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PROJECT PLANNING AND MANAGEMENT TECHNIQUES OF THE FAST-PACED TMX-UPGRADE CONSTRUCTION

C. D. Seberger
A. K. Chargin

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PROJECT PLANNING AND MANAGEMENT TECHNIQUES OF THE FAST-PACED TMX-UPGRADE CONSTRUCTION*

[illegible] P. Seberger, [illegible] K. Chargin

Lawrence Livermore National Laboratory, University of [illegible]
Livermore, CA [illegible]345

[illegible]

[illegible] TMX-Upgrade [illegible]

[illegible]

[illegible] TMX [illegible] TMX [illegible] The management [illegible] described here were used during the construction [illegible].

A [illegible] to the TMX-Upgrade [illegible], the TMX Upgrade Administrative Plan,[illegible] describes the management procedures for reporting and reviewing project status. This detailed the engineering parameters of the project--the tasks to be performed. The project was divided into 5 subsystems, which were then divided into smaller definable tasks producing a product-oriented tree of tasks. The result was a work breakdown structure (WBS) that defined the project in successively greater detail. This serves as a basis for all future planning, monitoring and control. An excerpt of the TMX-Upgrade WBS is shown in Fig. 1.

*Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under contract number W-7405-ENG-48.

WBS [illegible]		Account Number
[illegible]	MAGNET [illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]

[illegible] manpower, services and expenses [illegible] Figure 2 [illegible] sample [illegible]

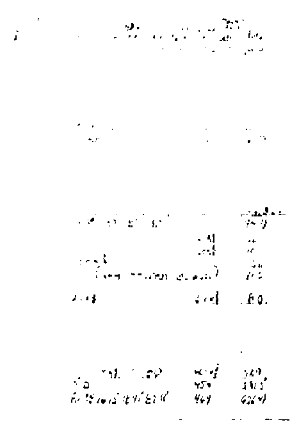

Fig. 2. A sample cost estimate sheet.

Coincident with the cost estimates is project scheduling. Since a WBS had been created with a technical description of each, the task of determining a logical sequence of activities was simpler. The five basic steps involved in most WBS tasks were design, procurement, fabrication, assembly, and installation. We found a graphic representation similar to a PERT chart the most appropriate. Along with detailing the activities that needed to be done, we estimated the duration of the activity in weeks, the sequence of activities (i.e. interdependencies), and the approximate start date of each path. (See Fig. 3.) A complete WBS structure, technical, cost and schedule baselines, and construction milestones are in the TMX-Upgrade administrative plan.

Each subsystem had a lead engineer responsible for the subsystem cost estimates, short-term schedules, and technical performance. The lead engineers reported [illegible] their functional, electrical, or mechanical [illegible] engineers. Based on inputs from the lead engineers, the project manager and the resource manager [illegible] TMX-Upgrade planning, monitoring, control, and reporting. To minimize the paperwork and to create an environment where the [illegible] management staff [illegible].

[illegible]

[illegible]

[illegible]

of project costs and control of the project. It must be detailed enough that analysts know where the money is going, yet not so complicated that there is too much paperwork. It also must be simple and clear enough that the staff of engineers and technicians will use the accounts correctly. We assigned account numbers at level 3 and summarized at levels [illegible] and [illegible]. Our complete WBS went to level 4.

[illegible] a computer program that we called DCA (Detailed Cost Analysis). (See Fig. 4.) This report had a page for each account number, [illegible] WBS level 4, and was then summarized [illegible] showed budget, [illegible] estimated remaining [illegible] one page for each [illegible] DCA [illegible] document.

The est[illegible]

[illegible]

Project Scheduling

[illegible]

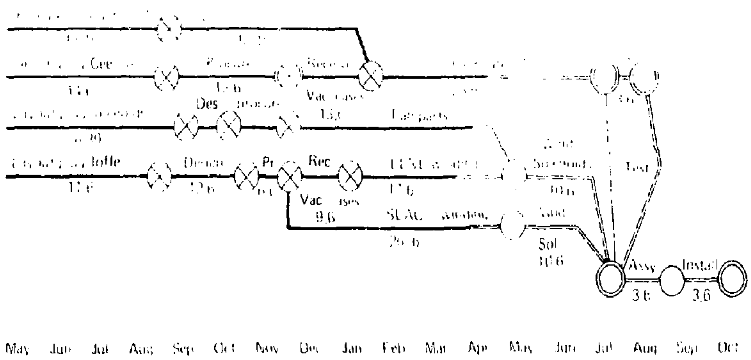

Fig. 3. Schedule of activities surr unding magnet system.

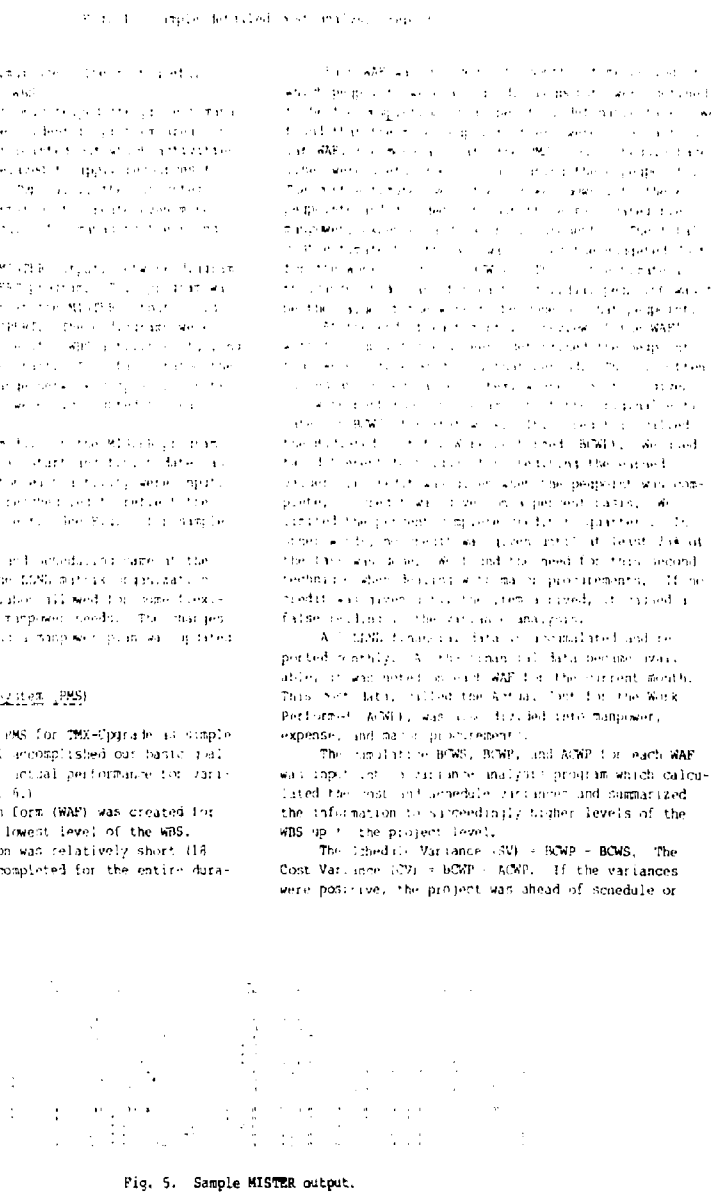

Fig. 5. Sample MISTER output.

Fig. 6. TMX-Upgrade Performance Measurement System (PMS) Variance Analysis Report.

less costly than originally estimated. If the variances were negative, the project was behind or spending more than was budgeted.

Another useful tool for PMS is the generation of performance indices. The Schedule Performance Index (SPI) = BCWP/BCWS. The Cost Performance Index (CPI) = BCWP/ACWP. If the SPI or CPI was greater than one, the results were positive, i.e., ahead of schedule or saving money, respectively. Conversely, if the SPI or CPI was less than one, the results showed the work package behind schedule or having a cost overrun, respectively.

The PMS data in Fig. 6 is shown cumulatively for each month and for an entire fiscal year at a glance. Note that the first column is a carryover from the previous fiscal year. Commitments are also shown on the PMS report as a reminder of additional expected costs.

The Reporting Phase

Concurrent with the operating phase is the reporting of project status. Guidelines for reporting information to DOE were set forth in the TMX Upgrade Administrative Plan. Monthly progress reports were given to DOE which included the following: 1) a narrative discussion of each subsystem detailing the progress for the past month, including highlights of major project milestones, 2) a table of costs by subsystem including the current approval baseline, current month's cost, cost-to-date, committed-to-date, and balance projected to complete the project, 3) major procurement status reports by subsystem, and 4) schedule status in the form of summary network diagrams by subsystem.

Quarterly and six-month reviews were required by the Administrative Plan. These reviews entailed oral presentations and written status reports of cost, schedule, procurement, and overall project status, and a tour of the facility. These reviews comprised information at WBS level 4 as compared to the monthly reports which were reported at level 5. Mechanisms for baseline changes were outlined in the Administrative Plan.

Conclusion

This paper has reviewed the project planning and management techniques used to monitor and control the $14.5-million cost and the 24-month schedule of the LLNL TMX-Upgrade experiment. The speed and efficiency with which we are able to complete the project in such a short time is due, in part, to these key points: 1) the subsystem engineers were responsible for the management of their individual subsystems; 2) management of the project used the minimum of staff; 3) all management tools were tied at the same level of the WBS, level 4; and 4) all of our management tools were compatible because of their common document formats.

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