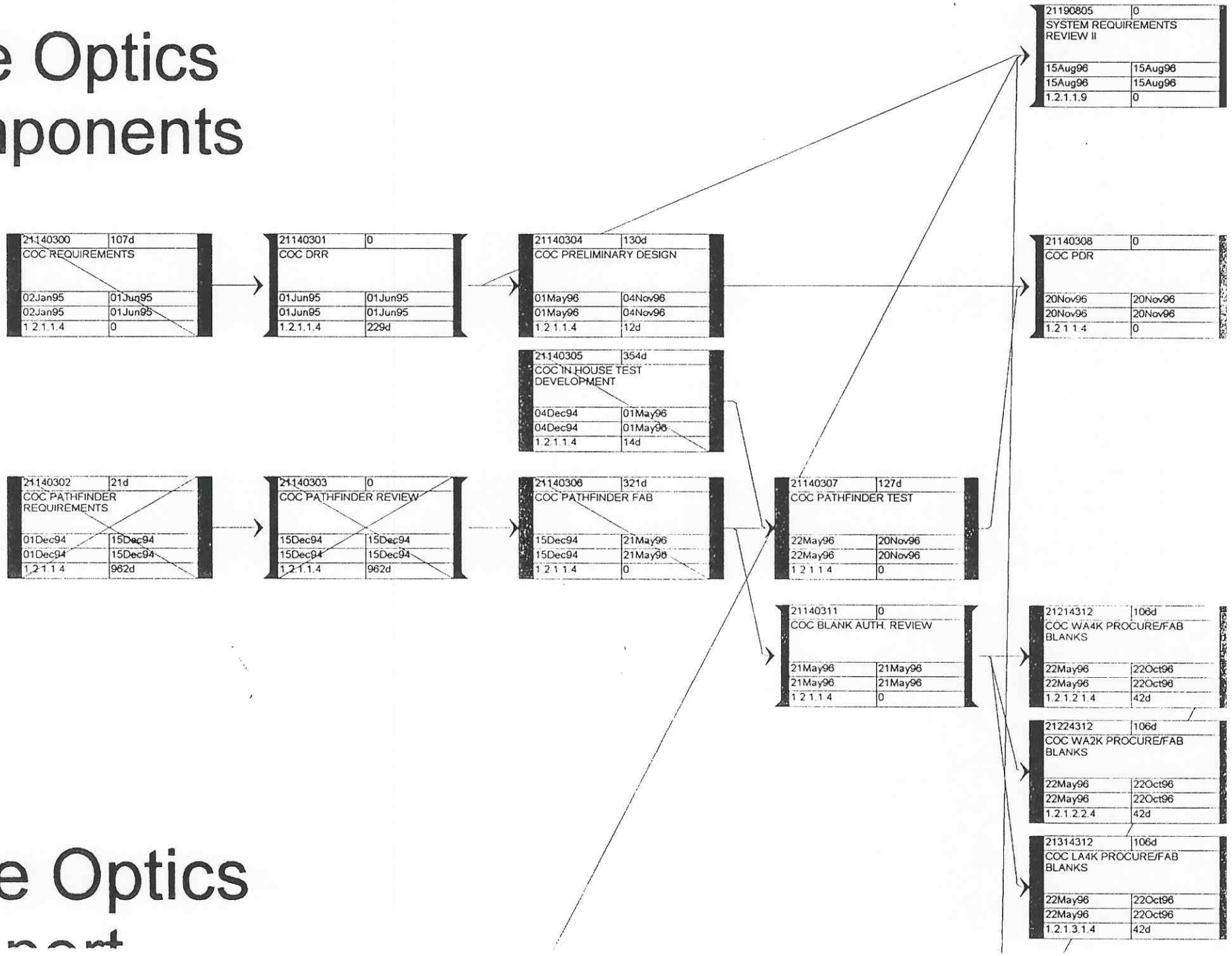
Core Optics Components Status Review 5/25/95

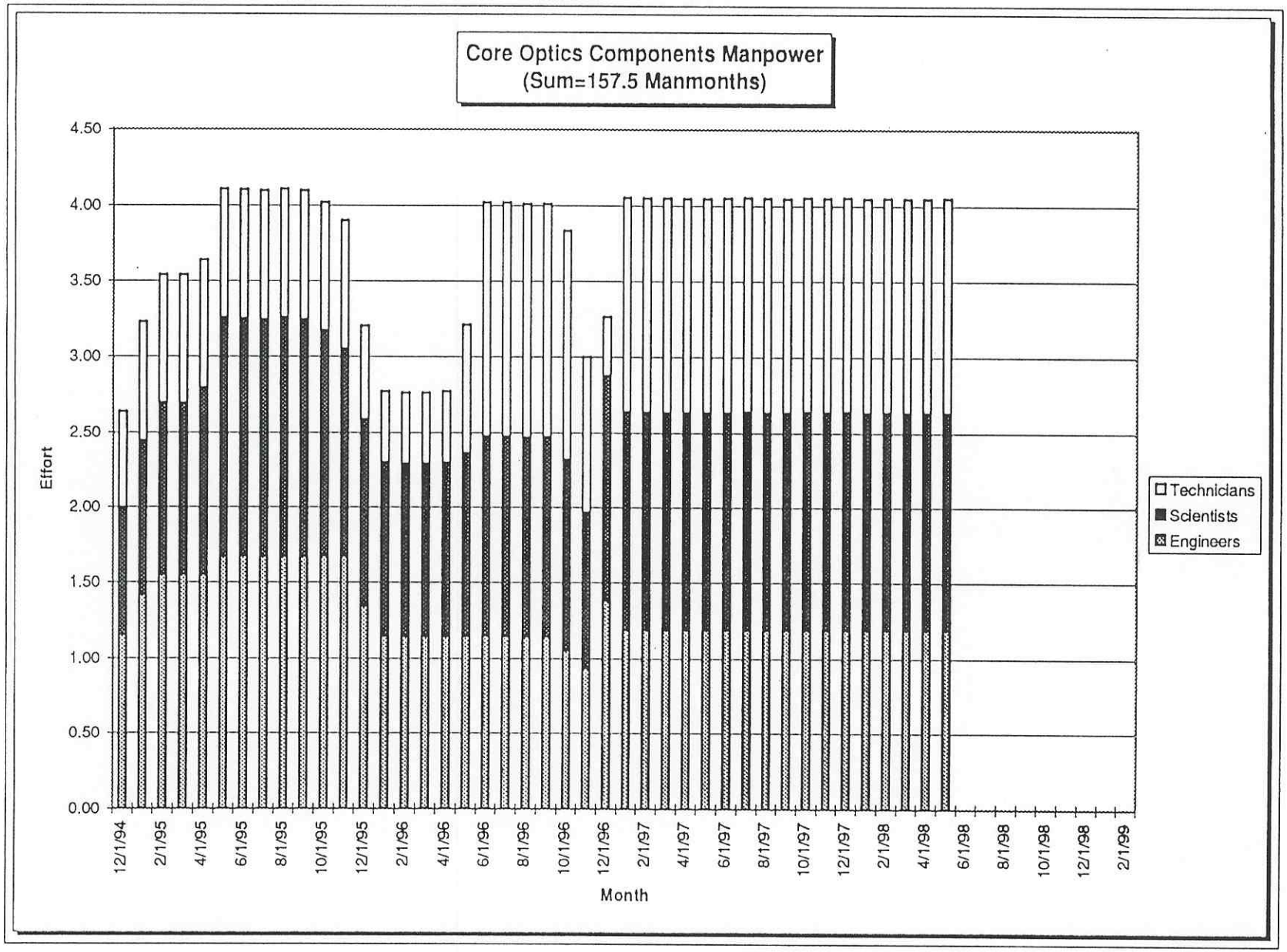
- Status of COC Task
  - ›› COC Pathfinder Fabrication
  - ›› COC In-House Test Development
- Metrology Task
  - ›› Baseline Plan
  - ›› Alternate Strategy
- In-House Tests
  - ›› Preparation for Them
- Management of Industrial Contracts

LIGO-G950032-00-D

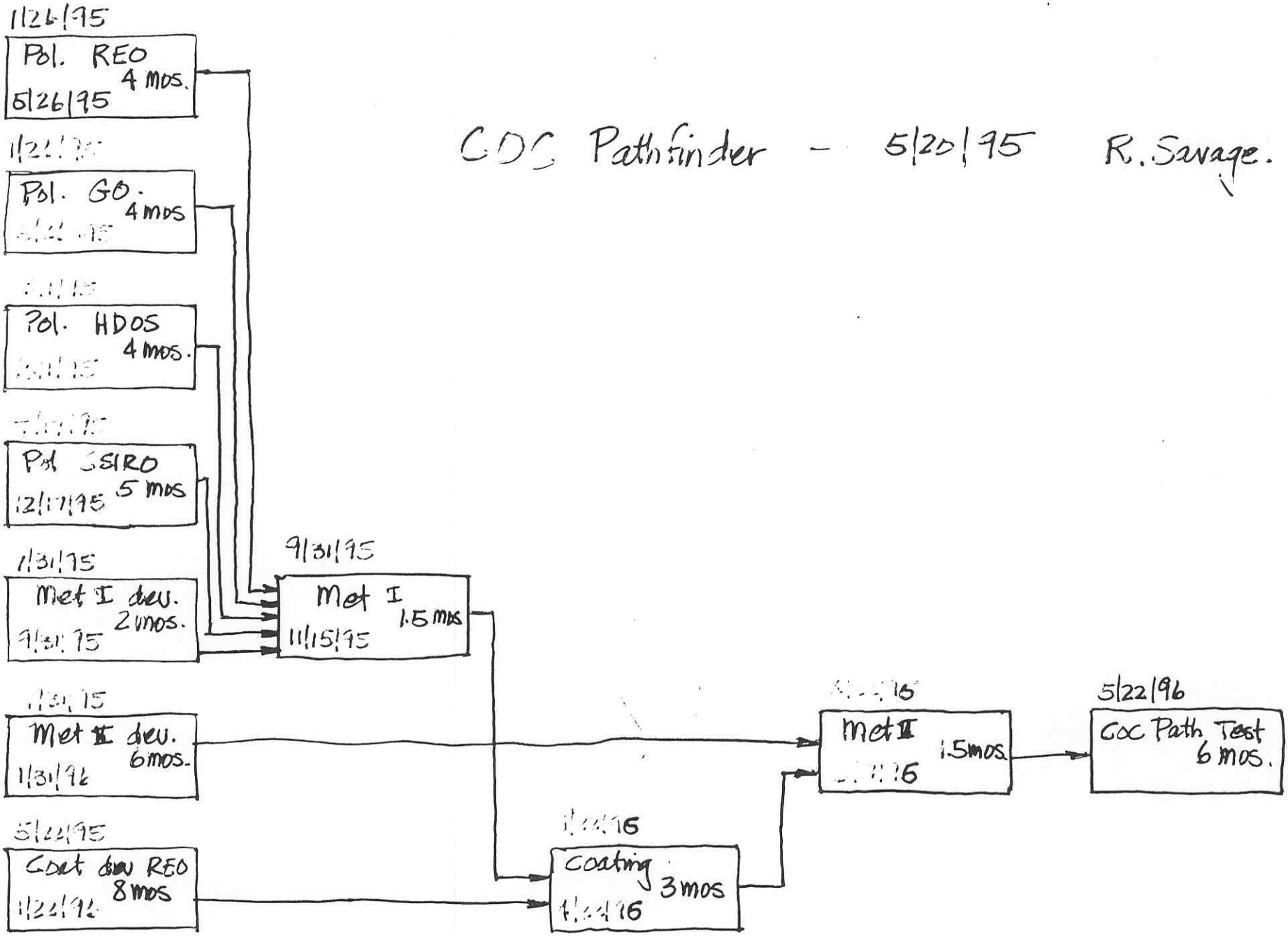
Core Optics Components



Core Optics Support


Core Optics Components Manpower
(Sum=157.5 Manmonths)
Effort
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
12/1/94
2/1/95
4/1/95
6/1/95
8/1/95
10/1/95
12/1/95
2/1/96
4/1/96
6/1/96
8/1/96
10/1/96
12/1/96
2/1/97
4/1/97
6/1/97
8/1/97
10/1/97
12/1/97
2/1/98
4/1/98
6/1/98
8/1/98
10/1/98
12/1/98
2/1/99
Month
Technicians
Scientists
Engineers

COC Pathfinder – 5/20/95 R. Savage.



WBS.No 1.2.1.1.4
Design/NR costs/SE Core Optics Comp.
Manpower

~rick/Detcost/12114.mp.081994.wk3
8/19/94

Task	Trips		In-House Labor Sci	Engr	Tech
TM Shipping Container (Prototype)	0	Design	0.1	0.6	0
		Procure	0	0.1	0
		Assembly	0	0.1	0
		Test	0	0.1	0
		Documentation	0	0.1	0.1
		Bake	0	0	0
			0.1	1	0.1

in Progress (S. Elieson).

	Trips		Sci	Engr	Tech
TM Shipping Containers	0	Design	0	0	0
		Procure	0	0.1	0.1
		Assembly	0	0	0.2
		Test	0	0	0.1
		Documentation	0	0	0
		Bake			0.3
			0	0.1	0.7

	Trips		Sci	Engr	Tech
Q Measuring Fixture	0	Design	0.1	0.7	0.1
		Procure	0	0.2	0.1
		Assembly	0	0.1	0.35
		Test	0.2	0.3	0.75
		Documentation	0.1	0	0.4
		Software	0.1	1.1	0
			0.5	2.4	1.7

done

	Trips		Sci	Engr	Tech
Shipping+Receiving	0	Ship/Receive			1.4
			0	0	1.4

in progress (S. Elieson)

	Trips		Sci	Engr	Tech
Polishing, Low-Tech	2	Design	0	0	0
		Procure	0	0.4	0
		Assembly	0	0	0
		Test	0.2	0.2	0
		Documentation	0	0.4	0
		Software	0	0	0
			0.2	1	0

G.O. + REO in progress due 5/26/95

WBS.No 1.2.1.1.4
Design/NR costs/SE Core Optics Comp.

Manpower

	Trips		Sci	Engr	Tech
Trans Meas Apparatus	0	Design	0.1	0.85	0
		Procure	0	0.2	0.2
		Assembly	0	0.5	0.5
		Test	0.25	0.6	0.5
		Documentation	0	0.5	0.5
		Software	0.5	0.5	0
			0.85	3.15	1.7

	Trips		Sci	Engr	Tech
Absorp. Meas Apparatus	0	Design	0.25	0.5	0
		Procure	0	0.1	0.1
		Assembly	0	0.35	0.25
		Test	0.5	0.5	0.5
		Documentation	0.1	0.2	0.2
		Software	0.5	0.5	0
			1.35	2.15	1.05

	Trips		Sci	Engr	Tech
Wet Cleaning Station	3	Design	0.25	0.75	0
		Procure	0	0.25	0.25
		Assembly	0	0.25	0.5
		Test	0.25	0.5	1
		Documentation	0.1	0.25	0.5
		Software	0	0	0
			0.6	2	2.25

	Trips		Sci	Engr	Tech
Analysis:	4	Design	3	0.5	
FFT code runs		Procure	0	0	
Analyzing Phase Maps		Data Collection	0.5	0.5	
		Test	2	1	
		Documentation	0.75	0.25	
			6.25	2.25	0

	Trips		Sci	Engr	Tech
In-House Testing	0	Transmission	0.68	0.68	1.7
		Scatter	0.34	0.34	0.85
		Abs (Surf + Bulk)	0.52	0.52	1.3
		Ringdown	0.56	0.56	1.4
		Q-Measurements	1	1	0.5
		Cleanings	0.5	0.5	1.25
		Test Eq. Maint.	1	1	2
			4.6	4.6	9

WBS.No 1.2.1.1.4
Design/NR costs/SE Core Optics Comp.
Manpower

	Trips		Sci	Engr	Tech
Pathfinder Evaluation and Development of Production Plan.	4	Data Analysis	1	0.25	
		Plan	0.5	0.5	
		Review + Iterate	1	0.5	
		Write Prod. Spec	0.25	0.25	
			2.75	1.5	0

	Trips		Sci	Engr	Tech
Task Supervision, Scheduling and Budget	0	Design	0.75	0.5	
			0.75	0.5	0

	Sci	Engr	Tech
Sub-Total (MAN MONTHS)	17.95	20.65	17.9

WBS.No 1.2.1.1.4
Design/NR costs/SE Core Optics Comp.
Contracts, Manpower

	Trips		Sci	Engr	Tech
Polishing, Hi-Tech	12	RFQ	1	0.5	
		Procure	0.5	0.5	
(2 contracts)		Contract Supervision	1	0.5	
HDOS		Test	0.2	0.2	
CSIRO		Reviews/Doc	0.5	0.5	
		Analysis	1	0.5	
			4.2	2.7	0

	Trips		Sci	Engr	Tech
Metrology I	8	RFQ	0.75	0.5	
		Procure	0.25	0.5	
		Contract Supervision	1	1	
		Test	0.25	0.5	
		Reviews/Doc	0.5	0.25	0.25
		Analysis	1.5	0.5	1
			4.25	3.25	1.25

	Trips		Sci	Engr	Tech
Coating	8	Design	0.5	0.25	
		Procure	0.5	0.5	
		Contract Supervision	0.5	0.75	
		Test	0.5	1	1
		Documentation	0.5	0.5	
		Analysis	0.5	0.25	
		Coating	0.2	0.2	
			3.2	3.45	1

	Trips		Sci	Engr	Tech
Metrology II	6	RFQ	0.25	0.2	
		Procure	0.25	0.5	
		Contract Supervision	0.5	0.75	
		Test	0.25	0.25	
		Reviews/Doc	0.5	0.25	0.25
		Analysis	1.5	0.5	1
Total Number of Trips=	47		3.25	2.45	1.25
Cost per Trip=	3				
		Total	Sci	Engr	Tech
Travel	141	(MAN MONTHS)	32.85	32.5	21.4

(330)

One "Trip" equals 1 person traveling an average distance (Chicago) for three days. This includes hotel, car per diem and includes overhead (58%). This is about $3k per trip.

Beamsplitter Analysis

- Physical Dimensions
  - ››Diameter and thickness
- Thermal Noise
- Compatibility with Suspension Concepts
  - ››"Stay clear" zones
  - ››Location of OSEMs
  - ››Number and location of beam dumps
- Orientation in Interferometer
  - ››Which side is coated?
- Substrate Homogeneity at 45 deg.
  - ››Corning 7980
  - ››LLNL measurements commissioned by Doug
  - ››FFT code analysis (Yaron and Brett)
- Coating performance options (Hiro)

Beamsplitter Analysis (cont.)

- Ability of REO to Coat
  - ››New planetary (chamber) required?
  - ››Diameter and uniformity of coatings
  - ››FFF code analysis (Yaron and Brett)

Metrology - Baseline Plan

- Competitive Procurement for Independent Metrology Contractor
  - ››Not HDOS or CSIRO
- Statement of Work (asst. from K. Creath)
  - ››Proof of measurement capability (632.8 nm)
  - ››Measure six uncoated optics (632.8 nm)
  - ››Measure six coated optics (514.5 nm)
  - ››Status
  - ››RFP being written (Irena and Rick) - 5/29
  - ››Project review completed - 6/7
  - ››Proposals due - 6/30
  - ››Select Contractor - 7/14
  - ››Initiate contract - 7/31
  - ››Estimated deliveries - see Pert chart

Metrology - Baseline Plan (cont.)

- Potential Metrology Contractors

  ››Zeiss - Germany

  — Strong polishing bidder; reviewers favorably impressed with metrology capabilities.

  — Concerns about willingness to openly discuss metrology (Creath, Walsh)

  ››NIST

  — "willing to provide you a sanity check if you want traceability" - Creath

  — "he does not want to bid against commercial companies" - Creath

  ›› Tropel

  — Appears to have measurement development capability

  — May not be interested in just metrology (prefers to polish optics as well)

  ››LLNL

  — Creath not familiar with capabilities; Doug has made measurements there (results under review) and is favorably impressed

Metrology - Baseline Plan (cont.)

- Zygo
  - Creath is doubtful of capabilities, but will discuss with Laars Selberg
  - Polishing proposal review committee not favorably impressed with metrology capabilities (weak proposal)
  - LIGO has unfavorable past experience with Zygo
- Wyco
  - Creath has extensive past experience with them and does not feel that they are suitable for this task
- Ball Corporation
  - Close to REO in Boulder
  - Creath rates them below Zygo, but will investigate
- SVGL, Marshall Space Flight Center, NASA - Goddard
  - Doug will provide contacts and Creath will investigate

Metrology - Alternate Strategy

- Measure All Six Optics at both HDOS and CSIRO
- Use NIST (or PTB or NPL) for Sanity Check and Traceability
- Do All Pathfinder Work - coating development work and metrology - at 632.8 nm
- Have Selected Production Phase Polisher Upgrade Metrology to LIGO Wavelength
- Advantages

  ››Utilize metrology processes we are already developing (and paying for) at HDOS and CSIRO

  ››Either HDOS or CSIRO likely to be fabrication phase metrology provider

  ››All metrology efforts benefit from cross checks

  ››This is more conventional role for Standards Bureau

  ››Eases competition-based secrecy and finger pointing

Metrology - Alternate Strategy (cont.)

>>NIST not interested in competing with industry

- HDOS - Andreas Nonnenmacher

>>Doesn't foresee contractual problems

>>Has had favorable experience working with Chris Evans - AXAF consensus standard work

>>Feels it is a good idea to have NIST's and CSIRO's verification of HDOS metrology, especially with regard to mount-induced errors

>>Feels information gained from metrology of other optics would benefit overall process

- CSIRO - Chris Walsh

>>Recommends validating and improving metrology processes by comparison of measurements made by others

>>Interactive working relationship with NIST and NPL (recommended PTB)

>>is not aware of commercial providers of required metrology

In- House Measurements Plan

- Determine which measurements are required

  ››Ring down, transmission, scattering (bulk and surface), absorption (bulk and surface), birefringence, internal mode Qs

  ››Determine required precision, area to be measured, time required for measurements

  ››Evaluate suitability of in-use procedures

  ››Evaluate outside availability of measurement services and/or equipment (including Virgo, GEO, etc.)

- Propose in-house measurement strategy
- Procure/fabricate necessary instrumentation

Management of Industrial Contracts

- ››REO - Ramin Lalezari
- ››HDOS - Andreas Nonnenmacher
- ››CSIRO - Chris Walsh
- ››Metrology Consulting - Kathy Creath
- ››Metrology - ?

- Weekly e-mail from contractors by Monday AM
- Weekly phone call
- In-scope technical direction communicated via TDM
- REO
  - ››System Requirements Review
  - ››Coating Readiness Review
  - ››Close-out Review
  - ››Technical Management/Progress Reviews (every 6 weeks)

Management of Industrial Contracts (cont.)

- HDOS
  - ››Systems Requirements Review
  - ››First Metrology Meeting
  - ››Certifications Meeting
- CSIRO
  - ››Systems Requirements Review
  - ››First Metrology Meeting
  - ››Certifications Meeting