

CRITICAL PATH ISSUE NO. 6

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## HOME OF THE BRAVES SCHEDULED BY CPM

At this writing the long task of obtaining a definite commitment from a major league baseball club to occupy the large \$18-million Atlanta Sports Stadium next spring is almost completed. Construction of the stadium is almost one-half completed, and the Critical Path Method is helping to assure that the job will be completed in time to toss out the first ball to the new Atlanta (nee Milwaukee) Braves next April.

The extremely short schedule, 12 months, desired by the Atlanta and Fulton County Recreation Authority resulted in premium bid prices for the construction contract and the need for close control of the schedule. The architects, a joint venture of Heery and Heery and Finch, Alexander, Barnes, Rothschild and Paschal, required the use of CPM for progress reports by the contractor. It turned out that the low bidder on the 12-month schedule was a firm with recent experience in using CPM on stadium construction. The contractor, Thompson & Street Company, had used CPM to help finish the University of Georgia Coliseum 40 days ahead of schedule (*Pathfinder*, August 1963).

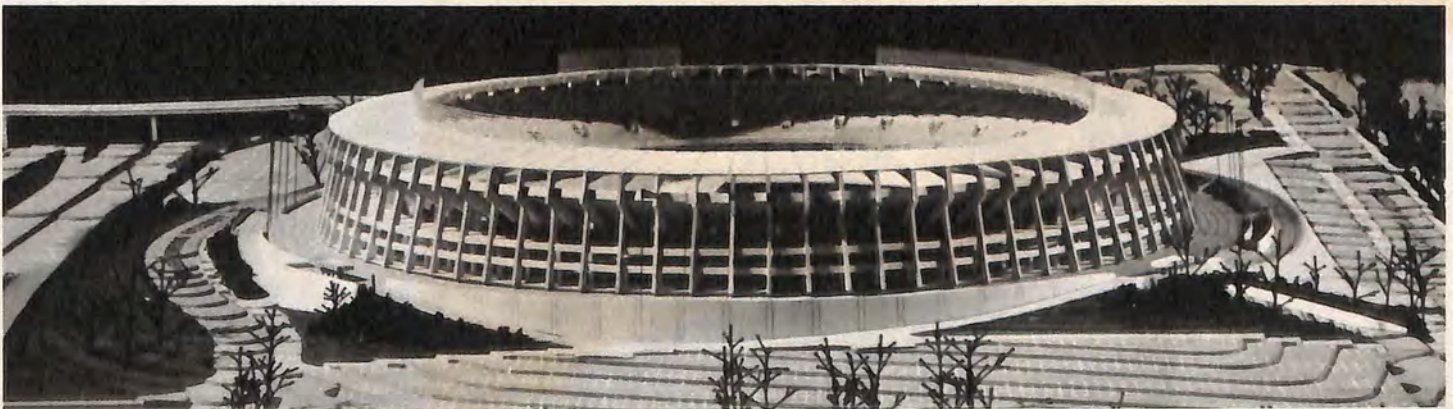
As in the Coliseum project, Management Science Atlanta assisted Thompson and Street in setting up the CPM schedule for the stadium and in handling much of the periodic updating. The network for the stadium contains 3240 activities drawn on 16 pages. The computer selected for the CPM processing was the Burroughs B-5000 at the Rich Electronic Computer Center at Georgia Tech. The B-5000 program has a capacity of 524,288 activities.

The specifications called for updating the CPM schedule every two weeks. At these updating periods, the progress of the previous two weeks, along with any changes in the logic of the construction plan which have developed during the reporting period, are fed to the computer and a current status report and new schedule are generated.

The management of Thompson & Street has stated that they would have used CPM on this project even if it had not been required. They report that one of the major uses of the updated schedules is better co-ordination among the many subcontractors, the general contractor, the architect, and the owner. A computer printout of the CPM schedule was made a part of many of the subcontracts. The CPM plan and schedule has also helped signal the need for some major revisions of the original construction plans.

An example of the type of management action which is implemented by the CPM schedule was the change in the established location of the precast yard. The original location of the yard was in the playing field area which would be close to the points of use for the cast structural items. A computer report indicated that there would not be enough time remaining after the finish of the precasting operation to be able to erect the temporary football bleachers, obtain the owner's approval, and remove the stands to clear the field for baseball. Consequently, the precast yard was constructed in the parking lot rather than on the playing field.

Figure 1. Atlanta's Major League Sports Stadium Will Seat 50,000 for Baseball, 57,000 for Football.





# NETWORK FORMATS DIFFER

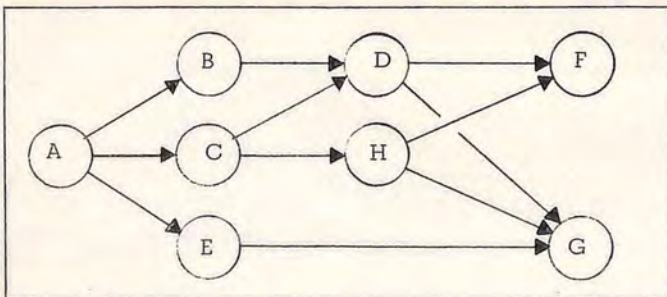
Currently, there are three project networking formats in use: (1) activity-on-arrow, (2) event oriented, and (3) activity-on-node. Interestingly, the apparent best format, the activity-on-node, is least used.

In the activity-on-node format, activities are graphically represented by nodes instead of arrows. The arrows are used to represent only the dependency relationships among the nodes. This format does not require the use of special dummy activities. The principal advantage of the format is its simplicity, since the avoidance of dummy activities eliminates the majority of networking problems. Professor John Fondahl of Stanford University, a noted CPM authority, supports the activity-on-node format as the best. The format is not too widely used primarily because it was not noticed until after the other formats became popular, and very few CPM computer programs are written for it.

In the activity-on-arrow format, activities are graphically represented by arrows. The arrows are interconnected to show, as nearly as practical, the true dependency relationships among activities. To correctly show dependencies, the activity-on-arrow format requires the frequent use of dummy activities at merge and burst points.

In the event-oriented format, which is most closely associated with PERT, the nodes may represent either "start" or "end" events. Activity descriptions are placed inside the nodes, and activities are represented by arrows, upon which time estimates are noted. Among users of the system, there is considerable variation in the use of start events and dummies. The system is essentially a hybrid combination of the other two systems. Due to its ambiguity at merge points and non-standard conventions, the event-oriented system often causes problems of misinterpretation.

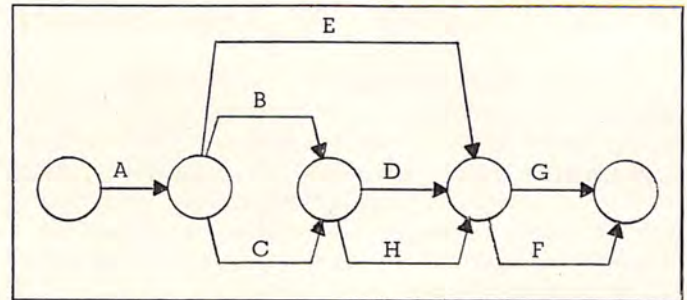
DEPENDENCIES FOR SAMPLE NETWORKS			
Activity	Depends On	Activity	Depends On
A	none	E	A
B	A	F	D, H
C	A	G	D, E, H
D	B, C	H	C



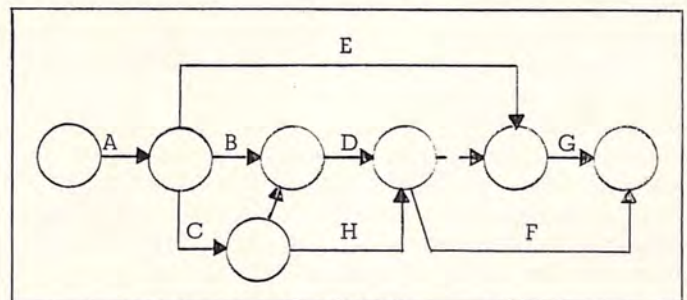
1. Activity-on-Node (Correct)

Examples of each of the three formats are illustrated below, along with common errors made when the two most popular formats are used.

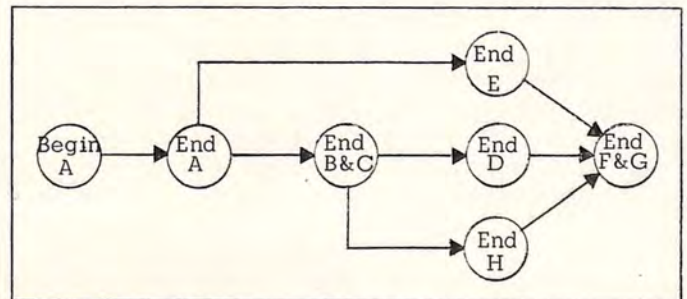
Management Science Atlanta currently uses the activity-on-arrow format almost exclusively because of the wide variety of CPM computer programs written for it. The popularity of the activity-on-node format, however, is expected to increase significantly in the near future. Recently, two new activity-on-node computer programs were made available, one for the



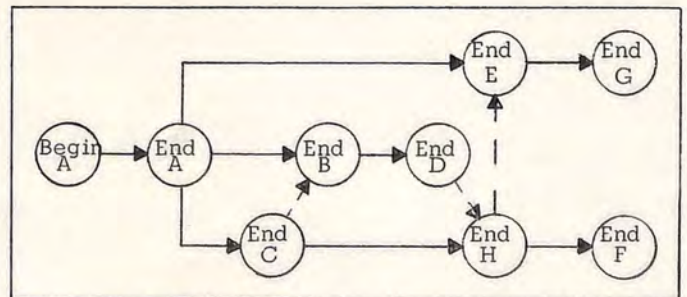
2. Activity-on-Arrow (Wrong)



3. Activity-on-Arrow (Correct)



4. Event Oriented (Wrong)



5. Event Oriented (Correct)