NSF Presentation -

Seismic Isolation System

Procurement Plan

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Procurement Sensitive Document-

Do Not Distribute

Outline

- **System Description and Status**
- **First Article Program and Production Schedule**
- **Procurement Plan**
- **HYTEC Contract Modification**
- **Summary**

Seismic Isolation: Subsystem Overview

- **Provides vibration-isolated mounting surfaces for all in-vacuum optical components**
- **Two types of seismic isolation stacks**
  - ››BSC Chambers (10 in WA, 5 in LA)
  - ››HAM Chambers (8 in WA, 4 in LA)
- **On critical path for detector installation**
  - ››Must be in place before anything else can be installed in vacuum
- **Most expensive detector subsystem**
  - ››Approximately $12 M (~20% of detector budget)

Seismic Isolation: System Status

- **Preliminary Design Review held 3/5/97**
  - ››HYTEC authorized to initiate final design of seismic isolation system
- **Tests of constrained-layer-damped metal springs continue to be promising**
  - ››All fabrication techniques developed
  - ››Load capacity, stiffness, damping
  - ››Acoustic transmission tests show adequate attenuation
    - — Tests for creep, creak to begin next week
- **Final design/fabrication plan reworked (using vendor estimates of fabrication times) to include first article fabrication and testing**

First Article: Goals

- **Reduce design risk before starting full fabrication**
  - ››Test actuators for smooth operation
  - ››Check for fit - eliminate interferences
  - ››Test assembly tooling and fixtures
- **Gain assembly experience early**
  - ››Train staff that will be installing seismic isolation system before starting real installation
- **Fabricate 1 stack of each type for testing plus some long-lead items for additional stacks with early need dates**
  - ››1 BSC stack for testing
  - ››1 HAM stack for testing
  - ››Long-lead (and low-risk) components for 2 additional HAM stacks

Seismic Isolation: Schedule

- **Complete First Article fabrication drawings and review - June/July 97**
- **Issue RFQ's for First Article - June/July 97**
- **Issue contracts for fabrication - Aug 97**
- **Begin First Article assembly - Nov 97**
- **First Article test complete - Jan 98**
- **Rework HAM First Articles (if needed) - Feb/Mar 98**
- **Final design review - Mar 98**
- **Issue final production awards - Apr/May 98**
- **Start First Article installation - Apr 98**
- **Start production stack installation - Oct 98**

Overall Procurement Summary

Element	First Article Cost		Production Cost	Procured By	Procurement Type
Bellows	1 BSC 1 HAM	$70 k	$500 k	Caltech	Build-to-Print w/ priced Option
Metal Springs	420 springs	$150 k	$850 k	Caltech	Build-to-Print w/ priced Option
Optical Tables	1 BSC 3 HAM	$40 k $50 k	$305 k	Caltech	Build-to-Print w/ priced Option
Actuators	1 BSC 1 HAM	$185 k $110 k	$2,600 k	HYTEC (First Art) /Caltech (Prod.)	Multiple POs (Catalog Items)
Stack Hardware	1 BSC 3 HAM	$85 k $185 k	1,340 k	HYTEC (First Art) /Caltech (Prod.)	Build-to-Print Contract
Non-vacuum Hardware	1 BSC 3 HAM	$20 k $60 k	$390 k	HYTEC (First Art) /Caltech (Prod.)	Build-to-Print Contract
Vacuum Support Hardware	1 BSC 3 HAM	$35 k $55 k	$510 k	HYTEC (First Art) /Caltech (Prod.)	Build-to-Print Contract
Assembly Fixturing	1 BSC 1 HAM	$100 k $100 k	$200 k	HYTEC (First Art) /Caltech (Prod.)	Build-to-Print Contract

LIGO

Procurement Plan: Bellows

- **LIGO requirement for range exceeds normal industry practice**
- **Several vendors contacted by HYTEC to solicit prototype**
- **Only one vendor (Senior Flexonics) would fabricate to LIGO requirements**
- **Prototype unit on order (by HYTEC)**
- **Plan: Caltech to issue RFQ for First Article (8 bellows) with priced Option for 124 additional units**
  - ››Will send RFQ to multiple vendors
  - ››Possible that only Senior Flexonics will respond
- **Award First Article contract Aug 97**
- **Exercise production Option Jan 98**

Procurement Plan: Metal Springs

- **Significant development effort to date to define manufacturing processes and to train vendor in manufacturing technique**
- **Only one vendor (Pegasus) qualified**
- **6 prototypes fabricated to date (HYTEC contract)**
- **Plan: Caltech to issue RFQ for pre-production run (420 springs) with priced Option for 3400 additional units**
  - ››Sole source based on time required to develop alternates
- **Award First Article contract Aug 97**
- **Depending on Option price (HYTEC has developed independent target price), begin development of second source**
- **Exercise Option Jan 98, or rebid**

Procurement Plan: Optical Tables

- **HYTEC/Caltech in process of qualifying multiple vendors (weld specimens, cleaning techniques, etc.)**
- **Important to stay with qualified vendor after First Article test; not enough time to requalify/rebid**
- **Plan: Caltech to issue RFQ for First Article (1 BSC, 3 HAMs) with priced Option for remaining units**
  - ››Will send RFQ to multiple vendors
  - ››Expect multiple bids
- **Award First Article contract - Aug 97**
- **Exercise production Option - Mar 98**

Procurement Plan: Actuators

- **Almost all actuator components are commercial catalog items**
- **Multiple vendors**
- **Will purchase on standard P.O.'s**
- **HYTEC to specify as part of design and to procure First Articles for test**
- **Caltech to purchase all remaining production units**

Procurement Plan: Hardware and Fixturing

- **Includes stack hardware, non-vacuum hardware, vacuum support hardware and assembly fixturing**
- **All to be fabricated via competitive build-to-print contracts**
- **No special need to continue with the First Article vendor for production units**
- **Plan: HYTEC to issue First Article fabrication contracts (at least 4) - Aug 97**
- **Caltech to bid and award production contracts - Apr/May 98**

HYTEC

- **Original LIGO contract to investigate damped metal springs**
- **Based on success, expanded to provide engineering support services for seismic isolation design, fabrication, test**
- **Experienced with similar problems**
  - ››Bill Miller, President
    - — Sr. Mechanical Engineer-Los Alamos National Lab (>20 years)
    - — Experience with highly stable, low vibration opto-mechanical structures for Laser Fusion
  - ››Tim Thompson
    - — Mechanical Engineering Group Leader at LANL
    - — Expert in precision mechanical structures and mechanisms
  - ››Eric Ponslet
    - — Ph. D. Mechanical Engineering
    - — Led damped metal spring development effort

HYTEC Contract: Proposed Modification

- **Builds on experience of HYTEC with LIGO seismic isolation system and similar projects at LANL**
- **Adds labor for First Article fabrication and testing**
- **Adds labor for assembly fixture design, build and test**
- **Adds labor for manufacturing oversight and installation support**
- **Adds funds for First Article procurements to be done by HYTEC**
- **Current Contract $1865 k**
- **Proposed modification $1642 k**
  - ››Labor $708 k
  - ››Material $934 k

Summary

- **Seismic Isolation system design maturity permits First Article fabrication and test**
  - ››Reduces design and performance risk
  - ››Reduces cost uncertainty
  - ››Gain assembly experience early to reduce schedule risk during integration
- **Procurement plan developed to:**
  - ››Move quickly on critical path subsystem
  - ››Preserve competitive bidding
  - ››Allow development of second sources if needed
- **What do we want?**
  - ››Approval of HYTEC contract modification
  - ››Comments and suggestions about overall procurement plan - any NSF concerns?
  - ››Advice on NSF approval process for First Article and production subcontracts