

# IDEAGRAMS

LESSON TWO

PERT/CPM AND  
NETWORK ANALYSIS  
HISTORICAL  
OVER-VIEW

- IDEAGRAMS:
- THINK VISUALLY
- CONCENTRATE
- ANALYSE CONTENT

## LESSON TWO

### PERT/CPM OVERVIEW:

To illustrate how the network analysis process developed

The IdeaGram concept grew out of the project management field – the same principles have been applied to written material to extract core ideas and concepts and present them in a clear and concise manner.

## Definition of the Problem

The original concept grew out of project managers gathering around a conference table with activity notes on 3x5 cards that they arranged in sequential order.

This process led to the formulation of both PERT (Milestone Oriented) and CPM (Activity Oriented).

The difference will be explained later in these presentations.

### IDENTIFY PROBLEM (PLANNING METHODS)

IDENTIFY PROBLEM

TO EFFICIENTLY PLAN, SCHEDULE & CONTROL

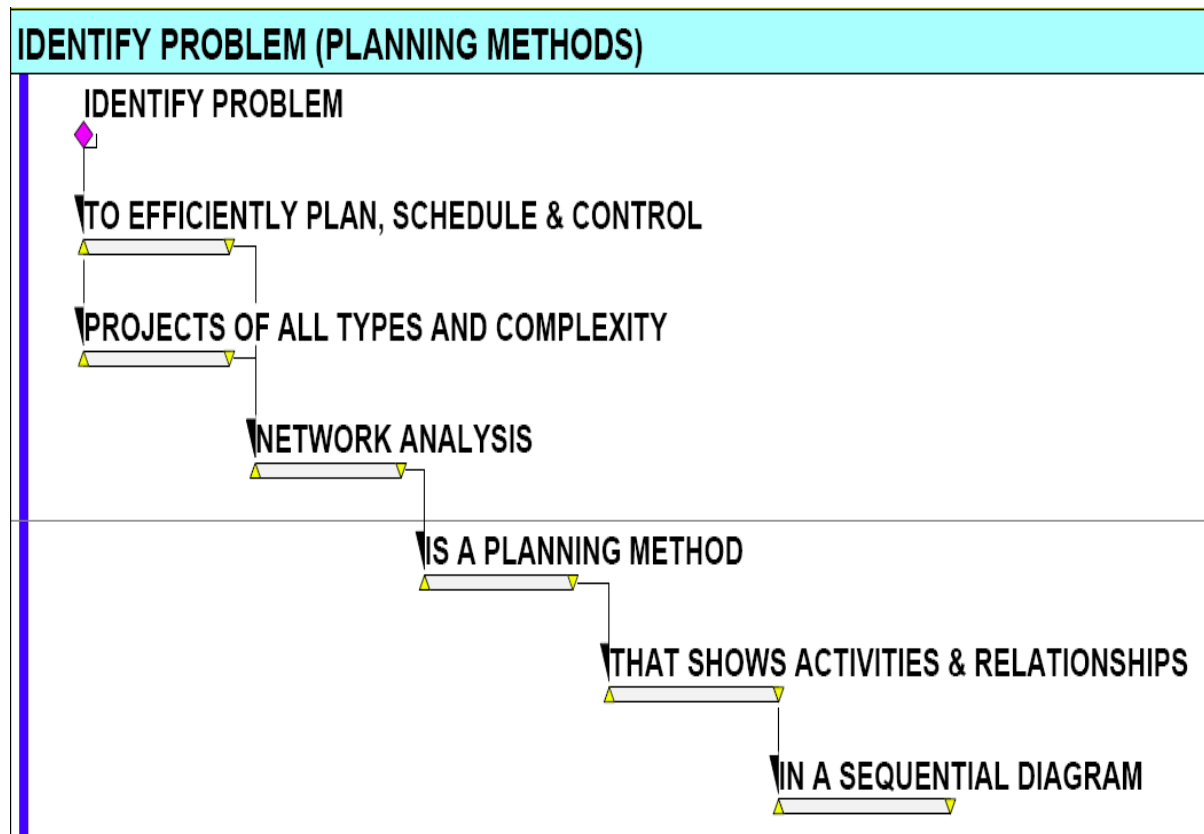
PROJECTS OF ALL TYPES AND COMPLEXITY

NETWORK ANALYSIS

IS A PLANNING METHOD

THAT SHOWS ACTIVITIES & RELATIONSHIPS

IN A SEQUENTIAL DIAGRAM



CPM –

## Critical Path Method

When I'm asked to explain what CPM stands for I often say:

Certified

Public

Menace

### CPM (CRITICAL PATH METHOD)

CPM (CRITICAL PATH METHOD)

IN 1955 THE DUPONT CORPORATION DEVELOPED CPM

AS A METHOD OF PLANNING SCHEDULING & CONTROLLING

PLANT TURN-AROUND MAINTENANCE PROJECTS

STAFF REPORTED INCREASED INSIGHT & COMMUNICATION

AMONG PROJECT PERSONNEL

DUPONT REDUCED PLANT TURNAROUND MAINTENANCE

SHUTDOWN TIME FROM 12 TO 7 DAYS

## PERT –

# Program Evaluation and Review Technique

### PERT (PROGRAM EVALUATION AND REVIEW TECHNIQUE)

PERT (PROGRAM EVALUATION AND REVIEW TECHNIQUE)

IN 1958 US NAVY, LOCKHEED & BOOZ-ALLEN HAMILTON

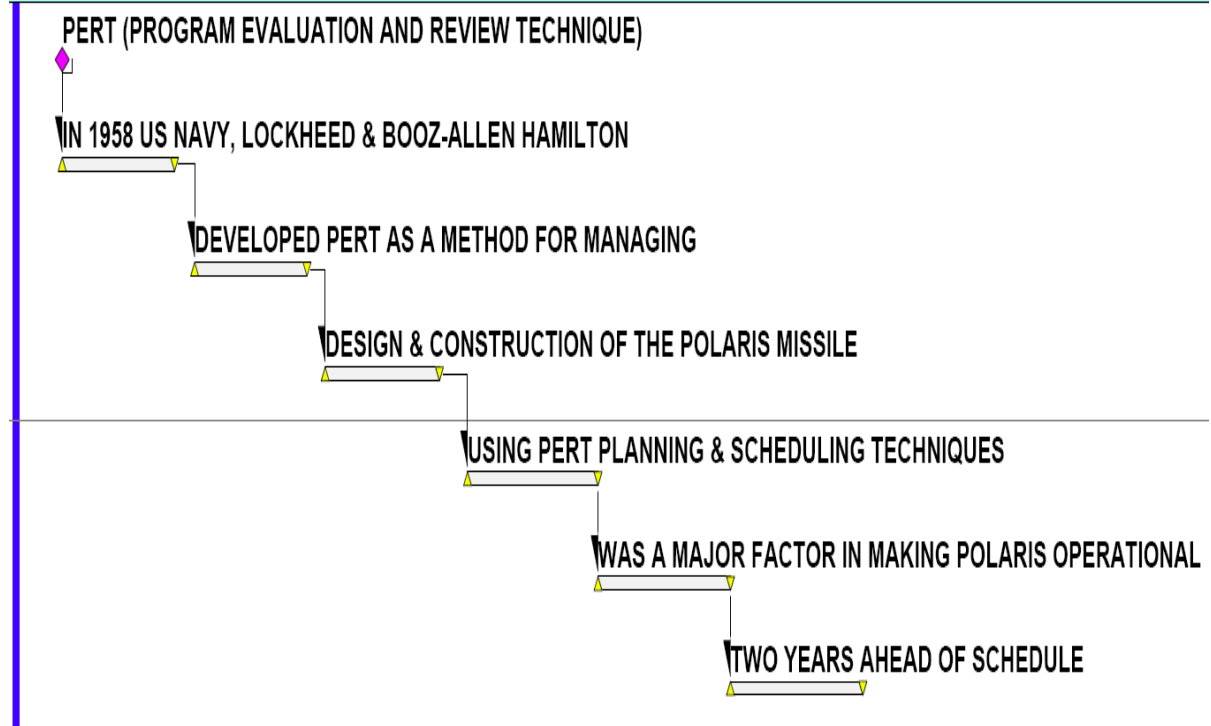
DEVELOPED PERT AS A METHOD FOR MANAGING

DESIGN & CONSTRUCTION OF THE POLARIS MISSILE

USING PERT PLANNING & SCHEDULING TECHNIQUES

WAS A MAJOR FACTOR IN MAKING POLARIS OPERATIONAL

TWO YEARS AHEAD OF SCHEDULE



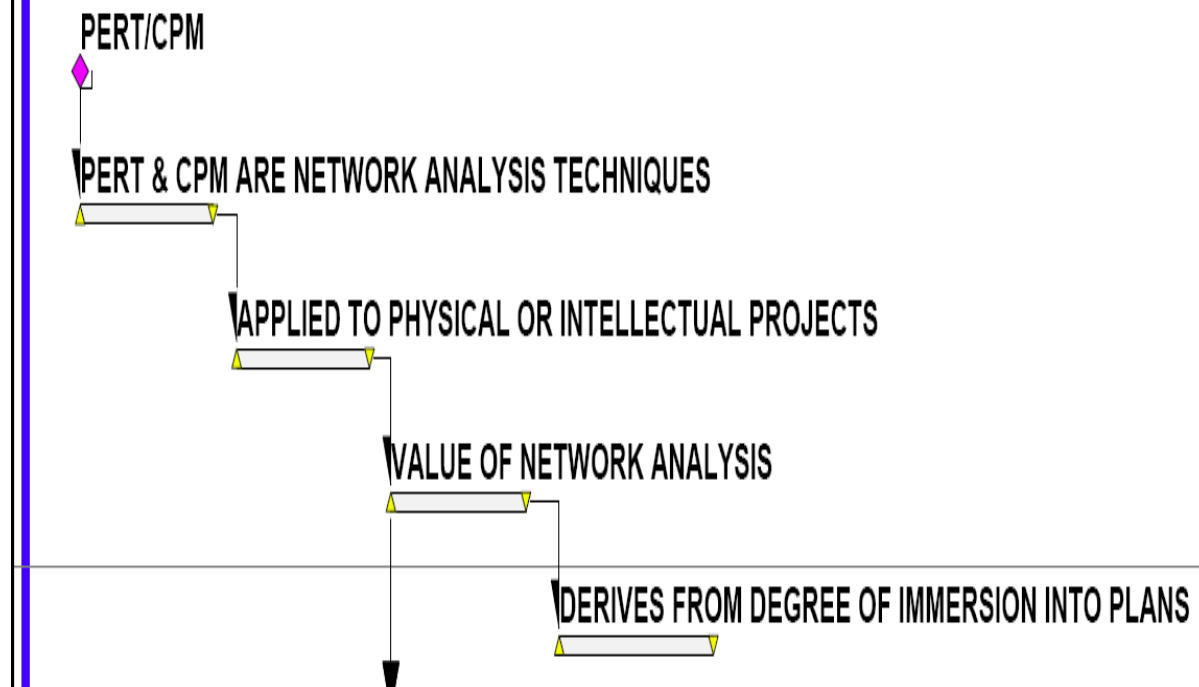
## PERT / CPM

PERT (historically) was milestone oriented so it had the activities in a box with a range of durations (optimistic, likely and pessimistic).

CPM originally had the activities on an arrow (hence Arrow Diagram) with a single duration attached to each activity.

In combination it is common to use boxes to signify major milestones and arrows to indicate activities that have duration.

### PERT/CPM (METHODS OF NETWORK ANALYSIS)

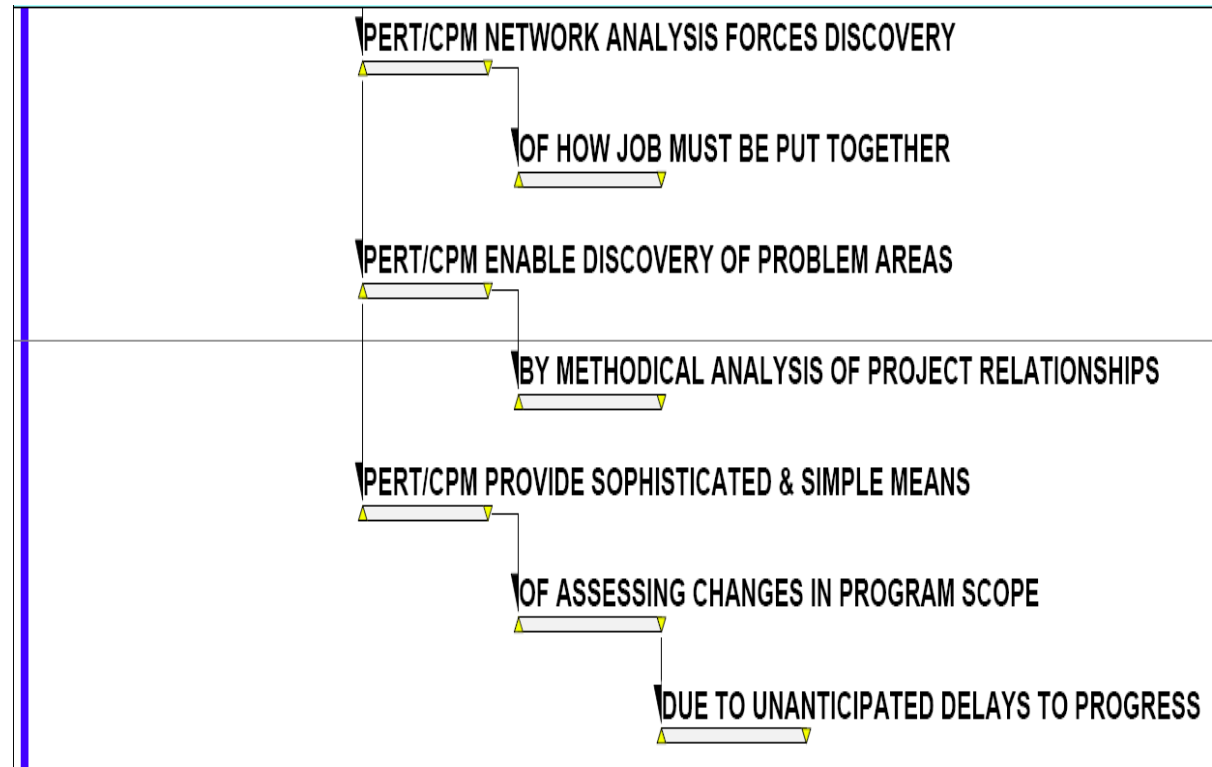


## THE MAGIC OF THIS TYPE OF ANALYSIS

There is an internal thinking, concentration and analytical process that results from preparing a detailed logic diagram.

When done in collaboration with other people the process results in a deep communication about the inherent sequence of the project that is being planned.

My mentor (Karl F. Elliott) used to say that we could walk away with the charts that were developed during a planning session and never return and still the project team would have attained a significant planning, communicating and understanding benefit.



## Parallel with the IdeaGram Process

In the same way that this technique constructs a diagram or model of a project, an IdeaGram constructs a chart of the core ideas of a narrative or process.

In some ways IdeaGram is a new word for an old process. I believe the uniqueness of many IdeaGrams that I've developed is in the nature of the content and the ability to read them in a clear and legible manner.

### NETWORK TECHNIQUE (METHODOLOGY)

#### NETWORK ANALYSIS TECHNIQUE

CONSTRUCT A DIAGRAM / MODEL THAT REPRESENTS

PROJECT ACTIVITIES IN A LOGICAL SEQUENCE

EVALUATE & REVISE ACTIVITY LOGIC & SEQUENCE

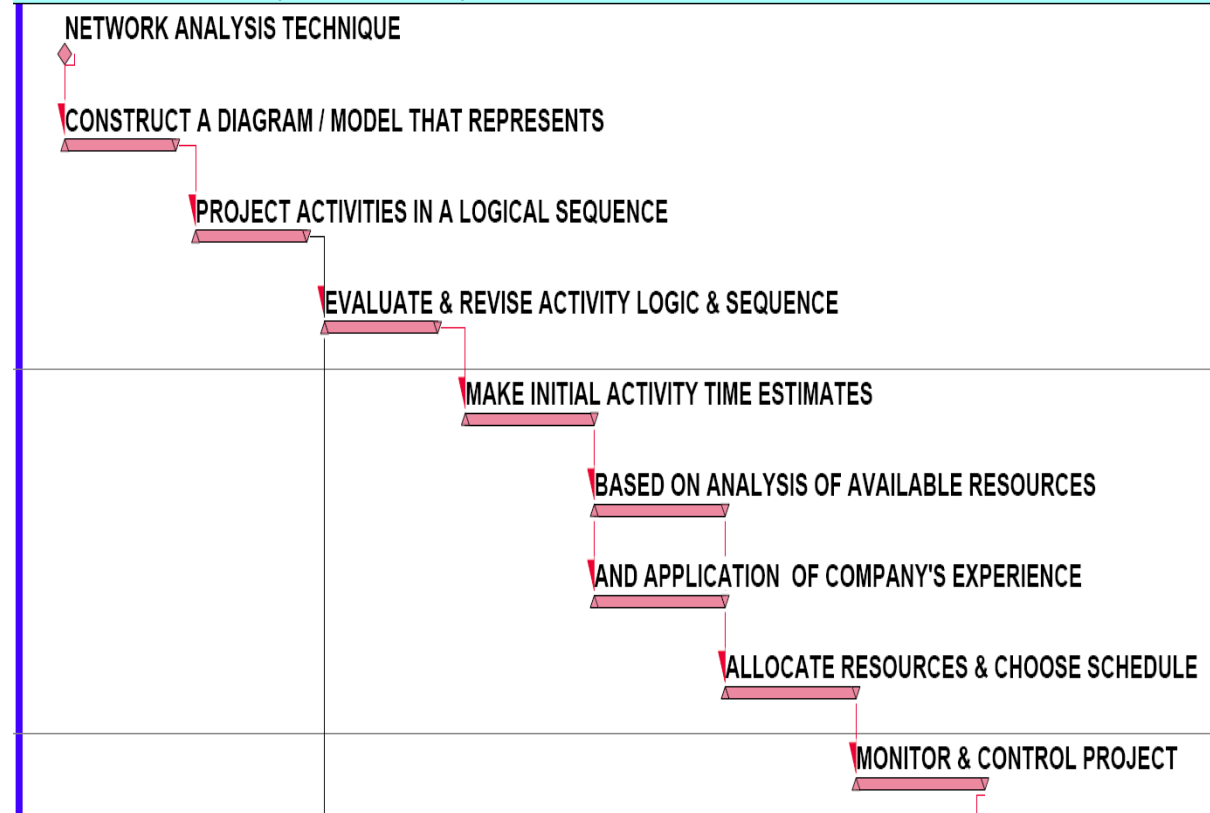
MAKE INITIAL ACTIVITY TIME ESTIMATES

BASED ON ANALYSIS OF AVAILABLE RESOURCES

AND APPLICATION OF COMPANY'S EXPERIENCE

ALLOCATE RESOURCES & CHOOSE SCHEDULE

MONITOR & CONTROL PROJECT





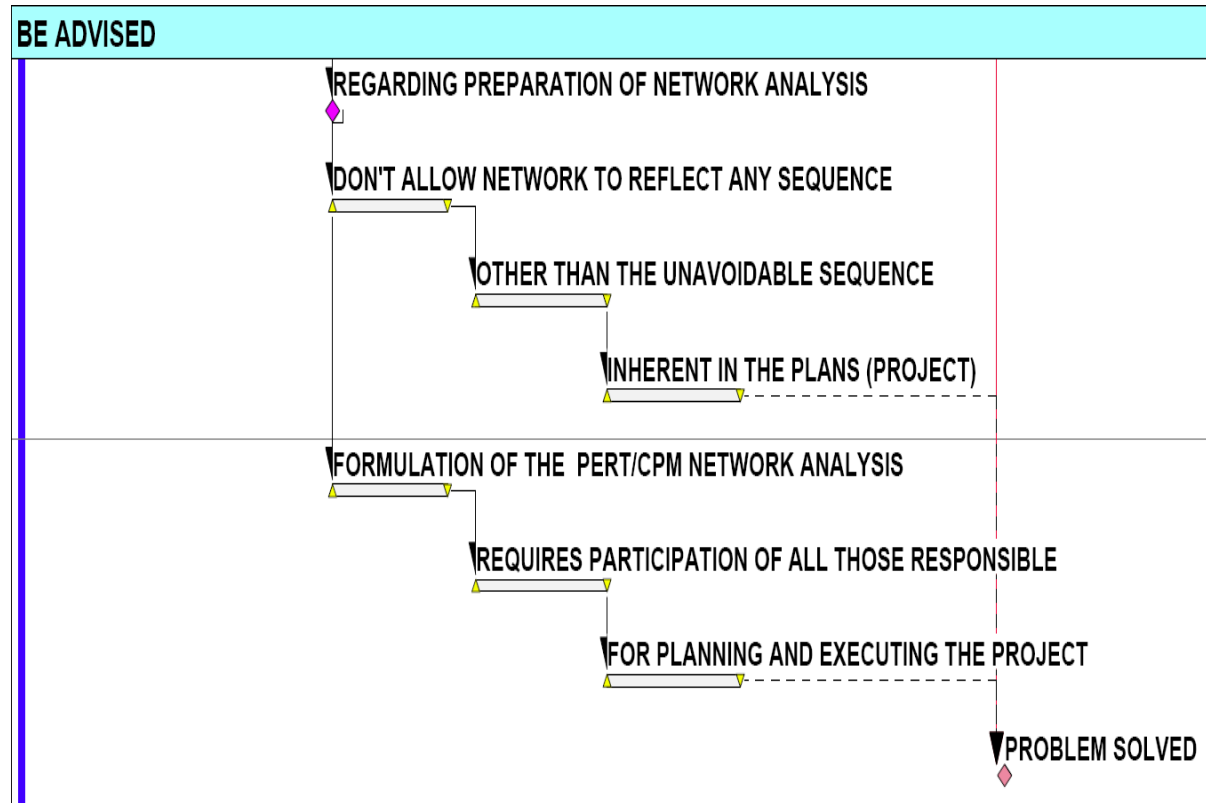
## SEQUENCE

The initial network should show the inherent sequential requirements for the construction of the project or endeavor.

If there are many elements that can be pursued simultaneously the initial chart should show that.

The “schedule” results from applying resources that may limit what is done first, next or thereafter. The initial network is just the first step.

Modern day “Agile” or “Push/Pull” sessions likewise are new words for a time-honored process.



# ARTICLE ON PERT/CPM NETWORK ANALYSIS

THIS ARTICLE PRINTED IN 1965 WAS THE BASIS FOR THE PRECEDING SERIES OF SLIDES THAT PRESENTED AN OVER-VIEW OF THE PERT/CPM NETWORK ANALYSIS PROCESS

THE PRECEDING SLIDES WERE AN EARLY APPLICATION OF THE IDEAGRAM CONCEPT

KARL ELLIOTT WAS MY MENTOR AND LONG TIME BUSINESS ASSOCIATE

I HONOR KARL WITH A SIGNIFICANT DEBT OF GRATITUDE AND APPRECIATION.

From the "CONSTRUCTORS' FORUM" March 1965, Official Publication, Northern and Central California Chapter, AGC.

## PERT/CPM NETWORK ANALYSIS

by  
Karl F. Elliott

*(We wanted something PERTinent on PERT and something C omprehensive, P ositive and M eaningful on CPM. Karl F. Elliott, 495 California Avenue, Palo Alto is a Management Consultant in Construction. He's a graduate civil engineer and has had extensive contracting experience. As a Lt. Colonel he commanded a combat battalion with the Third Army in Luxembourg and Germany. He has supervised and worked on projects from Florida to California . . . roads, airfields, dams, buildings, railroads and missile installations. Karl is a licensed general "A" and "B" contractor).*

Because of a need, two groups of people working independently, developed similar methods to fulfill the need.

The need - better methods of planning, scheduling and controlling complex projects. About 1955 Dupont assigned a group to find ways to reduce the overlap of information sources and to assist in planning, scheduling and controlling jobs. In 1957 they announced the development of a network analysis technique called CPM (Critical Path Method), because it identified the path of activities through a job which took the longest time to perform (hence critical path).

The first time Dupont tried the technique on a job it cost more money than it returned, but they noted that it gave the manager more insight into the job and provided better communication, so they decided to continue it's use. The second time it was used, on a plant turn-around maintenance job, it reduced the plant shutdown time from 12 to 7 days and at a saving of over \$200,000.

Shortly thereafter the Navy announced a technique for management to evaluate, review and make corrective decisions therefrom of its plan for a project or a program. It was named PERT (Program Evaluation and Review Technique) and was developed with Lockheed and the management consultant firm Booz, Allen & Hamilton to aid in managing the design and construction of the Polaris Missile. It is credited with shortening the delivery time for the missile something like two years. PERT also identifies the path of critical activities through a project.

PERT and CPM are network analysis techniques with little difference. Both, however, make major contributions to the sum of network analysis theory, and no one should try to become proficient in it by learning one to the exclusion of the other. They are universal in their application, and not pointed to any one field or industry.

In the original conception and development of both PERT and CPM the electronic computer was used. Since then it has been found that the calculations can be made without computers for all but the largest of project networks, and the fundamentals of network analysis can be applied equally as well to small projects as it can to large.

The network, called a diagram or model, is a representation of the various steps in a project shown in their logical sequence. The diagram is similar to a road map and can be read as easily. Since it is a graphic representation of the plan of a job, it is easily understood and agreed upon by all.

The work involved in making the network is of the greatest importance and value. Important because all the benefits to be derived from PERT /CPM stem from and rely upon a good network. Valuable because to have performed it correctly and completely, the minds of those involved will of necessity have delved into the plans in depth and detail. Network analysis forces discovery of how the job is put together, and this is one of its greatest contributions. It is a capital investment of thought.

Network analysis is applicable to any physical or intellectual endeavour that can be called a program or project, whether large or small. It can be used to plan and schedule frying eggs for breakfast as well as for a multi-million dollar construction project.

The frying of eggs can be broken down into about a dozen steps. By arranging these activities on a network in their logical order one immediately sees that cracking the eggs must be preceded by getting the bowl from the pantry and taking the eggs from the refrigerator. It can be said that this would be obvious to anyone. Nevertheless frying eggs for breakfast can be and is performed inefficiently many times, as are other jobs with as few steps. PERT and CPM have been used successfully to shorten the overall time involved in jobs with as few as a dozen activities or less.

What happens on the larger job with more activities and interrelationships. A person experienced in the particular field can untangle them as he studies the plans, and can find out how the job fits together. But prior to PERT and CPM there was no satisfactory way to record his discoveries either for his own use and further study, or to inform other. In general, once the human mind has to contend with fifteen to twenty activities with varying relationships it is necessary to put them down on paper. But how to portray them on paper is the problem. A list can be made, but it is quickly found to be inadequate. A bar chart can be used, but it is too sophisticated for the purpose at this stage. Why? To use a bar chart requires performing two functions simultaneously, planning and scheduling. So attempting to use a bar chart for planning will require a decision in scheduling as a time when information has not been developed for scheduling.

The network diagram of PERT/CPM has the capabilities to portray all the activities in a plan and their interrelationships. This, then, is what PERT/CPM is, an analysis of an entire project, broken into its component parts, each part or task shown as an arrow and all arranged in a network model flowing from left to right and showing their sequential relationships.

Once the network is completed, each arrow or task is assigned an elapsed time estimate based upon the experience of the company and the resources available for the job. By accumulating these time estimates along each path of activities the total time required for each path can be determined. The path requiring the longest time to complete determines the length of the job, and naturally is the critical path. The other paths with less time will have some leeway in their execution, which is called slack or float.

At this point many things can take place, among these allocation of resources and the choosing of a schedule. As a rule no decisions have been made up to now. It is here that the experience, intuition and judgement of the manager is allowed freedom in arriving at decisions with the aid of a working model of the job, and a body of valid information, within the framework allowed by the nature of the job.

A word of warning . . . Two common pitfalls in applying network analysis techniques are: (1) allowing the network to be compiled alone by support personnel such as planning, estimating, engineering, outside consultants or anyone other than those responsible for planning and building the job, and (2) allowing the network to reflect any sequence other than the unavoidable sequence inherent in the plans.

There is no better way of getting a thorough analysis and understanding of a job than by a network analysis. Whether you call it SPERT, PERT, CPM or whatever and whether you make the calculations manually, by slide rule or computer, you will gain by its use. The boss should not deny his managers, no matter how experienced and capable they are, the use of a tool which will allow the application of their experience and capability to the fullest extent.