RAMPS

A resource scheduling tool for multi-projects.

By Jack Moshman

NOT UNLIKE such fads as hula hoops, yo-yo's and Davy Crockett hats which periodically sweep through the younger generation, there have been management fads which attract a great deal of attention and ballyhoo, only to have their meteoric rise quickly fizzle out, leaving at best a small residue in certain quarters. The interest and enthusiasm which greeted early versions of the critical path methodology, and in particular the PERT system, have been tempered by the disillusionment that came with practice.

Reasons for this are not difficult to fathom. The PERT system makes a good straw man. One must realize that PERT was designed as a management aid in monitoring projects where the emphasis was on timely completion in particular, and on the control of costs as a secondary feature. PERT was *not* designed as a scheduling technique. Organizations attempting to use it in this fashion soon found that there was a great gap between the customary tabulations produced by a PERT program and a practical and realistic working schedule.

The "classical" Critical Path Method (CPM) was designed more as a scheduling aid, but in its customary application its major benefit is in providing assistance in calculating an advantageous balance using the trade-off between time and cost in accomplishing one particular piece of work.

The major deficit found by organizations concerned with the scheduling of "in-house" activities was the need to take explicit account of limited resources, and the fact that the organizations usually were concerned with the simultaneous management of a variety of independent projects linked together solely by their reliance on a common pool of resources. A conventional arrow diagram may show two activities in parallel. If, however, these activities use the same resource which is composed of less than the required number of units to run both activities concurrently, the two activities are necessarily constrained to be conducted serially. The limitation of available resources obviously has a serious effect on any critical path analysis. The term "resources" includes manpower with different skills; equipment such as computers, lathes, bulldozers and spectrometers; such facilities as test stands, warehouses and office space; and money divided into specified budgetary pockets.

New technique

To meet the needs of operating organizations, a technique was developed by C-E-I-R, Inc. that explicitly schedules limited resources among an arbitrary number of independent projects. This technique was given the acronym RAMPS: *R*esource *A*llocation and *M*ulti-*P*roject *S*cheduling.

RAMPS is a member of the family of techniques using the critical path methodology. It, like CPM and PERT, uses the by now conventional arrow diagram to describe the interrelationship of activities within a project.

A departure from previous procedures is the reliance in RAMPS on the amount of work concept. Rather than have the project manager arbitrarily prescribe a specified number of resources of one or more types which are needed to complete a project in an estimated number of time periods, RAMPS calls for the amount of work. Different rates of resource utilization at varying efficiencies might be used to accomplish the normal amount of work. For example, a particular job may normally require eight men for 12 days to complete the activity. The normal 96 man-days may be looked upon as the amount of work. If 10 men were available and assigned to the project, the job would be completed in 10 days, a saving of two days time but at an added cost of four man-days. The efficiency relative to the norm is 96 percent. On the other hand, if only five men were available, 24 days would be needed to complete the job, requiring a total of 120 man-days and representing an efficiency of 80 percent.

The flexibility achieved in using different utilization rates for resources by the application of the amount-of-work principle results in a great deal of flexibility while, at the same time, adequately representing the realistic changes in efficiency that occur when different resource utilization rates are applied. We live in a non-linear world, a fact recognized by RAMPS.

Flexibility

Other features that have been built into RAMPS include the ability to apply resources in teams, a recognition that at times limited resources can be expanded at increased cost through overtime or subcontracting, the ability to provide for, or to prohibit, possible interruptions of an activity once commenced. Interruptions, if permitted to occur, may involve an added cost.

Of major importance is the flexibility inherent in RAMPS to be responsive to the needs of management and to generate schedules which reflect individualized management criteria. Within the framework of providing different priorities to the completion of different projects, RAMPS can provide schedules which, subject to resource limitations, are those which complete projects at minimum cost, complete projects in minimum elapsed time, complete projects using resources at a level rate, or complete projects guided by other management objectives. RAMPS is an automated technique, running on the IBM 7090, in active use by a variety of organizations for the planning and scheduling of construction operations, paper flow, the replacement of one computer for another with the consequent training and reprogramming, the production scheduling of a variety of products and other applications.

Output from RAMPS normally is tabulated in two ways:

1. A project-oriented report provides to the project manager the number of units of each type of resource to be applied to each activity within the

FIGURE 1 — PROJECT SCHEDULE

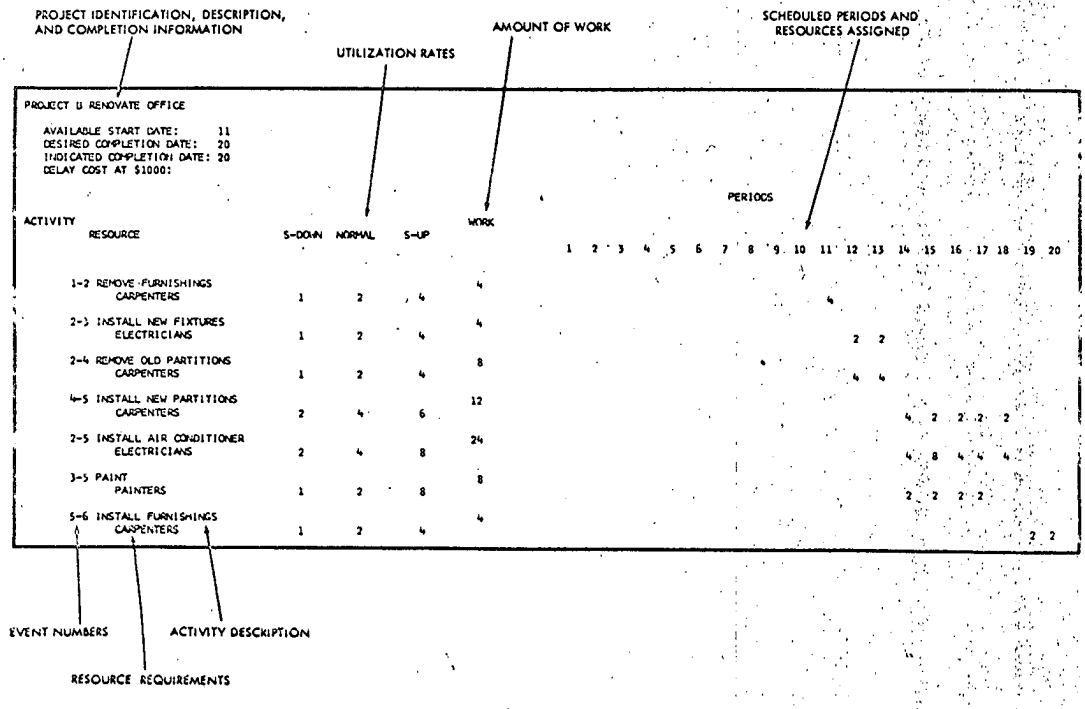
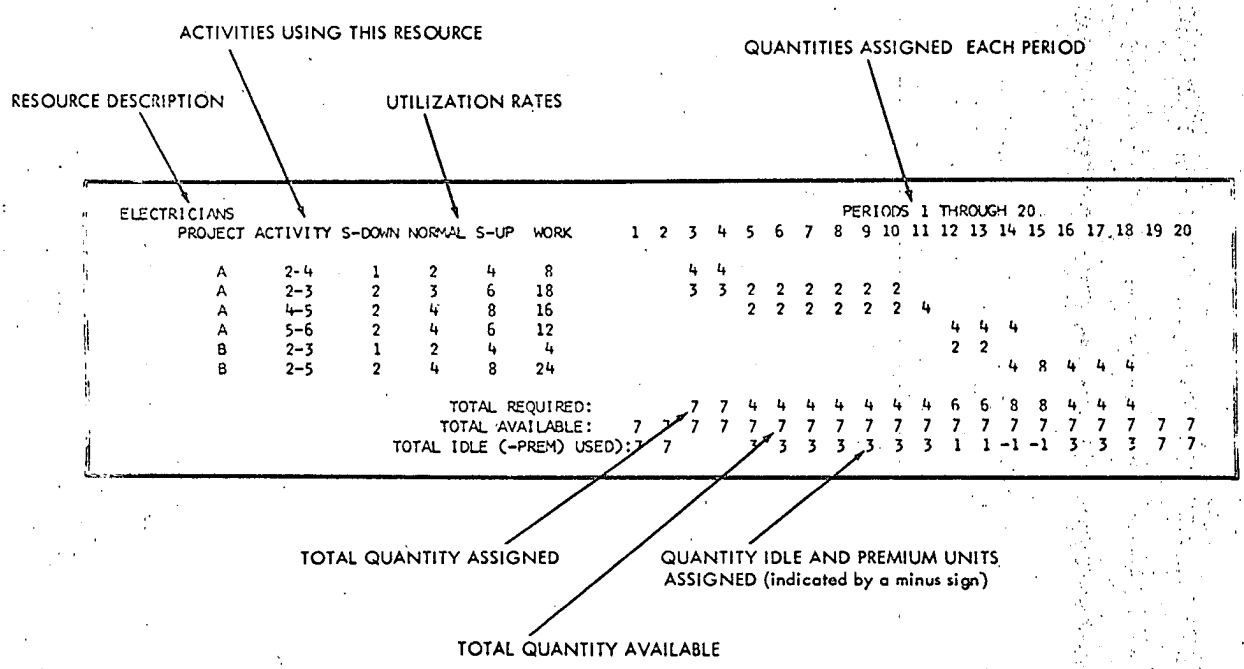


FIGURE 2 — RESOURCE ALLOCATION SUMMARY



project during each period of time over the life of the project.

2. A resource-oriented report, designed for the resource supervisor, shows him the requirements within the numbers available to him for each activity in all of the projects during each period of time.

Figure 1 shows the work schedule for a project denoted as Project B and a breakdown of the various types of information contained in all RAMPS schedules. Although RAMPS internally interrelates the schedules for all projects, the printed schedules are produced separately for each project. This allows those who are interested in a particular project to receive only the information for that project.

The heart of the schedule is the right-hand portion which shows the time periods during which each activity is to be worked and the quantity of each resource allocated during each period. To the left are the activity names, event numbers, amounts-of-work, resources required, and the three utilization rates — all of which have been reproduced from the original data given to RAMPS.

Note that the activities are listed in order by starting period. All activities scheduled to begin during period 1 are shown first, those starting in period 2 appear next, and so on until all the activities have been shown in the schedule. This is extremely convenient, especially in large projects where the schedule may extend over many pages. It allows the user to consider and act upon the total requirements of each time period in turn.

The information in the upper left corner of the schedule includes the specified start date, desired completion date, indicated or scheduled completion date, and the delay costs, if any. Obviously, this information is critical in determining the adequacy of the work schedule.

Supporting the project schedules are reports showing how much of each resource was used during each time period and the activities to which the resource was assigned. As shown in **Figure 2**, these reports also include the number of units available, assigned, and idle in each period. Note that each of these reports covers allocations of a resource to all the projects.

Modifications

RAMPS is constantly undergoing evolutionary changes to make it more and more responsive to a wide variety of applications. Some of the modifications introduced have been the automatic cycling of numbers of resource available to facilitate the scheduling process over different shifts or week ends when the resource pool may vary in number from that on the normal workday. By introducing unlimited resources, such as purchased material, it is possible to anticipate when material and supplies of different types will be needed and to plan the procurement in sufficient time to meet the needs of the schedule and concurrently to reduce the amount of capital tied up in inventory awaiting use.

Intelligent use of RAMPS enables management to spot flaws in work plans, to make better use of existing resources, and to provide a basis for sound judgment in planning the levels at which different resource types will be maintained. Above all, RAMPS may be looked upon as a technique to execute the decisions made by management, following guidelines and rules provided by management without usurping the responsibilities or prerogatives of management. ▣