# Installation & Test Plan Review
# Committee Report

June 27, 1996

**Star Note # 252**

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## 1. Introduction

A formal review of the STAR Installation & Test (I&T) Plan was held on June 11 and 12, 1996. On the first day, presentations were made by Ralph Brown, the I &T Manager, on the scope, management, plan and cost. The committee, composed of individuals with experience relevant to the installation and test of large detectors of this kind, discussed and evaluated the information presented during the morning of the second day and then held a close-out session with I&T management and others that afternoon.

The committee charge, review agenda, presentation materials and action items can be found in the Installation & Test Plan Review binder in the STAR Project Office. Many of the comments/issues are presented in some detail in the action items. The action items should be considered an appendix to this report.

## 2. Executive Summary

The review committee would like to express it's thanks to Ralph for his excellent presentation of the I&T plan. It allowed the committee more insight into the plan and therefore made the review more worthwhile.

Plans for the assembly and installation of the Magnet, TPC and Conventional Systems hardware in the IR buildings have been developed in sufficient detail to give confidence in the schedule. For other subsystems, the responsible subsystem management needs to work with the installation team to provide information on schedule, required resources, special needs and required access. STAR management should implement, with the appropriate subsystem managers, a formal mechanism for developing short MOUs between these various subsystems and the installation group.

A summary of the committees recommendations follow:

1) The committee believes (and Ralph himself admitted) the labor hour estimates are somewhat conservative. However, the committee recommends that labor hour estimates in the plan not be reduced at this time. Instead, the actual task team sizes, number of hours and O/T requirements should be re-evaluated after 3-4 months of data is accumulated from the initial magnet installation tasks.

2) The actual technician rates supplied by the AGS should be used instead of the old estimating rate of $299/day. An AGS technicians to job shoppers ratio of 1:1 is in order and should be made part of the plan. This would reduce the I&T plan cost of order $500K.

3) Reductions in I&T management as presented by Ralph Brown on the morning of the second day (less the 0.5 FTE reduction in subsystem manager) should be adopted and would reduce plan costs another $135K.

4) It is recommended that the technician trailer not be purchased, installed or outfitted at this time ($70K budget item). Instead, Installation and Test should be given authority to determine the use of the modular Operations Building for the near future.

5) It is recommended that the needs of each subsystem for electronics test equipment during installation and test at BNL be determined along with what test equipment subsystems will bring with them. When this task is completed the proper budget allocation can be made to I&T.

6) It is recommended that STAR Management put in place short MOU's between the various subsystems and I&T, outlining such things as schedule, required resources, special needs and required access.

7) The committee recommends that other STAR Subsystem Managers be reminded of the scope and interface definitions between I&T and themselves, to ensure that there is nothing left out and no overlapping of planned effort.

## 3. Critical Issues and Findings

- There must be strong integration of electronics and systems test into this schedule. Local I&T input is needed as well as detailed plans from subsystems. Milestones for system tests of TPC, CTB etc. utilizing on-platform electronics and final signal routing is needed ASAP.
- The committee suggests that a detailed plan and procedure for moving shield blocks around detector and beam pipe be developed. This is needed to reduce the risk of potential damage due to shortcuts during shield wall removal and reconstruction.

- There is a need for integration support of detailed installation planning including laydown areas and cabling at BNL ASAP.
- The plan does not account for power costs for the magnet during the test and mapping operations; STAR assumes this will be part of the overall RHIC power costs in FY98.
- There is a need for developing a detailed space usage plan for the Interaction Region (IR), Assembly Building (AB), Control Room (CR) and all trailer space.
- There is a need for someone to be responsible for ensuring that the cabling plan is enacted, to answer questions and to resolve problems as scientific labor accomplishes the installation.
- There is no budget in the plan for overtime. OT is a fact of life and has associated with it a 50% labor cost premium.

## 4. Scope and Interfaces

Installation and test as an integrating activity, with every subsystem as well as RHIC provided facilities and utilities, has a complex set of interfaces to deal with. The presentation of scope and the interface definitions that were presented were, to the best of the committees understanding, in line with the assumptions of the rest of the STAR Project.

To briefly summarize these interface definitions - I&T WBS scope will include technician support for hardware installation and test once subsystem elements reach the 6 O'clock Assembly Building. An exception to this is that all electronics crate installation, LV power and signal cable pulling and electronics testing will be done by collaboration scientific labor. Funds for continued subsystem engineering and technical support as well as the cost of detailed subsystem installation and test planning will be born by the subsystem WBS. All common installation and test equipment such as man-lifts, hand tools and rigging equipment will be provided by I&T whereas unique or specialized assembly fixturing and equipment will be provided by the subsystems.

The committee recommends that other STAR Subsystem Managers be reminded of these definitions to ensure that there is nothing left out and no overlapping of planned effort.

## 5. Technical Resources

Technical resource requirements have been integrated into the overall installation and test plan. This includes the identification of specific job skill requirements, man hours required and costs associated with specific tasks. Although labor estimates are thought to be conservative, no explicit contingency has been included for either time or dollars to complete a specific task. It should be expected that some tasks will require additional time and/or labor in order to be completed in time to not delay the final completion date. These contingencies should be explicitly identified, especially for those tasks that are considered a part of the critical path.

There may be a problem with the total number of technicians required at certain times during the assembly. It was indicated, for example, that in 1998 as many as 14 AGS mechanical technicians will be required for short periods. These peak work periods need to be closely examined and an understanding reached between STAR and AGS management as to how these peak periods can be managed without incurring project delays or excessive overtime costs.

The rates used for estimating AGS technician labor are high and assume no job shopper component. The cost per hour for a job shopper is about half that of an AGS technician. An AGS technician to job shopper ratio averaging 1:1 is an appropriate level for this project. Consequently, the actual technical labor costs are likely to be considerably less than the $1.4 M budgeted. The installation labor costs should be revised to reflect an appropriate mix of AGS technicians and job shoppers.

Some labor cost omissions are evident. There are no explicit allocations for overtime, shift differential, or for AGS management. These issues should be addressed in the AGS-STAR MOU.

The use of collaboration labor for signal cable pulls, etc., is recognized as a valuable cost savings measure. This labor pool, however, is not well defined and if subsystem installation activities that heavily rely on this resource are not closely managed, significant overall delays to the project completion date could occur.

The project needs to revise "bottoms up" estimates of technical resource requirements on an occasional basis. As these resources are expected to be made available from within BNL, I&T and the AGS must be kept up to date on the latest changes in needs. It will be much more efficient and cost effective if I&T management were to present the resource requirements to AGS management in the Aug./Sept. timeframe so that commitments can be made for trades as well as job shoppers prior to the beginning of the new fiscal year. For example, if this is done, STAR will be charged for so called allocated rates for trades instead of the standard rates, a cost savings of approximately 20%.

## 6. Management

STAR Installation and Test Management is the responsibility of Ralph Brown with support from Dave Dayton, the Facility/Technical Supervisor. Dedicated resources include one design engineer and a part-time consulting engineer. All other resources (technical and clerical) are made available as required from STAR, BNL Physics, AGS and university sources. In addition to the administration of the installation of STAR and all of its subsystems, Ralph is also responsible for the STAR magnet engineering.

One problem that was noted during the review was the continuation of full time design and consulting engineering support through to the beginning of the operations phase. While the committee supports the belief that these people may be useful again in operations, some other means of supporting them in the interim should be found (such as integration into the "Big Department" so they remain available). Other than this, no serious problems with Installation and Test Management were noted. However, it was recognized that other STAR resources should be made available to Ralph so he can offload many of the day-to-day or detailed administrative duties necessary to keep the project on track. For Ralph to be successful in both of these assignments, he must spend more of his time on the engineering and qualitative management issues rather than the detailed or quantitative administrative issues.

A practice that has been used successfully in previous detector collaborations is to hold weekly scheduling meetings. These meetings between I&T management and subsystem managers serve to keep relevant people current and to avoid misunderstandings of resources, time or other requirements. Additionally, it may prove useful to have a STAR I&T Web page. This web page could contain an overall summary schedule as well as current scheduling information and an actual snapshot of current work in the Assembly Hall. It would serve to keep the collaboration posted of current and upcoming events. This tool could be used to increase collaboration awareness, and perhaps go so far as to provide peer pressure and thus a greater level of commitment from collaborators.

## 7. Common Installation and Test Equipment

This area contains machine shop tools, technician trailer, rigging gear, hand tools, manlifts, fasteners/stores, trucks, work platforms and computers/ software for ME design.

The information presented was very good and was of much help to the committee in forming its recommendations. It was found that there were no specific recommendations for machine shop tools, manlifts, trucks, work platforms and computers/software for ME design. Some concerns are raised for the remaining items plus electronic test equipment that was not sufficiently covered in this work area.

Electronic Test Equipment: This is a complicated area that requires the cooperation of each of the electronic and software subsystems to resolve the needs. It is recommended to STAR management that the needs of each subsystem including Installation and Test at BNL be determined along with what equipment they will supply to BNL from the STAR purchased equipment. When this task is completed the proper budget allocation should be made.

Technician Trailer: It is recommended that the technician trailer not be purchased at this time. Installation and Test should be given authority to determine the use of the modular Operations Building in the near future (two year time frame). Management should then see that a long term plan is developed for all STAR space that takes into account the pre and post installation needs. This long term plan should be completed within the next year or two.

Rigging Gear: The costs were felt to be reasonable but did not contain possible contributions from the AGS. AGS as a source of some rigging tools should be investigated to identify potential cost savings.

Fasteners/stores: It was noted that there may be some double counting of these stores between Conventional Systems and Installation and Test. It should be determined if this double counting is real. If so, corrections should be made.

## 8. Schedule

Plans for the assembly and installation of the Magnet, TPC and Conventional Systems hardware in the IR buildings have been developed in sufficient detail to give confidence in the schedule. For other subsystems, the responsible subsystem management needs to work with the installation team to provide information on schedule, required resources, special needs and required access. STAR management should implement, with the appropriate subsystem managers, a formal mechanism for developing short MOUs between the various subsystems and the installation group. These documents can then serve as the basis for the scheduling of detailed activities at the IR. They will also provide a resource for the entire collaboration on the activities that will need to be accommodated at any time. A very important ingredient in this process is a timely update to insure that documents are current.

The only subsystem installation reviewed in detail by the committee was the TPC. The schedule for assembly and installation seems reasonable. As mentioned an MOU should be developed for the subsystems. In particular the details of the resources required during assembly and test need to be articulated. This is the first subsystem to be installed that is the responsibility of a group not located at BNL. The development of the MOU can serve as a model for the rest of the collaboration.

The detailed schedule and required resources for the electronics subsystems are less well defined. As this is an activity that can greatly impact detector completion, a complete MOU needs to be developed very soon. Other subsystems should begin to develop the information for the MOUs as details of the system are considered. This will insure installation requirements are part of the design process.

## 9. Cost

The committee has examined only in gross detail the costs associated with I&T. At this point our judgment is that they are completely consistent with the schedule presented, and like the schedule are quite conservative and thus certainly adequate for the task at hand. However, we note that the projected costs are significantly higher than the original budget and thus could adversely impact completion in other areas of STAR. We thus suggest that these costs be re-examined with an eye towards possible areas of savings. In particular:

- The actual technician rates supplied by the AGS should be used instead of the old estimating rate of $299/day. The mix of technicians and job shoppers should be conservatively estimated at 1:1, since the likely real mix and availability will require even more job shoppers. This could save approximately $500K.
- The reduction in management costs should be implemented as proposed--saving approximately $135K.
- The actual task team sizes, number of hours and O/T requirements should be re-evaluated as soon as sufficient data is accumulated from the initial magnet installation tasks.
- Many large items specified (e.g. hardware, tools, technician trailers, test equipment, etc.) should be revisited with an eye towards utilization of similar items available at the site (i.e. space), and from other sources at the AGS and within the collaboration.
- Usage of technicians instead of trades should be maximized where allowable.