	8	37
2000	4th	18	55	18	55
2001	1st	19	74	19	74
2001	2nd	34	108	34	108
2001	3rd	29	137	29	137
2001	4th	28	165	28	165
2002	1st	25	190	25	190
2002	2nd	19	209	14	204
2002	3rd	10	219	2	206
2002	4th	3	222	0	206
2003	1st	5	227	0	206
	TOTAL	227		206	

As of
8/27/02

Deliverables Projection

- | | |
|-------------------------------|-------------------------------|
| • Documentation | <u>Final</u> |
| – Hardware Maintenance Manual | Dec |
| – Operations Manual | Dec |
| – As-Built Drawings | Dec |
| • Testing | <u>Approx Scheduled Dates</u> |
| – Pre-ship AT | March 2003 |
| – Instrument Hardware Ship | March 2003 |
| – Post –Ship AT | April 2003 |
| – Final AT | April 2003 |
| – Commissioning | April – May 2003 |

Gemini Payments Summary – Current Work Scope

<u>Milestone</u>	<u>Payment</u>	<u>Date</u>	
		<u>Original</u>	<u>New</u>
Test Plans Delivered	\$50,000*	Mar-01	Mar-02
Parts Fabrication Complete	25,000	Jun-01	Jun-02
Manuals Complete	75,000	Aug-01	Dec-02
Warm Tests Complete	25,000	Dec-01	Sept-02
Cold Cycle Testing Complete	25,000	Mar-02	Mar-03
Pre-Ship Acceptance	80,000	Jun-02	Mar-03
Final Acceptance	<u>300,857</u>	Sep-02	Apr-03
Total	\$580,000		
Change order outstanding			
- Chile Delivery	\$176,925		

Conclusions

- The current project status shows us to be 92% complete
- We are in the integration phase
- The next issue is warm testing
- The estimated cost of GNIRS is \$ 4,500,551
- There is no schedule contingency left

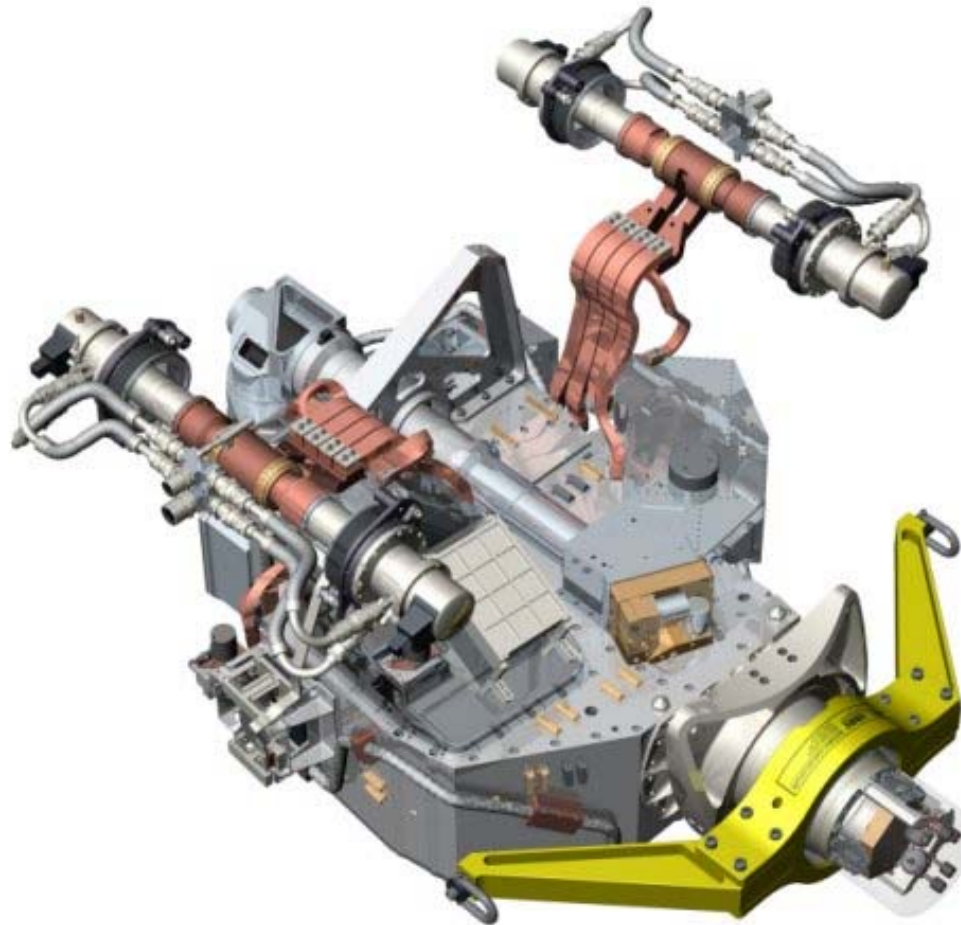
Milestones for Next Review

- The next Quarterly Review will be held in the January 2003 timeframe
- Flexure testing will be complete
- Two cold test cycles will have completed
- All draft manuals will be complete and to Gemini for review
- Design documentation deliverable will be complete
- Shipping container will be complete

Appendix A

Fabrication and Integration Images

Bench Rendering



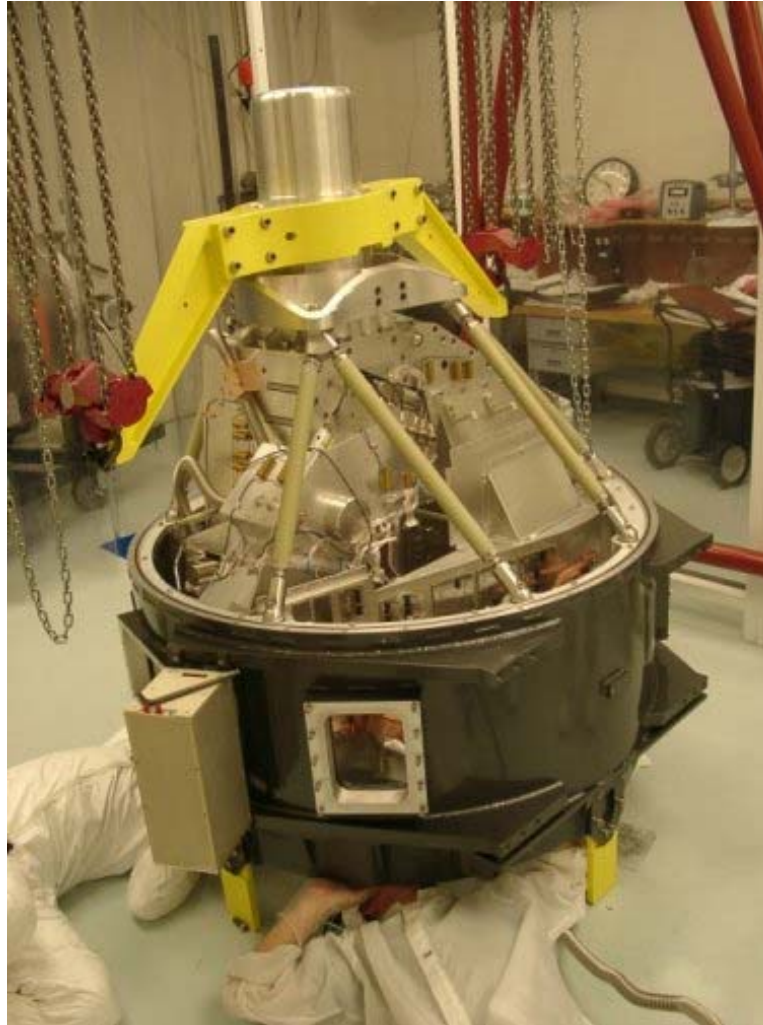
Hoisting the Bench



Fitting the Bench



Integrating the Bench

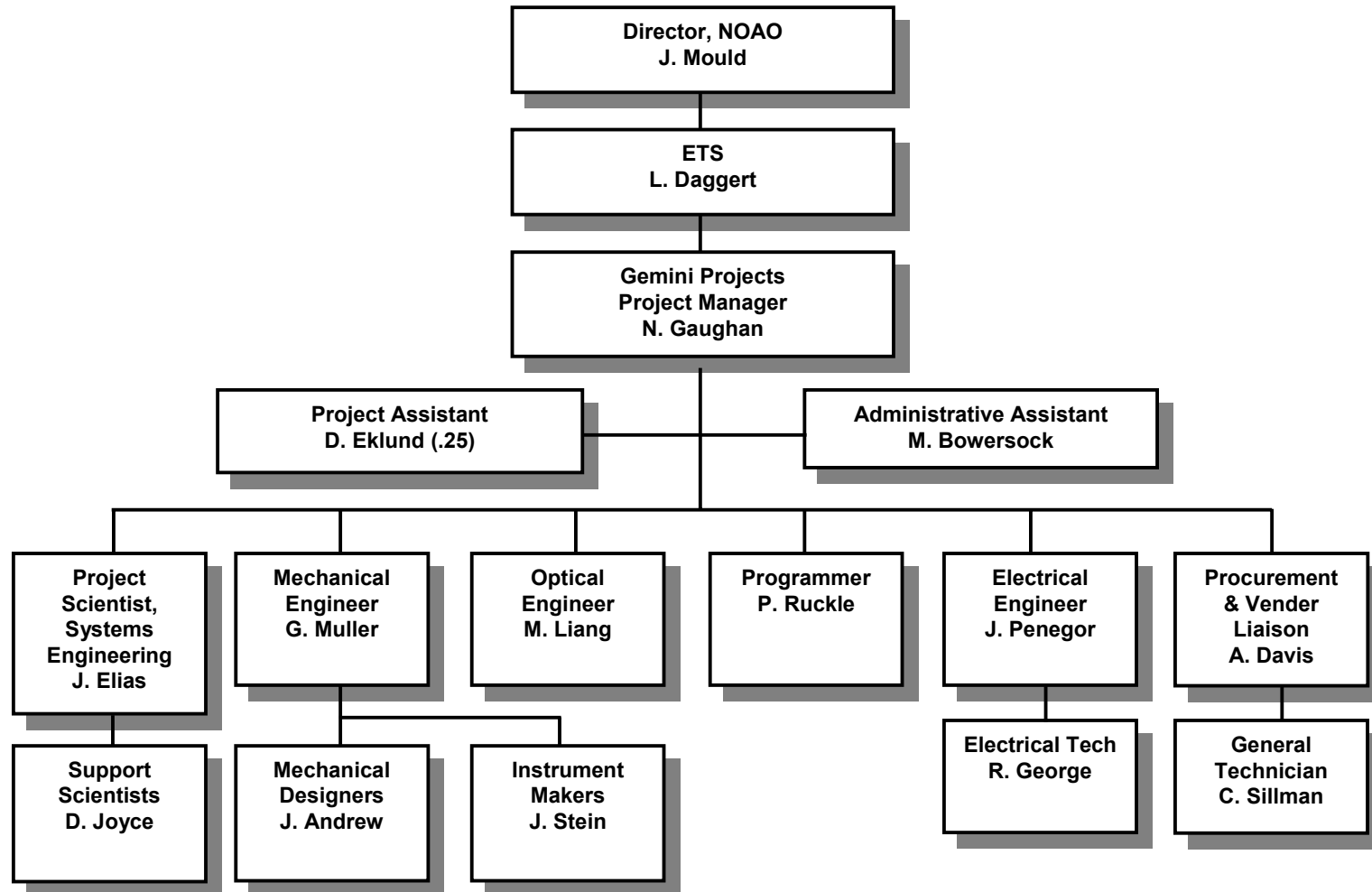


Bench Integrated with Bulkhead



Appendix B

Organization Chart
Milestones
WBS Chart



Milestones since MFR (3/01)

5.4.1.2.5	Motor Drive / Cryohead Control Chassis Complete	8/29/00	4/9/01	4/9/01
5.3.1.8.2.6	Grating Turret Drafting Complete	6/7/00	4/10/01	4/10/01
5.3.3.9.1.5	Bulkhead Assembly Design Complete	9/26/00	4/10/01	4/10/01
5.3.1.2.2.2.4	Long Red Camera Drafting Complete	10/4/00	4/13/01	4/13/01
5.3.1.104.5	Motor Drive Assembly Complete	8/2/00	4/16/01	4/16/01
5.3.1.2.3.1.3	Long Blue Camera Design Complete	5/31/00	4/17/01	4/17/01
5.5.4.1	Channel Access	NA	4/18/01	4/18/01
5.3.2.4.2.3.3	Offner Assembly Fabrication Complete	9/11/00	4/24/01	4/24/01
5.3.3.14.1.4	Vertical Installation Frame Assembly Design Complete	12/4/00	4/27/01	4/27/01
5.3.3.15.1.5	Horizontal Installation Frame Assembly Design Complete	12/5/00	4/27/01	4/27/01
5.3.3.17.1.5	Thermal Enclosure Mount Assembly Design Complete	1/23/01	4/30/01	4/30/01
5.3.3.19.4	Handling Fixtures Complete	NA	5/18/01	5/18/01
5.3.2.3.3.2.4	Collimator Compensating Mount Design Complete	NA	5/23/01	5/23/01
5.5.4.2	Instrument Coordination	NA	5/24/01	5/24/01
5.3.2.3.2.1.5	Collimator Cover Box Design Complete	5/5/00	5/30/01	5/30/01
5.3.3.13.1.5	Rear Dewar Shell Design Complete	3/29/01	5/31/01	5/31/01
5.3.3.9.2.6	Bulkhead Assembly Drafting Complete	2/21/01	6/1/01	6/1/01
5.3.1.8.6.4	Grating Fabrication Complete	11/28/00	6/1/01	6/1/01
5.3.3.12.1.5	Front Dewar Shell Design Complete	2/26/01	6/1/01	6/1/01
5.3.3.6.1.3	LN2 Pre-Cool Assembly Design Complete	11/16/00	6/6/01	6/6/01
5.3.1.2.3.2.4	Long Blue Camera Drafting Complete	11/27/00	6/6/01	6/6/01
5.3.3.17.2.6	Thermal Enclosure Mount Assembly Drafting Complete	3/14/01	6/8/01	6/8/01
5.3.2.3.2.2.4	Collimator Cover Box Drafting Complete	8/7/00	6/11/01	6/11/01
5.3.1.7.3.2	Filter Wheel Assembly Fabrication Complete	1/10/01	6/11/01	6/11/01
5.3.3.3.1.4	Cryo Cooler Design Complete	9/26/00	6/12/01	6/12/01
5.3.3.2.2.4	Detector Mount Assembly Drafting Complete	1/4/01	6/15/01	6/15/01
5.3.3.12.2.6	Front Dewar Shell Drafting Complete	3/16/01	6/19/01	6/19/01
5.3.2.1.8.3.2	Bottom Camera Cover Fabrication Complete	7/21/00	6/25/01	6/25/01
5.3.2.1.8.4.4	Bottom Camera Cover Complete	7/26/00	6/28/01	6/28/01
5.3.3.13.2.6	Rear Dewar Shell Drafting Complete	NA	6/28/01	6/28/01
5.3.2.2.3.1	Receive and Inspect IFA WFS electronics	9/5/00	6/29/01	7/3/01
5.3.1.6.5.3.2	Slit/Decker Assembly Fabrication Complete	3/5/01	6/29/01	6/29/01
5.3.2.1.6.3.2	LCFMH Fabrication Complete	8/1/00	6/29/01	6/29/01
5.8.1.3.1	Flat Mirrors Acceptance	6/2/00	6/29/01	6/29/01
5.3.1.3.2.4	Detector Focus Assembly Drafting Complete	1/26/01	7/2/01	7/2/01
5.3.1.2.6.3.4	Camera Hub Fabrication Complete	12/4/00	7/5/01	7/5/01
5.3.2.1.6.4.4	LCFMH Complete	8/4/00	7/5/01	7/5/01
5.3.2.4.2.4.4	Offner Assembly Complete	9/22/00	7/16/01	7/16/01
5.3.2.3.3.3.4	Collimator Compensating Mount Drafting Complete	NA	7/19/01	7/19/01
5.3.3.3.2.4	Cryo Cooler Drafting Complete	11/21/00	7/23/01	7/23/01
5.3.3.7.3.2	Optical Bench Mount Assembly Fabrication Complete	5/3/01	7/23/01	7/23/01
5.3.3.6.2.4	LN2 Pre-Cool Assembly Drafting Complete	12/7/00	7/25/01	7/25/01
5.3.2.3.1.3.3	Collimator Housing Fabrication Complete	2/13/01	7/25/01	7/25/01
5.3.2.1.3.3	Post-Slit Bench Fabrication Complete	11/20/00	7/30/01	7/30/01
5.3.2.2.1.3.4	OIWFS Assembly Fabrication Complete	11/30/00	7/31/01	7/31/01
5.3.3.7.4.4	Optical Bench Mount Assembly Complete	5/21/01	8/9/01	8/9/01
5.3.2.3.2.3.2	Collimator Cover Box Fabrication Complete	8/8/00	8/17/01	8/17/01
5.3.2.1.7.3.2	Top Camera Cover Fabrication Complete	7/19/00	8/17/01	8/17/01

5.3.3.11.1.4	Active Shield Assembly Design Complete	3/19/01	2/12/02	2/12/02
5.5.6.9	System Component Complete	NA	2/15/02	2/15/02
5.3.3.16.3.2	Dewar Mount Truss Assembly Fabrication Complete	4/10/01	2/15/02	2/15/02
5.3.1.4.4.2	Environmental Cover Assembly Testing Complete	8/7/00	2/18/02	2/18/02
5.4.3.5	Dewar Warm-up Controller Complete	4/10/01	2/19/02	2/19/02
5.3.3.10.2.6	Front Radiation Shield Assembly Drafting Complete	4/6/01	2/21/02	2/21/02
5.3.3.16.4.4	Dewar Mount Truss Final Assembly Complete	4/17/01	2/25/02	2/25/02
5.3.1.9.3.6	Prism Turret Fabrication Complete	4/13/01	2/26/02	2/26/02
5.3.3.11.2.6	Active Shield Assembly Drafting Complete	5/21/01	3/4/02	3/4/02
5.3.1.2.8.8	Camera Assembly Complete	5/25/01	3/5/02	3/5/02
5.3.1.8.5.8	Grating Turret Testing Complete	12/11/00	3/8/02	3/8/02
5.3.1.9.4.7	Prism Turret Testing Complete	4/25/01	3/19/02	3/19/02
5.3.3.10.3.2	Front Radiation Shield Assembly Fabrication Complete	8/1/01	3/19/02	3/19/02
5.3.2.3.3.5.4	Collimator Compensating Mount Assembly Complete	NA	3/29/02	3/29/02
5.3.3.3.3.2	Cryo Cooler Fabrication Complete	2/12/01	3/29/02	3/29/02
5.6.2.15	Receive IFU Mass Model and Fit Check	NA	4/1/02	4/1/02
5.3.1.3.3.6	Detector Focus Assembly Fabrication Complete	4/30/01	4/5/02	4/5/02
5.3.3.11.3.2	Active Shield Assembly Fabrication Complete	7/18/01	4/10/02	4/10/02
5.3.4	All Fab Complete	8/6/01	4/10/02	4/10/02
5.3.1.7.5.7	Filter Wheel Assembly Testing Complete	5/3/01	4/16/02	4/16/02
5.3.3.6.4.3	LN2 Pre-Cool Assembly Testing Complete	1/8/01	4/19/02	4/19/02
5.3.3.3.4.4	Cryo Cooler Assembly Complete	2/21/01	4/23/02	4/23/02
5.3.1.5.4.7	Acquisition Mirror Assembly Testing Complete	10/19/00	4/25/02	4/25/02
5.3.1.3.4.7	Detector Focus Assembly Testing Complete	6/5/01	4/30/02	4/30/02
5.4.4.2.6	Dewar Internal Connectors & Cabling Complete	9/6/00	5/10/02	
5.4.4.3	Dewar Electronics Complete	10/4/00	5/10/02	
5.8.3.1.8	Test Plans Complete	8/3/01	5/15/02	
5.5.8	Array and Instrument Controller Checkout Complete	NA	5/21/02	5/21/02
5.3.2.1.4.5	Post-Slit Bench Assembly Complete	3/26/01	5/31/02	5/31/02
5.3.3.10.4.2	Front Radiation Shield Assembly Complete	8/9/01	6/14/02	6/14/02
5.4.1.6.5	Spectrograph Thermal Enclosure Complete	1/9/01	6/17/02	6/17/02
5.4.4.1.5	Dewar Connector Interface Boards Complete	6/28/00	6/21/02	6/21/02
5.6.1.8	Telescope Simulator Complete	5/25/01	6/24/02	
5.7.3.2.1.5	Draft Software Maintenance Manual Complete	4/26/02	6/27/02	
5.3.3.4.4.4	Thermal Distribution Connector Assembly Complete	5/7/01	7/3/02	7/3/02
5.4.2.4	External Instrument Wiring & Cables Complete	10/23/00	7/9/02	
5.3.1.6.3.6.7	Slit/Decker Assembly Test Complete	4/13/01	7/26/02	7/26/02
5.7.3.2.3.6	Draft User's Manual Complete	5/2/02	7/26/02	
5.6.2.14	Dewar & Structure Assembly Complete	10/9/01	8/7/02	
5.4.5.2	Electronics Documentation Complete	5/31/01	8/22/02	
5.6.3.12	Mechanism Integration Complete	11/7/01	8/23/02	
5.6.4.1	Warm Test Begins	11/7/01	8/23/02	
5.6.4.7	Warm Tests Complete	11/21/01	9/10/02	
5.6.5.1	Cold Tests Begin	11/21/01	9/10/02	
5.3.3.18.4	Shipping Container Complete	4/26/02	10/8/02	
5.7.3.2.2.6	Draft Service and Calibration Manual Complete	3/25/02	10/11/02	
5.7.3.2.4.5	Final Manuals Complete	7/15/02	12/23/02	
5.6.5.17	Contingency	NA	3/13/03	

WBS - Total Project

