
LIGO

Status Report

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LIGO

Progress, Status and Plans

- NSB report almost one year ago
 - » Reorganization and restructuring of LIGO
 - » Cost Estimate
 - » Project Management Plan
 - » Technical and construction status
 - » Broadening involvement
 - » Plans for the future

- LIGO today
 - » Progress
 - Comparison with status and plans as reported to the NSB in November 1995
 - » Status
 - Present state of LIGO
 - » Future plans
 - Operations Proposal submitted and reviewed in Spring 1994. We have developed a plan beginning with establishing an operating group at the sites, commissioning the detector, first data taking in July 2000 and reaching design goal by end of 2002. The total cost is \$68.7M with operations costs of about \$20M/year steady state

LIGO Costs

● LIGO Approved Funding

- » Construction Project, including R&D \$292.1M
- » Strict build to cost approach
- » Out of scope items identified, being worked

- Pipelines in Louisiana (solved)

Transco \$274K

Enterprise \$124K

Shell \$125K

- Access Road Louisiana (solved)

State of Louisiana has approve additional appropriation -- total \$970K (+530K)

- State taxes for LIGO

Washington - applying for R&D exemption (ownership question) plan 8% -> 2%

Louisiana - enterprize zone application filed -- plan 8% -> 0%

● Major Contracts

- » PSI \$39.1 M (LIGO budget \$38M, two change controls -\$1.65M and -\$1.42M) Total -\$2.1M
- » CB&I ? (~\$5M high)
- » Design to our cost proceeding with Parsons

Comparison - NSB Report

Project Reorganization

- Project reorganization
 - » New project structure fully operational
 - Product oriented
 - Parallels the WBS system
 - Time phased tasks are resource loaded
 - » All key position filled; staffing on schedule
 - Present LIGO staff ~80
 - » Project Management Plan approved
 - » Cooperative agreement ammended
 - » MIT-Caltech MOU and attachment signed
 - MIT responsibilities delineated
 - » New MOUs with collaborating groups
 - many signed, others underway
 - include agreements with Stanford, LSU, VIRGO

LIGO

Staffing as of June '95

Task	Caltech	MIT	Total
Proj Mgt	4	0	4
Admin	6	2	8
P Control	8	0	8
Syst Int	6	1	7
Facilities	7	0	7
Detector	17	2	19
R&D	10	7	17
Grad Stud	4	5	9
TOTAL	62	17	79

Comparison - NSB Report

Project Management

● Project Controls

- » Project Management Control System (PMCS)
 - measure cost and schedule performance vs baseline -- reports variances, earned value, etc
 - reviewed and approved by NSF review committee (Spring 95)
- » Configuration Management
 - change technical, cost and schedule baseline
 - change control board -- about 20 actions so far
- » Document Control
 - complete records for all contractual communications
 - technical reports, publications, etc
- » Procurement and Contracting
 - strengthened and systemetized to handle size and large number of contracts
- » Accounting and Tracking System in Place
 - interface between LIGO and Caltech accounting
 - MIT reporting
 - contractors reporting

Status of LIGO Facilities

Civil Construction

- A & E Contract

- » R.M. Parsons -- initiated Jan 95
- » scope: design and construction management for buildings, enclosures, offices etc
- » requirements for seismic stability, noise sources, cleanliness
- » conceptual design approved in July for scope consistent with LIGO budget
- » final design proceeding as "design to cost"

- Status of Construction

- » Both sites acquired; no major problems remain
- » Washington:
 - rough grading completed; settling
- » Louisiana:
 - cleared and grubbed;
 - pipeline reconfigurations solved and underway
 - rough grading bids received, begin soon

Status of LIGO Facilities

Beam Tube

- Characteristics:
 - » length = 4 km (4 arms)
 - » diameter = 4 ft
 - » volume = 20, 000m³

- Design Contract with CBI
 - » Design report accepted
 - thin wall stainless spiral weld structure
 - 65 foot sections with bellow
 - quality control in material selection, welding, cleaning, etc
 - » Qualification test -
 - 130 ft section assembled, cleaned, baked and tested -- achieved design

- Construction contract
 - » pick up CB&I option or compete?
 - » strategy adopted is to negotiate option with CB&I, but be prepared to compete
 - » status -- final best offer today

Status of LIGO Facilities

Vacuum Equipment

● Characteristics

- » enormous volume (20,000 m³)
- » mostly standard vacuum equipment
 - 1st stage roughing atm -> 0.1 torr
 - 2nd stage roughing 0.1 torr -> 10⁻⁶ torr
 - steady state - ion/getter pumps
- » large gate valves (4 ft diam)
 - access and flexibility
- » controls and monitoring

● Status

- » Science requirements and review 6/94
- » RFP issued for design contract only
- » Two competitive contracts awarded (CB&I, PSI)
- » Final design and manufacturing
 - down select (6/95) to PSI
 - cost near LIGO budget (\$39.5M)
 - approved by NSF and awarded

Status of LIGO Detectors

R&D Program

- Sensitivity
 - » main features of 40 m spectrum understood
 - » monolithic test masses improve sensitivity
- Demonstration Experiments
 - » optical recombination demonstrated on 40 m
 - » acquisition locking with LIGO controls
 - » MIT phase noise experiments underway
- Switch to Nd: YAG lasers for LIGO
 - » best choice for reliability and high power for good sensitivity. Switch now to invest all resources in right laser and develop optics at longer wavelength.
 - » developing plan to integrate into LIGO baseline
 - acquire low power Nd:YAG soon and stabilize
 - install in 40 m to test in interferometer
 - design/acquire laser with LIGO power and test
 - integrate into detector design
 - » official change control when plan is developed and cost/schedule impact understood

Status of LIGO Detectors

Detector Implementation

- Detector Baseline Established for Costing (9/94)
- Detector Implementation Plan (1/95)
 - » Two Groups
 - interferometer (mechanical/optical systems)
 - control data systems (electronics, controls, data)
 - » Requirements being established from detector sensitivity goals
 - » Design over two years (now underway)
 - preliminary designs of subsystems
 - development of mirror coatings, etc
 - interfaces being determined
- Technical Review by NSF review panel Oct 9-11

LIGO

Committees and Community

● Committees

- » Caltech/MIT Oversight (chaired by L Allen) meets quarterly
- » Pre-program Advisory Committee (chaired by P. Saulson - Syracuse) met September advised on formation of LIGO Users, program committees

● Community

- » User Group with elected executive committee being formed
- » Meeting this winter in Aspen
- » WWW information on LIGO is extensive and growing
- » direct collaboration being discussed and formed
- » international agreements with VIRGO and GEO underway
- » exchange of scientists - S. Kamamura visiting Japan with exchange Japanese visitor
- » Visitors Program being formed and already active - B. Allen, D. Gustafson, P. Saulson visiting Caltech; K. Sliwa sabbatical at MIT

LIGO Status and Plans

Conclusions

- The LIGO Project is on track!
- We are still growing rapidly and entering into major contracts
- We are strictly building to cost
- The coming year should see most major contracts established and actual construction of facilities well underway
- Detector design will be vigorously pursued, making tradeoffs and optimizing the design before construction
- We will include as much outside help, advice as possible and keep the community informed