GEM IN-92-9

GEM Magnet Acquisition Plan

GEM Project Department

May 8, 1992

Abstract:

This plan describes the procurement process for the solenoidal magnet of the GEM detector. Information is proprietary, not to be shared with industry. The plan follows the FAR requirements and describes the selection of one vendor for magnet design fabrication, assembly and installation. The plan was submitted to the DOE for approval on May 14, 1992.

Superconducting
Super Collider

2550 Beckleymeade Avenue
Dallas, TX 75237-3997
214 708 1036

Office of the Director

May 13, 1992

Mr. Joe Cipriano
Director, SSC Project Office
U. S. Department of Energy - SSC
Mail Stop 1025
Central Facility
2275 N. Hwy 77
Waxahachie, TX 75165

Subject: Request for Approval of the SSCL GEM Magnet Advanced Acquisition Plan

Reference: DOE Prime Contract No. DE-AC35-89ER40486 with Universities Research Association, Inc. (URA)

Dear Mr. Cipriano:

Forwarded herewith is the SSCL GEM Magnet Advanced Acquisition Plan (AAP) developed under FAR Part 7 and SSCL policy guidelines. The plan represents SSCL's formal statement of the acquisition strategy of the subject procurement.

The plan's Executive Summary summarizes the overall GEM Detector program while detailing the GEM Magnet program. The planned approach represents the combined efforts of the SSCL staff and GEM Collaboration and applies lessons learned from the Dipole acquisition and other large scale magnet procurements. Additionally, DOE SSCL Project Office representatives reviewed the draft document and agreed in principle with the plan's strategy.

Final approval for construction of the GEM Detector by the SSCL Director, acting wih the advice of the Program Advisory Committee, would follow given favorable reviews of the Technical Design Report and associated documents by the SSCL and DOE.

Because of the criticality of this procurement, your immediate attention and a high priority in the approval process is requested. Should you have questions, please refer them to the SSCL GEM Project Manager, Gary Sanders, at extension 6189.

Sincerely,

Roy F. Schwitters

RF/wrd
Enclosure
cc: R. Van Ness
S. Brumley
G. Provencher
CENF 92 4200 E D 0009

GEM MAGNET ACQUISITION PLAN

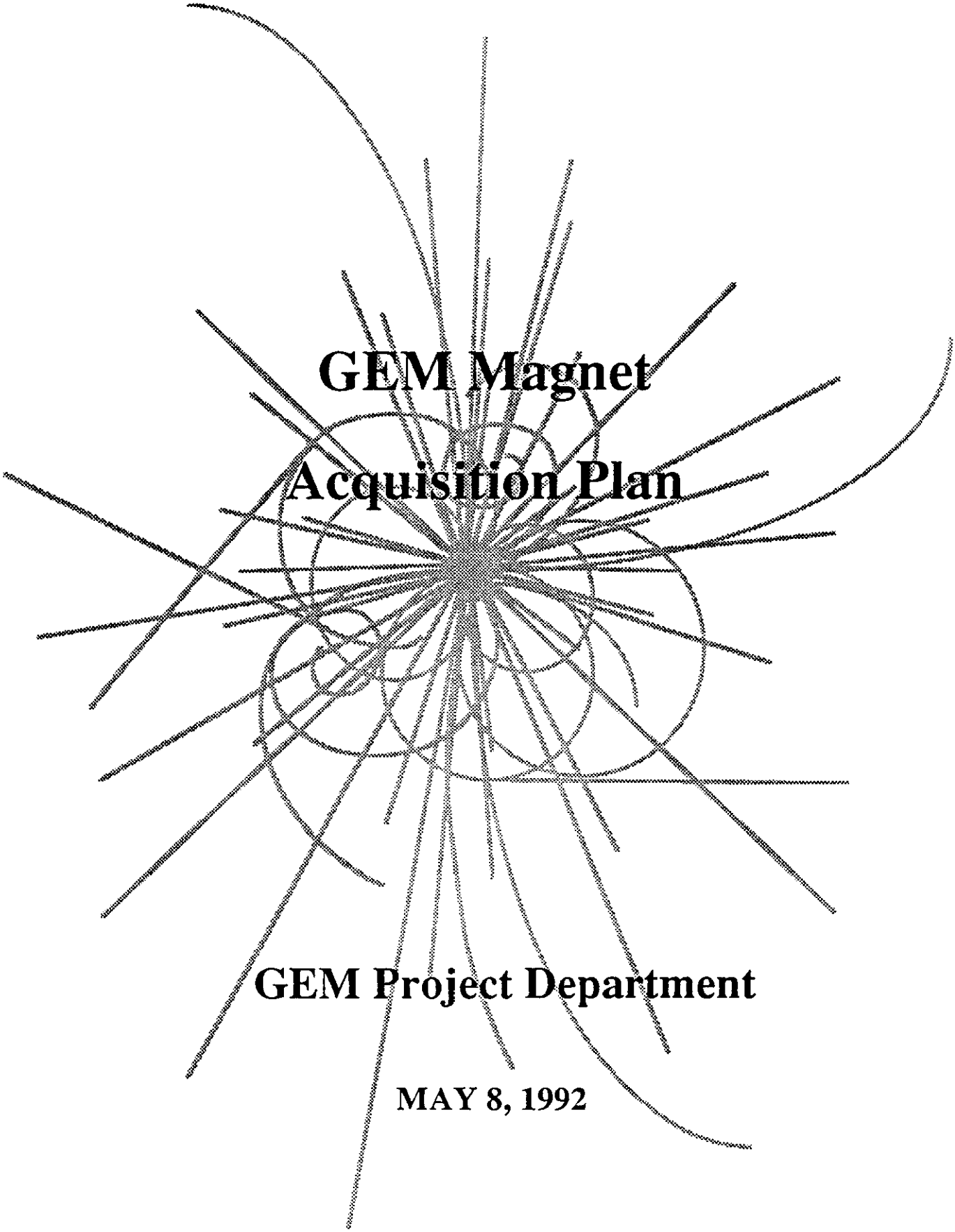
Routing Sheet

PERSON	*TITLE*	*STATUS*	*SIGNATURE*
Richard Fischer	GEM Business Manager	Review	Richard L. Fischer
Gary Sanders	GEM Project Manager	Approval	
Bill Davis	GEM Subcontract Admin	Review	
Fred Gilman	Physics Associate Dir.	Approval	Frederick J. Gilman
Charlie Dan	SSCL Procurement	Review	
for George Provencher	SSCL Procurement Dir.	Approval	
Steve Brumley	SSCL Legal Coun~~cil~~sel	Review	
Roy Schwitters	SSCL Director	Approval	

For the submittal of the GEM Detector Magnet Acquisition Plan to DOE on Friday, May 8, 1992

GEM Magnet

Acquisition Plan



GEM Project Department

MAY 8, 1992

TABLE OF CONTENTS

EXECUTIVE SUMMARY 1

a. Acquisition Background and Objectives 2
(1) Statement of Need 2
(2) Applicable Conditions 6
(3) Cost 6
(4) Capability or Performance 7
(5) Delivery or Performance Period Requirements 8
(6) Trade-Offs 10
(7) Risks 10
(8) Streamlining 10

b. Plan of Action 12
(1) Sources 12
(2) Competition 12
(3) Source Selection Procedures 13
(4) Contracting Considerations 14
(5) Budgeting and Funding 15
(6) Product Descriptions 16
(7) Priorities, Allocations, and Allotments 16
(8) Contractor vs. Government Performance 16
(9) Management Information Requirements 16
(10) Make or Buy 17
(11) Test and Evaluation 18
(12) Logistics 19
(13) Government-Furnished Property 21
(14) Government-Furnished Information 21
(15) Environmental Considerations. 21
(16) Security Considerations 22
(17) Other Considerations 22
(18) Milestones for the GEM Magnet Acquisition Cycle 22
(19) Identification of Participants in Acquisition Plan Preparation 23

Appendix A .....

EXECUTIVE SUMMARY

The Gammas, Electrons and Muons (GEM) Detector is one of the two major detectors planned to be on-line at commencement of Superconducting Super Colider (SSC) operations. The GEM Solenoidal Superconducting Magnet provides the magnetic field for tracking and the supporting structure for the other GEM Detector components; it therefore represents a fundamental item for the success of GEM Detector performance. As such, the magnet is the first major item on the critical path for the total detector project and for overall SSC operational availability for physics research.

The following sections contain descriptions of the detector and magnet and the role that they play in the overall SSC project. The GEM Detector is a design of the GEM Collaboration. Substantial research, development and actual product design work has been completed by the associated National Laboratories and collaboration members on the GEM Detector and specifically the GEM Magnet. In addition, the responsibility for the development and procurement of the critical superconducting conductor has been assumed by the SSC Laboratory. This material will be provided to the magnet fabricator by the SSCL as Government Furnished Material (GFM). Although the development effort is not yet complete, results to date and schedule considerations have indicated a current need for a partnership with industry for the completion of detail design and the fabrication and installation of the magnet subsystem.

Since the technical risk for the magnet is considered to be minimal and the required schedule is extremely tight, the SSCL believes that the project can be best accomplished by a single industrial subcontractor or joint venture working in concert with the National Laboratories and GEM Collaboration members.

The acquisition strategy proposed for the GEM Magnet is summarized below, in general conformance with Federal Acquisition Regulation (FAR) format and previously supplied DOE guidelines.

The SSCL intends to conduct a full and open competition and award a single subcontract to the successful offeror (single company, teaming arrangement or joint venture). Most of the contract funds will be expended under incentive-type cost-reimbursable contract line items that emphasize to the performing subcontractor the priority relationships between schedule, cost ,and technical performance.

SSCL and the GEM Collaboration will develop descriptive outlines for the magnet fabrication, assembly, installation and logistic support operations. These outlines will provide a framework for conceptual plans which will be developed by each offeror as a proposal requirement. The evaluation of these plans by the Source Selection Board (SSB) will provide important information related to each offeror's understanding of the overall scope of work required.

a. Acquisition Background and Objectives

(1) Statement of Need

The Superconducting Super Collider Laboratory (SSCL) is a high energy physics research facility being built by Universities Research Association (URA) in Ellis County, Texas, for the Department of Energy (DOE). The Supercollider is designed to produce reactions among the elementary constituents of matter at the highest possible energies. Results will be obtained by observing the head-on collisions of protons which are steered in two counter-rotating beams at nearly the speed of light around a 53 mile collider ring. These collisions will occur at an interaction region (IR) and be observed by complex and specially designed detectors. Data created as a result of reactions from a proton/proton collision are collected by several specifically designed detector systems and recorded for later analysis and study of the fundamental makeup of matter. The Gammas, Electrons and Muons (GEM) Detector at IR5 is one of two major detectors in underground halls on the east side of the ring planned to be on-line at commencement of SSC operations near the turn of the century.

The GEM Detector project, formed in mid-1991 by a collaboration of over 600 scientists and engineers from 85 institutions around the world, has submitted a Letter of Intent (LOI), which was subsequently approved, and is now drafting a Technical Design Report (TDR) for submission in late 1992. Approval for construction of the GEM Detector by the SSCL Director, acting with the advice of the Program Advisory Committee, would follow given favorable reviews of the TDR and associated documents by the SSCL and DOE.

The GEM Detector will observe gammas (photons) and electrons with a highly accurate electromagnetic calorimeter. The GEM design for muon measurement relies on tracking in a magnetic field outside of the calorimeter. High precision measurement of the muon momentum is attained by measuring the curvature over a 5 meter (m) track length in a magnetic volume. This design philosophy of an electromagnetic calorimeter in the center of a magnetic volume with 5 m minimum track length leads to the need for a very large electromagnet. Appendix A shows the complete GEM Detector with its major subsystems identified.

The GEM Collaboration is proposing a large superconducting solenoid with field shaping iron end poles. The magnet has been the subject of reviews organized by the Physics Research Division (PRD) of the SSCL, where international experts have pronounced the magnet design concept viable. The magnet represents an extrapolation of similar designs successfully operating in high energy physics. Within this concept the magnet would have a central magnetic field strength of 0.8 tesla (T), an outside diameter of 21.8 m, an inner diameter available for tracking and calorimetry of 18.0 m, an outside end-to-end length of 36.0 m and a coil length of 30.8 m. When complete it will be one of the largest magnets in the world. As a result of this physical size (see Figure 1 GEM Magnet Subsystem), significant amounts of on-site fabrication, sub-assembly and assembly are anticipated.

The primary requirement for the GEM Detector to be on-line at commencement of SSC operations places the GEM Detector Magnet Subsystem on the critical path of the GEM schedule. The GEM Detector is constructed on the beamline of the SSC and access to the detector will be extremely limited after the initiation of SSC operations. A significant amount of work will be required to install detector components following magnet installation. Because all of the other detector subsystems reside inside the magnet, it has to be the first item installed upon completion of the underground detector hall in early 1996. This in turn leads to a magnet subcontractor being selected in early 1993 to be able to start magnet coil winding and assembly on-site when the surface facilities at IR5 and IR8 are available in early 1994.

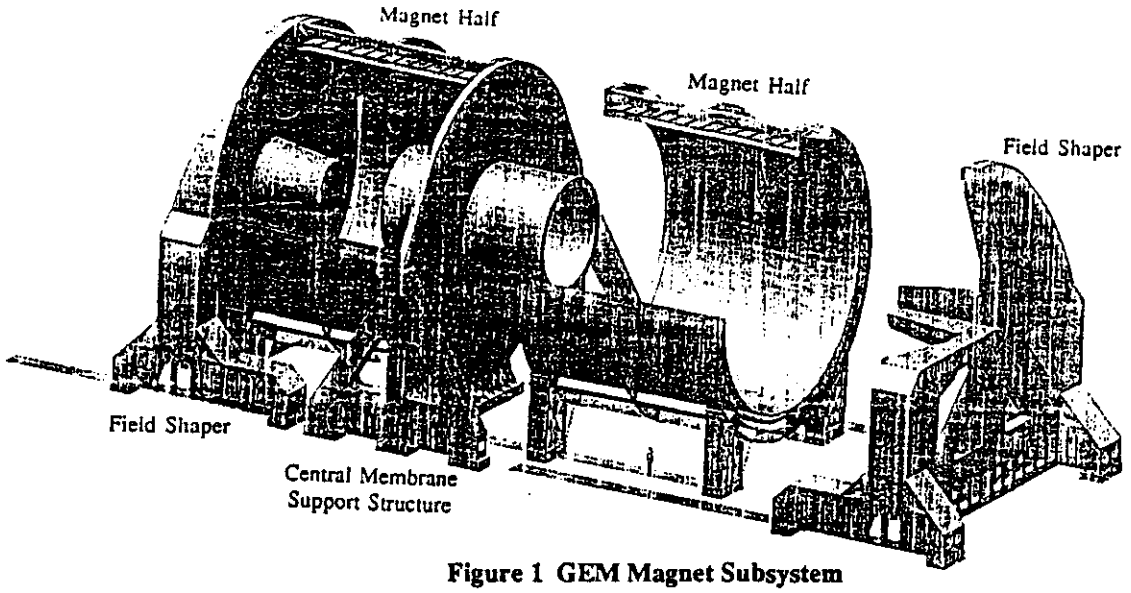


Figure 1 GEM Magnet Subsystem

Two R&D programs have been initiated by the SSCL with Lawrence Livermore National Laboratory (LLNL) and Massachusetts Institute of Technology, Plasma Fusion Center (MIT, PFC) involving the development of the magnet conceptual design, magnet conductor, and coil winding methods and tooling. These R&D programs were driven by the criticality of the schedule and will result in the following:

- Preliminary magnet design will be well developed before a subcontractor is selected.
- Superconducting conductor for the magnet windings will be developed and will be supplied to the subcontractor as Government Furnished Material (GFM).
- Coil winding concept will be partially developed, and some tooling will be supplied to the subcontractor as Government Furnished Equipment (GFE).

The SSCL intends to conduct a full and open competition and award a single subcontract to the successful offeror (single company, teaming arrangement or joint venture).

(i) Analysis of Acquisition Alternatives

Two reasonable alternative ways to acquire the GEM Magnet have been considered in detail. The two alternatives are analyzed here to determine the best overall solution relative to the three risk catagories of Technical Performance, Cost, and Schedule. These two alternatives were considered to be the only viable alternatives to adequately address the exact circumstances of the GEM Magnet acquisition.

The circumstances of this procurement lead the GEM Project Department (PD) to prioritize the risk catagories as follows:

1. Schedule Risk
2. Cost Risk
3. Technical Performance Risk

This ranking of risks is developed from several considerations. The GEM PD is committed to meeting the SSC commissioning date in 1999. To do so the GEM PD needs to follow an acquisition plan that minimizes schedule risk. By doing so it also should minimize cost risk. This magnet is technically straightforward and is not unlike other large superconducting magnets that have been built previously. The technology exists - the GEM Magnet is just much larger. Therefore, because the technical risks are relatively low with well understood technology, an acquisition plan to maximize technical innovation is not top priority. In addition, much of the

preliminary magnet design, winding development and some GFE tooling, and the magnet conductor procurement is being performed by SSCL/LLNL/MIT,PFC (the laboratories) and will be furnished to the magnet subcontractor. The following discussion of different acquisition alternatives will rank the risk catagories in the order of schedule, cost, and technical performance.

The two alternatives to be examined are: First, selecting one prime subcontractor to be responsible for all subcontract items - for final magnet design, procurement and fabrication, assembly, and installation and test. Second, having two prime subcontractors involved in the final magnet design and competitively down selecting to one prime for procurement and fabrication, assembly, and installation and test. These two alternatives will be discussed qualitatively and ranked. Then a comparison and conclusion will be made.

(ii) Single Design/Fabrication Subcontractor (1:1).

Schedule - The acquisition and installation of the GEM Magnet is on the critical path for commissioning the SSC. The use of a single subcontractor in partnership with the laboratories results in the shortest elapsed time to initiate start-up, program management, and systems engineering activities. In addition, to complete the detailed design and drawings, and place long lead tooling and materials on order, alternative 1:1 is considered to have the lowest schedule risk.

Cost - The 1:1 alternative provides the baseline cost estimate for the GEM Magnet. In discussing costs we will talk in terms of relative deltas of an alternative to the baseline. Therefore the 1:1 alternative has a cost delta of zero.

Technical Performance - This constraint is impacted by three factors - 1) adequate magnet design, 2) fabrication - high producibility and quality control, and 3) significant on-site assembly with associated logistics planning.

The first factor of technical performance is an adequate magnet design. With the laboratories performing much of the preliminary design prior to subcontract award, a concentrated and timely effort towards the transfer of this intellectual property and the completion of an adequate design is needed. The focused efforts of the laboratories with one industrial subcontractor offers a higher probability of timely and complete technology transfer rather than the spreading of effort to multiple subcontractors. Therefore, the first factor contributing to technical performance; i.e., adequate magnet design, has the lowest risk.

The second factor of technical performance - fabrication, is best addressed by a focused team effort. With an adequate magnet design, the development of the fabrication and quality assurance procedures is paramount. The focused attention of a single subcontractor in partnership with the laboratories provides the least risk to having the detailed procedures in place to produce a reliable GEM Magnet.

Third, due to the GEM Magnet's large physical size, much of the assembly area and logistics support infrastructure will have to be developed on-site at the SSC. The focused attention of a single subcontractor in partnership with the laboratories provides the least risk for developing the infrastructure needed to produce a reliable GEM Magnet.

Summarize 1:1 - The three constraints for the 1:1 alternative can be summarized as follows:

Schedule Risk	Medium
Cost Delta	$0
Technical Performance Risk	
- Design	Low
- Fabrication	Low
- On-site Assembly & Logistics	Low

(iii) Two Design/One Fabrication Subcontractors (2:1).

In addressing this approach, it is necessary to recognize there are certain potential advantages to carrying the competitive process through completion of final design. Enhanced cost realism and recognition of alternative design options are factors which could be realized from having two competitive design subcontractors.

Schedule - Two design subcontractors would have a negative impact on the program schedule. Two design subcontractors will increase the complexity of technology transfer from the laboratories to industry. Delaying selection of a magnet fabrication and assembly subcontractor until after the design phase would have a significant adverse impact on the start of long-lead procurement actions. The 2:1 approach would delay the program by 4 - 6 months, and potentially longer if significantly different coil winding approaches further impacted the procurement of long-lead coil winding tooling.

Cost - Two competitive design subcontractors could stimulate a reduction in cost during the final down-selection. However, there is a high initial investment to the project for a potential cost reduction in the final subcontract effort. It is not at all clear that the competitive proposals would reduce costs enough to make up for the cost of carrying an additional subcontractor, the cost of a delay in schedule, and the increased SSCL manpower cost to oversee two subcontractors. Also, the consequences of missing the SSC commissioning date are severe, and the costs to complete the GEM Detector after SSC commissioning increase significantly. Because of the well-understood technology, and the preliminary design work done by the laboratories, potential cost proposal reduction resulting from the competitive final design work should be minimal. The 2:1 approach is estimated to increase overall program costs by $5 to $10 million.

Technical Performance - The first factor of technical performance in the 2:1 alternative is an adequate magnet design. The GEM Magnet is not a technical design challenge, except for its physical size. Most of the design responsibility is resident in the laboratories through preliminary design. The competitive opportunities to improve on an adequate design are severely limited by the schedule. Incremental improvements can possibly be made, but only with additional unacceptable penalties to the schedule and cost constraints.

The second factor of technical performance in the 2:1 alternative is fabrication. Most of the fabrication and quality procedures will have to be developed. It is highly unlikely that a competitive design program can produce significantly improved procedures. With no preproduction program, etc. for verification of results, the 2:1 alternative is unlikely to produce any better results than the 1:1 alternative (since in that alternative, we will select the best industrial subcontractor).

Third, much of the assembly and logistics support will have to be developed in a new on-site infrastructure. Again, with no preproduction program, etc. for verification of results, it is highly unlikely that a competitive design program can produce an improved assembly and logistic support infrastructure.

Summarize 2:1 - The three constraints for the 2:1 alternative can be summarized as follows:

Schedule Risk	High
Cost Delta	$5 to$10 Million Increase
Technical Performance Risk	
- Design	Low
- Fabrication	Low
- On-site Assembly & Logistics	Low

(iv) Matrix Comparison and Conclusion

ALT	SCHEDULE RISK	COST DELTA ($M)	TECHNICAL PERFORMANCE RISK		
			DESIGN	FABRICATION	ON-SITE ASSY & LOGISTICS
1:1	Medium	0	Low	Low	Low
2:1	High	$5 to $10	Low	Low	Low

The alternative of one prime subcontractor or joint venture provides the best strategy for meeting the schedule, cost, and technical performance goals of the GEM PD and the SSCL.

(2) Applicable Conditions

The operational requirements for the GEM Detector are derived from the top level requirements for the SSC. These are delineated in the *System Specification (Level 1) for the Superconducting Super Collider, document E10-000001*, dated 2/14/92. In turn the GEM Magnet derives its requirements from the GEM Detector. The GEM Detector must be placed in series with the SSC Collider ring and must operate in conjunction with the collider. The contra-rotating collider beams pass through the detector, with collisions occurring at the detector center. The detector, and hence the magnet, must be designed to function correctly during all conditions of accelerator operations and must not produce adverse effects on proper operation of the collider. The detector and magnet must be complete and operational before proton beams can be delivered to the accelerator rings, and the magnet availability must be compatible with the overall availability required of the SSC.

The magnet completely surrounds the muon, calorimetry and tracking subsystems for the GEM Detector and provides the magnetic field needed by these subsystems to permit reconstruction of particle trajectories resulting from the proton beam collisions. Magnetic field strength, uniformity, direction, and location must all be compatible with and meet the requirements for these subsystems.

Orderly development of the GEM Magnet will be facilitated by application of sound Systems Engineering principles. Top level SSC requirements will be allocated to the GEM Detector and thence to the GEM Magnet by a careful "flow-down" analysis process. During this process, careful attention will be paid to cost and schedule constraints to assure that the magnet will not be "over-specified" by requirements in excess of GEM Detector requirements, that the magnet can be produced by experienced industrial firms, and that the magnet will meet the on-line performance and operational availability requirements laid down in the top level SSC system specification.

(3) Cost

The overall acquisition cost goal for the GEM Detector is $500M (FY91, including contingency). Within this context, the acquisition cost goal for the GEM Magnet subsystem is not greater than $120M (FY91, including contingency), which includes costs associated with R&D and conceptual/preliminary design performed by SSCL, LLNL, and MIT. This cost includes the superconducting solenoid with all auxiliary systems (power/protection, cryogenics, etc) and also the forward field shapers, and central detector support. For the proposed subcontractor Statement of Work (SOW), the cost goal is less than $70M (FY91). The cost estimates prepared by the laboratories and collaboration team, which have continued to show that the Magnet Subsystem total cost is within the $120M goal, also provide the basis for the subcontractor SOW cost goal; the cost estimates for the tasks in the subcontractor SOW were simply added up, and reasonable fees were applied to generate the cost goal.

(i) The life cycle cost (LCC) of the magnet subsystem is being considered in the design, but it appears to be dominated by the acquisition cost. The system is inherently inexpensive to operate, requiring relatively little electrical power, cryogens, and maintenance. The magnet is, however, the most important subsystem in the GEM Detector in determining the overall reliability of the detector. Since the magnet subsystem is a relatively simple system, with relatively few parts, reliability is, in fact, less of an issue for this system than for most others at the SSC (e.g. the collider dipoles). In any case, consideration of LCC issues is an important feature of the design, and estimates of the LCC are being made. The design team is striving to minimize the overall LCC, and will develop, as needed, parametric models to determine the expected operating costs, given specific design data.

(ii) Design-to-cost is a central feature of the entire GEM Detector, and is manifested clearly in the present magnet subsystem conceptual design. As discussed above, there is a clear cost goal for both the overall detector and the magnet subsystem, and the cost estimate for the magnet is maintained and updated as the design evolves to ensure that it remains below the target. Much of the preliminary design of the magnet subsystem will be complete by the time this procurement is ready to place, and for this reason, design-to-cost issues drive the laboratories team much more strongly than the subcontractor.

(4) Capability or Performance

The GEM Magnet subsystem must provide a stable, well-characterized, large-volume magnetic field to support the operation of the other detector subsystems. The central magnetic field strength, 0.8T, is modest in comparison with other large superconducting magnet systems, which have been operated at higher field strengths and in more difficult geometries. Because of its unusually large size, the magnet has a relatively high stored energy [2.5 gigajoules (GJ)] at full charge. Since this energy could cause significant damage if deposited in any component in an uncontrolled manner, excellent magnet stability and protection are key to overall success. This will require careful magnet construction, frequent in-process testing/verification, and excellent quality assurance. In addition, the large size of the magnet necessitates field-fabrication and field-assembly of many large and heavy components, some of which need to be clean, well-aligned, and mobile.

Careful construction and excellent quality assurance/quality control (QA/QC) will be important considerations of the proposed subcontract SOW. The subcontractor must have outstanding capabilities in this area. The construction of the coil subassemblies is a particularly critical area in this regard, since it is impossible to conduct reasonable and useful subassembly tests prior to overall system checkout and testing. A SSCL approved QA/QC program and implementation procedures must be established immediately to guide design and all component fabrication and assembly efforts. This program will be based on risk analysis, complexity, and unique attributes of the systems and components and will feature documented inspections of components at all successive stages of production. As defined in the quality program, workers will be trained and qualified for the work performed. Furthermore, the details of the fabrication procedure must be compatible with quality assurance procedures, and the subcontractor will be expected to provide expertise in this area during the engineering and planning phases. The subcontractor must provide the detailed procedures to validate the ongoing work, as well as the overall fabrication sequence. Quality assurance requirements will be passed down to all lower tier subcontractors and vendors, as directed by the quality assurance program and the contract.

Since careful construction is also vital to overall success of the GEM Magnet, the subcontractor must provide engineering, planning, and construction personnel who are experienced in the key areas. Coil production and assembly is one extremely important area where this experience is needed. An early focus in the subcontractor effort is on the development of the winding tooling. This tooling must be compatible with timely, accurate production of the coil modules, as well as with the required QA plan. The subcontractor must provide engineering design personnel who are experienced in this area.

Large-scale field construction is another important capability which is required. Most of the hardware required for the magnet subsystem is too large to be assembled off-site and then transported to the SSC. Instead, large components and subassemblies must be fabricated and assembled on-site. This activity requires engineering and planning personnel who are familiar with the complexities of large-scale on-site fabrication, rigging, installation and associated logistic support, so that activities can be carefully planned to minimize cost and schedule risks.

(5) Delivery or Performance Period Requirements

The IR5 underground experimental hall benefical occupancy date (BOD) is in April of 1996. The GEM Magnet will be the first detector subsystem to be installed. Prior to that the hall will have been available since the January 1996 joint occupancy date (JOD) for installation of tracks/rails or other heavy component moving equipment. The first field shaper with a support structure will be lowered, followed by a magnet coil half, the central membrane, another magnet coil half, and the final field shaper. During this time the magnet power supplies, cryogenic and control systems are connected. Finally, the magnet halves will be rolled together, field shapers will be put in place, and the magnet will be cooled down to 4.2 kelvin (K) and operated at full current and field. When the magnet subsystem has been fully tested and the magnetic field mapped, the two mobile halves will then be rolled to the far ends of the underground hall to make room for the remaining detector subsystems to be installed.

Because the magnet is first in the installation sequence and must also be thoroughly tested ahead of other subsystem installations, it is on the critical schedule path for the detector. The GEM Detector schedule is shown in Figure 2. This schedule shows the completion of the first half coil and vessel testing in April of 1996, coincident with the underground hall BOD.

It has been mentioned previously that the coils will be wound on-site. This activity must precede the magnet installation underground. To install winding tooling on-site and wind 24 coil modules, assemble the modules into magnet coil halves, assemble the inner and outer cryostat vessels around the half coils and perform close-out welds on the cryostats, vacuum leak test the vessels, and cold leak test all the cryogenic lines at 77 K, takes 27 months, which corresponds to the time between the winding building occupancy date (February 1994) and the completion of cold testing on the second magnet half (June 1996).

These schedule demands result in the need to order certain long lead items in parallel with the completion of the development programs for the magnet conductor and winding concept. The milestones for these long lead items are shown in Figure 2 to be early in 1993. These critical long lead items are:

a) Place order to upgrade the cabling machinery in January 1993
b) Place order for on-site winding tooling in February 1993
c) Place order for magnet conductor cable in March of 1993

To provide confidence in the magnet conductor design and in the winding concept for this large magnet, development activities were initiated by the laboratories in early 1992. Because of the critical need date for the magnet and the need for performing development work on the magnet conductor and winding approach, separate development contracts will be placed by the laboratories for this effort.

GEM DETECTOR SCHEDULE

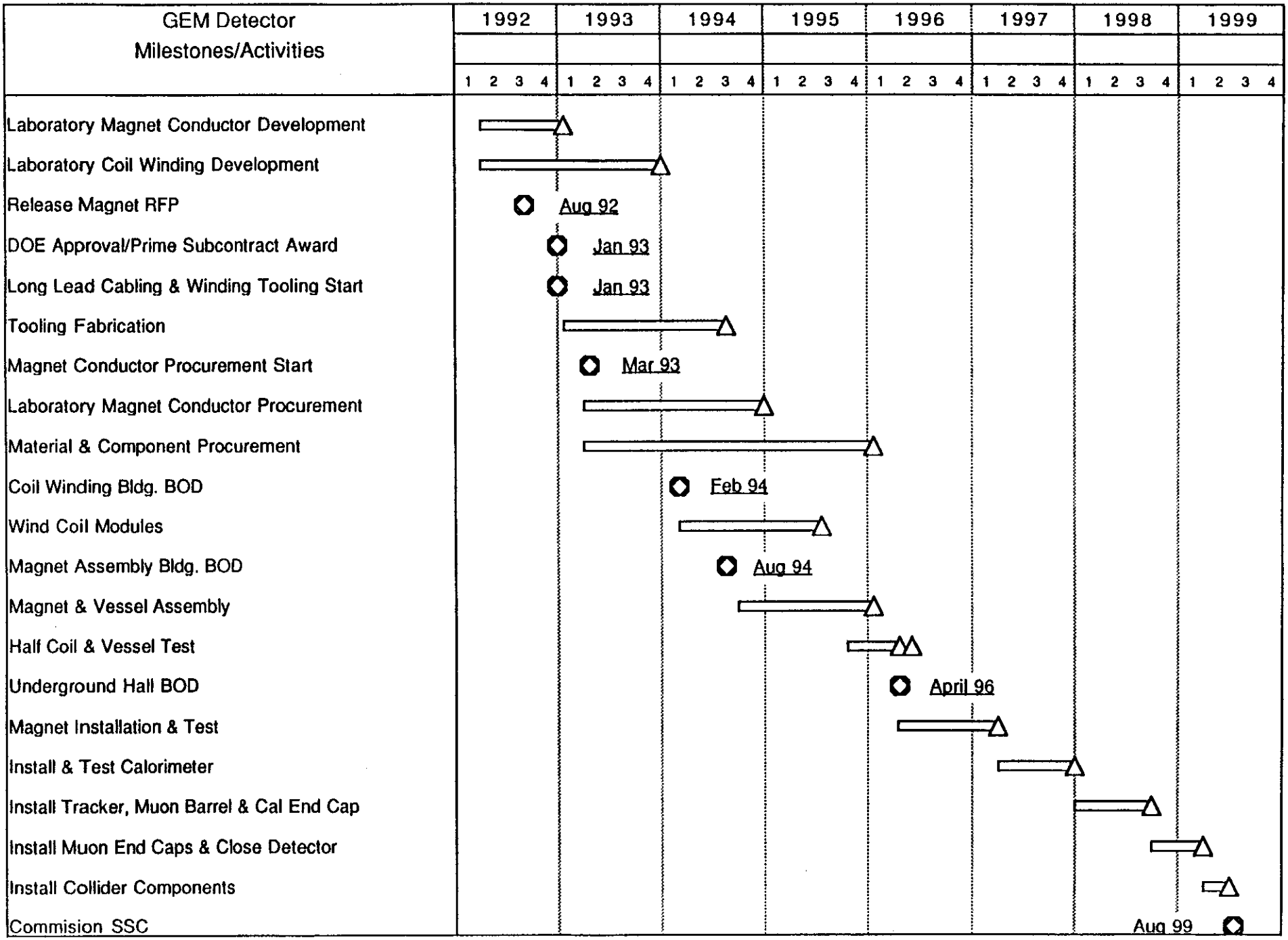


Figure 2

Thursday, May 7, 1992

(6) Trade-Offs

The GEM Detector Magnet is technically a relatively simple system with modest performance capabilities. However, its physical size dominates the technical considerations. Much of the preliminary design and development is focused on utilizing proven design concepts to reduce cost and schedule risk and address the large size of this magnet. Much of this preliminary design and development is being performed by the laboratories in such areas as magnet preliminary design, magnet conductor design, and coil winding technology and tooling development. Through substantial initial interaction and review with a number of international experts several conductor configurations and winding schemes were identified. These were analyzed and down selected to two which were analyzed in further detail. The concept described herein represents the final selection.

(7) Risks

The technical risk in the GEM Detector magnet development is due primarily to the magnet's very large size. Although it will be one of the largest superconducting magnets ever built, it will operate at a relatively modest field of 0.8 T. The large magnet size primarily affects the winding and assembly operations, both of which are being designed to accommodate the size. Because of the size, some of the winding and assembly operations will be done on-site. A winding development activity is planned to prove the winding concept well in advance of the actual production winding process. Reliability will be achieved through the design's use of cable-in-conduit magnet conductor which has been demonstrated on the U.S. Demonstration Poloidal Coil Program to have a large tolerance for small conductor motions and heating disturbances which can cause other types of superconductors to have less energy margin.

Cost risk lies primarily in the potential for rework of the large number of cryogenic connections which must be leak tight. Stringent QA/QC measures will be implemented to insure the integrity of all cryogenic connections at the earliest possible stage of fabrication. The continuously welded conduit, which houses the superconducting cable, will be continuously leak-checked during fabrication. All field welds to the joints in the magnet conductor will be leak-checked upon completion of the weld, prior to the next stage of assembly. Welds on the cryostat cryogenic tubing will also be leak-checked upon completion and the entire magnet, after assembly, will be leak-checked at 77 K on the surface, prior to being lowered into the underground experimental hall. The welding procedures on the magnet conductor will be fully proven during the development program and these procedures will become part of the quality control requirements for the production fabrication.

Schedule risk is a consideration due to both the size of the magnet and the number of cryogenic connections which must be leak tight. The magnet conductor and winding development activities will provide opportunities to revise, fine-tune, and document the manufacturing procedures which will be used during fabrication. The magnet conductor development program includes the fabrication and testing of piece parts, including the coil joints, well in advance of the need to fabricate these items for production. The first development winding is scheduled to begin well ahead of the first production winding; early enough to enable the lessons learned to be incorporated in the design of the winding tooling for production. The schedule risk is also related to a rapid procurement process and the availability of the on-site facilities.

(8) Streamlining

The SSCL hosted the first of several planned technical interchange meetings on the GEM Magnet on April 1, 1992, with most of the industry representatives that have shown interest in the project in attendance. A second (optional) meeting is planned for late July, 1992.

Since only a single GEM Magnet procurement is ever contemplated, all requirements associated with reprocurement will be eliminated, as well as requirements unrelated to the fundamental performance of the magnet.

As soon as DOE approval of the Acquisition Plan is obtained, a "draft" RFP will be promulgated to industry for comment. Potential bidders will be specifically asked to identify any requirements as candidates for either elimination or tailoring to improve project schedule, or to reduce cost without increasing risk in technical performance. Following receipt of the industry input, SSCL will consider each recommendation, utilizing the conceptual plan technique, for its probable benefit to the project as well as its impact to the project risk assessment.

A basic objective of the GEM Project is to require the use of commercial off-the-shelf(COTS) or modified COTS goods, materials and specifications whenever possible.

The use of concurrency to reduce costs and/or improve schedule will be considered on a case-by-case basis, after a thorough consideration of potential risk to the project.

b. Plan of Action

(1) Sources

The SSCL issued a Commerce Business Daily (CBD) announcement and conducted an Industrial Technology Meeting to discuss the GEM Detector Magnet requirements. As a result of this meeting a list of prospective offerers has been developed. The current listing contains the following:

Albert H. Halff Associates, Inc.
Babcock & Wilcox
Bath Iron Works Corporation
Bechtel Corporation
Chicago Bridge & Iron
Commercial Energy Products Corporation
Ebasco Services, Inc.
General Dynamics Corporation
Grumman
Intermagnetics General Corporation
Jered Brown Bros.
Lockheed Missiles & Space Company, Inc.
Martin Marietta
Murdock, Inc.
Oxford Instruments, Inc.
Precision Components Corporation
Southwestern Engineering and Equipment Co.
Stone & Webster Engineering Corporation
Westinghouse Electric Corporation

A determination has been made that the estimated procurement dollar value meets the dollar threshold necessitating a lower tier subcontracting plan. Further, it is the policy of URA to comply with the spirit and requirements of Public Law 102-104 to the fullest extent possible within the technical complexity of the GEM Magnet procurement. Accordingly, the selected subcontractor shall be requested to develop and submit a lower tier sub subcontracting plan which includes all of the elements listed in FAR 52.219-9, Small Business and Small Disadvantaged Business Subcontracting Plan. The plan, when approved by URA, shall be incorporated into and made a part of the GEM Magnet Subcontract.

(2) Competition

There are about twenty industrial firms or joint ventures/teams that have demonstrated some level of expertise or have expressed strong interest in participating in this competition. The plan is to have open competition for the GEM Magnet subcontract with a single firm or joint venture/team being selected via a rigorous source selection process.

The major components or subsystems of the GEM Magnet are as follows:

- Central Membrane & Support Structure
- Magnet Coil Halves (12 Coil Modules Each)
- Cryostat (Vacuum) Vessel Halves
- Forward Field Shapers & Support Structures
- Cryogenic System - Liquid Helium Supply
  - Thermosyphon System
  - Forced Flow System
- Magnet Power Supply System
- Magnet Protection System
- Magnet Control System

Because of the critical schedule, the laboratories development and procurement of GFM magnet conductor and coil winding methods and GFE tooling will be broken out and development initiated before the prime magnet subcontract award. The selected GEM Magnet subcontractor will be

before the prime magnet subcontract award. The selected GEM Magnet subcontractor will be brought into this task immediately after contract award. SSCL also plans to provide the basic cryogenic plant and magnet power supply systems as GFE. No other component or subsystem breakout is anticipated at this time.

A project Provisioning Parts List (PPL) will identify all items required to repair and maintain the magnet over its 15-year expected lifetime and will be deliverable as a part of the GEM Magnet procurement. For items not commercial off-the-shelf (COTS) the subcontractor shall guarantee continued availability for the 15-year lifetime or deliver spares in accordance with the failure rate analysis at the time of magnet acceptance.

(3) Source Selection Procedures

The GEM Magnet procurement has been designated as a major procurement. Source selection will be conducted under the policy, procedures and guidance of the SSCL Procurement Department Standard Practices Manual (SPM), dated July 1, 1991. Under this guidance, the acting GEM Project Manager, Dr. Gary Sanders, will serve as the Source Selection Authority (SSA) for the procurement and appoint, in writing, a Source Selection Board (SSB), chaired by Mr. Paul Reardon, Associate Director of the SSCL and GEM Magnet Project Manager, to satisfy the duties of the SSB which include:

(a) Approve the Request for Proposal(s) (RFP) prepared by the Procurement Department member.

(b) Develop the Subcontractor prerequisites and qualification criteria (if any) and evaluation criteria, with associated weightings, to be used in the evaluation of proposals, and to be incorporated into the RFP.

(c) Obtain necessary reviews/approvals of the RFP, in accordance URA's prime contract with DOE and the SPM.

(d) Conduct pre-proposal conferences, if necessary, in accordance with SPM procedures.

(e) Perform thorough evaluations of all proposals received, in strict accordance with the criteria published in the RFP.

(f) Develop a SSB Report, ranking the proposals according to the criteria published in the RFP, and submit the Report to the SSA with a recommendation for selection.

(g) Perform such other functions as may be assigned by the SSA.

The Source Selection Authority may:

(a) Select the recommended source;

(b) Direct the SSB to continue negotiations with all firms still in the competitive range, through Best and Final Offers (BAFOs);

(c) Request further information from the SSB; or

(d) Make an independent decision to award to an offerer other than the one recommended by the SSB.

(i) SSB Structure.

The evaluators will be segregated into the areas of Technical, Management, and Cost. All levels of the SSB may be augmented by specialists, identified as advisors.

(ii) Evaluation Criteria.

The evaluation criteria will define those elements which the SSB and SSA shall consider in making a selection decision. These criteria will be assembled into major area categories related to technical, business/management, and cost issues and further divided into subcriteria, as necessary to ensure comprehensive evaluation, using the following terminology: item, factor, and subfactor. SSCL and the GEM Collaboration will develop descriptive outlines for the magnet fabrication, assembly, installation and logistic support operations. These outlines will provide a framework for conceptual plans which will be developed by each offeror as a proposal requirement. The evaluation of these plans by the Source Selection Board (SSB) will provide important information related to each offeror's understanding of the overall scope of work required. Proposals will be evaluated solely against the criteria specified in the RFP.

(iii) Source Selection Plan.

The SSB will develop a Source Selection Plan which will be the general plan for the process. The plan identifies SSB members, qualification criteria, evaluation criteria, weights and detailed procedures for scoring and ranking the proposals. The plan must be approved by the SSA prior to implementation.

(iv) Preservation of Integrity of the Source Selection Process.

Everyone who participates in the evaluation process (board members, advisors, etc.) will be required to sign a Confidentiality Certificate and a Conflict of Interest Certificate. The SSA will brief all participants on the sensitivity of the source selection process, the prohibition against unauthorized disclosure of information, and the requirements pertaining to conflicts of interest. Each individual involved in the evaluation should inform the SSA in writing whenever the individual's participation in source selection activities might reflect against the government or the SSCL because of a real, apparent, or possible conflict of interest. Conflicts will be resolved by the SSA, working jointly with legal counsel.

(4) Contracting Considerations

Current GEM project plans call for a GEM Magnet subcontract award in early January of 1993. The GEM Magnet will be procured with a single, multi-year, subcontract that encompasses four major contract items:

(i) Item 1 will contain all the subcontract start-up activities and the efforts to complete the final magnet detailed design package. Considerable product definition has been accomplished by the laboratories and the collaboration and this final effort, which culminates at CDR, is seen as that necessary to assure that the defined product can be efficiently produced by an industrial partner. Tooling concepts will also be finalized under Item 1. A Cost-plus-fixed-fee (CPFF) contract type is seen to be most appropriate for Item 1, with the SSCL assuming the technical direction role.

(ii) Item 2 will include the tooling design, fabrication, assembly, and proofing; the procurement of parts and material required for both tooling and magnet fabrication; magnet fabrication and assembly at both the subcontractor's facility and on-site at the SSC; all packaging, handling, and shipping; and the preparation and delivery of all CDRL items.

Other than the massive sizes involved, the Item 2 effort is not viewed as technically challenging or requiring new technology or innovation. Considerable interface with SSCL is expected as a result of the pre-contractual efforts by the laboratories and the collaboration on both the magnet conductor development and procurement and the coil winding technology development. Because of the large physical size, heavy SSCL interface, and a one of a kind build, the cost uncertainties associated with the Item 2 efforts are too great to negotiate a realistic ceiling price within a reasonable range from target cost; otherwise a Fixed-Price-Incentive (FPI) contract arrangement would be considered. A Cost-Plus-Incentive-fee (CPIF) contract with an incentive on cost is seen as the most appropriate type of contract under the conditions described. A simple share ratio is envisioned. A Small amount of the fee pool for this contract item could appropriately be allocated to several key project schedule milestones.

(iii) Item 3 will support the installation of the magnet into the detector hall and the resultant system test and inspection activity leading to a DD 250 transfer of accountability for the magnet to the SSCL. The full scope of this activity would be nearly impossible to define at this time due to the necessary interaction with so many other SSC system elements i.e. conventional construction, beam line interfaces and alignment issues. A CPFF contract type is seen to be most appropriate for this item.

(iv) Item 4 would encompass the total project management and system engineering effort, including the preparation and presentation of all project reviews. A Cost-Plus Award-Fee (CPAF) would be most appropriate to recognize the change in emphasis required for the efforts under this contract item, as the project matures. Development of the detail evaluation criteria just prior to each award period would capture the current project priorities and would facilitate the appropriate subcontractor reward opportunities.

As mentioned previously, to protect schedule, the magnet conductor is being developed and procured by collaboration members outside of this procurement and will be supplied to the industrial subcontractor by the SSCL as GFM. Coil winding techniques are also being developed and will be supplied to the subcontractor by the SSCL, along with certain items of GFE coil winding tooling, cryogenic plant, and power supplies.

Other than streamlining, no special clauses, special solicitation provisions, or FAR/DOE Acquisition Requirements (DEAR) deviations are contemplated.

(5) Budgeting and Funding

The GEM Magnet design exists at this point in time as a conceptual design, and it is developing rapidly toward preliminary and final design definition. The design is known in reasonable detail at this time, and it will be understood in much more detail as the design progresses while the acquisition process is proceeding.

Although there is no direct experience base for the construction of a magnet of this size, budget estimates for the GEM Magnet Subsystem have been developed and refined several times by the laboratories and collaboration team since October 1991. These estimates have been influenced by assessments received from qualified industrial vendors. These inputs have been reviewed internally within the GEM Collaboration and have been found to be reasonable. Independent estimates from magnet experts, such as at the GEM Magnet Technical Panel workshops, have also confirmed these numbers. These budgetary estimates have been derived for a program consistent with the planned delivery date of the magnet subsystem.

A preliminary distribution of these costs over time has been made and a refinement is in progress. Because the magnet is on the critical schedule path for the GEM Detector, it is important to ensure adequate funding in the early years to maintain the aggressive schedule. Unanticipated

shortfalls in the yearly funding will not only delay the start-up date for the GEM Magnet, but will increase the total cost as well.

Foreign participation may be an important feature of the GEM Magnet acquisition. We anticipate two types: commercial and contributory.

Foreign Commercial. In accordance with DEAR 970.71, competition will be solicited consistent with the performance and the nature of the product being procured. Accordingly, proposals will be accepted from international sources and evaluated on the same basis as domestic firms. To the extent applicable to the anticipated contracts, the Buy American Act will be observed.

Foreign Contributory. The exact extent and nature of foreign contribution is undetermined and probably beyond the control of SSC. If such interest solidifies, SSC is prepared to include foreign contribution into the GEM Magnet subsystem. However, it is important that the foreign contributor be technically ready to accomplish the actual proposed production activities. Such a contributor would become a Item 2 participant on a no-cost or reduced-cost basis. The subcontractor will be required to interface with any foreign contributory participant accepted by SSCL and the GEM Collaboration. In the event of foreign contributory participation, the subcontractor scope of work would have to be reduced accordingly. Depending on the area of proposed foreign involvement, commitments could be accepted as late as January 1994 and still meet the overall milestone schedule.

(6) Product Descriptions

This element is nonapplicable to this procurement.

(7) Priorities, Allocations, and Allotments

This element is nonapplicable to this procurement.

(8) Contractor vs. Government Performance

This element is nonapplicable to this procurement.

(9) Management Information Requirements

The GEM Magnet subcontract will be larger than $50M , and a integrated cost and schedule control system will be required. This system will follow the guidelines being issued in the DRAFT NOTICE DOE N 4700, dated 2/5/92. This document replaces DOE 2250.1 and the requirement for complete and formal implementation of Cost/Schedule Control System Criteria (C/SCSC). However, the significant criteria of C/SCSC will be customized and implemented in accordance with DOE N 4700. The three main objectives of the cost and schedule system are:

a. Baseline Development - This includes work scope development, cost estimating, scheduling of project activities, technical baseline, and identifying responsible individuals.

b. Project Performance - This includes funds management, accounting, work authorizations, performance analysis, earned value, and reporting.

c. Baseline Maintenance - This includes proper change control management of the technical, schedule and budget baselines.

The following requirements shall be included in the GEM Magnet RFP and subcontract:

a. Work Breakdown Structure (WBS) for the work to be performed. The GEM PD will provide a summary WBS which defines the first three levels of the WBS and the reporting levels.

b. WBS Dictionary

c. Project Management Plan

d. Critical Path Schedule

e. Program Milestones Schedule

f. Cost Performance Report - earned value will be reported comparing the expenditure of money to the work accomplished.

g. Schedule and Technical Status Report

h. Formal reviews of the management system by the GEM PD to assure criteria are satisfied.

i. Configuration Management Plan

j. Conceptual Plan For Fabrication, Assembly, and Installation

k. Procurement Make or Buy Plan

In addition to cost and schedule reporting defined above, the GEM PD will use other management tools, as appropriate, to manage the subcontract cost and schedule.

A dedicated GEM Magnet project management team will meet with the subcontractor in monthly reviews. The team will include the Project Manager, the Subcontract Administrator, technical and quality assurance representation and a cost analyst. Additionally, DOE auditors will audit the subcontractor at the request of the GEM PD.

Throughout the subcontract there will be a series of technical reviews, such as Preliminary and Critical Design Reviews for the magnet, design reviews for the tooling, a Production Readiness Review for coil winding, etc. These reviews provide visibility of the contractors progress and introduce control gates to allow the GEM PD to approve future work. Also, factory visits are contemplated as a means to assess project progress. There will be quality assurance reviews and on-site surveillances as determined in the final design development phase. A variety of oversight techniques will be utilized to assure that the project's needs are best served.

(10) Make or Buy

A subcontractor make or buy plan will be a requirement of the RFP. The details of this plan will be in general accordance with the provisions of the Federal Acquisition Regulations, Subpart 15.7 - Make - or - Buy Programs.

(11) Test and Evaluation

There will be two general types of testing related to this program: development and acceptance testing.

The laboratories team is pursuing an aggressive development program, aimed at generating detailed, supportable, and tested designs for the magnet conductor and the winding approach. In conductor development, sample lengths of superconductor will be procured and tested to ensure that material with adequate properties can be produced by several vendors. In parallel with this superconducting strand testing, a length of "surrogate" conductor will be produced, using copper wire in place of the superconductor, in order to demonstrate and test each step in this critical process. First, a dummy cable will be produced by cabling copper wire with nominally the same properties (for cabling purposes) as the real superconducting strand; this will demonstrate the cabling process. Next, this dummy cable will be used to test the tube mill which forms the conduit around the conductor; a full surrogate cable-in-conduit will result, and this can be thoroughly leak checked to validate the tube-mill process. Finally, the aluminum sheath will be applied to the cable-in-conduit, and the resulting assembly will be dimensionally inspected and leak checked again. This will validate the final conductor-production process. The winding approach will be tested by conducting a test winding of this surrogate cable into a surrogate coil form of the correct radius. This testing is intended to validate the overall concept as well as the key tooling concepts required.

Acceptance testing will be quite extensive at all phases of fabrication and assembly, and the exact sequence of steps will be defined in the quality assurance plan produced by the subcontractor. All of the test results will be used by SSCL and the LLNL/MIT team to verify that the parts satisfy the requirements. At this time, planned components of this plan are:

- Magnet Conductor
  - Superconducting strand inspection and cryogenic testing
  - Visual inspection of cabling
  - Non-Destructive Evaluation (NDE) of conduit weld
  - NDE of joint hardware
  - Leak check of entire cable-in-conduit
  - Leak check of aluminum sheathed cable-in-conduit
- Coil form - visual, NDE of welds
- Winding
  - Dimensional inspection of coil form after assembly
  - Visual and voltage test of ground plane
  - Voltage test of conductor insulation during winding
  - Voltage test of conductor to ground after winding
  - Visual inspection during winding
  - Dimensional inspection after winding
  - Leak testing after winding
- Coil module sub-assembly
  - Visual and electrical test of superconductor splices after assembly
  - Leak check after assembly, including thermosyphon system
- Vacuum vessel
  - In-process weld inspection: visual and dye-penetrant
  - Vacuum-leak test after completion
- Thermal shields
  - In-process weld inspection: visual and dye-penetrant
  - Vacuum-leak test after completion
- Cold mass supports
  - Dimensional inspection
  - NDE - radiography or ultrasonic

- Coil assembly
  - In-process weld inspection: visual and dye-penetrant
  - Leak tests of all internal piping
  - Vacuum-leak test after assembly
  - Cold-leak, cold-short test after assembly
- Field Shapers
  - Material certification and magnetic testing
  - In-process weld inspection: visual and dye-penetrant
  - Dimensional inspection
- Power/Protection system
  - Dummy-load acceptance testing
- Cryogenics system
  - System-operation acceptance testing
- Vacuum System
  - Leak testing
- Control system
  - System-operation acceptance testing
- Overall Magnet
  - System-operation acceptance testing
  - Detailed field-mapping

(12) Logistics

The Logistics Support requirements for the SSC are identified in the DOE approved *System Specification (Level 1) for the Superconducting Super Collider, document number E10-000001*, dated 2/14/92. It categorized the requirements into five levels: (i) Maintenance, (ii) Reliability, Maintainability and Quality Assurance, (iii) Provisioning and Supply Support, (iv) Documentation, and (v) Training.

(i) Maintenance

In general, the subcontractor shall be responsible for all maintenance on the GEM Magnet during the construction, installation and testing phases. The SSCL shall assume responsibility for maintenance following successful test and demonstration of all magnet performance characteristics delineated in the development specification. The SSCL may reserve the right to subcontract the maintenance to the development subcontractor, to subcontract maintenance to a third party, or to perform maintenance using laboratory personnel.

Maintenance activities shall be classified as repairable on-site without removal from the magnet, repairable in a laboratory repair facility after removal, and returnable to the subcontractor or his designated repair facility. As part of the documentation requirements, the subcontractor shall provide a listing of repairable parts, annotated as to method and place of repair.

The subcontractor shall provide an estimate of the time needed for removal, repair, bench-testing, re-installation, and calibration or alignment for each repairable part, as applicable. The subcontractor shall also identify all standard and special tools and test equipment needed to remove, repair, test, calibrate and align all magnet components.

The definition of "maintenance" shall not be applied to consumables, such as cooling gases and liquids or other replenishable products. These shall be procured through the normal operating budget process.

(ii) Reliability, Maintainability and Quality Assurance

The Level 1 system specification for the SSC requires that "the Experimental System infrastructure will support the capacity of sensing and recording of experimental data at least 80% of the time the Collider is at operational energy and luminosity." A Failure Modes, Effects, and Criticality Analysis (FMECA) will be performed by the SSCL to provide guidance to the subcontractor. Reliability Assessment will be conducted throughout the GEM Magnet procurement to assure that the magnet subsystem has the requisite reliability to assure that GEM Detector and SSC availability requirements are not impacted.

The subcontractor shall perform sufficient reliability and availability analyses to determine the expected failure rates for all repairable or replaceable subsystems and components for the magnet. From this failure rate analysis, the subcontractor shall estimate the quantity of each replaceable module needed to maintain the magnet over a period of 15 years following acceptance of the magnet by the laboratory.

In order to maximize probability of high availability, the subcontractor shall have a strong Quality Assurance program approved by the SSCL in his manufacturing and sub-contracting organization. Quality Assurance Plans and procedures will be required as part of the subcontractor source selection criteria.

(iii) Provisioning and Supply Support

The subcontractor shall develop and maintain a PPL which identifies all items required to repair and maintain the magnet. To the extent practical, this PPL shall incorporate standard parts and test equipment already in use by the laboratory and identified in the laboratory PPL. Copies of the laboratory PPL shall be made available to each prospective subcontractor upon request.

The subcontractor shall identify all repair or replacement items not available commercially as off-the-shelf components. For each such item, the subcontractor shall guarantee continued availability of the non-standard item over the 15-year expected life time of the magnet or shall offer to deliver the quantity of spare modules estimated in accordance with the preceding paragraph at the time of acceptance of the magnet.

(iv) Documentation

The subcontractor shall develop and make available support documentation, including the PPL as identified above, all manuals necessary for operation and maintenance of the magnet and all training materials, including manuals, needed to train laboratory personnel in the safe, efficient operation and maintenance of the magnet. The support documentation shall be prepared using good commercial practices and shall be provided in clean, reproducible hard-copy form. To the extent practical the documentation shall also be provided on magnetic media. The format and content of the magnetic media shall be negotiated between the laboratory and the subcontractor.

As an entity of the United States Government under the Department of Energy, the SSCL shall retain the rights to all data, inventions, processes and technology developed by the subcontractor under any contract with the laboratory or arising as a result of the effort performed by the subcontractor under such contract. The laboratory reserves the right to retain the exclusive rights to any such data, inventions, processes or technology, or to assign such rights to the subcontractor or to a third party in accordance with government policy and regulations in place at the time.

(v) Training

The subcontractor shall design and develop training courses, training aids and training materials necessary to train laboratory technicians, engineers and physicists in the operation and

maintenance of the magnet. The subcontractor shall develop and deliver a training plan which recommends the types of training courses, the qualifications of potential attendees, and the suggested number of trainees for each course.

The final selection of training courses, the location of the training (whether at the contractor's facility or at the laboratory), as well as the number and type of individuals requiring training, may be negotiated at the time of subcontract award.

(13) Government-Furnished Property

The following Government-furnished property will be furnished to the subcontractor as either GFM, GFE, or Government Furnished Facilities (GFF):

The magnet conductor will be developed and acquired by the laboratories through a separate procurement. The magnet conductor will be furnished to the subcontractor as GFM beginning in early 1994.

The magnet coil winding methods and some tooling will be developed and acquired by the laboratories through a separate procurement. The magnet winding tooling will be furnished to the subcontractor as GFE in early 1994. The cryogenic plant and power supply equipment for the magnet will be supplied to the subcontractor as GFE to maintain commonality and economy of scale with similar SSC equipment.

The GEM Magnet Coil Winding Building and associated facilities, and Magnet Assembly Building and associated facilities (including Underground Detector Hall) will be furnished to the subcontractor as GFF beginning in early 1994.

(14) Government-Furnished Information

The following Government-furnished information (GFI) will be furnished to the subcontractor in early 1993 after subcontract award:

Specifications - Experimental Systems Element (GEM Detector, IR5 & IR8 Experimental Halls & Support Facilities), Subsystem (GEM Magnet & GEM Electronics; IR5 Utilities, Underground Hall, Infrastructure, Surface, and Support Buildings; IR8 Utilities, Infrastructure, Surface, and Support Buildings),and Component (Conductor, Cryogenic Plant, and Power Supply) Specifications

Plans - GEM ES&H Documents (Emergency Operations Procedures, Safety Assessment Reports,and Hazard Analysis Report), GEM Project Management Plan, GEM Experimental Facilities User Requirements Report

Drawings - Preliminary design documentation, conductor R&D results, and coil winding R&D results

(15) Environmental Considerations.

The GEM PD is engaged in design effort to optimize the GEM Detector for the SSC. As a part of this effort, the GEM Collaboration is recommending adopting a single-coil, solenoid configuration, without iron flux return. The proposed conceptual design methodology, will maintain compliance with applicable DOE Orders, the SSC Final and Supplemental SSC Environmental Impact Statements (FEIS, SEIS), their Records of Decision (ROD), the Mitigation Action Plan (MAP), and applicable regulatory codes and standards. This proposed design action is

described more fully in the *GEM Magnet Technical Panel Reports 1-3* and in *Considerations Leading to the Choice of Open Field Magnet, GEM Note # GEM TN-91-30.*

The environmental impact associated with the GEM Magnet's static magnetic field was addressed in the FEIS and the SEIS for the Superconducting Super Collider. The Superconducting Super Collider FEIS and SEIS examined the environmental impacts based upon the configuration specified by the Invitation for Site Proposals, from which the proposed action represents no environmental change. The intent is to not produce any measurable negative effects upon the public or the environment. The existence of a small static magnetic field produces no adverse environmental impact. The SEIS Record of Decision (ROD) stated that the overall potential for adverse environmental impacts is small, while substantial potential exists to mitigate any impacts.

There are no specific requirements noted which should be included in solicitations or contracts to furnish the GEM Magnet assembly.

(16) Security Considerations

This element is nonapplicable to this procurement.

(17) Other Considerations

None noted.

(18) Milestones for the GEM Magnet Acquisition Cycle

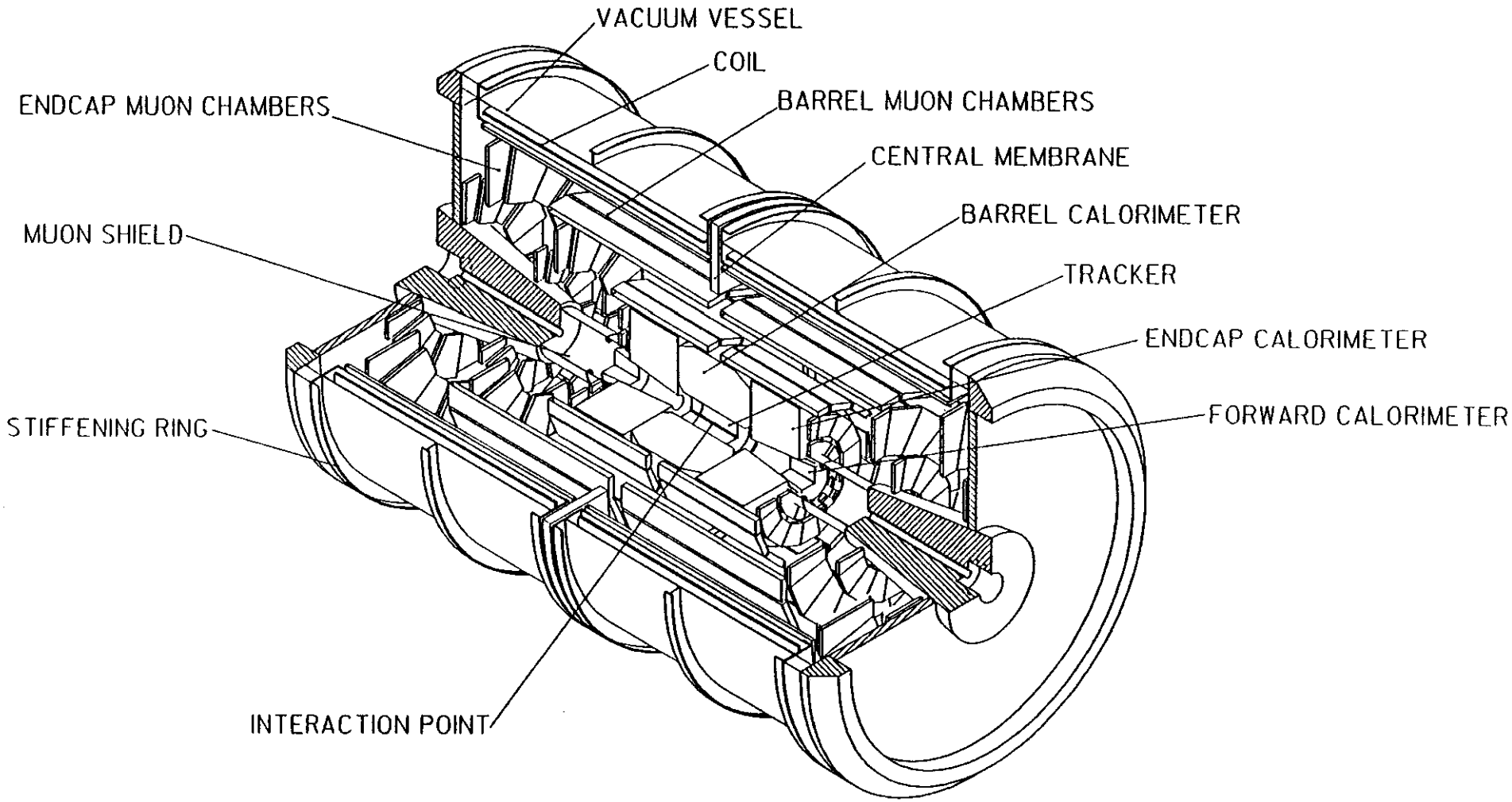
The GEM Magnet is on the critical path of the GEM Detector schedule and is driven by the Collider Commissioning milestone in August 1999. It is further determined by the logic of the detector component installation sequence, the availability of facilities, and the surface assembly and manufacturing process required. These factors dictate an April 1996 milestone to begin placement of components in the detector hall. This necessitates that the magnet acquisition be pursued as a high priority action item with the following milestones leading to a January 1993 award of the magnet subcontract:

Industrial Technology Meeting & Start Acquisition Plan Document	1 April 1992
Start RFP (Including SOW & Data Requirements)	8 April 1992
Submit Acquisition Plan for DOE Approval	15 May 1992
RFP Review by Contract Review Board (CRB)	Early June 1992
Release Draft RFP for Industry Comments	Late June 1992
Program Advisory Committee (PAC) Review	Early July 1992
Industrial Technology Meeting (Optional)	Mid July 1992
Receive Comments on Draft RFP	Mid July 1992
Submit RFP for DOE Approval	Early August 1992
Release RFP to Offerors	Late August 1992
GEM Magnet Proposals due to SSCL	September 1992
DOE Lehmann Review	September 1992
Proposal Evaluation, Fact Find & Negotiation Complete	November 1992
Submit Subcontract Package to DOE for Approval	December 1992
GEM Magnet Subcontract Award	January 1993

(19) Identification of Participants in Acquisition Plan Preparation

Name	Title	Phone
Gary Sanders	Project Manager, GEM	(214) 708-6189
Barry Barish	Collaboration Spokesman, GEM	(214) 708-6326
Mike Harris	Chief Engineer, GEM	(214) 708-6143
Richard Fischer	Prog. Plng/Bus. Ops Manager, GEM	(214) 708-6026
Alan Tinker	Subcontract Coordinator, GEM	(214) 708-6008
Bill Flick	Consultant	(512) 282-5811
Paul Reardon	Magnet Project Manager, GEM	(214) 708-5036
Gary Deis	Deputy GEM Magnet Project Manager, LLNL	(510) 423-7533
Ryszard Stroynowski	Magnet Chief Physicist, GEM	(214) 708-6043
Norm Gober	System Engineer, GEM	(214) 708-6119
Peter Marston	Engineer, MIT,PFC	(617) 253-5722
Brad Smith	Engineer, MIT,PFC	(617) 253-7852
Tony Chargin	Deputy Associate Director, LLNL	(510) 422-8281
Ronn Woolley	Envir., Safety & Health, GEM	(214) 708-6079
Bill Davis	Procurement, SSCL	(214) 708-1706
Jerry Gunnels	Quality Assurance Officer, PRD	(214) 708-6380

GEM DETECTOR



Appendix A