

**NSF Presentation -
Subcontract
for
ELECTRICAL CONTRACTOR SERVICES
for the
Beam Tube Bakeout
at
LIGO Hanford Observatory**

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**Procurement Sensitive Document-
Do Not Distribute**



Background Beam Tube Bakeout

- **Technical need**
 - ›› Reduce optical noise due to gas pressure in beam tube
 - ›› Reduce contaminants to minimize risk to optics
 - ›› Method: 300 F for 30 days by passing 2000 amps through tube wall - demonstrated by CBI during Qualification Test
- **Originally proposed as part of CBI contract**
 - ›› CBI price was high due to perceived risk, standing army costs
 - ›› CBI price: \$6M (1995); current LIGO est.: \$4.4M
- **Developed plan to use LIGO on-site staff**
 - ›› Presented to NSF at April 1997 review
 - ›› Rationale for using on-site staff vs. subcontractor
 - ›› Electrical contractor role was presented at that time
- **Local A&E (D. Hittle & Assoc.) helped us design bakeout electrical equipment**
 - ›› Prepared specs and drawings in terms electrical contractors understand

Role of Electrical Contractor in Beam Tube Bakeout

- **Initial portable equipment assembly**
 - ›› AC transformer/panelboards (14 assemblies)
 - ›› DC power supplies (4 assemblies)
 - ›› DC cables (1 set)
 - ›› Beam tube connections (1 set)
- **Install and troubleshoot initial (Y2) setup**
 - ›› Verify safety grounding
 - ›› Satisfy Washington Dept. of Labor and Industry concerns
 - ›› Satisfy bakeout safety and technical needs
- **Move portable equipment to next module (3X)**
 - ›› Intermittent work
 - ›› Includes installing and moving heater jackets and controllers, similar to PSI vacuum equipment bakeout
- **Pack equipment for shipment to LIGO
Livingston Observatory**

Why Time and Materials Subcontract?

- **Bakeout involves unusually large amount of temporary power (1 megawatt) with schedule-critical moves**
 - ›› **First-time setup will resolve technical and safety issues**
 - ›› **First move will work out choreography for efficient moves (1 week per move extra = 2 month completion delay)**
- **T&M contractor = temporary, specialized extension of LIGO staff (licensed electricians)**
- **Contractor has responsibilities**
 - ›› **Furnish suitable and adequate manpower when needed**
 - ›› **Provide technical supervision for electrical work**
 - ›› **Obtain permits**
 - ›› **Coordinate utility service connections/disconnections**
 - ›› **Arrange for state inspections**

Why Time and Materials Subcontract? (con'd)

- **Althouse is bakeout technical manager, has fixed-price commitment to project**
 - ›› Will be resident at Hanford during bakeout
- **Corresponding LIGO Livingston Observatory work expected to be firm-fixed-price**

Bakeout Electrical Services Procurement

- **Nine companies solicited, 4 proposals received**
- **T&M rates similar**
- **On basis of written proposals, Sun River clearly superior on technical basis**
 - ›› **Widely varying cost estimates and technical content**
 - ›› **Decided to conduct discussions for clarification**
- **After discussions, concluded:**
 - ›› **All proposers could perform work**
 - ›› **Sun River technical plan was best match to work**
 - ›› **LIGO experience with Sun River positive**
- **During negotiations, Sun River agreed that their cost estimate was too conservative**
 - ›› **Sun River agreed that LIGO estimates are adequate**

Subcontract Management

- **Althouse will be in residence at LHO**
- **Task definitions, schedule goals and ceiling price spelled out in contract**
- **Daily review of progress, resolution of problems**
- **Weekly accounting of hours and material expenditures by task, assembly**
- **Weekly measurement of progress**
- **Compare with budgeted (target) amounts**
- **Take corrective action if necessary**
- **Target hours/\$ amounts in Technical Direction Memorandum #1 (summarized below)**

Subcontract Management (con'd)

Target labor hours/material costs

Task	Duration weeks	Labor hours	Labor \$K	Materials \$K	Equip. \$K	TOTAL \$K
1a	4	969	45.9	54.9		100.6
1b	10	558	26.3	33.0		59.6
2	4	355	16.8	3.0		19.8
3	10	92	4.3	3.0		7.3
1,2,3 undistributed		400	22.0		11.5	33.5
4	1	583	28.3		5.5	33.8
5	4	245	12.0	3.0	3.2	18.2
6	1	583	28.3		5.5	33.8
7	4	245	12.0	3.0	3.2	18.2
8	1	583	28.3		5.5	33.8
9	4	198	9.7		2.5	12.2
10	4	569	27.3		2.3	29.6
TOTALS:		5380	261.0	99.9	39.2	400.1