PRESENTATION TO NSF

FOR

VACUUM EQUIPMENT PROCUREMENT APPROVAL

March 16, 1995

LIGO-G950008-00-V

Vacuum Equipment Procurement

Gerry Stapfer
John Worden

LIGO

AGENDA

- OVERVIEW
- DESCRIPTION OF VACUUM EQUIPMENT
- TECHNICAL SPECIFICATION
- PROCUREMENT STRATEGY
- PHASE-A SELECTION
  - APPROACH
  - EVALUATION
  - SELECTION
- SCHEDULE
- REVIEWS AND RECOMMENDATION

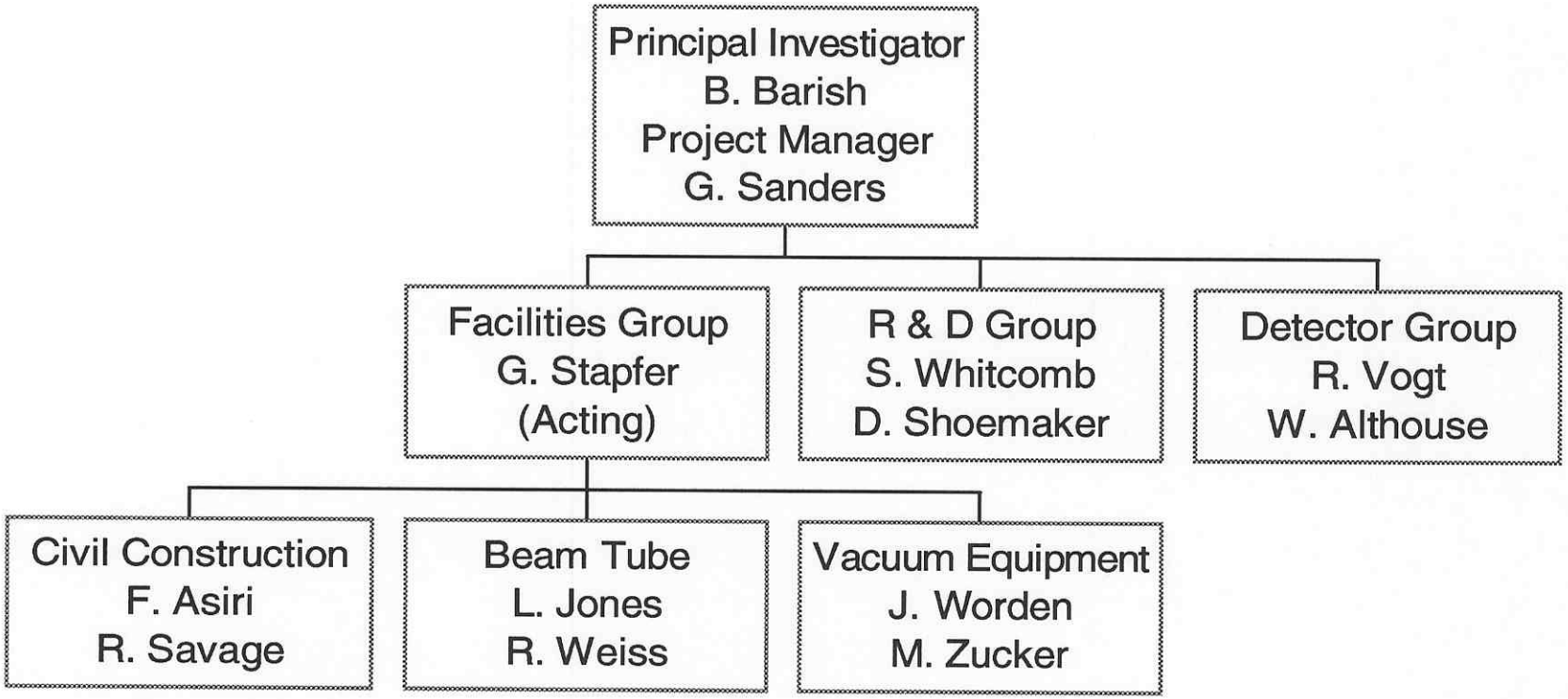
OVERVIEW

OBJECTIVE

- TO SUMMARIZE AND REVIEW :
  - THE PRODUCT
  - THE PROCUREMENT STRATEGY,
  - SPECIFIC APPROACH,
  - CURRENT STATUS AND
  - CONTRACTOR SELECTION
- TO FACILITATE AND AID THE NSF APPROVAL PROCESS

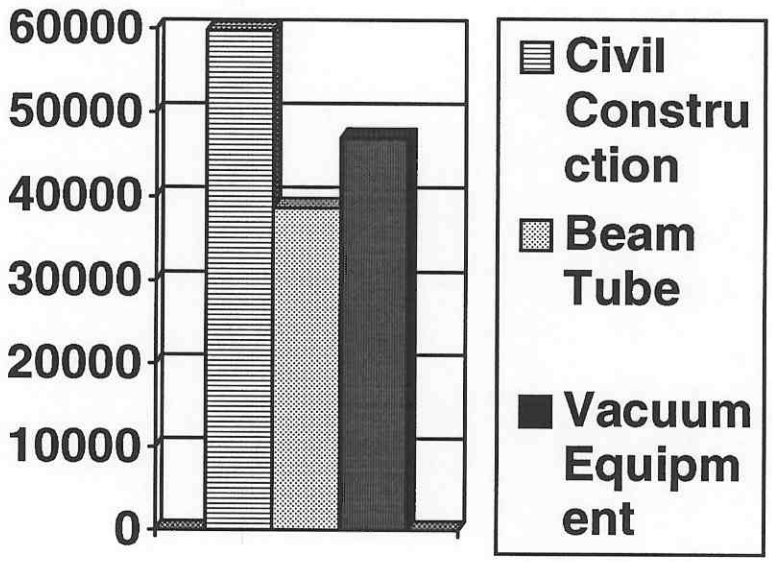
WERE WE BELONG

LIGO Project Organization



RELATIONSHIP TO OTHER PROCUREMENTS

- THE VACUUM EQUIPMENT CONTRACT IS A LARGE COMMITMENT FOR LIGO
- PHASE A CONTRACT IS A RELATIVELY SMALL PART OF THE OVERALL EFFORT
- ONE OF THE PHASE A CONTRACTORS WILL BE DOWN SELECTED TO PERFORM THE MUCH LARGER REMAINING PORTION OF THE EFFORT



WHAT ARE WE PROCURING?

- THIS PROCUREMENT PROVIDES ALL OF THE VACUUM EQUIPMENT FOR BOTH LIGO SITES
- THE PROCUREMENT IS IN TWO PHASES
  - PHASE-A, DESIGN PHASE
  - PHASE-B, FABRICATION /INSTALLATION PHASE
- PHASE-B WILL BE AWARDED TO ONE OF THE SELECTED PHASE-A CONTRACTORS

HOW DID WE GET HERE ?

• AUGUST 31, 1994	SCIENTIFIC REVIEW OF SPECIFICATION
• OCTOBER 6, 1994	SELECTION OF CONTRACTING MODE
• FALL 1994	PREPARATION OF RFP
• DECEMBER 2, 1994	RFP REVIEW
• DECEMBER 8, 1994	ISSUED RFP ~40 COMPANIES
• DECEMBER 16, 1994	BIDDERS CONFERENCE
• JANUARY 1995	EXTENDED DUE DATE TO FEB. 10, 1995
• FEBRUARY 10, 1995	RECEIVED PROPOSALS
• MARCH 7, 1995	REVIEW OF RECOMMENDATION
• MARCH 8, 1995	SOURCE SELECTION BOARD REVIEW AND APPROVAL

VACUUM EQUIPMENT

JOHN WORDEN

- Arrived LIGO Feb. 1994
- >2 years at SSCL as the lead vacuum engineer for Accelerator Systems Division.
  - Lead a group of engineers and designers in the design and procurement of vacuum systems for the LINAC, LEB, MEB, HEB, COLLIDER, including transfer and abort lines.
  - ~20km of conventional (warm) vacuum systems, ~80km of cryogenically pumped insulating vacuum, ~10,000 active components (pumps, gauges, valves).
  - ~26M dollar budget.
- 10 years at TRIUMF (worlds largest cyclotron in Vancouver, Canada)
  - Beamline Engineer and experimental area coordinator.
  - 6 month exchange visit to CERN to work with the PS Vacuum Group.

VACUUM SYSTEM

The LIGO Vacuum *System* (Vacuum Equipment + Beam Tubes) provides:

- A clear aperture for the interferometers.
- A clean environment for the precision optics.
- A low pressure in order to minimize diffraction and acoustic coupling.

The LIGO Vacuum *System* will be the world's largest high performance vacuum system with a pumped volume of roughly 20,000 m^3.

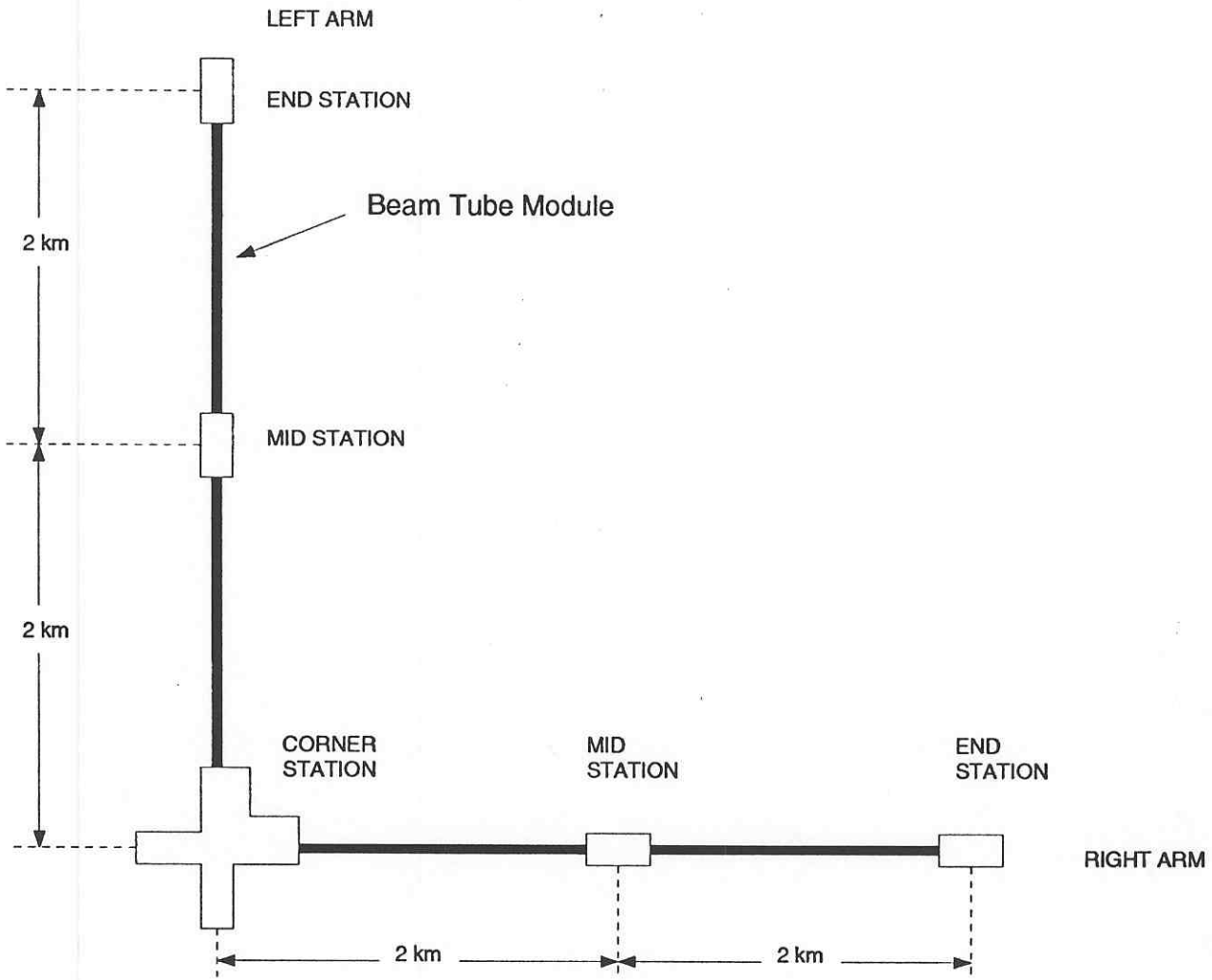


Figure 1. LIGO Geometry

VACUUM EQUIPMENT

The LIGO Vacuum Equipment will be a robust, conservative design in order to operate reliably 24 hours per day, year round.

- Designed for operation until 2001 without modification.
  - 2 interferometers in WA and 1 in LA.
- Advanced interferometers may required improved vacuum performance:
  - Obtained by adding getter pumps to existing ports. Very low impact.
- Future interferometers will require:
  - Additional chambers, tubes, pumps, valves.

VACUUM EQUIPMENT

The LIGO Vacuum Equipment (located in the corner, mid, and end stations) consists of six subsystems:

- Vacuum envelope (all stainless steel)- 34 large chambers, ~1000 feet of 72 inch, 48 inch, 30 inch vacuum pipe, ~100 large diameter bellows and >200 large flange connections, ~1000 smaller flanged connections.
- Pumping subsystem - 10 Roots pumping carts, 20 turbomolecular pump carts, 100 ion pumps, 12 large cryogenic pumps.
- Valve subsystem - 4x60 inch, 32x48 inch, ~100 x 10 inch gate valves, plus hundreds of small valves.
- Monitor and control subsystem - ~100 sets of gauges, ~200 valve controllers, 12 cryogenic pump controllers, 100 ion pump controllers...etc.
- Vent and purge subsystem - High purity air distribution system with 10 dry air compressors, 20 soft wall clean rooms (class 100)
- Bakeout subsystem - 10,000 square feet of heating and insulating blanket with >100 temperature controllers.

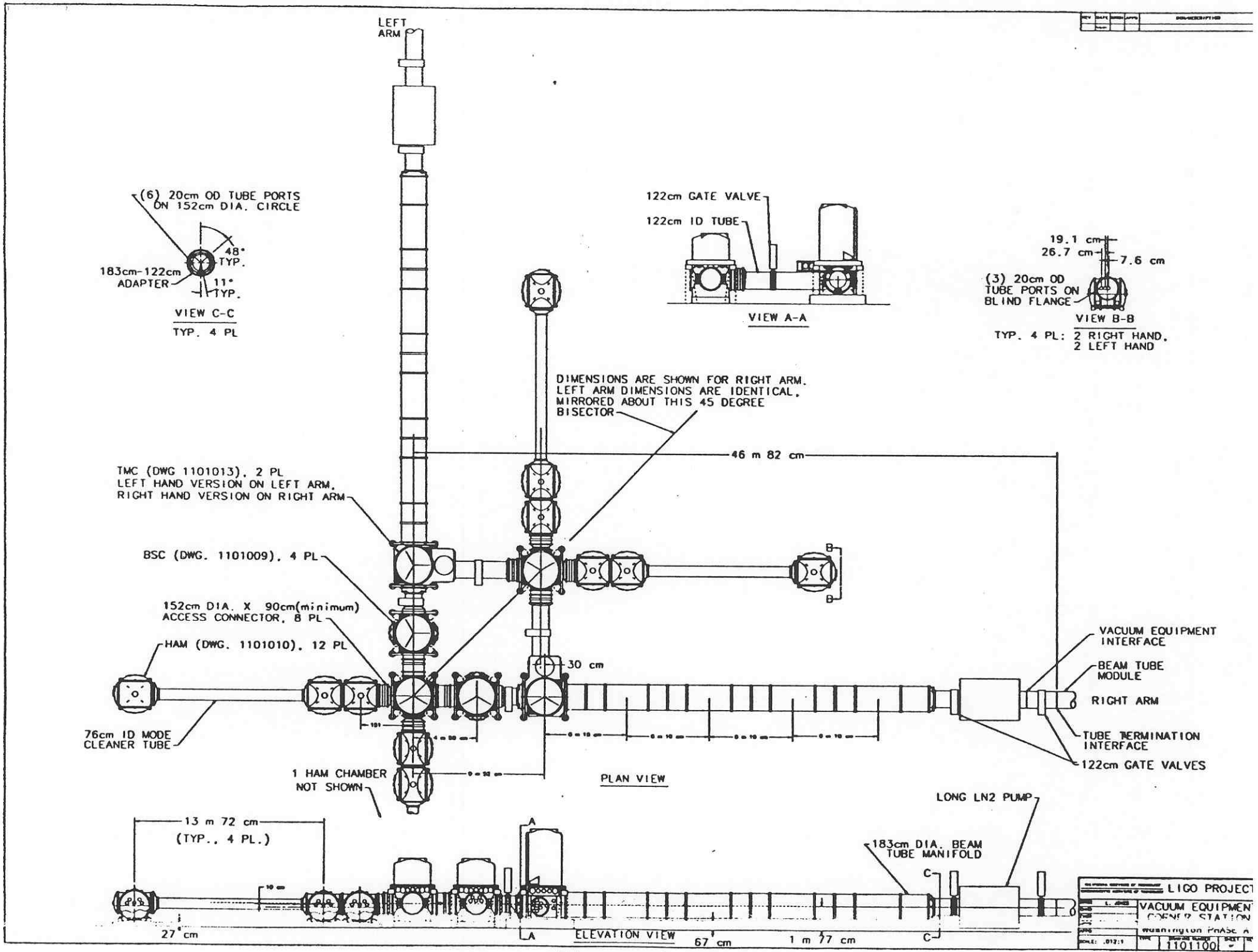
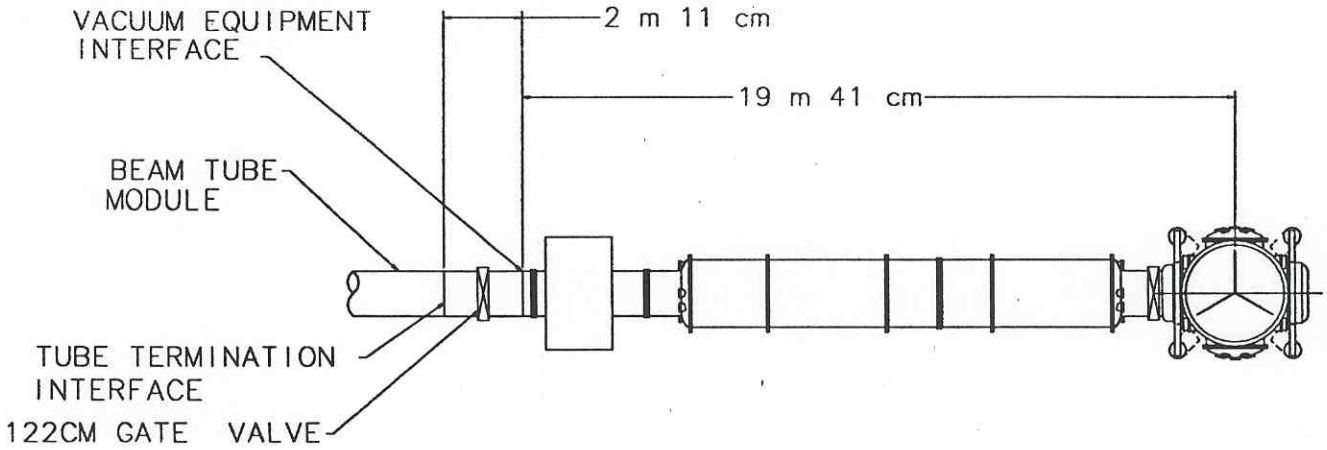
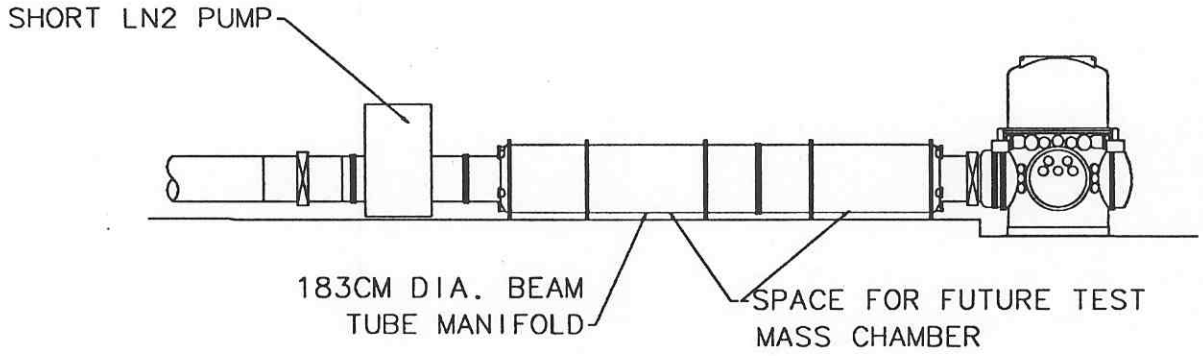

LEFT ARM
(6) 20cm OD TUBE PORTS ON 152cm DIA. CIRCLE
48° TYP.
183cm-122cm ADAPTER
11° TYP.
VIEW C-C
TYP. 4 PL
122cm GATE VALVE
122cm ID TUBE
VIEW A-A
19.1 cm
26.7 cm
7.6 cm
(3) 20cm OD TUBE PORTS ON BLIND FLANGE
VIEW B-B
TYP. 4 PL: 2 RIGHT HAND, 2 LEFT HAND
DIMENSIONS ARE SHOWN FOR RIGHT ARM. LEFT ARM DIMENSIONS ARE IDENTICAL, MIRRORED ABOUT THIS 45 DEGREE BISECTOR
46 m 82 cm
TMC (DWG 1101013), 2 PL LEFT HAND VERSION ON LEFT ARM, RIGHT HAND VERSION ON RIGHT ARM
BSC (DWG. 1101009), 4 PL
152cm DIA. X 90cm(minimum) ACCESS CONNECTOR, 8 PL
HAM (DWG. 1101010), 12 PL
30 cm
VACUUM EQUIPMENT INTERFACE
BEAM TUBE MODULE
RIGHT ARM
TUBE TERMINATION INTERFACE
122cm GATE VALVES
76cm ID MODE CLEANER TUBE
1 HAM CHAMBER NOT SHOWN
PLAN VIEW
LONG LN2 PUMP
13 m 72 cm
(TYP., 4 PL.)
183cm DIA. BEAM TUBE MANIFOLD
27 cm
ELEVATION VIEW
67 cm
1 m 77 cm
LIGO PROJECT
VACUUM EQUIPMENT
CORNER STATION
1101100

Figure 4.



PLAN VIEW



ELEVATION VIEW

END STATION

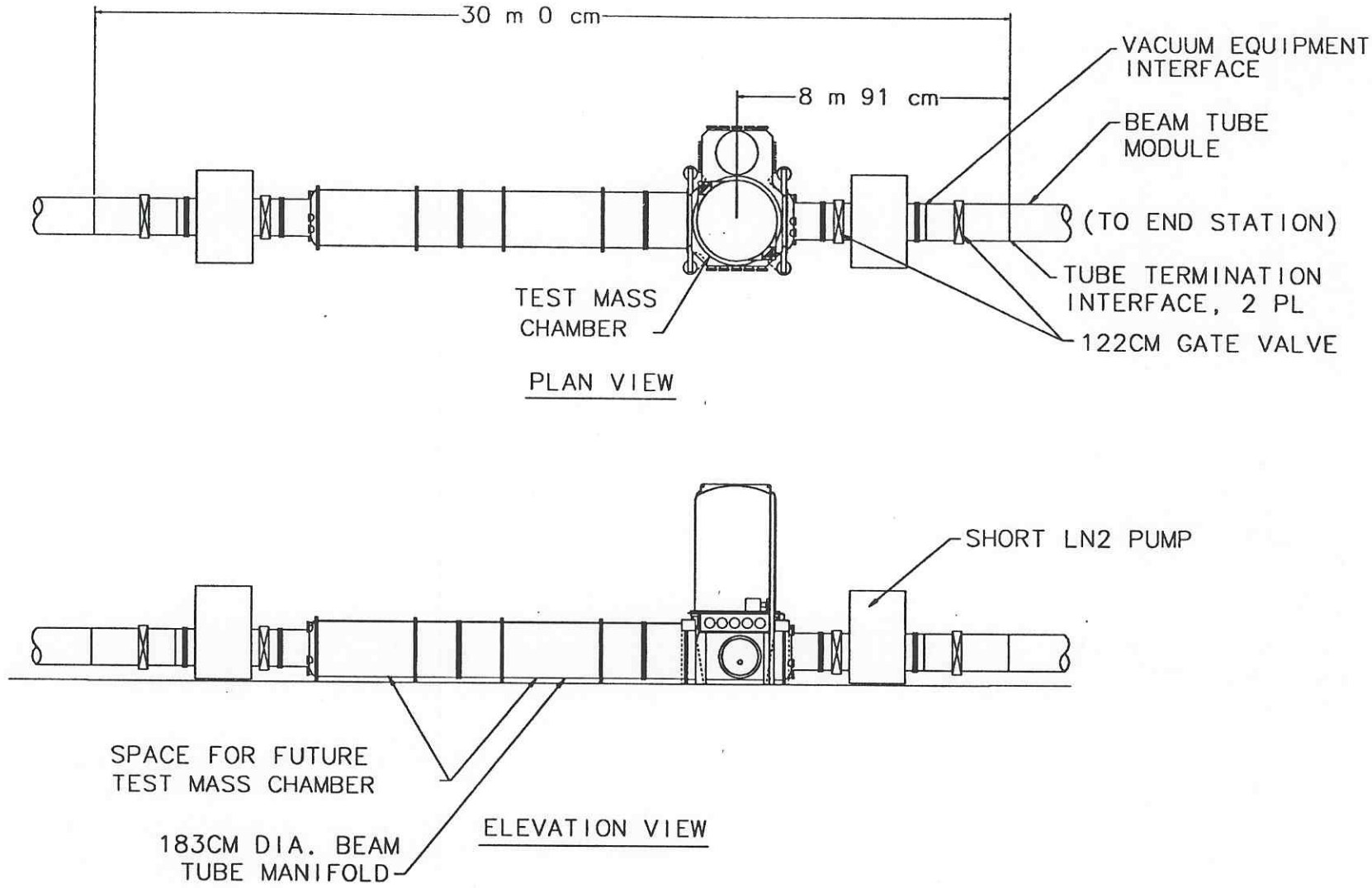
BOTH SITES

Figure 6.

LIGO PROJECT

VACUUM EQUIPMENT
END STATIONS

1101102



MID STATION WASHINGTON

LIGO PROJECT

VACUUM EQUIPMENT
MID STATION
Washington

1101103

Figure 7.

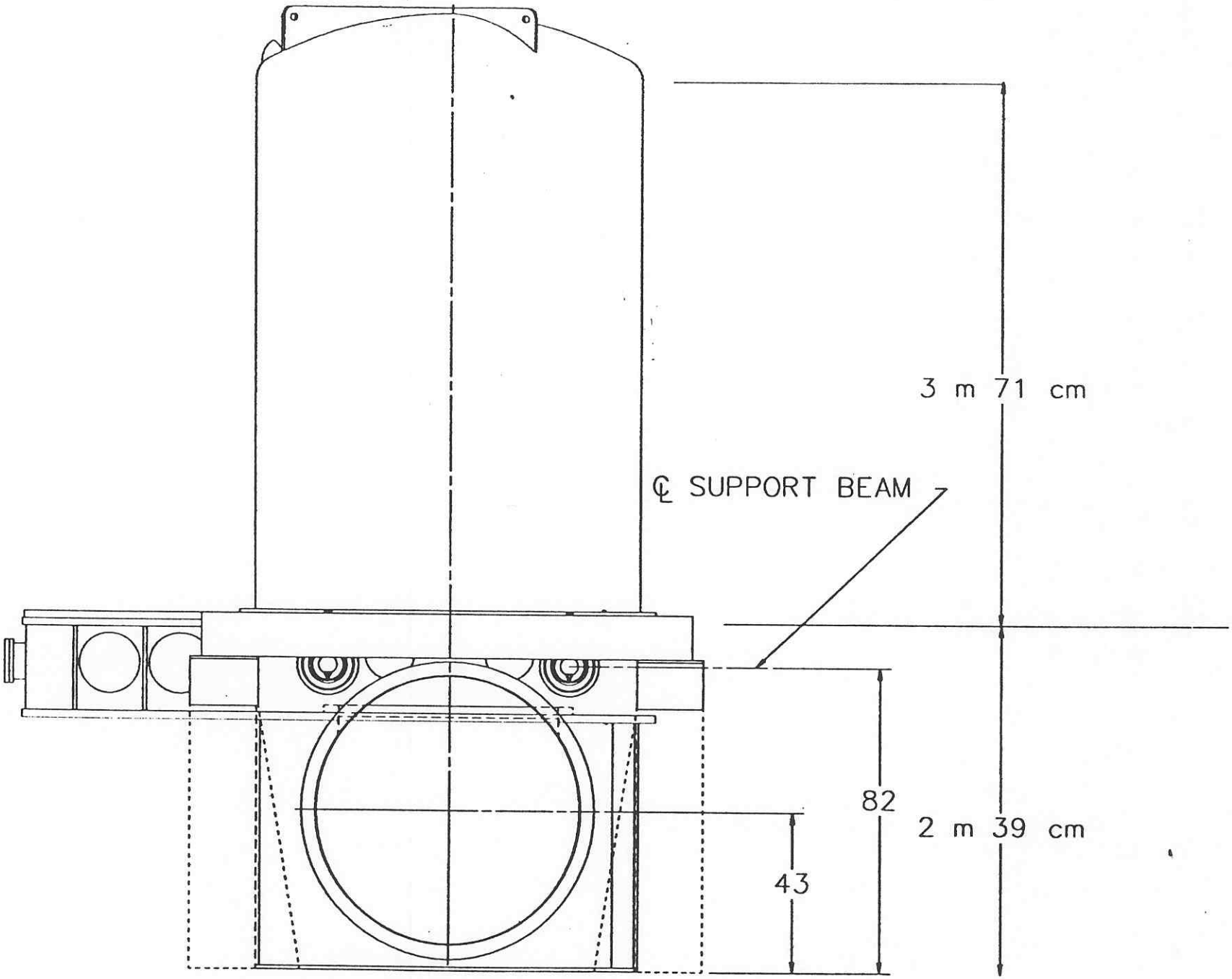
VACUUM ENVELOPE

Three types of chambers:

- Beam Splitter Chamber (BSC) - two functions - houses beam splitter mirrors and test masses.
- Test Mass Chamber (TMC) - houses retractable test masses.
- Horizontal Access Module (HAM) - houses input and output optics like mode cleaners.

Various tubes and bellows:

- 3 Diameters - 72 inch, 48 inch and 30 inch, for connecting chambers together into contiguous volumes.
- Many large bellows to allow expansion/contraction of connections.

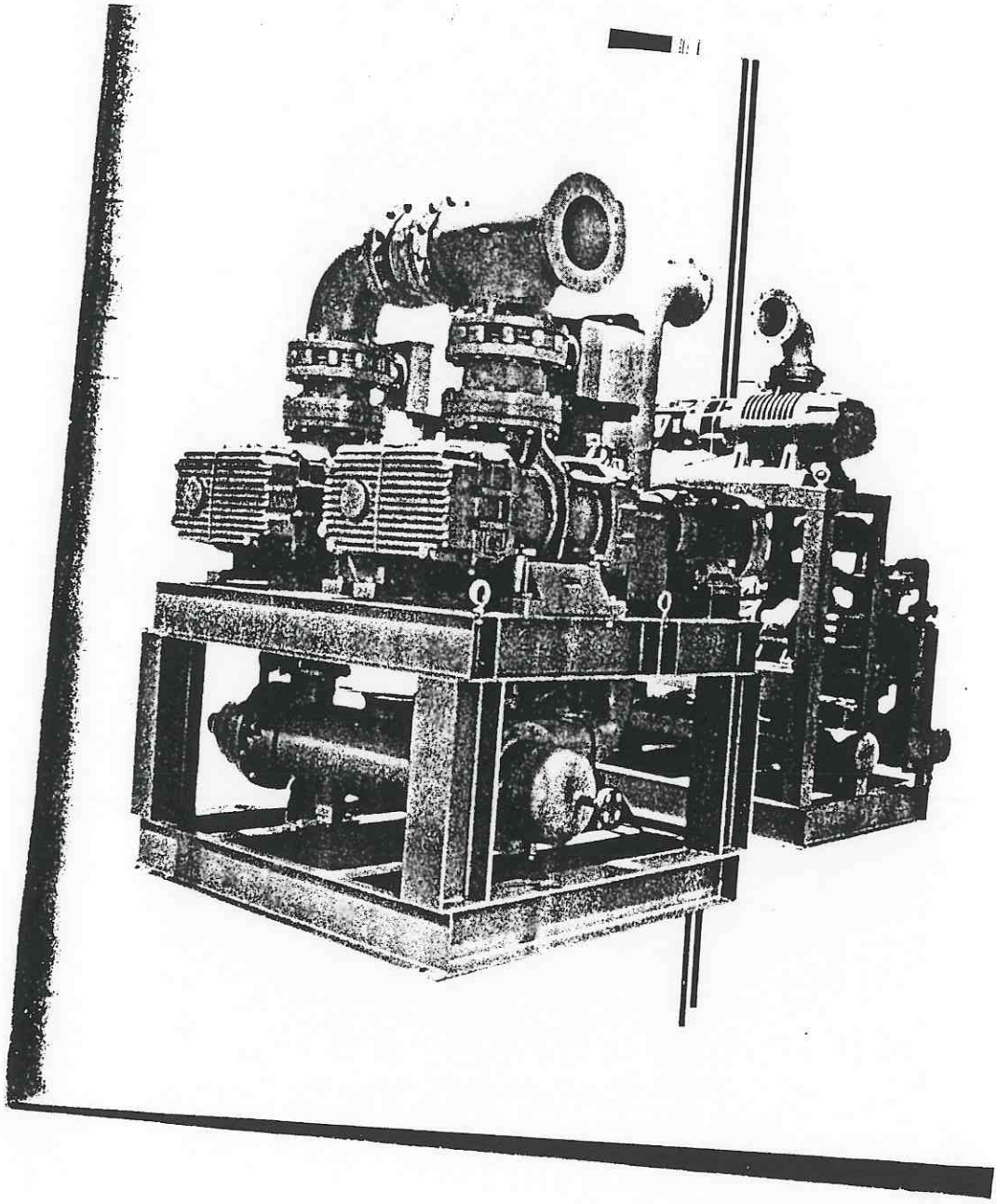


TMC Chamber

PUMPING SUBSYSTEM

Different types:

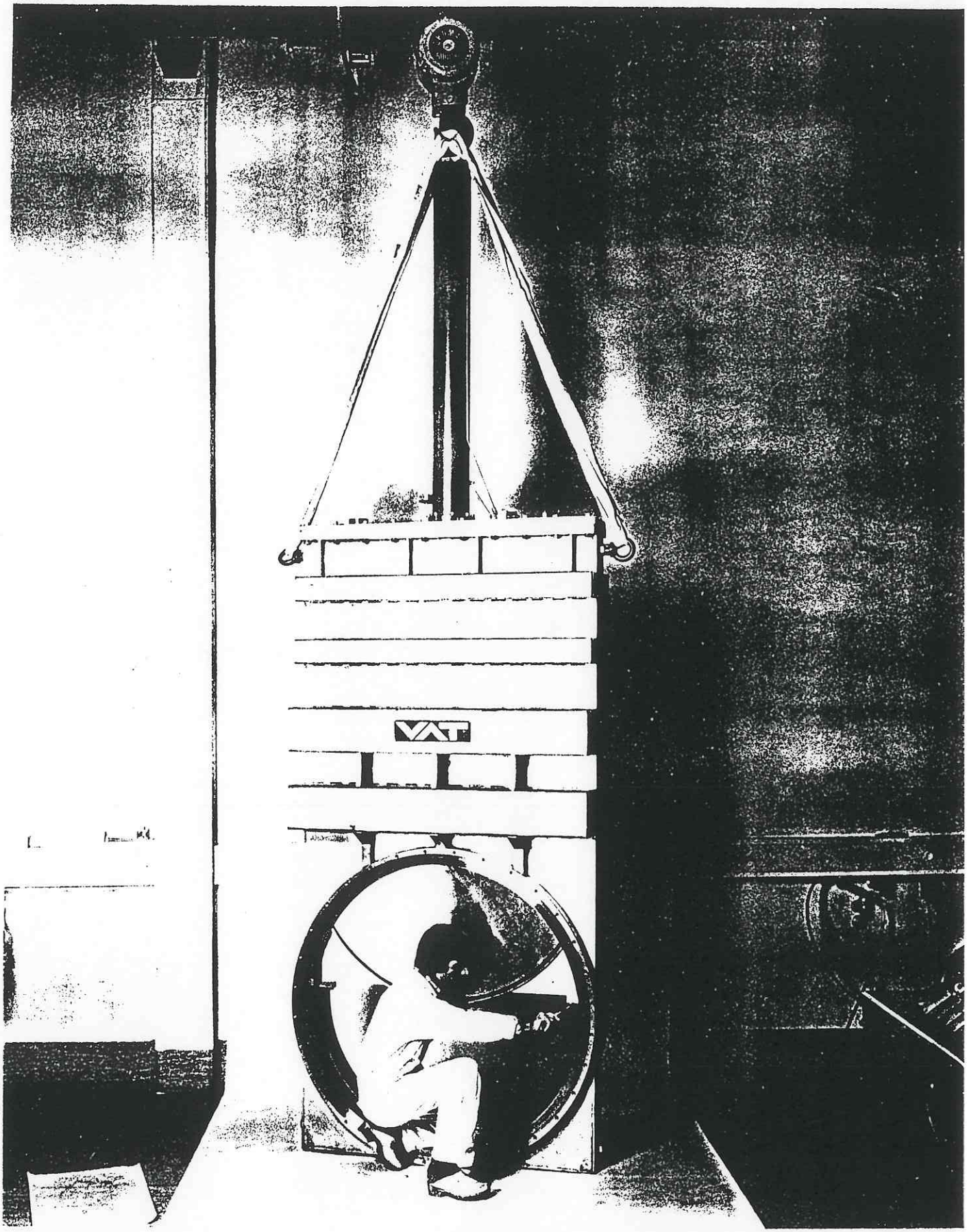
- First stage Roughing - from atmosphere to ~0.1 torr.
  - Roots blower pumps.
- Second stage Roughing - from 0.1 torr to 10^{-6} torr.
  - Turbomolecular pumps.
- Steady state - Ion/getter pumps - 10^{-6} torr and lower.
- Steady state - 80K pumps - cryo-pumps specifically for water vapor.
- Other - Annulus pump system, auxiliary turbo pumps.



VALVE SUBSYSTEM

Valves allow for the isolation and pumping of different volumes. Several sizes and types are needed:

- 60 inch gate valves - used in the TMC chamber.
- 48 inch gate valves - used to isolate interferometers from each other and to isolate the stations from the beam tube - for repair and maintenance of both interferometer and vacuum components.
- 10 inch gate valves - used to allow connection of roughing pumps.
- smaller valves - used for venting, purging, gauge mounting, annuli connections, etc.


VAT

SOW DELIVERABLES
Continued

3. Cost proposal - A fixed price proposal based on the technical and management proposal:
   - This is the cost for the design and build task at both sites (Phase B).

PROCUREMENT STRATEGY

APPROACH

- LISTED APPLICABLE STRATEGY APPROACHES
- REVIEWED APPROACHES
  - LIGO INTERNAL PROJECT REVIEW
  - REVIEW AND DISCUSSION BY OUTSIDE EXPERTS
- SELECTED OUR PREFERRED APPROACH:
  - TWO DESIGN CONTRACTORS
  - DOWN SELECT TO ONE FABRICATION/INSTALLATION CONTRACTOR

WHY TWO PHASES ?

A TWO PHASED PROCUREMENT STRATEGY WAS SELECTED TO:

- MAXIMIZE THE DESIGN INPUTS FROM TWO CONTRACTORS
- MAINTAIN THE COST COMPETITIVENESS AS LONG AS POSSIBLE
- MINIMIZE THE COST UNCERTAINTY FOR THE FABRICATION-INSTALLATION PHASE OF THE CONTRACT

DESIGN; PHASE A

- EACH CONTRACTOR DEVELOPS ITS OWN PRELIMINARY DESIGN
  - A FIXED PRICE OF $ 250K WAS DETERMINED TO BE ADEQUATE, BASED ON OUR IN-HOUSE ANALYSIS
  - ALL COMMUNICATION WITH THE CONTRACTORS WILL BE COMMON, WITH BOTH CONTRACTORS, TO ASSURE FAIRNESS

PHASE A DELIVERABLES

- ATTEND THREE UPDATE MEETINGS
  - KICK OFF MEETING, REQUIREMENTS UPDATE MEETINGS
- DELIVER A PRELIMINARY DESIGN OF THE VACUUM EQUIPMENT
  - SYSTEM SPECIFICATIONS, DRAWINGS, SCHEMATICS
- PROVIDE A PROJECT MANAGEMENT PLAN
  - DESCRIBING DESIGN, FABRICATION, INSTALLATION
- SUBMIT A FIXED PRICE PROPOSAL
  - FIRM FIXED PRICE PROPOSAL FOR PHASE B

DOWN SELECTION CRITERIA

THE DOWN SELECTION FOR PHASE-B WILL BE BASED ON THE DELIVERABLES RECEIVED AT THE END OF PHASE-A:

FROM THE RFP:

"THE SELECTION FOR PHASE B AWARD WILL BE BASED ON THE RELATIVE TECHNICAL MERITS OF THE PRELIMINARY DESIGN DELIVERABLES AND THE COST EFFECTIVENESS OF THE PROPOSED APPROACH FOR THE PHASE B IMPLEMENTATION."

PHASE A SCHEDULE

- KICK OFF MEETING
  - » BOTH CONTRACTORS WILL BE PROVIDED WITH THE SELECTION CRITERIA; 1 WEEK AFTER RECEIPT OF ORDER (ARO)
- UPDATE MEETINGS
  - » TWO MEETINGS ARE SCHEDULED TO PROVIDE UPDATED REQUIREMENTS AND OTHER PERTINENT INFORMATION TO THE CONTRACTORS (I MONTH AND 2 MONTH ARO)
- PRELIMINARY DESIGN REVIEWS
  - » A SEPARATE PDR IS SCHEDULED FOR EACH CONTRACTOR AT THE CONCLUSION OF THE PHASE A DESIGN (3 MONTHS ARO, SCHEDULED FOR JUNE 23 AND 24, 1995)

SELECTION OF PHASE A CONTRACTOR

RFP

- REVIEWS
  - INTERNAL LIGO PROJECT REVIEW
  - FORMAL REVIEW OF THE RFP WITH VACUUM EQUIPMENT REVIEW PANEL (DECEMBER 2, 1994)
- RFP SOLICITATION
  - COMPANIES WHICH HAVE EXPRESSED INTEREST IN THE PAST
  - COMPANIES CONTACTED DURING THE BEAM TUBE RFP SOLICITATION
  - SMALL & DISADVANTAGED COMPANIES IDENTIFIED FROM JPL FILES

RFP (CONT)

- ISSUED RFP
  - ISSUE DATE, DECEMBER 8, 1994
  - ISSUED TO 40 COMPANIES
- BIDDERS CONFERENCE
  - HELD ON DECEMBER 16, 1995
  - 24 COMPANIES ATTENDED
- RFP DUE DATE
  - ORIGINAL DUE DATE WAS JANUARY 23, 1995
  - DUE DATE WAS EXTENDED TO FEBRUARY 10, 1995

STATUS

- RECEIVED PROPOSALS
  - FOUR PROPOSALS WERE RECEIVED BY FEBRUARY 10, 1995
- EVALUATION OF PROPOSALS
  - THE EVALUATION COMMITTEE COMPLETED ITS EVALUATION BY MARCH 3, 1995
- REVIEW OF EVALUATION
  - THE REVIEW PANEL REVIEWED THE RECOMMENDATION OF THE EVALUATION COMMITTEE ON MARCH 7, 1995
- SOURCE SELECTION BOARD
  - THE SOURCE SELECTION BOARD MET ON MARCH 8, 1995
- SUPPORTING DOCUMENTATION
  - ADVANCE SUPPORTING DOCUMENTATION WAS SENT TO NSF ON MARCH 14, 1995

SELECTION PROCESS

FOLLOWED ESTABLISHED PROCESS FOR LIGO PROCUREMENTS:

- PROPOSALS ARE EVALUATED AGAINST PRE-ESTABLISHED CRITERIA BY A PROPOSAL EVALUATION COMMITTEE (PEP)
- THE PEP DELIBERATES ITS FINDINGS AND REACHES CONSENSUS, AND
- RECOMMENDS THE CONTRACTORS TO BE SELECTED FOR THE DESIGN PHASE.
- THE RECOMMENDATION IS REVIEWED BY THE VACUUM EQUIPMENT REVIEW PANEL AND IF CONCURRED, FORWARDED TO THE
- SOURCE EVALUATION BOARD (SEB), WHICH MAKES THE FINAL DECISION REGARDING THE PROCUREMENT

PROPOSAL EVALUATION COMMITTEE

- COMMITTEE MEMBERS
  - STAN WHITCOMB, LIGO, R&D GROUP LEADER (CHAIR)
  - KEN JOHNSON, JPL, GROUP SUPERVISOR SPACE SIMULATOR FACILITIES
  - IRENA PETRAC, LIGO, SUBCONTRACTS MANAGER
  - JOHN WORDEN, LIGO, VACUUM EQUIPMENT TASK LEADER
  - MIKE ZUCKER, LIGO, VACUUM EQUIPMENT COGNIZANT SCIENTIST

PANEL MEMBERS

- VACUUM EQUIPMENT REVIEW PANEL MEMBERS
  - FRED DYLLA, CEBAF
  - GENE GIBERSON, JPL, ASSISTANT LABORATORY DIRECTOR (RET)
  - YASMIN MERALI, CALTECH PROCUREMENT MANAGER (ACTING)
  - GERRY STAPFER, ACTING FACILITIES GROUP LEADER (CHAIR)
  - RAI WEISS, INTEGRATION SCIENTIST
  - NSF OBSERVER(S)

BOARD MEMBERS

- THE FOLLOWING ARE MEMBERS OF THE VACUUM EQUIPMENT SOURCE EVALUATION BOARD:
  - P. JENNINGS, CALTECH VP BUSINESS & FINANCE (CHAIR)
  - W. ALTHOUSE, DETECTOR DEPUTY GROUP LEADER
  - B. BARISH, PRINCIPAL INVESTIGATOR
  - S. POOL, CALTECH LEGAL COUNCIL
  - G. SANDERS, PROJECT MANAGER

PROPOSAL EVALUATION

- THE EVALUATION COMMITTEE COMPLETED THE FOLLOWING TASKS:
  - IDENTIFY STRENGTHS AND WEAKNESSES BASED ON STANDARD TEMPLATE
  - INDIVIDUALLY SCORED
  - CONSENSUS SCORE
  - RECOMMEND SELECTION

PROPOSAL ADEQUACY

ARE FOUR PROPOSALS ADEQUATE TO MAKE THE SELECTION?

- WE EXPECTED BETWEEN THREE TO SIX PROPOSALS
- WE RECEIVED FOUR PROPOSALS FOR THE BEAM TUBE
- A LARGE NUMBER OF CONTRACTORS ATTENDED THE BIDDERS CONFERENCE, MOST OF THESE WERE COMPONENT MANUFACTURERS, THUS NOT ELIGIBLE TO PROPOSE INDEPENDENTLY
- INQUIRIES REVEALED THAT NONE OF THE "NO BID" CONTRACTORS DECLINED DUE TO OUR ACQUISITION STRATEGY

THE FOUR PROPOSALS RECEIVED ARE ADEQUATE TO MAKE THE SELECTION

PROPOSAL EVALUATION

- FOUR PROPOSALS WERE EVALUATED BY THE EVALUATION COMMITTEE:
  - CHICAGO BRIDGE AND IRON (CBI)
  - HITACHI ZOSEN CORPORATION
  - LOCKHEED MISSILES AND SPACE COMPANY (LMSC)
  - PROCESS SYSTEMS INTERNATIONAL (PSI)
- ALL FOUR PROPOSALS WERE JUDGED TO BE RESPONSIVE

EVALUATION CRITERIA

• UNDERSTANDING OF REQUIREMENTS	25PTS
• ORGANIZATION AND RESOURCES	25PTS
• TECHNICAL APPROACH	25PTS
• MANAGEMENT APPROACH	15PTS
• PRICING	10PTS

TOTAL SCORE	100PTS

PROCESS SYSTEMS INTERNATIONAL

- RANK 1 ST.
- STRENGTHS
  - VERY GOOD UNDERSTANDING OF REQUIREMENTS
  - SUITABLE FACILITIES AND PERSONNEL SKILLS
  - GOOD TECHNICAL APPROACH
  - SYSTEMATIC MANAGEMENT APPROACH
  - COMPLETE AND REALISTIC BUDGET ESTIMATES
- WEAKNESSES
  - NONE IDENTIFIED

CHICAGO BRIDGE AND IRON

- RANK 2 ND
- STRENGTHS
  - GOOD UNDERSTANDING OF LIGO REQUIREMENTS
  - SUITABLE TECHNICAL APPROACH
  - SYSTEMATIC, SOLID MANAGEMENT APPROACH
  - REALISTIC BUDGETARY ESTIMATES
- WEAKNESSES
  - LIMITED VACUUM EXPERIENCE OF KEY PERSONNEL

LOCKHEED MISSILE & SPACE COMPANY

- RANK 3 RD
- STRENGTHS
  - GOOD UNDERSTANDING OF REQUIREMENTS
  - SIGNIFICANT "TURNKEY' PROJECT EXPERIENCE
  - RIGOROUS MANAGEMENT APPROACH
- WEAKNESSES
  - SIGNIFICANT DEFECTS IN TECHNICAL APPROACH
  - LIMITED PRICING DETAILS AND LACK OF REALISM

HITACHI ZOSEN CORPORATION

- RANK 4 TH.
- STRENGTHS
  - EXTENSIVE CORPORATE RESOURCES
- WEAKNESSES
  - NO KEY PERSONNEL IDENTIFIED
  - MANAGEMENT APPROACH NOT SUFFICIENTLY DETAILED
  - INSUFFICIENT PRICING INFORMATION

PAST PERFORMANCE

- PROCESS SYSTEMS INTERNATIONAL
  - 25 kW CRYO-PLANT ISABELLE (BNL)
  - 4500 W 4K CRYO-PLANT (SSCL)
  - CRYO-COMPONENTS (CEBAF)
- CHICAGO BRIDGE & IRON
  - 50 FT DIA HIGH PERFORMANCE VACUUM VESSEL (HELSTF)
  - LARGE CAVITATION CHANNEL TEST FACILITY (NAVY)
- LOCKHEED MISSILE & SPACE COMPANY
  - UNDERGROUND NUCLEAR WEAPONS TEST PROGRAM (DNA)
- HITACHI ZOSEN
  - JAPANESE GRAVITY WAVE PROJECT (ALL ALUMINUM)

FINANCIAL ADEQUACY

- PROCESS SYSTEMS INTERNATIONAL
  - PARENT COMPANY IS CHART INDUSTRIES INC. SALES OF $80-100 M DURING PAST THREE YEARS
  - PARENT COMPANY IS WILLING TO GUARANTEE THE PERFORMANCE OF PROCESS SYSTEMS INTERNATIONAL
- CHICAGO BRIDGE & IRON
  - LARGE INTERNATIONAL COMPANY; GROSS ANNUAL SALES IN EXCESS OF $100 M
- LOCKHEED MISSILE & SPACE COMPANY
  - LARGE AEROSPACE COMPANY; GROSS ANNUAL SALES IN EXCESS OF $100 M
- HITACHI ZOSEN
  - LARGE INTERNATIONAL CONGLOMERATE; ANNUAL SALES IN EXCESS OF $100 M

SCHEDULES

NEXT STEPS

- BEGIN DESIGN COMPETITION
  - GOAL MARCH 23, 1995
- CONDUCT PRELIMINARY DESIGN REVIEW
  - JUNE 23-24, 1995
  - INCLUDES AN FFP PROPOSAL FOR PHASE B
- SELECT PHASE B CONTRACTOR
  - JULY 1995

RELATION TO A&E

THE CONCEPTUAL DESIGN FOR THE LIGO FACILITIES, INCLUDING THE TRADE STUDIES, WILL BE COMPLETED BY JUNE 30, 1995

- THE A&E DESIGN ACTIVITY INCREASES SHARPLY AT THIS JUNCTURE, AS THE DETAILED DESIGN IS INITIATED
- THE VACUUM EQUIPMENT DESIGN IS A CRITICAL INPUT TO THE A&E DESIGN
- THE PRELIMINARY DESIGN OF THE LIGO FACILITY DEPENDS ON THE COMPLETION OF THE VACUUM EQUIPMENT PRELIMINARY DESIGN (JUNE 23-24)
- SLIPPAGE OF A&E CONTRACT WOULD RESULT IN PROJECT END DATE SLIP AND INCREASED COST (STANDING ARMY)

REVIEWS AND RECOMMENDATION

VACUUM EQUIPMENT REVIEW

- VAC EQ REVIEW PANEL MET ON MARCH 7, 1995
- EVALUATION RESULTS WERE PRESENTED BY THE EVALUATION COMMITTEE
- AFTER DELIBERATION, THE PANEL MEMBERS UNANIMOUSLY CONCURRED WITH THE SELECTION AND ENDORSED THE RECOMMENDATION

SOURCE EVALUATION BOARD

- THE BOARD MET ON MARCH 8, 1995
- THE SELECTION RECOMMENDATION WAS REVIEWED
- THE BOARD AGREED TO AWARD THE VACUUM EQUIPMENT DESIGN CONTRACT TO:

PROCESS SYSTEMS INTERNATIONAL
AND
CHICAGO BRIDGE AND IRON

CONCLUSION

THE LIGO PROJECT RECOMMENDS THAT THE NATIONAL SCIENCE FOUNDATION APPROVE THE SELECTION OF:

PROCESS SYSTEMS INTERNATIONAL

AND

CHICAGO BRIDGE & IRON

TO CONDUCT THE VACUUM EQUIPMENT PHASE A DESIGN FOR LIGO

ISSUES

- HOW DOES LIGO
  - RETAIN COMPETITION
  - PRECLUDE A CONFLICT OF INTEREST
  - MAINTAIN FAIRNESS

- CBI IS UNDER CONTRACT FOR THE DESIGN AND QUALTEST PHASE OF THE BEAM TUBE
- CBI WILL BE NEGOTIATING OR BIDDING FOR THE FABRICATION AND INSTALLATION OF THE BEAM TUBE DURING THE DESIGN COMPETITION

CONFLICT OF INTEREST

- TO PRECLUDE ANY CONFLICT OF INTEREST LIGO WILL COMPLY WITH ALL FEDERAL AND CALTECH PROCUREMENT REGULATION:
  - MAINTAIN STRICT CONTROL OF COMPANY SENSITIVE INFORMATION
  - PROVIDE EQUAL ACCESS TO LIGO INFORMATION TO BOTH CONTRACTORS PRIOR TO DOWN SELECTION
  - CONDUCT CONTRACTOR MEETINGS ONLY WITH BOTH DESIGN CONTRACTORS PRESENT DURING THE COMPETITION PHASE

FAIRNESS

- FAIRNESS IN EVALUATION
  - THE COGNIZANT MANAGERS AND SCIENTISTS ARE DIFFERENT FOR THE BEAM TUBE AND THE VACUUM EQUIPMENT TASK
  - THE EVALUATION AND SELECTION PROCESS IS KEPT SEPARATE FOR THE DIFFERENT CONTRACTS
  - THE EVALUATION CRITERIA FOR PHASE B ARE ESTABLISHED PRIOR TO THE CONTRACT START
  - BOTH CONTRACTORS ARE FULLY APPRAISED AS TO WHAT THE EVALUATION CRITERIA ARE

COMPETITION

- THE SELECTED CONTRACTING MODE IS DESIGNED TO PROVIDE MAXIMUM COMPETITION FOR THE VACUUM EQUIPMENT PROCUREMENT
- IN THE EVENT THAT CBI SHOULD BE THE WINNER FOR BOTH CONTRACTS, THE COMPETITIVE NATURE OF THE DOWN SELECTION IS OUR BEST ASSURANCE THAT BOTH PROCUREMENTS ARE COST EFFECTIVE