

## TABLE OF CONTENTS

	Page
Introduction	1
The Managing Function	2
The Planning Function	4
Developing the Plan	5
Getting Started	5
Logical Work Packages	6
Significant Events	7
Sequence and Interrelationships	7
Scheduling	8
Program Model	9
Broad Objectives and Precise Goals	10
Managing the Program	12
Organizing	12
Integrating	13
Measuring	14
Feedback	15
Program Costs	16
Reports to OPS/W	18
	Appendix
Example of Preliminary Planning	A
Examples of Broad Objectives and Precise Goals	B
Flow Diagram - Essentials of Public Safety Telecom Program	C
PERT as a Management Tool	D
Facts About PERT	E

Francis M. Gerry

March 12, 1971

## MANAGING PUBLIC SAFETY TELECOMMUNICATIONS PROGRAMS

### Introduction

In studying the documents provided to OPS/W by many of the Missions (planning documents, implementation orders, monthly reports, etc.), one finds a need for better evidence of detailed planning of Telecommunication Programs toward measurable goals. In some cases it is difficult for OPS/W to assess the progress achieved toward the program objectives. For instance, an objective such as "develop communications to bring about significant improvement in police operations" is often followed by a report that "communications were further developed and significant improvements in police operations were achieved". The problem, of course, is that such statements are too imprecise to serve as planning goals or to permit measurement of progress toward the goals.

In Public Safety Programs it is corollary that achievement of objectives is urgent and should be accomplished as soon as possible. Achievement of more and more sophisticated police telecommunication systems is required in minimum time. Methods of planning and evaluating progress should be improved if the more rigid requirements of police systems are to be met successfully.

Some have expressed the view that specific measurements of progress in terms of quantitative units is not possible because Public Safety projects deal with many intangible matters which do not lend themselves to precise yardsticks. While this is true to some extent, in some elements of these programs it can be diminished where more appropriate measurements are attempted.

It is true that there is a great deal of uncertainty inherent in the forecasting of specific accomplishments. This fact makes it imperative to use planning techniques which allow the areas of uncertainty to be forecast in advance, to the extent possible, so that effective anticipatory action may take place.

It is also true that Public Safety projects are highly complex, requiring many actions to proceed simultaneously to influence or to be influenced by many other actions which at first glance might appear to be only remotely connected. This series-parallel relationship complicates any attempt to simplify planning procedures. However, the uncertainties and the complexities do not make it impossible to effectively plan and measure progress. They do make it absolutely necessary to use highly organized methods of planning and evaluating.

Obviously, the Public Safety Advisors and their counterparts are daily planning and carrying out specific tasks calculated to contribute toward realization of objectives. In many instances, however, daily plans and task definitions exist only in the minds of the individuals concerned.

Experience has shown that documentation of these detailed plans and their formal organization by the use of some well-developed planning technique (such as PERT\*) provides benefits of far greater magnitude than the value of the time spent in so doing.

Especially in the field of police telecommunications, precise goals for development can be clearly identified and established in country plans and programs. The goals can be defined in terms which permit precise measurements of progress over specified periods of time.

The purpose of this study is to develop and suggest techniques to guide Public Safety Advisors in realistically planning the work to be performed, and managing and measuring its performance against those plans.

### The Managing Function

Every working individual is a manager in the broad sense. He manipulates the resources under his control to accomplish the objectives of his job. In the case of a manual laborer, these resources may include only the individual's personal time and physical labor. In the case of an industrial supervisor they may include the time and physical labor of many individuals, plus the use of capital equipment, materials, and engineering designs.

The control exercised by a manager may be direct, as in the case of the supervisor who has the power of hiring and firing individuals and allocating materials and equipment to be used by them. Or the control may be indirect, as in the case of an advisor or consultant who must accomplish objectives by persuading others who exercise direct control.

The Public Safety Advisor is a manager who exercises direct control over his own actions (and those of his staff) and indirect control over the actions of his counterpart. He exercises direct control over the material resources contributed by U. S. AID but indirect control over the material resources contributed by the host country. As a manager, he can profit from the understanding and use of basic management principles.

The elements of managing are all contained in four basic concepts:

Planning,  
Organizing,  
Integrating,  
Measuring.

Planning is the preparation for doing work and is of as much importance as the doing of the job. It encompasses the setting of objectives and places requirements on the "ways and means" (resources available) to bridge the gap between the present status and the end objective.

Organizing means the arranging of all resources so that they may be utilized in the most advantageous and efficient manner to get the job done.

\* PERT: Program Evaluation and Review Technique

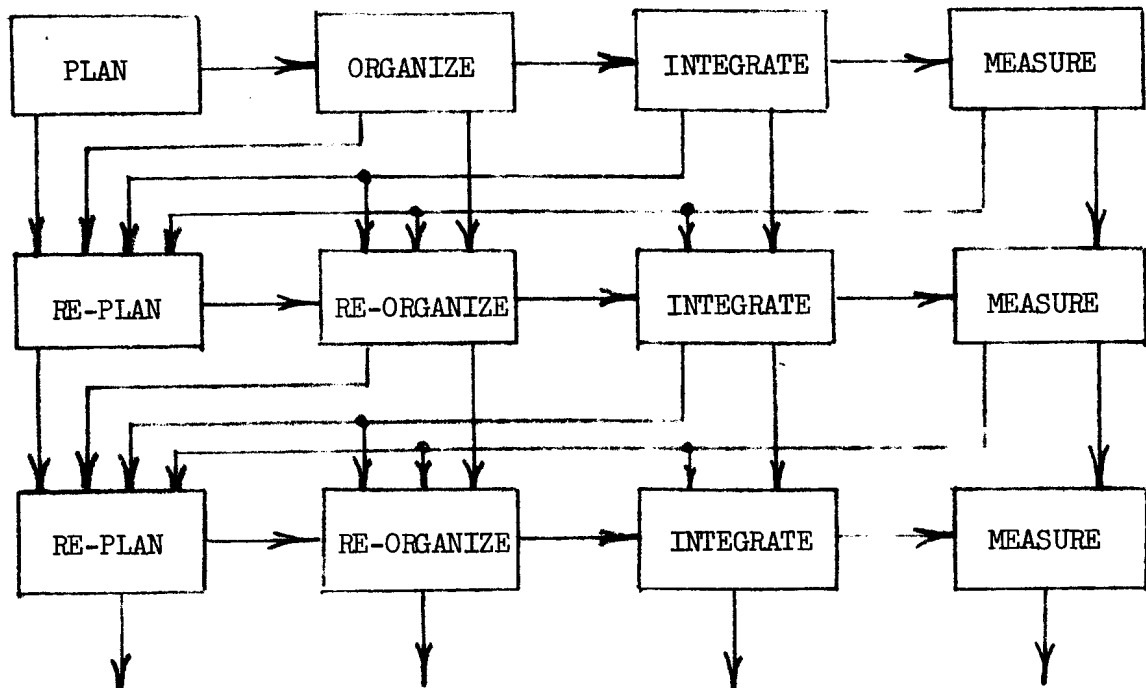
It encompasses the "spelling out" of the responsibilities and relationships of all contributors, the "laying out" of all material resources so they will be readily available when needed, and the establishment of administrative procedures to facilitate the work.

Integrating is the manipulation of the resources to accomplish the actual doing of the work. It calls for the accomplishment of the human and material interfaces necessary to make all the resources actually contribute as they should toward the end objective.

Measuring is the estimating of progress toward the end objective and the regulating of management actions. In addition to the taking of measurements, it includes the feedback of these measurements as data to figure "course corrections". A measurement of how far the "mark is being missed" is necessary to determine how much corrective action to take.

All of these concepts are dynamic. All must be done continuously and simultaneously. Although the planning function must be started first in a new program, the "accomplishment of a documented plan" requires the application of all four concepts immediately. For instance, it is necessary to manage (that is, to plan, to organize, to integrate, and to measure) the efforts necessary to accomplish a "documented plan".

The following diagram illustrates graphically the "living relationships" of these concepts in a "going" program. Time progresses downward in the diagram. The flow from left to right is almost instantaneous. At any given moment in the life of a program, planning, organizing, integrating, and measuring are theoretically taking place.



## The Planning Function

Planning is the preparation for doing work and is of as much importance as the doing of the job. It encompasses the setting of objectives and places requirements on the "ways and means" (resources available) to bridge the gap between the present status and the end objective.

For a moment consider the broad aspects of how to start to do any work. First, there has to be an understanding of what has to be accomplished. At this point broad objectives may be stated, such as completion of a study/survey, design of a telecommunications system, installation and test of equipment, selection and training of manpower, development of operational and maintenance capabilities, etc.

Next, a plan must be developed for achieving the objective. The effort to be expended in planning and the detail to be considered are functions of the cost and complexity of the final objective. But no matter what the magnitude of the objective, a plan of some nature has to be conceived. Many times the planning activity is not recognized as such because of its simplicity and the involuntary nature with which the thinking process works.

There are a number of factors which must be considered while developing a plan. For instance, a plan will require the utilization of resources: Manpower, facilities, tools, materials, etc. U. S. AID Public Safety projects draw upon the resources of the local police as well as U. S. AID. A program agreement is usually made, each party agreeing to allocate the required resources. The rate at which the project can utilize each resource must be considered and time periods must be designated for the assignment of each resource. To establish these requirements on the resources, the present status or committed load on each resource must be established. The plan for achieving the objective is made up of all this and more. The plan should establish who is responsible for what actions, how much it is to cost, and when it is to be completed.

When the initial plan has been recorded, it must not be considered as "cast in concrete". It must be changed from time to time as project evaluations indicate that important aspects of the objective can not be accomplished. For instance, at some point in a project it may become evident that the objective cannot be achieved within the planned time period. Sufficient replanning should be done at this point to make up the lost time and, thus, achieve the schedule objective. If this is impossible, sufficient replanning should be done to establish a new, more realistic schedule.

The planning process can be pictured as a series of loops or cycles. An initial plan must be made, then evaluated. As a result of evaluations the project, or some portion of the project, will have to be replanned, then re-evaluated. This cycling of planning and evaluating may occur many times during the life of a project and ultimately results in a workable plan for accomplishing the objective.

It is no mean task for an advisor to keep all these details in mind. The techniques and tools described here can contribute to simplifying the work involved in planning. A PERT analysis of the events to be accomplished, the relationships between the pieces of work, and the estimates of elapsed time will accomplish more than any single unassisted mind could.

## Developing the Plan

### Getting Started

Public Safety programs are initiated because areas of deficiencies are clearly recognized by the Advisors as well as the local government of the host country. These areas are usually listed in preliminary studies, PROPs, and Program Agreements. Improvements desired in these areas are listed and established as "objectives". This establishes the "charter" for the actual operation of the Public Safety Program. The planning function starts at this point.

Although there are many approaches that may be used, an "outline approach" to detailed planning is recommended herein. The first step is to list all the activities which must be carried on during the program. Within these activities, specific tasks or work packages should be listed. This is done by "thinking through" the program from start to finish.

Each Advisor knows the kind of specific actions he has done, can do, and will do day by day to further the progress of his program. He can do such things as confer with his counterparts, inspect facilities, study operations, demonstrate equipment trouble-shooting methods, teach classes, write lesson plans, demonstrate equipment installation, write specifications, design systems, prepare PIO/C's, make written recommendations, etc. He knows the kind of things his local police counterparts should do and, hopefully, will do day by day to further the progress of the program. They should do such things as prepare and approve adequate budgets, allocate funds, provide manpower, conduct training classes and on-the-job training, provide facilities, install equipment, compile operation manuals, repair equipment, order spare parts, etc. From all of these possible actions, specific logical work packages should be listed that must be accomplished in order to reach the objective.

With each work package should be listed the significant events at which points progress in accomplishing the tasks may be measured. For instance, significant events in the task of installation of a base station at a precinct headquarters might be:

- Official allocation of space for the installation.
- Completion of installation drawings.
- Arrival of equipment on site.
- Completion of tower base and guy anchors.
- Completion of tower erection.
- Completion of AC power facilities in building.
- Completion of transceiver installation.

Completion of antenna and RF cable installation.  
Start of Station tests.  
Completion of Station tests.  
Start of Station operation.

After the listing of all the significant events indicating the accomplishment of the work packages, the next step is to establish the relationships and sequence of the events and to assign responsibility for each event. The final step in the plan will be to establish schedule dates for each event. When all of these things have been done, the events with their scheduled dates become the precise goals for which the Public Safety team members (Advisors and local counterparts) strive each day.

The key to "getting started" is the "thinking through" of the program. In addition to the "thinking through" by the individual advisor, a conference or round table approach with counterparts and other advisors can provide a more complete list of work packages and serve to involve all concerned in the planning of work for which they will be responsible.

#### Logical Work Packages

The tasks leading to "events" must be broken down into logical work packages. This requires concentration on the "content of work" in each work package. To understand the "content of work" one needs to understand the actual physical and intellectual actions that are required. The best understanding comes from the actual experience of having done similar work in the past.

The individuals responsible for the execution of the work should be called upon to define the work content. If one is called upon to define his own work packages, based on his own experience, his own confidence in his ability to execute the work is very high. In turn, the confidence of the program manager can be high also. If the responsible individual has not had experience on which to base his definition of work content, he should be urged to consult with someone who has had experience so that the confidence level can be kept as high as possible.

In the same way, scheduled dates for the completion of the work packages should be set by those responsible for the work and be based upon a full understanding of the work content of the package.

The local police program manager (or the Public Safety Advisor) should discuss work content with the responsible individuals to make sure that work content is realistic and fully understood, and that responsibility for the work package and schedule is fully accepted. There can be no confidence in the fulfillment of responsibility where understanding and acceptance by the individual is not complete.

By this process, vague objectives, the accomplishment of which cannot be clearly envisioned, are translated into actual work packages which are clearly understood and of which the accomplishment is highly probable.

### Significant Events

A "logical work package" should be arranged so that it culminates in a "significant event" which is clearly distinguishable by all concerned as the completion of the work package or the start of a subsequent work package. For instance, if the "work package" is the performance of a study of operational procedures in the police radio dispatch room, it would logically be completed by a written report. The "significant event" might be defined as "completion of study report" and would represent the point in time when the report is published. If the work package is the design of a radio network, the significant event might be the publishing of the network diagrams and equipment specifications to which a specific schedule date can be assigned. If the work package is the integration of several activities in preparation for testing a new radio network, the significant event might be the "start" of the network tests.

Significant events are of great importance in project management since they are milestones on the road to project objectives and are invariably points of measurement and decision.

### Sequence and Interrelationships of Work Packages

For the accomplishment of any work package, it is often a prerequisite that one or more other tasks be completed first. It does no good to schedule work for completion by a certain date if the prerequisite work packages cannot be completed in time to allow it. Thus, it is important that the manager of a project, as well as those responsible for the accomplishment of the work packages, recognize and understand the sequence and interrelationships of the work packages. Understanding is necessary in order to establish realistic plans for the efficient progress of work. Understanding will also provide the "climate" for efficient teamwork among all responsible individuals.

At this point in planning, when it is desired to visualize the most logical and orderly sequence and interrelationship of work packages, it is usually helpful to lay them out in a flow diagram. The type of diagram recommended is that used in the well known Program Evaluation and Review Technique (PERT). In this type diagram, significant events are represented as blocks on the diagram while work packages are represented by the lines between the events. (See diagrams in Appendix A.) Arrows are used to show the logical direction of flow from event to event. Insofar as possible, flow is from left to right. Obviously, such a diagram can have both a "series" and "parallel" sequence of work packages and events. That is, the diagram allows for simultaneous accomplishment of many work packages and the simultaneous occurrence of events. Whether or not events actually occur simultaneously depends upon the elapsed time required to complete the work packages. This brings us to the subject of scheduling.



### Scheduling

Scheduling should not be attempted until the series/parallel relationships of work packages and events are defined in the above described flow diagram. Most Public Safety telecommunications programs are of such complexity that attempts to schedule them before making the above described analysis result in unrealistic schedules.

The program schedule depends upon the elapsed time required to accomplish each of the work packages. An elapsed time estimate for a work package depends upon an individual's estimate of the work content of the package.

The source of the elapsed time estimate for a work package should be the individual responsible for the accomplishment of the work. The accuracy of his estimate will depend upon his past experience. If he is not experienced in the work, an experienced person should assist him, if possible.

An individual's estimate may depend upon several intangible factors, such as his understanding of and willingness to comply with the requirements of an urgent situation, pressures placed upon him to complete other conflicting work, his desire to give a pleasing rather than realistic estimate, etc. Managers (Public Safety Advisors and local counterparts) must learn to evaluate the possible motives behind an individual's estimates and must take steps to assure realism and honesty.

In addition to the above mentioned influences on an individual's estimates of time required, there are legitimately many other factors which affect an estimate. For instance, he may be requested to work "around the clock" disregarding all other work, being assured of the availability at the right time of all required manpower and resources. In this case, the estimated time might be termed the "most optimistic". Or, he may be asked to estimate the "most probable time" which is the time he would expect if the work proceeds normally during regular working hours within the context of normal manpower and a normal workload of other activities.

Finally, he may be asked to estimate the "most pessimistic" time. This is defined as a time which will not be exceeded, barring "acts of God", but which might conceivably be approached. This is an estimate of the case in which all the tolerances on the "most probable time" build up in a detrimental fashion. (For instance, several employee absences might coincide with an unusually large influx of other work. At the same time, required material may arrive late and a tool might break down! These are all things which have happened and occasionally happen simultaneously.)

In some programs, contributors are requested to estimate a separate time figure for each of the three above cases. These three figures, the "most optimistic", the "most probable", and the "most pessimistic", are

recorded for each work package. If only one estimated figure is required for each work package, it is important that the manager "have a feel" for the kind of tolerances that can be expected.

Estimated time figures for each work package should be recorded on the lines of the diagram. The summation of all time figures in a given "path" across the diagram gives the total time for activities of that "path". A "path" starts at the opening event of the program and proceeds through one line at a time in the direction of the arrows to the closing event of the program. Obviously, there are many "paths" across a diagram if it has many parallel work packages and events. The summations of the time figures of the various "paths" will vary. The path which requires the greatest time to complete must set the overall schedule for the program.

It should be remembered that scheduled dates must be realistically achievable. In addition, there must be a desire and determination by the responsible individual to achieve the schedule. Assignment of completion dates on a diagram does no good unless the individuals concerned have accepted the challenge that the dates represent.

### Program Model

All of the above described information, when developed and documented, forms a program model. It furnishes an integrated picture of the program as planned for the benefit of management as well as the individual contributors. Before work actually starts, and even during the actual progress of the program, the model may be used for many worthwhile purposes:

1. It can be critically scrutinized by all concerned in order to correct and improve it. Theoretical corrections and improvements can be introduced and tested to determine their actual effect without jeopardizing the program itself.
2. As the program progresses, the portion of the model representing the completed portion of the program can be corrected to determine the effect on the uncompleted portion. Thus, future plans can be corrected and will become more and more accurate as the program progresses.
3. The model can be used by the manager as a tool to help him coordinate and integrate all the activities of the program.
4. The model reveals the most critical areas and priorities of the program. As the program progresses, it reveals the areas which can be changed to provide needed remedial action.
5. Such a model, constructed by the Public Safety Advisor, may be used to influence his counterparts and give them managerial training. If such methods are not accepted by the counterparts, the Public Safety Advisor may still use the model to give him an understanding of the program beyond that of the counterparts. The Advisor will then be in a position to influence the program by the "power of his knowledge".

### Broad Objectives and Precise Goals

As indicated earlier in this report, one finds in some cases insufficient evidence in the documents provided to OPS/W by many of the Missions of detailed planning of Telecommunication Programs toward measurable goals. Most goals presented are general statements of broad objectives which, of course, are necessary as a charter to define general areas of activity. However, in addition, efficient activities demand precise quantitative goals to be achieved by specified deadlines.

The significant events developed in the above described planning technique, together with their scheduled dates, should become the precise goals of the program.

A broad objective, such as "establish a series of regional communication maintenance facilities", should be followed by precise goals, such as "establish communication maintenance facilities in the headquarters of Region A by March 31, 1971, headquarters of Region B by June 30, 1971, headquarters of Region C by September 30, 1971, and headquarters of Region D by December 31, 1971".

Planning toward these precise goals must be even more detailed and precise, of course. Each task that must be accomplished in order to reach a goal must be defined, scheduled for completion by a certain date, and must have responsibility assigned to, and accepted by, an individual.

A broad objective, such as "establish a modern communications operations center to include centralized radio and telephone operations", should be followed by a precise goal, such as "establish a communications operations center at the police headquarters building combining radio nets A, B, C, and D and 50 telephone lines; to commence in-service operation by June 30, 1971. U. S. AID shall be responsible to provide design, installation instructions, and control console equipment. All other requirements, including 1,000 sq. ft. of floor space in the police headquarters building, electrical power facilities, building alterations, furniture, and labor for installation of all equipment, shall be provided by the National Police".

To accomplish this precise goal by June 30, 1971, will require the setting up of a number of subgoals representing the accomplishments of many measurable tasks. The first step in the detailed planning should be the listing of all the tasks (or work packages) which are necessary to the accomplishment of the final goal. Achievable completion dates and individual responsibility should be assigned for each work package.

The following is a list of events that represent the completion of logical work packages, all of which are precise goals which must be completed in order to reach the objective of establishing a modern communications operations center:

1. Assignment of 1,000 sq. ft. of floor space in Police Headquarters building for COC, complete by (date), responsibility assigned to \_\_\_\_\_.
2. Draft of COC design, room layout, plans for alterations, complete by (date), responsibility assigned to \_\_\_\_\_.
3. Access to new COC space to commence alterations by (date), responsibility assigned to \_\_\_\_\_.
4. Completion of AC power installation, partitions, other alterations by (date), responsibility assigned to \_\_\_\_\_.
5. Assignment of personnel to installation team complete by (date), responsibility assigned to \_\_\_\_\_.
6. Console equipment furnished by U. S. AID to arrive on site by (date), responsibility assigned to \_\_\_\_\_.
7. Assembly and internal wiring of console complete by (date), responsibility assigned to \_\_\_\_\_.
8. Interconnection of remote control equipment with transceivers in radio equipment room, power connections, complete by (date), responsibility assigned to \_\_\_\_\_.
9. Contractual agreement between National Police and the Telephone Company, complete by (date), responsibility assigned to \_\_\_\_\_.
10. Installation of telephone lines, intercom equipment, and telephone equipment, complete by (date), responsibility assigned to \_\_\_\_\_.
11. Start of COC systems test by \_\_\_\_\_, responsibility assigned to \_\_\_\_\_.
12. Assignment of COC operating personnel by (date), responsibility assigned to \_\_\_\_\_.
13. Completion of operating instructions, procedures, and manuals by (date), responsibility assigned to \_\_\_\_\_.
14. Training plans and simulation materials for COC operator training ready by (date), responsibility assigned to \_\_\_\_\_.
15. Completion of simulated COC training exercises, start of in-service operations by (date), responsibility assigned to \_\_\_\_\_.

### Managing the Program

The planning of the program by means of some organized process similar to that already described is probably the most important single step in the accomplishment of the program. However, a documented plan (lists of work packages and events, flow diagrams, schedule estimates) is only a tool which in itself does not assure the achievement of any goals.

The "machine" to actually accomplish the program must be organized, set in motion, and guided to the destination. It may even have to be "repaired" en route.

### Organizing

All resources must be organized so that they may be utilized in the most advantageous and efficient manner to get the job done. One of the most important steps is the "spelling out" of the responsibilities and relationships of the individuals who contribute to the program. Everyone who is expected to be active in the program must know where his responsibility starts and where it ends. The mere assignment of responsibility by the program manager is not enough. There must be sufficient communication between the manager and the individual to assure that the assigned responsibility is fully understood and accepted. In many cases, the Public Safety Advisor must urge his counterpart to accept and fulfill certain responsibilities. The Advisor must learn to distinguish between mere assent (to momentarily please the Advisor) and true acceptance of a challenging responsibility.

In addition, all other resources must be properly organized to contribute efficiently to progress. For instance, administrative procedures to get funds budgeted and to actually provide the funds when and where needed during the life of a program are required. The lack of pre-established channels to provide necessary funds can hold up or even wreck a program. Most Public Safety Advisors have observed problems caused by lack of local funds for the police to buy spare parts to repair deadlined radios, to buy gasoline to keep vehicles in operation, or to send an installation team to the field as planned. In many cases, the host country agreed in the Program Agreement to provide the funds, but the program manager failed (or did not know how) to set up procedures to channel the money to the right place at the right time.

Similarly, procurement practices (both those of U. S. AID and the local government) must be so organized that necessary equipment and material can be purchased and delivered to the job sites as planned. All of the so-called "services" contributing to the progress of the program must be organized to provide "smooth channels" through which they can contribute.

### Integrating

Once the "machine" is functioning, it needs to be "guided" and "maintained". Integration is the managerial coordination of people and things on a day to day basis to keep the program progressing on schedule in accordance with plans. It should be done on a "preventive maintenance" basis but often has to be done on an urgent "problem solving" basis.

The output of one work package may not quite match the input of the next recipient work package. Progress could break down at this interface. The work of integrating is similar to the work of systems engineering in that proper interfaces must be provided.

If proper interfaces are not arranged ahead of time, problems will arise during the program which may bring progress to a halt. These problems are complicated in that they may involve several different organizations, such as the local police organization, the local government organization, the local U. S. AID Mission, AID/W, GSA as the Authorized Agent, and various suppliers. The organizations involved are not necessarily under a single management. Yet, someone must integrate the program whether by "directive" or "persuasive" management.

The Public Safety Advisor's chief counterpart is the logical individual to officially integrate the program. He will utilize the Advisor's services to a greater or lesser degree depending upon his own capabilities and the working arrangement. In some cases, the only one in a position to integrate all involved organizations and individuals is the Public Safety Advisor.

Some examples of problems which may require special integration efforts are:

Installation instructions published in English by the equipment manufacturer cannot be read by the installation team members who do not speak English.

Due to a misunderstanding, the tower erection crew may arrive on site before the tower material is delivered to site.

Manufacture of new transceiver equipment may be held up due to nonreceipt of operating frequency information which must be originated by the official frequency allocation agency in the local country.

A manager must take certain integrating steps to prevent such problems or they could become serious hindrances to program objectives.

### Measuring

In order to determine performance and "factor in" the dynamic realities of an active program, realistic measurements must be constantly made. When work packages and significant events are defined during the planning stage, the definitions should suggest measurements. For instance, an obvious "go-no-go" measurement for use on events scheduled by date is the periodic comparison of actual status with scheduled status. The program is either "on schedule" or not.

However, inherent in the determination of whether a program is "on schedule" or not is a measurement and understanding of the "quality" of the work package output. If, for instance, a written report is published "on schedule" by date, the program is "on schedule" only if the report is adequate for the purpose intended. If the report is inadequate, it may have to be refined or the work leading up to it may have to be redone. In this case, the program may not be "on schedule" for the event has not actually been achieved. This illustrates the difficulty in fully measuring a program by evaluation of schedule performance only. Other measurements must be devised for evaluation of the more intangible aspects, such as:

Degree to which contributors are cooperating to achieve common goals.

Efficiency with which resources (material and human) and delegated authority is being used.

Quality and accuracy of component efforts leading to smooth integration toward program goals.

With the planned program model (flow charts, work packages and events) as a background, measuring of the more intangible aspects may be done through periodic written reports, oral discussion meetings, or by management interview with individual contributors. A combination of all three methods are usually used to get before management the facts necessary to measure the status of a program.

Periodic written reports are helpful to measure specific parameters, especially those which lend themselves to numerical count. For instance, a measure of the effectiveness of a radio technician training program might be deduced from a monthly count of the number of deadlined radio sets awaiting repair by the technicians. A measure of the effectiveness of a training program to improve a radio vehicle dispatching system might be deduced from periodic measurements of vehicle response time.

Much of the measurement of intangible aspects of the program can only be done by skilled interrogation of the contributors at periodic group meetings or in private interviews. Only in informal "give and take" sessions is it possible for a manager to determine if a contributor is

realistic about his chances of meeting his goals, if he has neglected to consider some important factors, or if he has compromised on the quality or accuracy of his output.

### Feedback

Measuring does no good if it does not generate feedback into the planning, organizing, and integrating activities of the program. The feedback in turn must generate managerial and individual contributor corrective action if a program is to achieve its goals. If measurement reveals an event is only slightly behind schedule, it may be possible to make up the lost time within the overall existing program without changing the schedule for final goal achievement. If measurement reveals a serious schedule slip, replanning and rescheduling of all affected work packages and events are in order.

If rescheduling is necessary it should be done without delay, getting full agreement and acceptance from all contributors. Conferences should be held to assure an understanding of the problem by all concerned. Subsequently, documents summarizing the results and outlining required changes in the program model should be produced. At any point in time during a program the plans and schedules, although different from those originally estimated, should represent the present best estimate of future performance.

"Machinery" to facilitate feedback should be set up within the program. A particular contributor may recognize the need to replan a portion of the program but may require help or authority from a higher level. Procedures should be set up providing clear channels of communication and action so that any contributor can influence the entire program, if necessary. Each contributor should be encouraged to consider the effects of his actions on the entire program and not just its effect on his small area of responsibility. Each contributor should be encouraged to feel a responsibility for the overall program and communicate his actions to all who could possibly be affected.

Should measurement data indicate schedule slippage, action possibilities might include such things as:

Addition of manpower.

Juggling of manpower, taking advantage of manpower available from noncrucial paths on the flow diagram.

Re-evaluation of alternative approaches.

Earlier ordering of materials and equipment where they might be limiting.

Subdivision of a material order to more than one vendor to speed up delivery.



Assignment of special expediting personnel.

Use of "tighter" program management techniques (for example, daily check on progress of critical items to assure immediate corrective action).

Rationalization to minimize the effect of problems shown up by the measurement process should be avoided. Assume that the input data to the program model was good and that the flow diagram analysis is valid. Then take positive action to improve the program. Don't just change the schedule estimates on the basis that "they're only guesses anyway". The chances are excellent that the initial "guesses" are the most valid.

### Program Costs

Program costs have not been mentioned specifically to this point in this study report. This does not mean that their consideration is not important. The discussions thus far have assumed that considerable emphasis was given to cost planning when the Public Safety Programs were initiated. It has been assumed that the programs were proceeding under relatively fixed budgets of money, manpower, and other resources. After a budget is fixed, the objective of program management is to get the job done efficiently within the budget, saving money if possible. Certainly the management techniques discussed above can assist in "living within the budget".

Budgets for U. S. A.I.D. Public Safety advisory efforts on a typical program in country "X" are set up a year or more in advance, sometimes on the basis of objectives only vaguely defined and usually before work packages, precise program goals, and flow diagrams have been considered. Once the budget is set and the fiscal year starts, the program simply must do the best it can under the fixed budget, whether it is adequate or not. Since the Public Safety effort in country "X" is considered a relatively long term effort, the work not completed this year is scheduled for another year. After all, it is sometimes said, the police organizations of country "X" are so poor and so inefficient that the "injection" of some new equipment and day to day advisory assistance, even though based only on "broad brush" considerations, cannot help but improve the situation. Then too, at the time that the budget was estimated, the goal for the Public Safety Program was simply "to bring about significant improvements in police operations". At the end of the fiscal year several "significant improvements" can be pointed out. Discussion of the Public Safety Advisors performance during the fiscal year would probably also bring out the fact that the local funds budgeted by the police of country "X" were greatly inadequate, and the ability of the police to absorb change was limited. However, it should be clear to the Public Safety Advisors in country "X" that more could have been accomplished if they had foreseen the details of the program more accurately at the time the budget was estimated. Under these conditions it cannot be said that the Public Safety Program in country "X" has met the urgent requirement of maximum progress in the shortest length of time.

Experience has shown that the program planned and managed so well as to be done in the shortest length of time usually also costs the least. The program which runs beyond schedule not only costs more but achieves less in the context of the urgent need to counter the world insurgency threat. It is probable that the program in country "X" could have been completed with better results in shorter time if management techniques similar to those described above had been introduced in the earliest possible planning stage.

Since initial program budgets must be estimated long before the actual start of the program, it is extremely important that the first edition of the detailed program model be set up in time to assist in these estimates. The initial budgets will set the stage for progress for several years to come. It is important that they accurately cover an optimum program effort.

The planning techniques already described in this study report are ideal for estimating program costs. When "thinking through" the content of each work package, especially when considering the elapsed schedule time to be allowed, it is necessary to determine how many people, how much material, what processes, what facilities, and what other resources will be required. When the basic figures for these things are recorded, it is a relatively easy process to multiply them by unit costs and finally summarize to obtain a total cost for each work package. The figures for each work package may be entered directly onto the lines of the program flow chart and then summarized for the entire program. Not only will such a process allow one to arrive at the most accurate cost estimate, it will assist in "selling" the estimate to those responsible for budget approval.

Not only is it important for U. S. A.I.D. Public Safety Advisors to use techniques of this type for planning and budgeting the U. S. A.I.D. program, it is even more important in terms of lasting good to the police organizations of the host country to bring them into use by the local police themselves. It is precisely because the local police in underdeveloped countries are so poor that optimum methods must be used to help them get the most for their money.

In some underdeveloped countries it appears that the local police are operating under a condition in which manpower is more readily available than cash funds for other resources. Although manpower costs money in any country, in the underdeveloped countries there is more manpower available at a lower cost than in the U. S. Undoubtedly it is this fact that has led some of the underdeveloped countries to fragmentize the job structures of the police. This has been done to such an extent in some countries that, for instance, each radio patrol vehicle must be manned by three or four men. One of the men is a radio operator who is expected to do nothing more than operate the radio. He is not skilled at any other duty, cannot take part in police investigations or make arrests. Another is the driver who does nothing else but drive the vehicle. It is assumed that this is the most economical and advantageous arrangement under the circumstances. But is it? A program model to illustrate the operation of

the radio patrol over a reasonable study period might illustrate that a more economical operation is possible under a different job structure. In another example, the planning model for a new system installation program could provide a means to determine whether it is more economical to train and form installation teams from police personnel or to contract installation to an outside firm.

Considerations such as these, to minimize costs, are even more important in poor countries than in the U. S. The techniques used to make the trade-off determinations can also be used to explain and persuade local counterparts of the validity of the proposed changes.

#### Reports to OPS/W

It is not a purpose of this study to increase the requirements for written reports from the Missions to OPS/W. Improvements in telecommunication program management undoubtedly will provide a "payoff" in better quality reports. Selected "milestone" type goals should be enumerated in appropriate documents and the progress toward these goals should be reported in the monthly reports.

Personnel of the Telecommunications Branch would appreciate receiving selected copies of documents showing the "big picture", such as network and system diagrams, profile lists of equipment in use, periodic flow charts marked with progress to date, etc. In addition, information is needed which will assist them to understand the appropriateness of new network designs and the usage of new equipment being ordered on PIO/C's.

#### Recommended Additional Reading

- |  |        |
|--|--------|
| "PERT Guide for Management Use"<br>Prepared by PERT Coordinating Group, June 1963.   | \$0.40 |
| "Line of Balance Technology, A Graphic Method<br>of Industrial Programing"<br>Prepared by Naval Material Command, NAVMAT<br>P1851 (Rev. 4-62). | \$0.60 |

These booklets are available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., 20402.

## APPENDIX A

### EXAMPLE OF PRELIMINARY PLANNING PUBLIC SAFETY TELECOM PROGRAM

#### Background of Example.

This Public Safety Telecom Program was started with a survey/study by a Telecommunications Advisor working in close cooperation with his counterpart, the Chief of the local National Police Telecommunications function. A system design for the communications system of the entire National Police organization was made and approved by the local government and by U. S. AID. The first increment of equipment was specified in detail and released for procurement. At this point the Telecommunications Advisor left the country.

Procurement of the first increment of equipment was completed in the United States and shipment was made to the country.

At the start of the program described below it is assumed that all necessary equipment, supplies, tools and test equipment have arrived in country and are stored in their original containers in a warehouse in the Capitol City.

#### Objective .

The objective is to install and start operation of the first increment of equipment in the shortest possible time. A Public Safety Telecommunications Advisor will return to the country to assist and direct the work as desired by his counterparts. The local counterparts stand ready with at least 10 experienced technicians to carry out the installations.

#### Preliminary Planning.

The attached documents illustrate the preliminary planning done by the Telecommunications Advisor in the United States just prior to his departure to the country. Information used in the planning was taken from the survey/study report made some time ago. The purpose of this preliminary planning is:

- to provide detailed goals for which to strive from the beginning.
- to illustrate to AID/W officials the magnitude of the program and the problems involved.
- to provide a plan with illustrations from which to discuss the program with the local counterparts upon arrival in country.

The first task to be done upon arrival of the Telecommunications Advisor in country is to re-plan the program with the counterparts.

APPENDIX A (Continued)

The first step in this preliminary planning process was the listing of all the tasks of which the Advisor could foresee. The list was reviewed by other experienced Advisors and modified to be as complete as possible. The list of tasks is attached.

The next step was the lay out of the tasks in sequence to allow the simultaneous completion of as many as possible in the shortest possible time. In so doing, a flow diagram was constructed arranging the tasks in serial/parallel order and showing the influence of each task on the others. Finally, the attached flow chart (Fig. 1) was constructed showing significant events (at which times the tasks may be measured) in serial/parallel order on a time schedule.

This chart (Fig. 1) forecasts that approximately 8 weeks will be required to get the program started and complete the first installations in Net "A". The chart indicates approximately 4 weeks will be required to install Net "B" and slightly over 3 weeks will be required to install each additional network. In addition, it shows how the training program may be started and carried on simultaneously with the installation program.

Fig. 2. is a more detailed PERT\* diagram of the first 8 weeks of work on Net "A". It shows that the first 10 days are to be devoted to site plans, inventory/checkout of equipment, and training of 3 installation crews. One crew will be formed to erect antenna towers and install antennas. Another crew will install base stations. A third crew will install mobile and portable stations.

The diagrams, Figs. 1 and 2, translate the broad objective and the list of tasks into detailed goals with measurable events at specified times.

\* Program Evaluation and Review Technique.

APPENDIX A (Continued)

LISTS OF TASKS TO BE PERFORMED  
PRELIMINARY PLANNING, PUBLIC SAFETY TELECOM PROGRAM

Site Planning

Visit sites in Capitol City (Net "A") to be installed first.  
Select optimum location for operating each base station.  
Select antenna tower or mast site, locate base, guys, and cable runs.  
Determine power source, plan power installation.  
Make installation sketches.

Installation Crews

Select and assign personnel for installation teams. (3 teams:  
tower erection team, base station team, and mobile station team.)  
Train each team on model installation.

Equipment (Assumed to be in-country)

Inventory and checkout equipment.  
Prepare for distribution to job sites.

Installations in Capitol City. (45 base stations, 20 mobile stations,  
18 portable stations, 12 guyed towers, and maintenance shop.)

Supervision by Public Safety Advisor of first several installations  
of each type.

Final checkout of Net "A".

Other Installations. (Nets B, C, D, E, F, and G)

Visit each station site with counterpart.  
Make installation plan and sketch each site.  
Make installations (partial supervision of Public Safety Advisor)  
Final checkout of each network (Check netting, freq., deviation,  
power output, VSWR, and clean up problems one site at a time.)

Operator Training (Equipment familiarization and network operations).

Start operator training.  
Draft Operations Manuals.  
Put Operator training on continuous basis to eventually include all  
police officers.

Technician Training

Start equipment maintenance training for techs. (VHF-FM equipment  
theory, test equipment theory, trouble-shooting, systems maintenance.)  
Set up sessions on repeat basis until all technicians are trained.

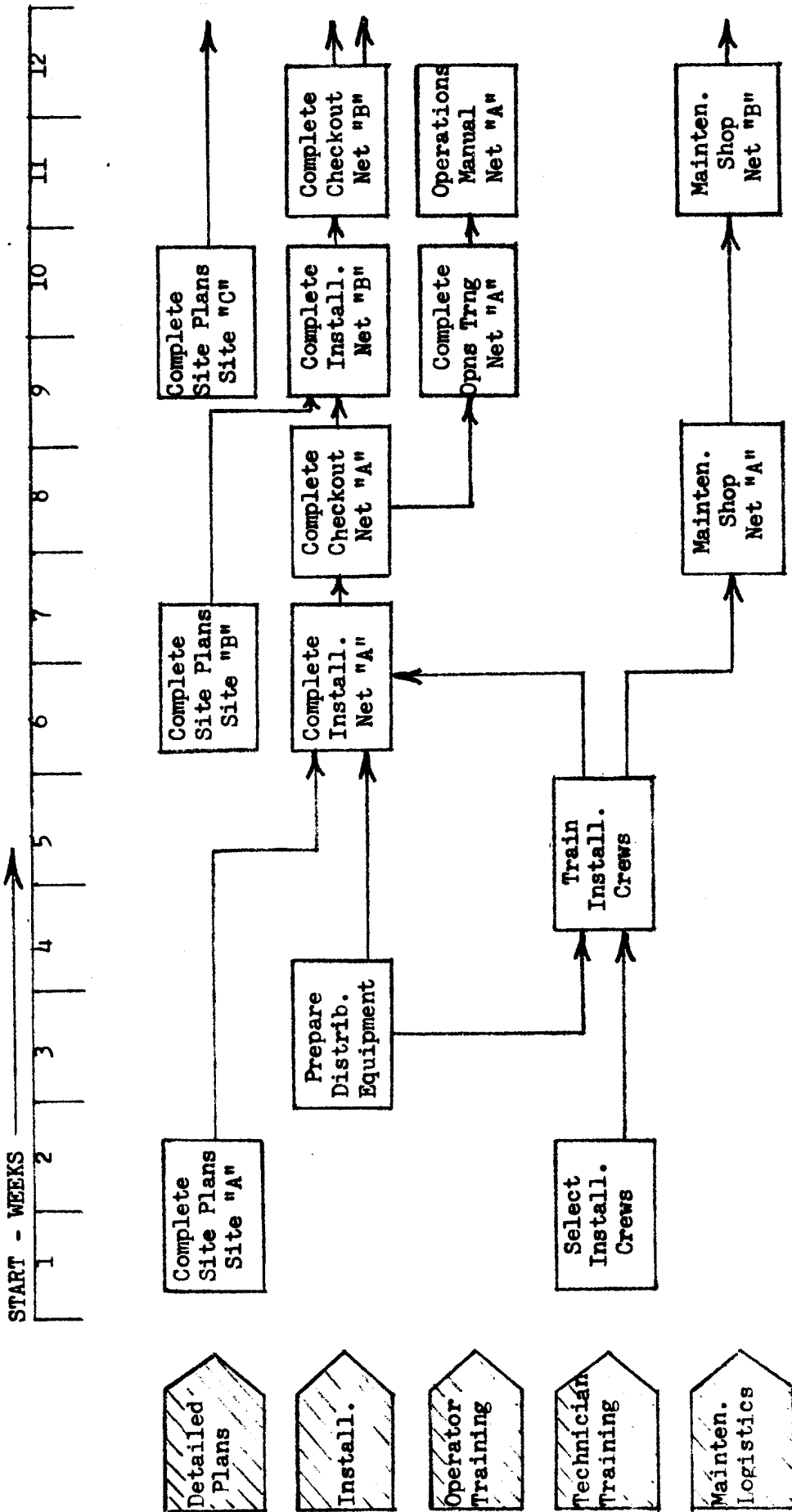
APPENDIX A (Continued)  
LISTS OF TASKS TO BE PERFORMED (Continued)

Maintenance Shops

- ° Plan each area shop.
  - Set up logistics system.
  - Set up administrative records.
  - Install each maintenance shop (form special team if personnel available)
  - Set up preventive maintenance program, inspection program.
- Set up continuing long term training programs (basic technician, advanced technician, and on-the-job.)

APPENDIX A (Continued)

(continued next page)



PRELIMINARY PLANNING, PUBLIC SAFETY TELECOM PROGRAM  
Fig. 1.

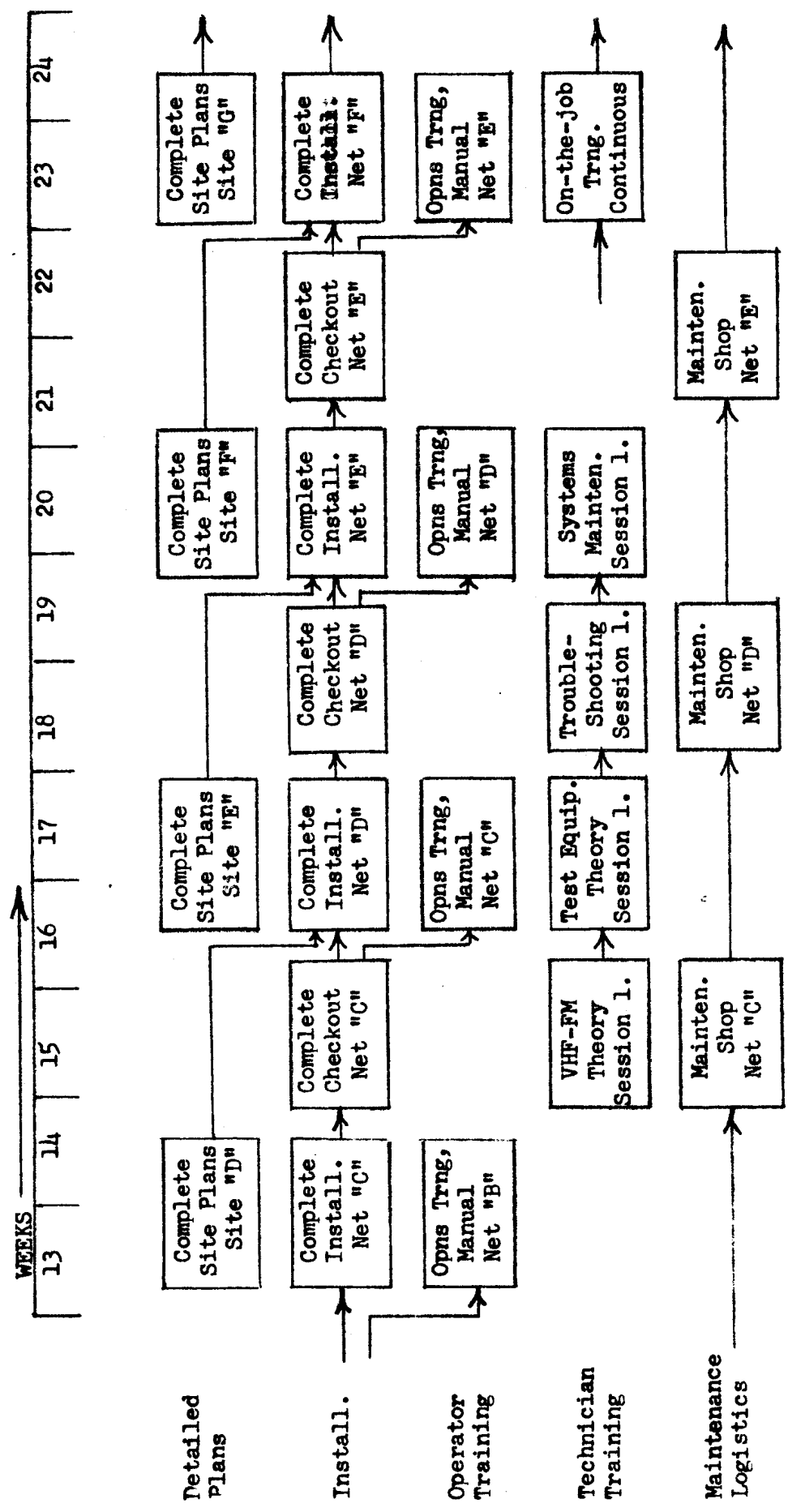
FMP, 2/2/71



APPENDIX A (Continued)

(continued next page)

(continued from previous page)



PRELIMINARY PLANNING, PUBLIC SAFETY TELECOM PROGRAM (Continued)  
Fig. 1. (Cont'd)

APPENDIX A (Continued)

(continued from previous page)



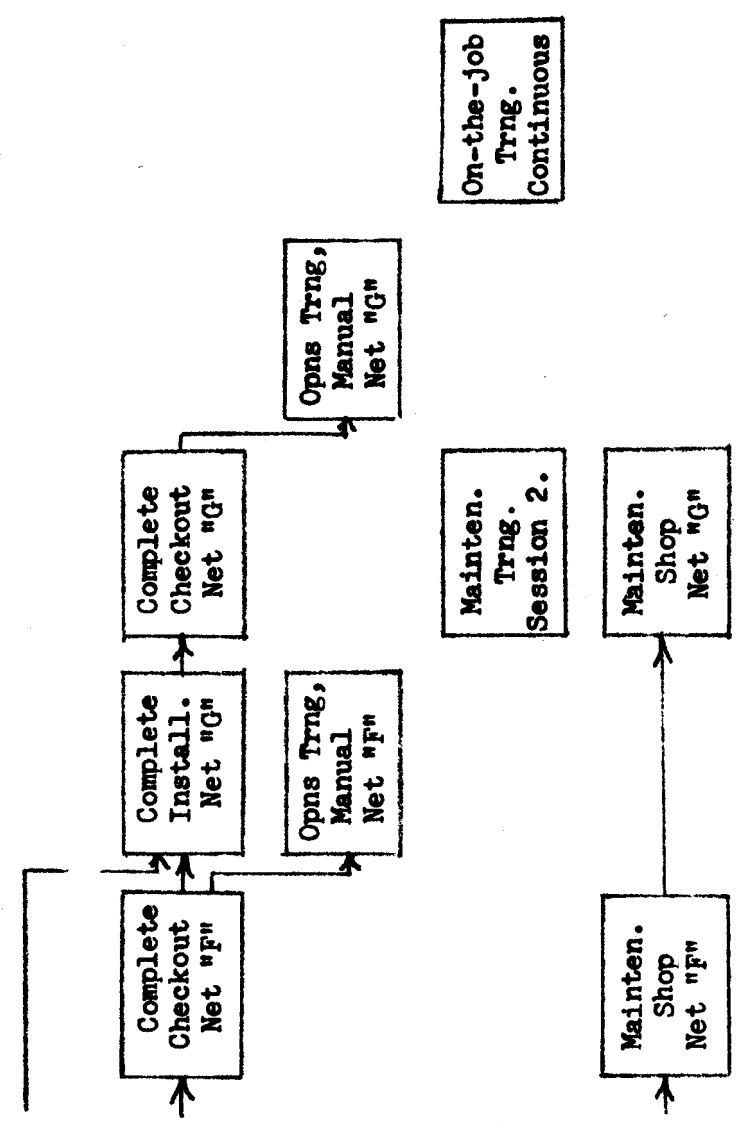
Detailed Plans

Install.

Operator Training

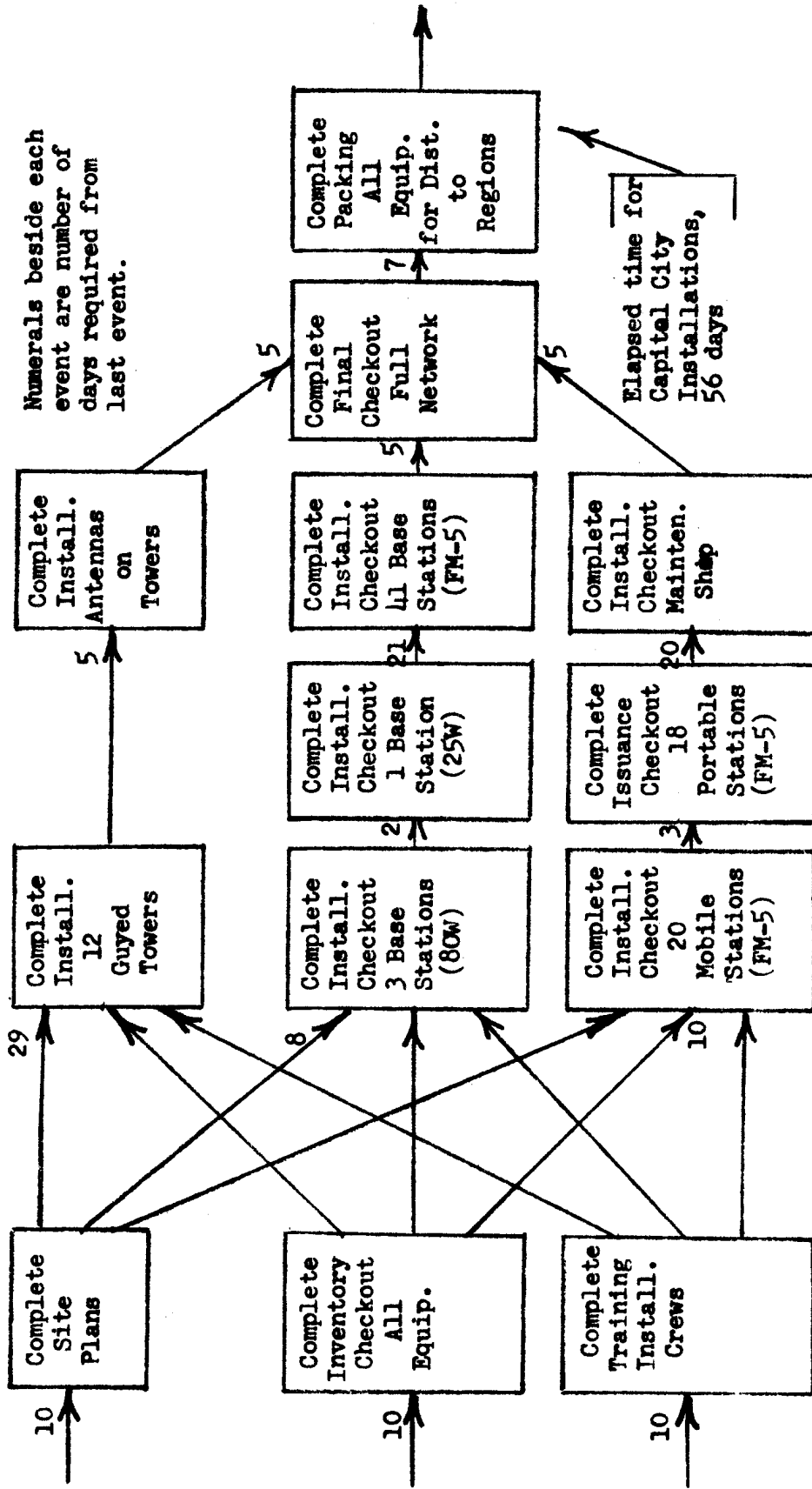
Technician Training

Maintenance Logistics



PRELIMINARY PLANNING, PUBLIC SAFETY TELECOM PROGRAM (Continued)  
Fig. 1. (Cont'd)

APPENDIX A (Continued)



Numerals beside each event are number of days required from last event.

Elapsed time for Capital City Installations, 56 days

PRELIMINARY PLANNING, PUBLIC SAFETY TELECOM PROGRAM  
 Detailed Planning, First Eight Weeks  
 All Sites, Capital City, Net "A"  
 Fig. 2.

FMP, 2/2/71

APPENDIX B - Examples of Broad Objectives and Precise Goals  
TELECOM NETWORK OPERATION

Broad Objectives:

Provide more effective law enforcement by emphasizing improvements in communications.

Develop the communications of the police forces and bring about significant improvement in police operations.

Render assistance in use of communication equipment.

Assist in overhaul of communications center to provide more efficient dispatching of patrol vehicles.

Develop multi-agency use of police radio net.

Improve communication capabilities of internal security forces.

Precise Goals: \*

Complete study of network operational methods and procedures. The study may be further planned and expressed as a series of sub-goals, such as:

Complete plan for study of Communications Operations Center (message counts, paper work flow, access to file information, decision process, elapsed time measurements, storage of temporary information, retrieval of information, dispatch and command aids, etc.)

Complete study of Communications Operations Center.

Complete study of communications practice in precinct stations.

Complete study of communications practice in vehicles.

Complete study report with recommendations for improvement of operations.

Complete changes in Communications Operations Center layout, paper work forms and procedures, as recommended by the study.

Complete plans for operational training exercises (to introduce changes in operational methods and procedures).

Start network operational training exercises.

Complete network operational training exercises.

Complete recommendations for combining of different network operations.

Complete approvals for combining of different network operations.

Start combined network operations.

Complete recommendations for writing of police communications manual.

Assign writing of sections of communications manual.

Completion of drafts of manual sections.

Complete overall communications manual draft.

Complete editing and approvals of communications manual.

Publish police communications manual.

Correction to old goals as result of periodic measurements.

New goals formed as result of periodic measurements.

\* Each goal must be scheduled for completion by a specific calendar date and responsibility must be assigned to (and accepted by) a specific individual.

APPENDIX B  
TELECOM NETWORK OPERATION (Continued)

Measurements:

Comparison of scheduled completion dates with actual completion dates of all goals.

Number of communication stations (by type) in operation.

Number of two-way links (by network and type) in operation.

Message count, each link, at beginning and end of each reporting period.

Number and duration of communication failures.

Evaluation and causes of communication failures (including human and procedural failures).

Elapsed time measurements within the Communications Operations Center.

Elapsed time measurements for actions within the entire network.

Narrative description of benefits realized.

APPENDIX B

TELECOM MAN-POWER TRAINING

Broad Objectives:

Improve capabilities of technicians.  
Train ten technician candidates in basic electronics each year.  
Train operations personnel.  
Train equipment installation teams.  
Train administrative personnel.  
Assure capability for maintenance of existing and future equipment by trained personnel.  
Improve radio maintenance knowledge and technical practices of qualified local radio technicians.

Precise Goals:\*

Complete study of capability level and educational needs for each technician.  
Complete recommendations for improvement of capabilities of each individual technician.  
Complete planning and curriculum for special courses, such as:  
    Theory and Use of Electronic Test Equipment.  
    Installation of HF-SSB Station Equipment.  
    Theory and maintenance of \_\_\_\_\_ (specific equipment) .  
Complete selection of instructors for special course.  
Complete selection and approval of students for special course.  
Complete scheduling of special course.  
Start special course.  
Complete special course.  
Complete rescheduling of special course for additional groups of students.  
Complete recommendations for on-job-training of selected apprentices (designating students, teachers, periods of training, subjects to be stressed, etc.)  
Start on-job-training of Mr. \_\_\_\_\_ .  
Complete on-job-training of Mr. \_\_\_\_\_ .  
Complete survey of basic electronics training facilities available in-country for police students.  
Complete recommendations for basic electronics training of police students (decision to use available schools or start new schools).  
Complete contract with local school for training police students.  
Complete selection of (number) student candidates to attend first session of basic electronics school.  
Complete selection of (number) student candidates to attend second (third, fourth, etc.) session of basic electronics school.  
Start first session basic electronics school.  
Complete first session basic electronics school.

\* Each goal must be scheduled for completion by a specific calendar date and responsibility must be assigned to (and accepted by) a specific individual.

APPENDIX B

TELECOM MAN-POWER TRAINING (Continued)

Precise Goals:\* (Cont'd.)

In addition, many other precise goals might be formed, such as:

Goals to start a new police basic training school (including location of instructors, procurement of facilities and equipment, etc.).

Goals to improve utilization of technician talent. (Start man-hour reporting system showing allotment of technician's time, etc.)

Goals to train police in operation and use of telecom equipment. (Equipment familiarization courses, procedures and techniques familiarization courses, operational exercises and drills, etc.)

Goals to train administrative and logistics personnel (storekeepers, warehousemen, etc.).

Correction to old goals as result of measurements.

New goals formed as result of measurements.

Measurements:

Comparison of scheduled completion dates with actual completion dates of all goals.

Number of qualified repair technicians on-job at beginning and end of each reporting period.

Number of technicians on-job who are graduates of U. S. Participant Training courses.

Number of apprentices in on-job-training status at beginning and end of each reporting period.

Number of trainees in basic electronics training courses at beginning and end of each reporting period.

Number graduated from (name of course) training course this period.

Comparison of number graduated from (name of course) training course with number targeted for graduation.

Number completing on-job-training this period.

Comparison of number completing on-job-training with number targeted for completion this period.

Number of qualified instructors for (name of course) training course.

Man-hours actually devoted to repair deadlined sets during period.

Man-hours actually devoted to on-job-training during period.

Man-hours actually devoted to (name of course) training course this period.

Man-hours actually devoted to (other important work functions) this period.

Narrative reports of intangibles and meanings of above measurements.

\* Each goal must be scheduled for completion by a specific calendar date and responsibility must be assigned to (and accepted by) a specific individual.

APPENDIX B

TELECOM EQUIPMENT MAINTENANCE

Broad Objectives:

Improve equipment maintenance.  
Periodic inspections and improvement of station installations.  
Elimination of recurring maintenance problems.  
Establish a series of regional communications maintenance facilities.  
Assure capability for maintenance of existing and future equipment.

Precise Goals:\*

Move and consolidate old maintenance shops at one new location.  
Complete assignment of \_\_\_\_\_ sq. ft. of floor space for new maintenance shop at (name of bldg.).  
Complete building alterations for new maintenance shop.  
Complete installation of shelves, cabinets, workbenches, and furniture in new maintenance shop.  
Complete installation of test equipment and tools in new maintenance shop.  
Complete movement of spare parts stocks to new shop location.  
Start maintenance and repair operations in new location.  
Complete review of spare parts stock record system.  
Complete recommendations for improvement of spare parts stock record system.  
Inaugurate changes to stock record system.  
Complete recommendations for new equipment maintenance records.  
Inaugurate changes in equipment maintenance records.  
Complete inspection of base station installations in \_\_\_\_\_ network.  
Complete inspection of mobile stations in \_\_\_\_\_ network.  
Complete recommendations for corrections and improvement of station installations.  
Complete field work to correct and improve installations.  
Complete study of specific problems of equipment submitted for repair.  
Complete report and recommendations to eliminate recurring problems.  
Reduce backlog of deadlined sets by (number of sets, or percentage).  
Reduce average out-of-service time of deadlined sets to (number of days or hours).

Measurements:

Comparison of scheduled completion dates with actual completion dates of all goals.  
Number of deadlined sets awaiting repair at beginning and end of each reporting period.  
Number of sets submitted for repair during period.  
Number of sets actually repaired during period.  
Period of time out-of-service for each set submitted for repair.

\* Each goal must be scheduled for completion by a specific calendar date and responsibility must be assigned to (and accepted by) a specific individual.



APPENDIX B  
PROCUREMENT AND INSTALLATION OF TELECOM COMMODITIES

Broad Objectives:

Implement commodity portion of plan for communications modernization.  
Assure capability for maintenance of equipment through availability of spare parts and shop equipment.

Provide radio equipment for modernizing dispatch center.

Furnish modern equipment to update police communications.

Improve civil police functions by providing....some commodity support in communications.

Establish telecommunications system for which U. S. AID will fund radio and radar land equipment, communications operations center, and power sources.

Precise Goals: \*

Complete survey/study of present police telecom system (or individual police telecom network).

Complete recommendations for new facilities and equipment.

Complete agreements defining U. S. and local government responsibilities in provision of new facilities and equipment.

Complete detailed specifications for each item of new equipment and/or spare parts.

Complete worksheet PIO/Cs.

Dispatch worksheet PIO/Cs to OPS/W for action.

Complete survey and design of each installation site.

Complete detailed plan for all work involved in installation of new equipment.

Receipt of (item description) in country. (Schedule in accordance with forecasts from OPS/W.)

Assign personnel to installation team.

Complete training of installation team.

Deliver (item description) to job site. (Make separate goal for each major item or group of items.)

Complete installation of AC power and other preparation of facilities. (Make separate goal for each site.)

Complete tower erection. (Separate goal for each site.)

Complete equipment installation. (Separate goal for each site.)

Complete tests and adjustments. (Separate goal for each site.)

Site ready for first operational exercises. (Separate goal for each site.)

Network (all sites) ready for police operations.

Corrections to old goals as result of periodic measurements.

New goals formed as result of periodic measurements.

\* Each goal must be scheduled for completion by a specific calendar date and responsibility must be assigned to (and accepted by) a specific individual.

APPENDIX B  
PROCUREMENT AND INSTALLATION OF TELECOM COMMODITIES (Continued)

Measurements:

Comparison of scheduled completion dates with actual completion dates of all goals.

Comparison of originally estimated funds to actual funds required (local police funds and U. S. funds).

Numerical results of equipment and network performance tests (VSWR measurements, frequency measurements, power output measurements, communication ranges achieved, etc.).

Narrative evaluation of capability of installation team to make satisfactory installations.

Narrative evaluation of equipment to actually provide function desired.

APPENDIX B

Additional Suggestions for Telecom Program Goals and Measurements

Precise Goals: \*

Goals for assignment of required additional personnel.

Goals for effecting improvement in budgeting and other administrative practices.

Goals to achieve improvements in spare parts provisioning, specification, procurement, and record keeping.

Goals to achieve workable joint emergency operation of all security forces.

Goals to provide better access for citizens to communicate with police.

Goals to improve police response to public service type calls (accident, assistance in disasters, "civil action", etc.)

Goals for achievement of "model" projects and "demonstration" projects.

Measurements:

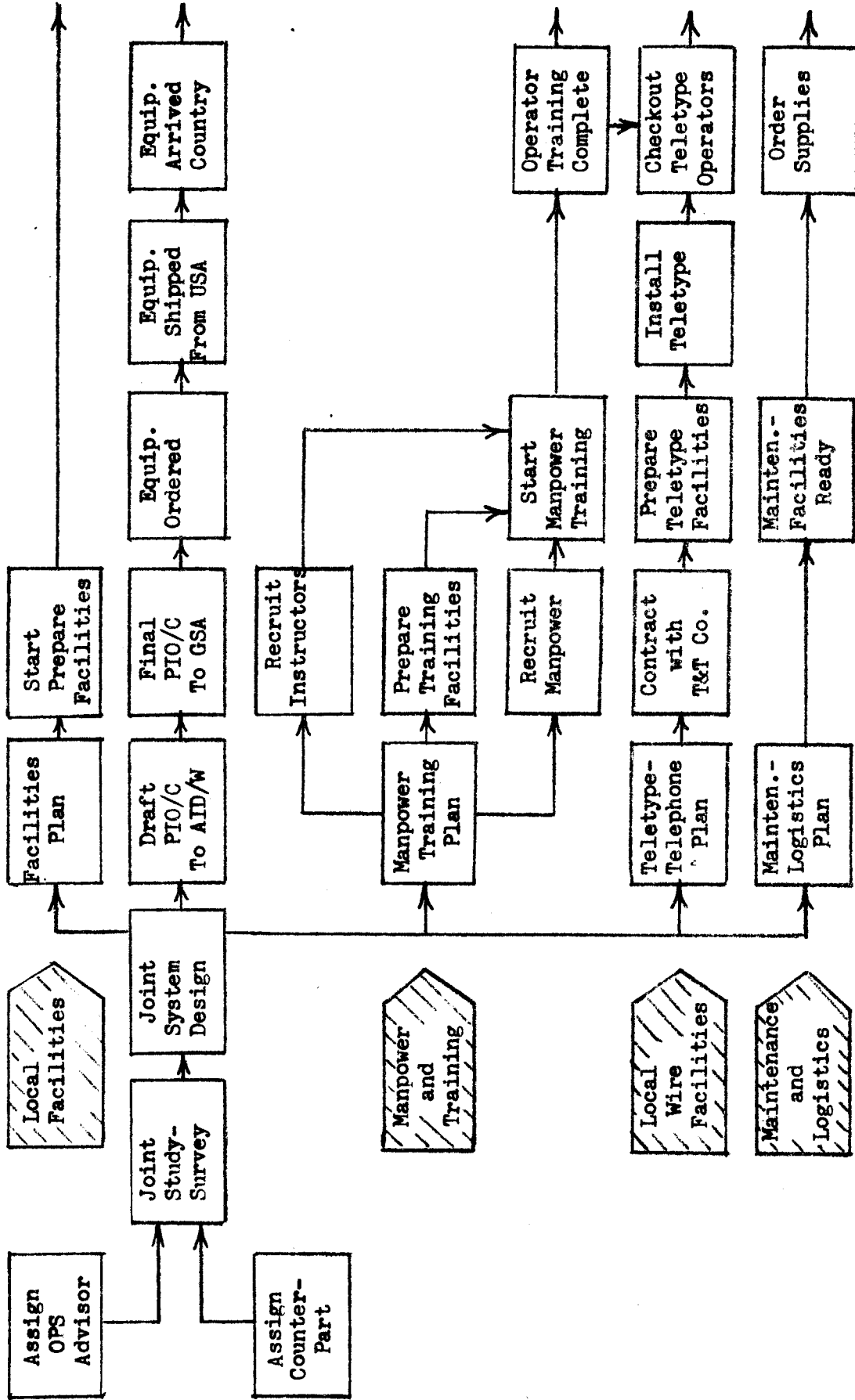
Special reports on usage of U. S. AID furnished equipment.

Special reports on police actions improved by use of communication networks (such as: arrests made, crimes prevented, crimes solved, citizens protected, criminals captured, special assistance in emergencies and natural disasters, etc.)

\* Each goal must be scheduled for completion by a specific calendar date and responsibility must be assigned to (and accepted by) a specific individual.

APPENDIX C

Page 1. (Continued next page)



(Continued from previous page)

Page 2.

