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The Management Information Tool System

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The Management Information Tool System (MITS) was developed by the MTA New York City Transit Department of Capital Program Management (CPM) to establish a work force planning and cost performance database.

Although the concepts adopted in MITS are familiar to cost control professionals, it was implementing these time-proven ideas in a centralized computer system for a large public agency that proved significant.

This article explains the organizational changes that made MITS necessary, describes the system, presents lessons learned, and indicates some of the impacts that MITS had on CPM.

OVERVIEW

In 1995, the MTA New York City Transit Department of Capital Program Management reorganized. This was done to better serve its internal customers and to more efficiently use its technical work force.

In order to achieve the goals of this reorganization, CPM created MITS to plan work force usage and provide comparative cost performance.

CPM manages a capital program amounting to $1 billion a year in construction costs. This involves more than 200 construction contracts and 80 design projects at any time.

CPM has over 1,600 employees. The majority are architects and structural, electrical, mechanical, environmental, and signal engineers. In addition, there are also schedulers, estimators, and quality assurance professionals.

It became clear that the new organization would need a tool that allowed managers to plan their work force needs by technical discipline. These plans also had to be rolled-up by discipline and organizational units.

Once managers had a tool for planning their work force needs, it would be important to show them how they used resources over time. Therefore, the concept of trending actual usage was identified as a major need. This allowed all levels of the organization to view their plans in light of actual performance.

In addition, the new organization created independent business units called program areas, whose main role was to accomplish the capital program and to serve the internal client whose projects they were designing and building.

This brought up the other major aspect that drove the creation of MITS. Senior management recognized a need to measure cost performance across all program areas and to show performance indicators that compared these business units. The MITS main menu (see figure 1) highlights the functions that were needed to manage CPM's new organization.

REORGANIZATION

The new organization, which came into existence at the beginning of 1996, divided the department into eight program areas that served CPM's major clients. The technical work force resources that these program areas use to accomplish their workload were matrixed from an engineering services area.

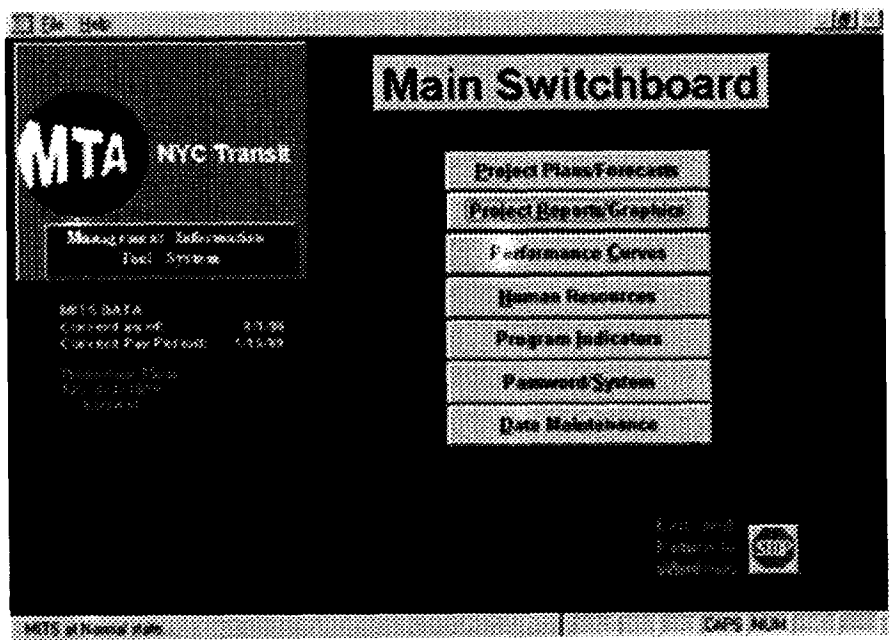

Figure 1—The MITS Main Menu

Old Organization

Previously, CPM had a functional organization structure (see figure 2). All design resources reported to the deputy vice president (DVP), designs, and there were several construction DVPs who were responsible for work that was assigned by type of contract. Therefore, all infrastructure work, including structural rehabilitations, mechanical systems such as pumps and fan plants, and electrical systems such as power substations or communications, were assigned to the DVP, infrastructure. There was a similar DVP area for new routes (63rd Street connection) and shops and yards.

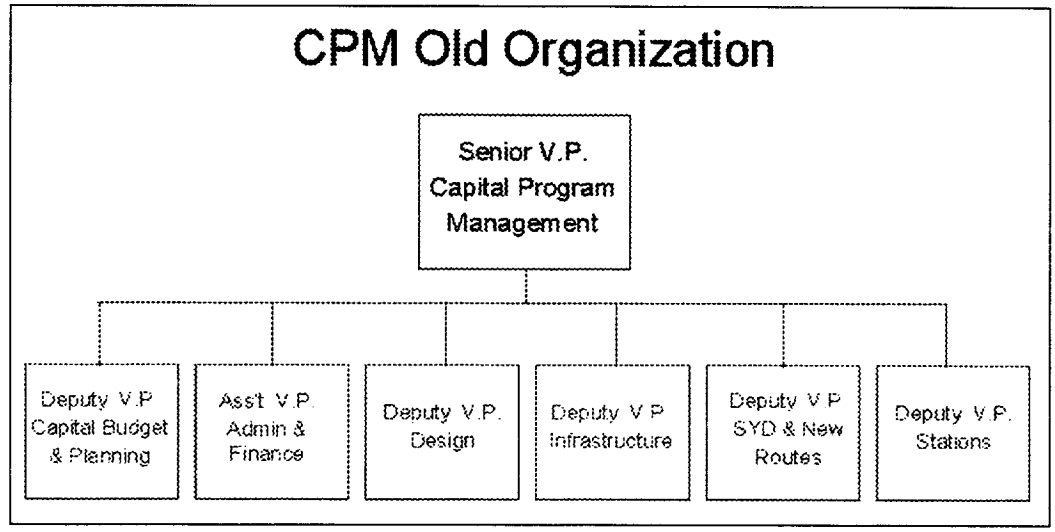

Figure 2—CPM With A Functional Organization Structure

The one exception to this model was the stations program. Given the size and visibility of the stations rehabilitation program, CPM was already experimenting with a new organization structure for this program area, going back to 1992. The stations program had its own dedicated planning, design, and construction management staff.

Problems

Under the old organization, each DVP "owned" the budget quota for his or her people. Therefore, any requests for additional resources always had to be brought to the head of the department in a budget process that was not uniform.

Furthermore, since all design and design support during construction were performed by one centralized area, work priorities usually had to be set at the DVP level.

The new organization's goals were:

- give program areas more control and accountability in meeting client needs;
- make the work force more flexible; and
- push the decision-making down in the organization to the project level.

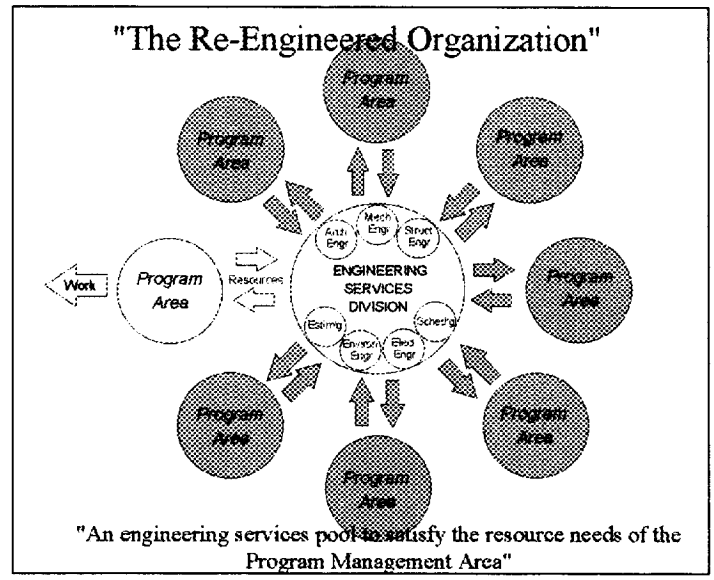

Figure 3—Program Areas Managed by a Program Manager

New Organization

Projects in the new organization were assigned to the program area that served a particular client, regardless of project type.

This meant that some program areas, such as line equipment, focused on pumps and vents, while the shops, yards, and buses program area had a variety of project types, including large depots and small equipment renovation projects.

Each of these program areas is managed by a program manager who has responsibility for both design and construction (see figure 3). In turn, program managers have as many design managers and construction managers reporting to them as needed to accomplish their work load. When a design project is

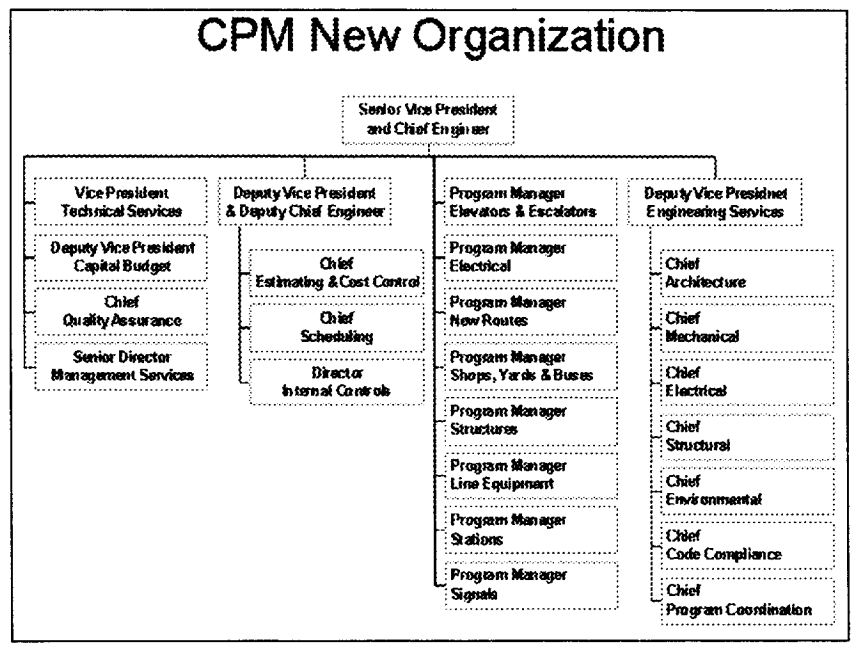

Figure 4—CPM's New Organization With Discipline Chiefs

awarded to a construction contractor, project responsibility shifts from the design manager to a construction manager.

All program, design, and construction managers were selected jointly by CPM senior management and the client area they would be serving.

Engineering services was created to encompass all technical disciplines. Each discipline is managed by a chief, whose primary responsibilities are to make sure that sufficient qualified resources are available to get the capital projects done, to ensure that work is performed up to technical quality standards, and to manage the career growth of employees in their discipline.

Under the new organization (see figure 4), budget quota or "human resources" are owned by the discipline chiefs. It becomes apparent that discipline chiefs who have to fulfill resource requirements in program areas will be very interested in how many hours it takes to design or construct a project.

MITS SYSTEM

CPM turned to a private-sector AE consulting firm, Stone and Webster Engineering Corporation (SWEC), who has a long history of matrix management, to assist in finding a solution to work force planning and performance measuring tools.

A team was developed involving CPM personnel and consultants from SWEC. The CPM members possessed extensive knowledge of cost control, existing CPM data systems, and CPM's labor distribution system. The SWEC members contributed cost control and computer programming support.

Requirements

From the outset, it was decided that the final product had to:

- be user-friendly and intuitive;
- operate in a Windows desktop environment;
- use existing computer hardware and communications infrastructure;
- use existing data sources; and
- allow easy modification.

MITS was developed in Microsoft Access and users shared databases over a Novell LAN. Workstations are Pentium powered personal computers running Microsoft Windows95. Users call up MITS through a run-time version of Access, which is installed on their workstations.

Direction

The challenge was to create an information system that supported decision-making in an organization structure that had never been introduced into a public-sector engineering organization such as CPM.

Senior management knew the direction that the organization had to take but could not spell out every detail. This required that the MITS development process had to be flexible and oriented to the needs of all levels of the organization.

Data Sources

The system is comprised of multiple tables, the most important of which store work force planning data and project information. These detailed work force plans are maintained by cost engineers who interact with the design and construction managers on an ongoing basis.

Schedule information is updated by cost engineers who attend design and construction project review meetings. In addition, dates are checked each month against a corporate reporting system to ensure that data is consistent.

As mentioned above, MITS does not operate in a vacuum. It relies on "official" budgets and expenditure data that is maintained in TA corporate systems.

Engineering work force expenses are imported every 2 weeks, and this coincides with CPM's time card processing. This information is imported in detail and also in summarized form.

In addition, every month the latest budget and outside contractor expenditures are imported from the corporate capital budget system. Since the budget is detailed and requires that all task expenses be recorded against projects for accounting reasons, MITS was forced to devise a "mapping" table that allows it

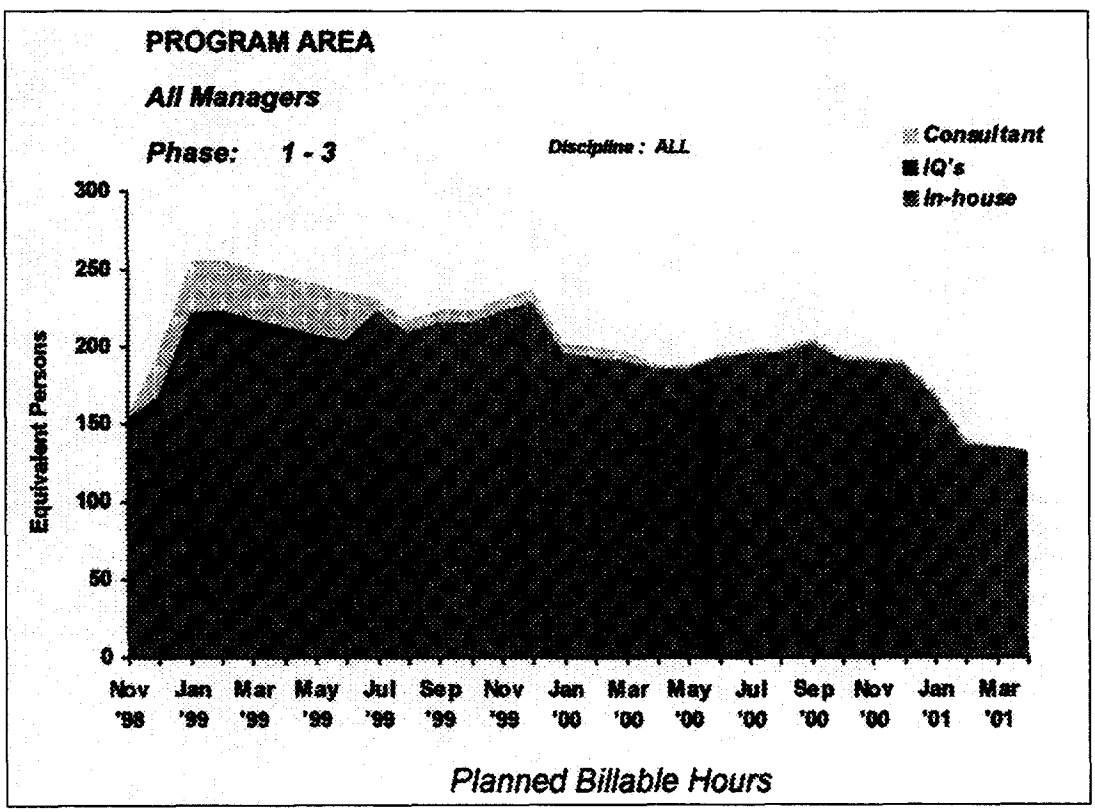

Figure 5—A Workforce Chart

to define which funds are active for the project being designed or constructed. Each cost engineer who is familiar with the funding and the current work load reviews the "mapping," which then drives the current budgets and associated expenditures.

Reports and Chart

MITS reports and charts can be grouped into five major categories:

- project milestone reports;
- work force planning and trending;
- cost performance curves;
- cost indicators; and
- employee listings by discipline and program area.

The milestone reports are lists of either design or construction projects that are used at project review meetings. They define a manager's workload and highlight goals and forecast dates.

Work force planning reports and charts are extensive (see figure 5). They contain planning data for both CPM's internal staff as well as current projected consultant services. This information is presented from the program area as well as from the discipline point of view.

Cost performance curves were established to give managers an easy way to look at the progress of a project. Previously, CPM had only tabular reports that showed cumulative expenses against budgets. Many senior managers felt that this did not present a complete picture. Instead, they thought a simple graph of expenses against a straight-line budget projection would be a better management tool.

These graphs, known as cost performance curves (see figure 6), were produced for every active design and construction project. In addition, they were then aggregated by program area and by CPM to give an idea of comparative performance. Another category of information that MITS presents is cost indicators. These include charts for overhead charges by program area, ratios of design costs to construction bid costs, and ratios of construction administration and support costs to construction bid costs.

Implementation

Part of the difficulty in establishing a new work force planning database is to get sufficient accurate data that can be presented to senior management for their decision-making.

During the fall of 1996, senior management requested a report indicating what work force requirements were needed to complete the current capital program under the new organization. This mandate required that work force on every active and new project be planned to a sufficient level of detail needed to:

- trigger budget requests for additional employees;
- determine which technical disciplines were under-staffed; and
- determine which projects could not be undertaken with in-house staff and would have to be ear-marked for outside consultants.

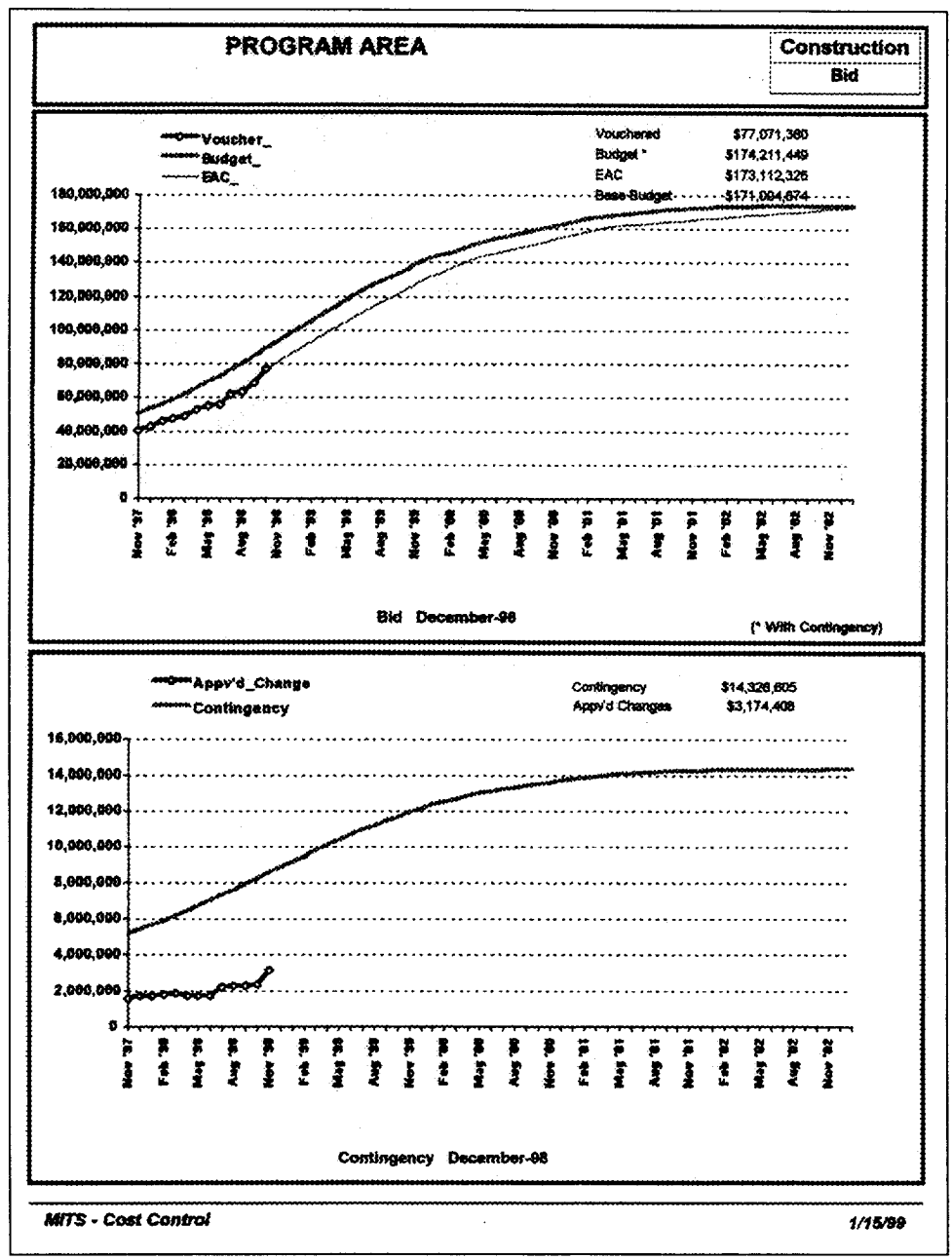

Figure 6—Cost Performance Curves

This was MITS' birth under fire. Cost engineers interacted with design and construction managers and were the front-line soldiers introducing MITS to the organization.

During this initial stage, these cost engineers were the ones who received feedback on which aspects of MITS were meeting user needs. They also were the ones who experienced first-hand any improvements to the system that made their lives easier or helped meet program area needs.

Along with mandates for work force projections, MITS also started implementation by providing control reports for design and construction project review meetings. This ensured that MITS had the current population of projects and the most current dates.

Another action that focused the implementation of MITS in the organization was the publication of a monthly cost performance report to senior management. The cost performance report contains summary cost performance curves, an analysis indicating which projects contribute to over/under-performance, work force plans, and performance ratios.

This report filled an information need in a crucial area of management and also highlighted the important role that MITS assumed.

OBSERVATIONS

As CPM introduced the concepts behind MITS to the new organization, several points were reinforced by feedback from managers and users:

- new concepts usually are more readily accepted if they tie into existing processes or work flows;
- it is wiser and more consistent to use existing data sources than to store and maintain duplicate data; and
- given a large amount of detailed information, people prefer graphs and summary reports.

Existing Work Processes

From the outset, MITS took a straight-forward view that a design manager or construction manager would have no trouble identifying and planning for all technical employees working on their projects.

It was assumed that a design manager had all employees in front view and could gauge their input on a project. It turned out that this was true for most employees on a project but never for input from construction managers in the same program area. It turned out that the construction administration employees who attended constructability meetings and provided input during design actually worked in the construction manager's office and contributed to the project on a sporadic basis.

Another case was design support during the construction phase. The construction manager always had a good handle on his own staff operating out of the construction office. However, any input on the work activities of the designers who sat in the design manager's office and reviewed drawings was in the hands of the design manager, not the construction manager.

It became clear that the original belief that a design or a construction manager had all of the resources needed to do a project was true in the work sense but not in the administrative sense. This meant that the manager would get the necessary services in some cases but not have control over the day-to-day activities of these employees.

The latter situation pointed out that the work force plans had to distinguish between employees who performed construction administration duties and those who were designers. This introduced another level of detail called a "function."

This new tag actually facilitated planning activities by discipline chiefs. It turns out that it was extremely useful for the chiefs to know the level of design activities (both pure design as well as design support) apart from construction administration.

Previously, MITS viewed work activities strictly on a design phase versus construction phase basis. The organization came back and told MITS that designers and construction administration personnel were not readily interchangeable. Planning had to be done for them separately.

Once MITS recognized the distinction and found a mechanism for incorporating "function" into planning databases, reports, and charts, people accepted the tools and started to provide meaningful information.

Using Corporate Data

When the first reports showing work force plans versus actuals were issued, MITS stored actuals as they were supplied. These charges came in every 2 weeks and were religiously captured and stored. The system displayed these numbers for individual projects as well as on summary reports.

After a year, we started to observe that whenever employees moved from a major discipline to a support discipline, all of their actual charges on projects moved from one discipline to another. This occurred when an employee who was, for example, a mechanical engineer, decided to gain work experience as an estimator or a scheduler. Often, these employees return to their major discipline having received valuable exposure.

Naturally, the managers who took a great deal of time to make accurate discipline plans were not thrilled with having to go back and adjust their plans because of routine administrative changes.

Not only did MITS start to have minor discrepancies with discipline actuals, but adjustments to time records were not being reported accurately.

The solution was to have the corporate database that processed biweekly time charges refresh MITS summary data every 2 weeks. This solved both problems.

By importing the summary charges as well as the details on a regular basis, we were assured that MITS data was synchronized with the corporate database at any time. When adjustments occurred, they were reflected as soon as possible. The lesson learned from this was that cooperative processing made things more accurate.

Graphs and Summary Reports

The initial work force planning reports that MITS issued were detailed 8 1/2 x 14 sheets that showed each work hour by month.

Although this was the appropriate tool for reviewing project planning data, it never gave an overview of the project. Instead, the more appropriate tool was a summary report that listed all of the disciplines and showed a graph of the plan versus actuals. This became the management vehicle for showing work force needs at a glance.

Here is an example where MITS was able to present a tool that highlighted work force planning data by adopting an existing report.

Previously, CPM used a design status report to show progress and work force resource usage on design projects. The format and name was adopted by MITS and used as a summary report for design projects. In addition, a similar construction status report was developed for work force usage during the construction phase.

Each report summarized information and presented the work force distribution graphically with accompanying actuals. The lesson from this was that people can deal with graphs and summarized data more easily than raw data. In turn, they are also more willing to adopt the concept if they can get their hands around the data, particularly if there is a lot of it.

UPCOMING CHALLENGES

The primary mission of MITS is to provide information tools needed to plan work and measure performance. This is a dynamic process that really never ends.

Cash Flow Modeling

Once CPM management started to look at work force and workload charts, the need to make more realistic projections became the next level of expectation.

This was observed by CPM senior management and the agencies that fund the capital program. Capital funding is tied to realistic work modeling. This is important not only on financial grounds but also for planning resources.

When MITS performance curves were first developed, most managers thought that a simple chart showing actuals against a straight-line budget projection was all that anyone would need to tell if a project were in trouble. Although this is true, when managers are asked to explain variances and when it comes to unusual projects, it seems more appropriate to allow managers to accurately model how they will flow cash or use work force.

The solution to this was to develop a module that provides project modeling capabilities. The next step is to research past performance and develop generic or specific models for projects or programs of work.

"What-If" Scenarios

Another challenge is in the area of providing program areas with the ability to perform "what-if?" analysis concerning their future work. This may entail measuring the impact on workload of adding additional projects and determining which technical disciplines will be short of resources.

MITS is able to export detailed work force planning data to Primavera's P3. The resulting P3 network can be used to present different scenarios. The results then can be re-imported into MITS. The challenge is to raise managers' awareness of this capability and to make it easier to use.

Workforce Forecasting

Another challenge is to provide MITS users with a module that allows managers to forecast their projected workforce usage on a regular basis. This will allow us to measure workforce usage against a set plan and report workforce needs based on forecasts from "time now" to the end of the project.

Once a workforce plan is established, it is usually not changed unless a major development occurs in the project. Instead, monthly forecasts of expenses to the end of the project are recorded. MITS initially recorded the number of hours that any employee was scheduled to work on the project and used this information to present a forecast to the end of the project.

During implementation, many managers informed us that they could not easily do this for each employee who charged their project. They mentioned that not all employees working on their projects reported to them or even their program area. Therefore, it would be a major administrative task to call all the support areas that provide services and to try to determine which employee would be assigned to work on their project.

Instead, many managers indicated that it would be easier to forecast future needs by discipline. This modification entails changing the forecasting module and all the accompanying reports and charts.

EFFECT ON THE ORGANIZATION

After 2 years' experience, workforce planning and cost performance reporting are integrated into the new CPM organization.

Some of the results that can be observed include:

- raised awareness of cost performance and cost savings opportunities;
- lower level managers, particularly resident engineers on construction projects, assume larger roles in planning and cost control;
- senior management focuses more on program performance, especially in making presentations to the MTA oversight board; and
- proactive management was introduced by focusing on more planning and anticipating events instead of reacting to them.

MITS data focused attention on these issues and provided a tool for managers to plan work and identify resources.

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