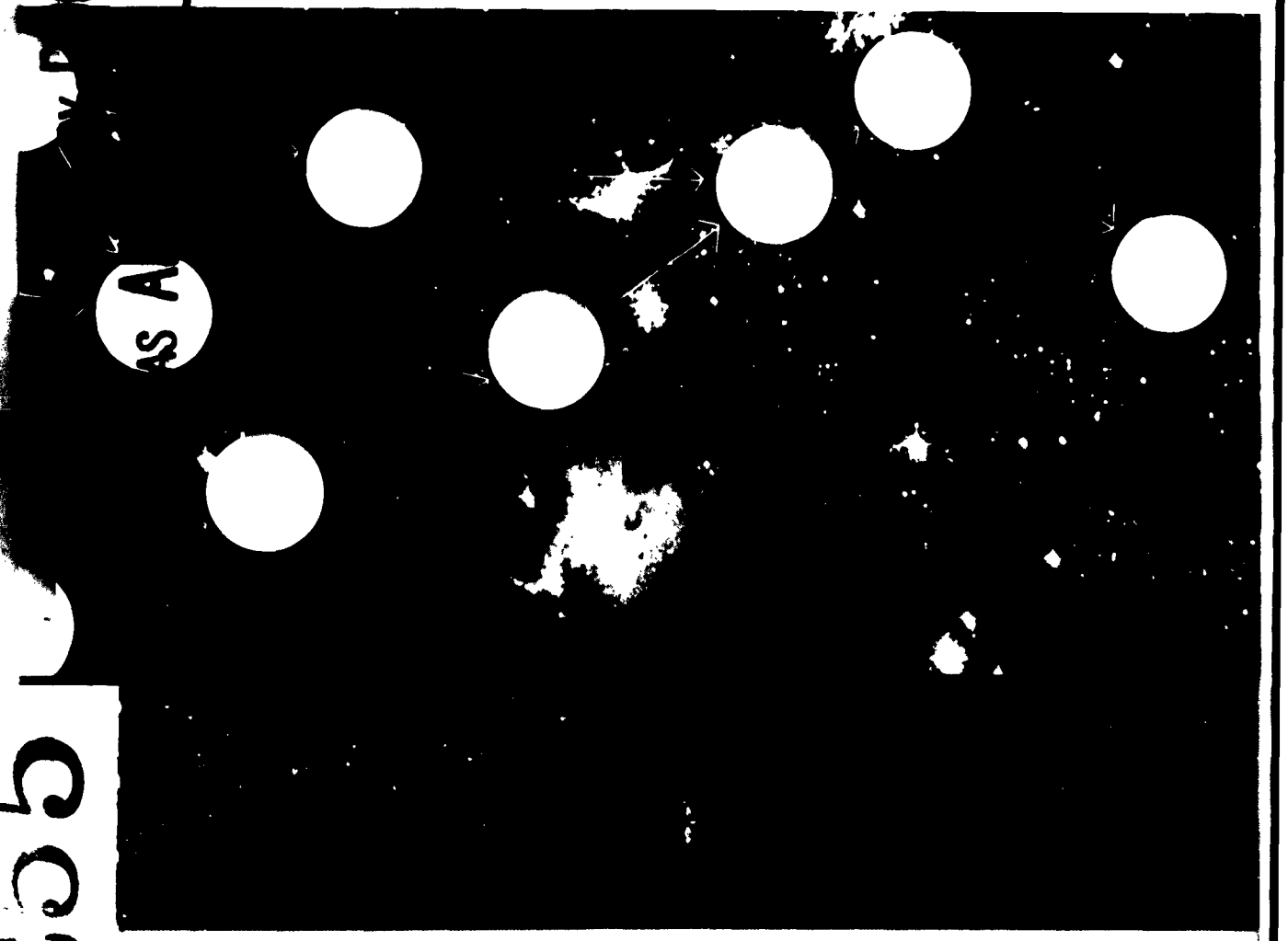
USAF • PERT



VOLUME III

PERT-COST SYSTEM DESCRIPTION MANUAL

ADVANCE COPY FOR AFSC IMPLEMENTATION

DECEMBER 1963

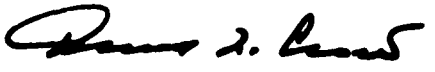
FOREWORD

This manual is Volume III of the USAF PERT series. It contains a detailed description of the USAF PERT Cost System. It provides methodology and guidance and serves as a reference for all levels of management in the application of PERT Cost.

A basic principle upon which this manual was developed is the required flexibility of PERT Cost to accommodate, in so far as possible, existing contractor accounting systems. The rule applied is that actual costs charged by contractors to various work efforts be consistent with the procedures used in estimating these costs.

This manual incorporates the uniform PERT Cost Output Reports approved by OSD PERT Coordinating Group, March 1963. It replaces USAF PERT Cost System Description Manual, dated March 1963.

Comments concerning any part of this document are solicited from both government and industry sources, and should be forwarded to Hq AFSC (SCCSS), Andrews AFB, Washington, D. C., 20331.



DUWARD L. CROW
Brigadier General, USAF
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USAF PERT

VOLUME III

PERT COST SYSTEM DESCRIPTION MANUAL

DECEMBER 1963

USAF has produced a series of PERT documents to provide understanding of the USAF PERT TIME and PERT COST Systems presently in use. This manual, Volume III, is the third in the USAF PERT series.

USAF PERT

VOLUME	I	USAF PERT TIME SYSTEM DESCRIPTION MANUAL
VOLUME	II	USAF PERT TIME SYSTEM COMPUTER HANDBOOK
VOLUME	III	USAF PERT COST SYSTEM DESCRIPTION MANUAL
VOLUME	IV	USAF PERT COST SYSTEM COMPUTER PROGRAM HANDBOOK, PART I USAF PERT COST SYSTEM COMPUTER PROGRAM HANDBOOK, PART II
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CHAPTER I

INTRODUCTION

CHAPTER I

INTRODUCTION

Complex research and development programs can be managed effectively if program managers have the means to plan and control the schedules and costs of the work required to achieve their technical performance objectives. The serious schedule slippages and cost overruns that have been experienced on many weapon and space programs indicate that managers at all levels need improved techniques at each stage in a program to:

- define the work to be performed;
- develop more realistic schedule and cost estimates based on the available resources;
- determine where manpower and other resources should be applied to expedite critical activities and to best achieve the time, cost, and technical performance objectives; and
- identify those areas developing potential delays or cost overruns, in time to permit corrective action.

The PERT COST System, a complement to the basic PERT TIME System[1], was developed to meet these planning and control needs of each level of management. In the system, both cost and schedule are planned and controlled on a common framework or structure. This interrelation, a significant feature of the PERT COST System, permits more accurate measurement of program status. Following is an abbreviated description of PERT COST.

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[1]It is assumed that the reader is familiar with the USAF PERT TIME System.

The program planning begins with the development of the work breakdown structure. The lowest level end-item[1] subdivisions of the structure are broken down into the tasks required to accomplish the end item. These tasks are called "work packages." Responsibility for the accomplishment of each work package is then assigned to an individual or an organization.

When the work packages under each end item are identified, the detailed networks for the corresponding parts of the program are constructed. Network activities are identified with the work packages they represent. Each work package will normally be represented by one or more activities. The beginning and ending of the work package can be identified by the first and last events in time associated with this work package. The networks are developed in the manner described in the USAF PERT TIME System Description Manual, dated September 1963.

After a schedule has been prepared, a cost estimate is developed for each work package. This cost is based on the manpower and other resources required to perform the work package in its scheduled time. (By summarization up the work breakdown structure, cost estimates for each end item and for the total program are derived automatically.)

The estimates are analyzed to eliminate unnecessary manpower costs and premium payments for materials and services. For example, monthly manpower requirements are totaled by skills and examined to minimize needless overtime and hiring caused by manpower peaks that will be followed by troughs. This manpower "smoothing" is accomplished by rescheduling slack activities to periods when the skills are not required by critical activities.

The PERT COST System requires periodic comparisons among:

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[1]The term "end item" is used in this manual to represent the hardware, documents, services, equipment, or facilities that are deliverable to the government or that are a commitment on the part of the contractor.

- estimated, budgeted, and actual costs for each work package;

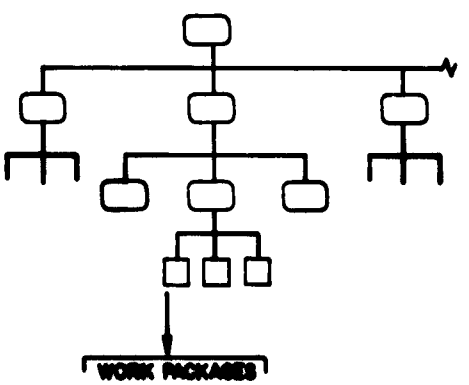
- estimated and actual time of each associated network activity.

This comparison significantly improves cost and schedule control by establishing the cost and time status of the program and identifying any potential cost overruns and schedule slippages. Concurrent estimates of the cost and time needed to complete work not yet performed are also obtained in order to predict future schedule slippages and cost overruns and to identify difficulties in the performance of critical work packages early enough to take corrective management action.

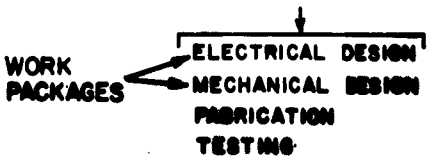
The cost estimates required by PERT COST are based on projections of manpower and other resources that will be assigned for the performance of each scheduled work package. Since the line supervisors responsible for performing the work participate in estimating the manpower and other resources required, the cost estimates also serve contractors as yardsticks for internal measurement and control of performance.

In summary, the following six basic concepts underlie the PERT COST System:

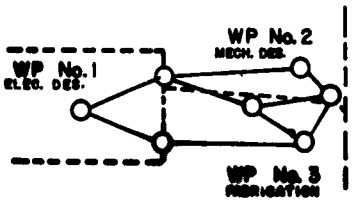
1. Work Breakdown: The overall program is broken down by the government and the contractors into successively smaller pieces of hardware, services, equipment, or facilities until manageable units for planning and control are derived. A summary code structure is developed to permit cost summarization. Budgets are established. Actual costs are then accumulated by work package, enabling a comparison of actual and budgeted for the work accomplished to date.



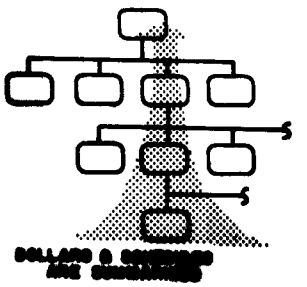
2. Work Packages: Work packages are established for each of the lowest level units on the work breakdown, and a charge number is assigned to each work package.



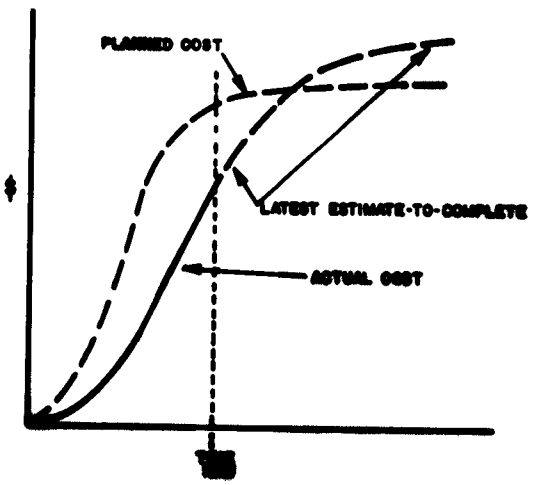
3. Networks: Networks are constructed which graphically interrelate activities and work packages.



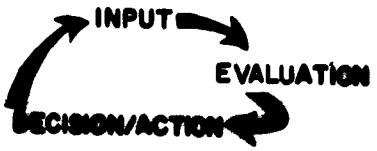
4. Time/Cost Interrelation: Time and cost data can be directly correlated at the total program level as well as at the work package level. Summarization of work package costs up the work breakdown structure enables the same comparison to be made for the total program and for each end item.



5. Cyclic Updating of the Estimates: Periodically, an estimate-to-complete is made for each work package which is in progress or not yet performed. The addition of actual costs to the estimates-to-complete produces the estimate at completion for the work package.



6. <u>Program Evaluation/Decision/Action</u>: Program evaluation is continuous throughout the life of the program. Management decisions are based on analyses and comparisons of actuals to planned time and cost.



CHAPTER II

THE PERT COST SYSTEM

CHAPTER II

THE PERT COST SYSTEM

This chapter describes the phases of the PERT COST System to provide a basis for the discussion in the succeeding chapters. It also discusses the applicability of these phases to the weapon system development program.

A. System Phases

Because of the feedback, or repetitive, characteristics of the PERT COST System operation, the system is represented as a cycle with two components: the Planning Phase and the Operating Phase. During the Planning Phase, the work breakdown structure is developed, the tasks required for the accomplishment of the program's end items are defined in terms of work packages, and the cost estimates for the performance of the work packages, within their scheduled times, are made.

When a plan has been approved, work is authorized and the Operating Phase of PERT COST begins. In this phase, program status is measured and future progress is forecasted. These two phases and the elements they include are illustrated in Figure II-1.

Ideally, the whole program is planned, the plan is approved, work is authorized, and the operating phase of measuring, processing, analyzing, and decision-making begins. In actual practice, however, a plan for part of the program is developed and approved, and execution of this plan then commences while other parts of the program are still being planned. Also, part of the Planning Phase is repeated when it is necessary to revise the plan for portions of the program that have been in process. Consequently, planning tends to continue throughout the life of the program.

B. PERT COST Implementation and Operation Summary

The PERT COST System implementation requires coordination between the Air Force and its contractors. The sequence in which the system is implemented and the data flow of the

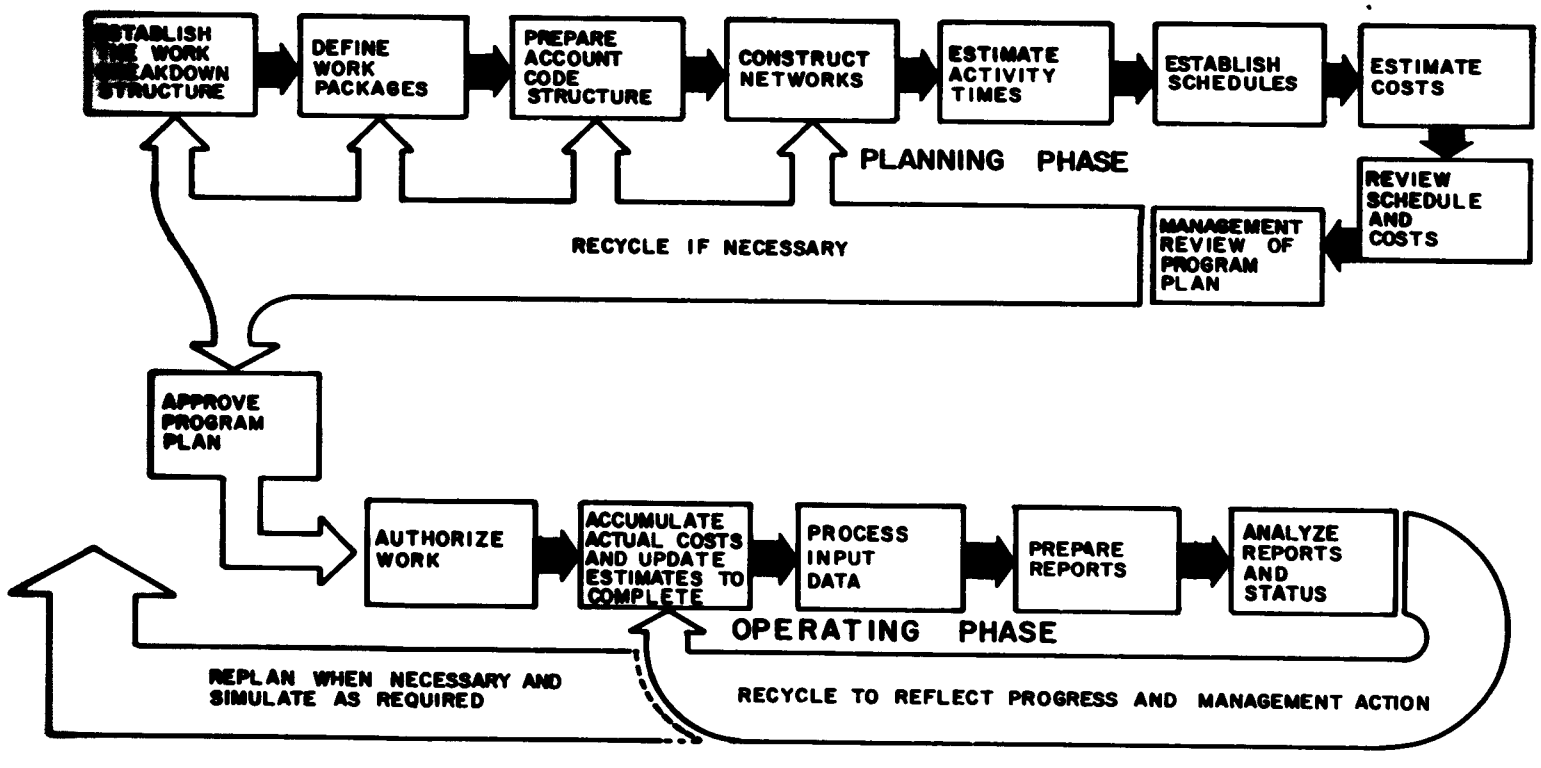


FIGURE II-1 — PLANNING AND OPERATING PHASES

Operating Phase are described below and shown in Figure II-2. The exact sequencing and data flow are a function of the contractor selection method and the contractor's management structure (e.g., prime contractor, IAC), and whether there is a Definition Phase.[1]

1. The System Program Office Planning Stage

The Request for Proposal must include the following PERT information:

- a work breakdown structure, developed to the extent that the program is defined and accompanied by a summary number structure which is related to the Materiel Program Code (MPC);
- a preliminary Program Management Network;
- tentative program and intermediate milestone completion dates;
- a statement of the requirements of the PERT COST System to be implemented. This statement will include:
  - identification of the reports to be submitted to the System Program Office;
  - the required level of detail;
  - the frequency of the reports and the report delivery dates;
  - the backup data to be available;
  - the extent to which the system will be applied at the subcontractor locations;
- a requirement for contractor submission of a PERT COST implementation and operation plan;

---

[1]For a summary of PERT COST implementation in the Definition Phase, refer to Appendix A.

- a statement of the PERT COST information to be submitted by the contractor in the management portion of his proposal.

2. Contractor Proposal Preparation Stage

The bidder, in preparing his proposal, performs the following PERT operations:

- extension of the work breakdown structure to the lowest level of end-item subdivision;
- the definition of work to a level of detail consistent with the stability of the work breakdown structure;
- expansion of the Program Management Network to support the objectives outlined in the Request for Proposal;
- preparation of activity time estimates;
- processing of the network data, evaluation of the plan, and replanning, as required, until a plan consistent with directed dates has been achieved;
- establishment of scheduled dates from which scheduled elapsed times (t_s) are derived;
- preparation of cost estimates in support of items shown on the work breakdown structure;[1]
- processing of the resource estimates to show total costs and rates of expenditure for the total program and each of its end items; and
- management review and approval of the program plan.

---

[1]Proposal preparation in the Definition Phase requires definition of work packages and development of work package cost estimates.

3. Negotiation and Contract Award Stage

In the negotiation between customer and contractor, the following PERT COST steps are performed:

- reaffirmation or revision of the work breakdown structure and supporting networks;
- definition and System Program Office approval of work packages;
- reaffirmation or revision of the PERT COST reporting requirements;
- verification that the contractor's PERT COST System will generate reliable data; and
- award of the contract with the requirement for PERT COST implementation and operation.

4. PERT COST Operation

The contractor's requirements in the operation of PERT COST include:

- the assignment of charge numbers;
- the accumulation of costs, consistent with normal company procedures and satisfying the requirements of the PERT COST System;
- summarization of actual costs as described by the contract;
- recording of work progress in terms of completed work packages or items on the work breakdown structure;
- updating of time and resource estimates;
- processing of actual and estimated time and cost data to produce the PERT COST reports.

From the PERT COST reports, the contractor prepares his evaluation of the program, which includes:

- preparation of PERT COST management reports for management analysis;

- identification of current and potential problem areas and formulation of solutions to eliminate or minimize the problems.

The contractor then provides the Air Force with the contractually required PERT COST reports and narrative reports identifying and describing the progress and/or problems and presenting the action taken or proposed for the elimination of the problems.

The System Program Office will conduct a continuous analysis of the complete program, resulting in feedback of direction, information, and data to the contractor's management system.

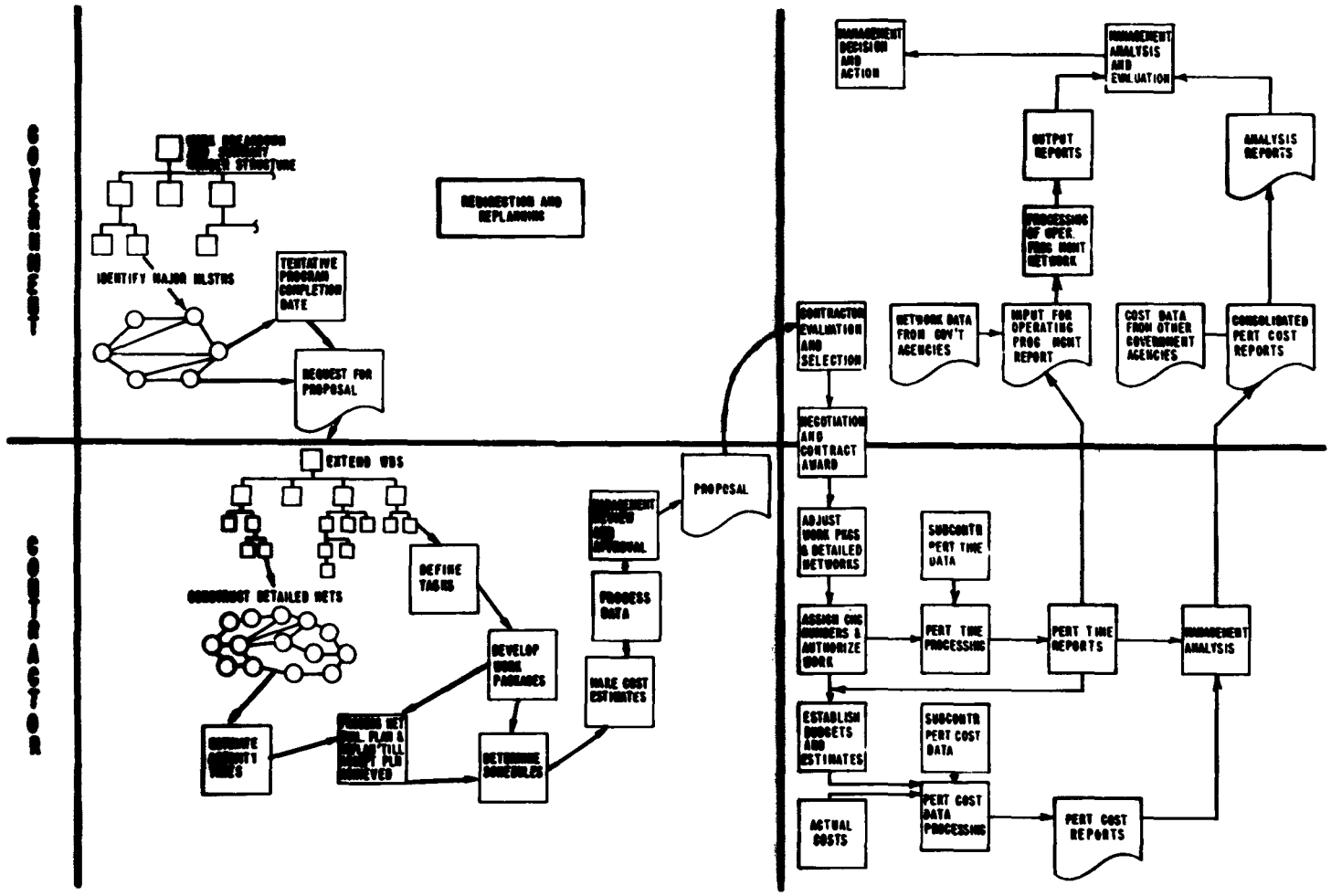


FIGURE II-2 — DATA FLOW

CHAPTER III

PLANNING

CHAPTER III

PLANNING

The PERT COST Planning Phase includes:

A. Work Breakdown Structure

B. Work Packages

C. Account Code Structure

D. Networks

E. Time Estimates and Schedules

F. Resource and Cost Estimates

G. Revision of the Plan

Each of these elements is described below.

A. Work Breakdown Structure

During the initial program analysis, the System Program Office identifies and interrelates the program objectives. These objectives are subsequently stated in terms of service or hardware end items that are deliverable to the government or that constitute a commitment on the part of a contractor. The further division of each end item into component parts creates a program or work breakdown structure. This breakdown is consistent with the:

. Materiel Program Code (MPC) structure;

. specification tree;

. contract items.

The System Program Office program breakdown structure provides the contractor with a basis for continuing the breakdown to successively lower levels until the subdivisions become manageable units for planning and control purposes.

This detailed program breakdown provides a framework for:

- defining and relating program objectives;
- planning and controlling integrated cost and schedules;
- summarizing cost and schedule status;
- assembling technical specifications.

The development of the work breakdown structure, Figure III-1, begins at the highest level of the program with the identification of end items. The major end items are then divided into their components (e.g., systems, subsystems, functions, manuals, subservices, etc.). During the contractor Proposal Preparation Phase and continuing through the Definition and Execution Phases, the planning and control become more detailed. Subdivision of the work breakdown structure continues to successively lower levels. Figure III-2 shows an actual work breakdown structure, broken down to five levels of subdivision.

The end-item subdivisions appearing at the last level in the work breakdown structure are then divided into the recognizable "jobs" required for the accomplishment of these items. These "jobs" are the work packages.

Once established, the work breakdown structure must be maintained and updated to reflect the changing situation. The configuration and content of the program breakdown and the specific work packages to be identified vary from program to program depending on several considerations:

- size and complexity of the program;
- structure of the various organizations concerned;
- program managers' judgment of work assignments;
- degree of uncertainty involved;
- time available for planning.

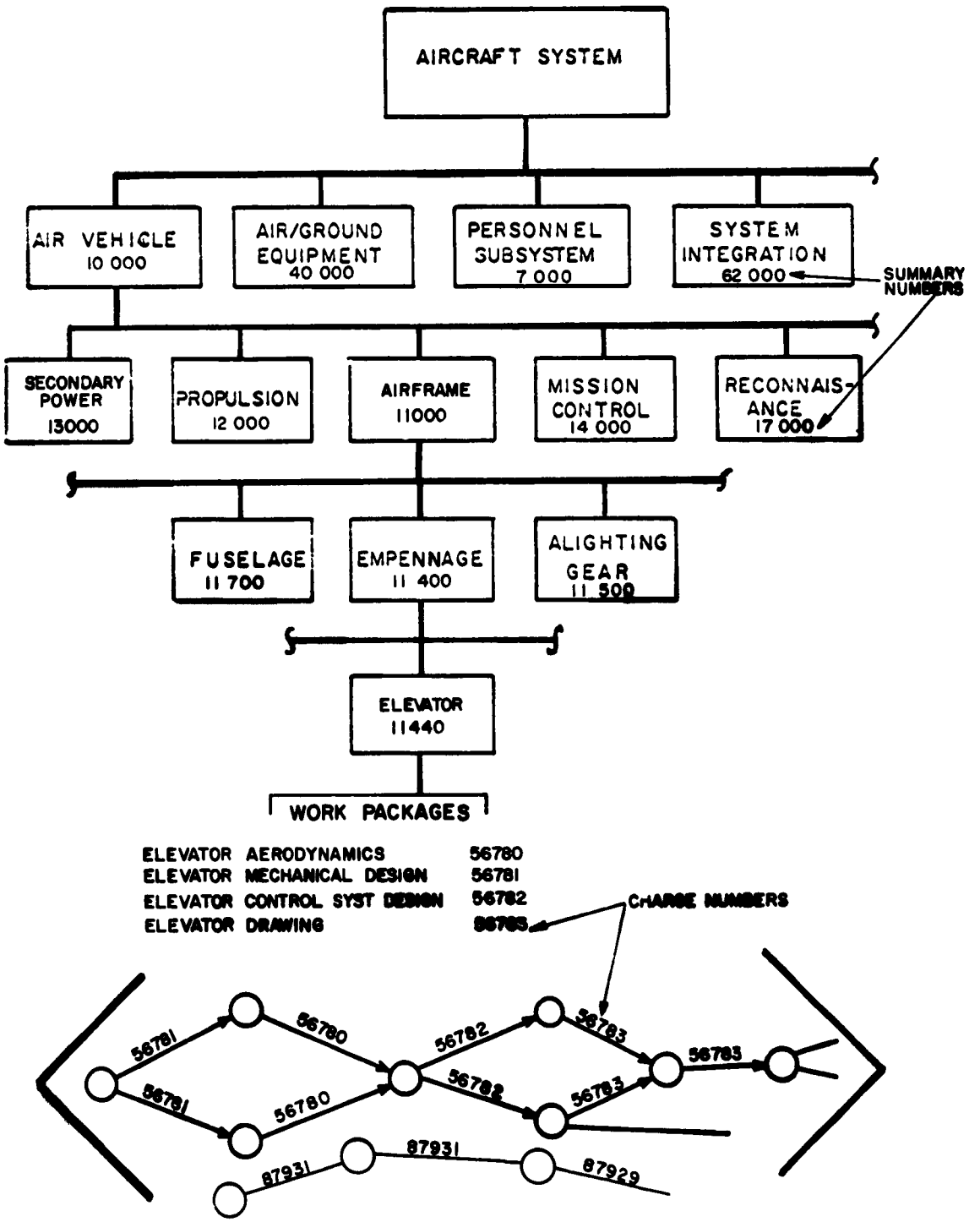


FIGURE III-1 — WORK BREAKDOWN STRUCTURE WITH ACCOUNT CODE STRUCTURE AND WORK PACKAGE/ NETWORK CORRELATION

Aircraft System RDT & E	Air Vehicle	Air Frame	Wing Fuselage Empennage Alighting Gear Environmental Control Major Mating
		Propulsion	Engine Starter Fuel System Fire Protection Installation Composite
		Secondary Power	Electrical Hydraulic Installation Composite
		Mission Control	Flight Control Mission and Traffic Control
		Offensive	Firepower Control Armament
		Penetration Aids	
		Reconnaissance	
		Other	Maintenance Mockups Other
	Initial Spares	Air Vehicle Air Ground Equipment	
	AGE	Air Frame Propulsion Secondary Power Mission Control Offensive Defensive Reconnaissance Composite	
	Personnel Subsystem	Equipment Data Life Support OOPRI Training Equipment Training Test and Evaluation	 Maintenance Trainers Air Trainers Training Film
	Development	Integration Engineering System Testing	 Wind Tunnel Major Component Testing Fatigue Test Static Test Flight Test Cat I Flight Test Cat II Support Aircraft
	Technical Data	Engineering Data Tech. Orders and Manuals	 AGE Airborn Systems Aircraft Miscellaneous
	MANAGEMENT	MANAGEMENT	MANAGEMENT

FIGURE III-2 — TYPICAL AIRCRAFT SYSTEM WORK BREAKDOWN STRUCTURE

B. Work Packages

The work package is the basic cost planning and control element in the PERT COST System. Where the work breakdown structure defines the program objectives, the work package defines the work required and the functional responsibility for the performance of this work. The work package is the link between the cost accounting system and the PERT COST System, and serves as the basic unit for:

- estimating costs;
- establishing budgets;
- accumulating actual costs; and
- comparing actuals and estimates with budgets.

The content of the work package is represented on the PERT network by one or more activities. The first and last events associated with these activities are the identifiable beginning and ending points of the work package. Therefore, the work package is the basic unit for assigning schedule and cost responsibility to first-level supervision.

Of major importance to the accuracy of the PERT COST System is the size of the work package; i.e., the dollar amount and the time duration of the work package. Dollar amounts should be small and the time duration should be short to gain the most precise control from the system; however, consideration must be given to practical requirements.[1] The size for the work package may be modified by one or more of the following conditions:

- Some activities such as Value Engineering, Tool Maintenance, Travel, Liaison, and Management are essentially supporting functions, cutting across the hardware-oriented work packages and extending over the life of the contract at a "level of effort." For these activities,

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[1] The DOD/NASA PERT COST Systems Design Manual, dated June 1962, suggests a work package size and duration of $100,000 and three months.

work packages are established and control is exercised by limiting the expenditures in a given time period to a predetermined amount.

- The size of work packages governs the total number of work packages in a program. This number should not be so great that the response of the system is slow and the cost of control exceeds its value.

- The work package should be a clearly defined, recognizable task. If a work package has a "clean" ending event which makes its size larger than the suggested size but provides better work definition and cost control, a longer time duration or greater cost may be desirable.

The specific beginning and ending points finally adopted must be clearly recognizable, not only to the analyst but to the personnel performing the task. Their understanding is necessary so that they can estimate and charge in the correct manner. Finally, when more than one organization will perform work in a work package, the organization responsible for the work package must see that the division of work to be done is clearly defined and that agreement on the cost and the scope of the work is reached.

C. Account Code Structure

The account code structure is a framework of numbers which is used for summarizing (with summary numbers) and charging (with charge numbers) the costs of a program. It follows the pattern of the work breakdown structure. An account code structure is illustrated in Figure III-1.

The account code structure must be based on the program breakdown to insure that all cost generating effort has been included. During the Definition Phase, the contractor will work with the System Program Office to develop networks in which accounting charge numbers are represented to the maximum extent, by network activities.

A summary number is assigned to each end-item subdivision of the work breakdown structure. It is used for summarizing costs automatically at each level of the work breakdown structure, thereby providing the cost figure for each end item. Thus, cost data for use by progressively higher levels of program management is provided.

Subsequent to final coordination of the contractor's detailed program breakdown structure and detailed network, the System Program Office designates the summary numbers that will be assigned to each end-item subdivision on the work breakdown structure. These summary numbers are based upon the major Materiel Program Codes (MPC) and contain the subordinate management and functional MPC's developed by the System Program Office for a specific program. They are directly related to, or part of, the numbers assigned to events on the network.

A charge number is assigned to each work package. It is against these charge numbers that cost estimates are made, planned cost is established, and actual costs are accumulated. A charge number may also be assigned to a summary end-item on the work breakdown structure when there is no further shredout below it.

The Work Breakdown Structure Input Form described in Chapter V is a medium for describing the relationships of charge numbers to summary numbers and the relationships of summary numbers to higher level summary numbers.

PERT COST does not require the contractor to develop a new cost accumulation system, although some modification to his current estimating and budgeting system may be required. Contractors may continue to assign charge numbers which have significance to their existing accounting systems. Most contractors and government agencies have cost accumulation systems that permit summarization of costs by contract, end-item functional cost category (e.g., design, fabrication, etc.) and task, or job. This same structure, with only minor modification, can serve as the cost accumulation system for PERT COST. The PERT COST summary numbers (which need not appear in the internal accounting system) can regroup the assigned charge numbers for summarizing costs up the work breakdown structure.

D. Networks

Two types of networks[1] are maintained during operation of the PERT COST System:

- the Program Management Network which is required by the System Program Office to reflect the total system acquisition plan; and
- the Detailed Networks which are developed by the contractors as operating level plans for their portions of the program.

A Program Management Network is a top-level network, initially prepared as part of the precontractual planning effort. This network is used as a planning network in:

- the preparation of the program plan, the Work Statement, and the Request for Proposal;
- the evaluation and source selection process; and
- the conveying of key events to the contractor for his guidance in preparing Detailed Networks.

Later, in the negotiation and early contractual phases, the network is refined through the assistance of contractors and government agencies, and becomes the operating version of the network for both planning and control purposes.

Detailed Networks are prepared by each contractor and supporting government agency, based on the program breakdown and the Program Management Network. It is important to note that each event on the Program Management Network must appear somewhere in the detailed networks to assure a valid time relationship between the two levels of planning. Activities on the Detailed Network are identified with the work package they represent. A work package may sometimes be represented by only

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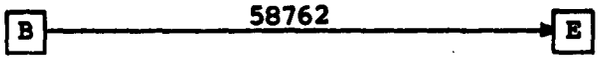
[1] A more detailed discussion of networks is presented in USAF PERT, Volume I.

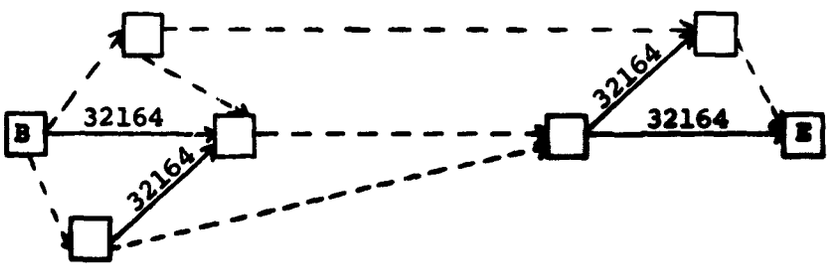
one activity, with a beginning (B) and ending (E) event. For example:

Stabilizer Mechanical Design



Frequently, however, a work package will be represented on a network by a number of activities separated by events which serve as beginning or ending points for other activities in the program. For example:

Stabilizer Electrical Design - 32164



The first and last events in time (Events B and E in this example) for a group of activities representing the work package identify the beginning and end of the work package effort on the network. Thus, when schedules are established, scheduled dates for the beginning and ending of work packages and summary items are also established. It is in this manner that time and cost are correlated at the basic planning and control level.[1]

---

[1] The existence of time/cost correlation at the work package level does not, in itself, guarantee the presentation of a similar relationship at summary levels. Care must be taken during initial planning phases to devise a coding system and to select significant milestones within summary items, so that this relationship is preserved. Some techniques for accomplishing this relationship are discussed in USAF PERT, Volume V.

PERT COST does not require costing of each activity in the detailed networks. Not only might such a procedure generate expensive and burdensome detail, but activities may not provide the best subdivision for cost control.

There are some work efforts in a program that, because they do not constrain progress towards the end objectives, need not be represented on the PERT network. However, if the effort generates direct charges to the contract, it must be accounted for in the cost summarization. For example, program management, if it is charged as a direct cost to the program, may be charged to a work package or a summary item, but it is not necessarily represented by activities on the network.

E. Time Estimates and Schedules

The time estimating and scheduling process begins when the Government Master Schedule and the Program Management Network, which contain directed event dates (T_D), e.g., Start Cat I Testing, IOC, etc., are made available to the contractor. The contractor then prepares a summary network. The logic of this summary network is reviewed by the higher level managers of the functional areas (Engineering, Manufacturing, etc.) to ensure uniformity of thinking. When the logic is assured, cognizant personnel estimate the activity expected elapsed times (t_e). The calculated event dates (T_E) on the summary network are then compared to the scheduled dates (T_S) of these same events in the Contractor Master Schedule. The PERT COST System calculates an earliest completion date (S_E) and a latest completion date (S_L) for each activity in the network. These terms are similar to the T_E and T_L described in the basic PERT TIME System.[1] Differences between scheduled and calculated dates can be reconciled by:

changing the scheduled dates in the Contractor Master Schedule to agree with the network dates (government-directed scheduled dates (T_D) cannot be changed); or

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[1] See USAF PERT, Volume I.

- replanning the network logic or activity expected elapsed times to make the summary network dates agree with the Contractor Master Schedule.

After differences are resolved, the Contractor Master Schedule is published for program guidance.

When the Contractor Master Schedule is published, the contractor can prepare detailed work packages. The detailed schedules are then established for the tasks within the work packages.

Supporting detailed networks are constructed which contain the events appearing in the detailed schedules and the activities required for the completion of the work package. Schedule evaluation is achieved by comparing the calculated duration for each work package with the duration shown on the detailed schedules. The calculated and scheduled work package durations are made available in the header block of each work package Cost Estimating and Updating Form (see Chapter V). Serious differences are resolved by either changing the detailed schedules (within the parameters of the Contractor Master Schedule) or modifying the network plan. The network data is then processed, and the schedule and slack printouts are analyzed by the operating managers to assure that the directed event dates will be met. If the printouts show that the network plan will not allow the directed dates to be met, the network plan is modified and the network data is reprocessed. This cycle is repeated until an acceptable network plan is developed.

The detailed schedules are issued to all operating level managers for direction in establishing their internal day-to-day operating schedules. The elapsed times on the network and the detailed schedules for each work package then become the basis for cost estimating in the Initial Planning Phase.

F. Resource and Cost Estimates

Once the scheduled elapsed times are determined, cost estimates are made by determining the manpower, material, and other resources required to perform each work package for its scheduled period. Estimates are made by time period, starting

with the period in which the work package is scheduled to start and terminating in the period in which the work package is scheduled to be completed. The resource estimates are converted to dollars to determine the direct cost of each work package. Indirect costs may be added either to each work package or at summary levels of the work breakdown structure, depending upon the accounting practices of the contractor. The resource and cost estimates can subsequently serve as the basis for developing budgets for each work package. The resource estimates may be entered as man-hours, direct dollars, or total dollars. If the entry is made as man-hours, the estimates are converted to dollars to determine the direct cost of each work package.

Separate cost estimates are not necessary for each activity in a work package, since this would result in excessive detail and might lead to unrealistic accounting allocations. Costs may be estimated at lower levels than the work package.

For instance, although there is only one department responsible for the work package there may be more than one department performing on the work package. Estimates, therefore, may be by performing organization within the work package. An example of this situation is a qualification test involving Manufacturing, Engineering, and Quality Control. The cost estimate for this work package would consist of the estimates from all three performing organizations.

The estimates may be further broken down, by resource, if desired by the contractor; that is, they may be broken down into types of manpower, material, etc. to obtain the useful manpower and material summarization reports. Estimates of charges (such as travel, computer time, and consultants) are normally difficult to estimate and control properly at the work package level. They usually involve several work packages; therefore, they are estimated at a higher level of the work breakdown structure and are charged at that level.

The resource estimates may be recorded on the PERT COST Cost Estimating and Updating Form discussed in Chapter V. This form is both a computer printout and input form. It presents an estimator with the work package description and schedule, and provides for entry of manpower estimates and other direct costs such as materials, subcontract, special

equipment, and services. The Work Package/Activity Listing is also presented to the estimator as a guide in scheduling resources to reflect the network plan.

G. Revision of the Plan

If the proposed program plan falls short of the objectives established, the manager may adjust costs and schedules by one or more of the following techniques:

- The schedule of slack path activities can be adjusted to minimize overtime requirements or additional hiring;
- The planned resources for work packages can be revised by trading off interchangeable resources between critical and slack paths;
- A greater or lesser amount of concurrence in performing activities can be employed;
- The specifications or method of performing the work can be modified, thereby altering deleting, or adding activities.

This replanning cycle continues until the proposed program plan is in agreement with the required objectives of time and cost.

CHAPTER IV

OPERATING

CHAPTER IV

OPERATING

When the program plan has been approved, work commences and the measurement and evaluation of progress begin. In this Operating Phase, the approved plan is used as the standard against which program progress is controlled and evaluated. The steps in the Operating Phase are:

A. Accumulating Actual Costs

B. Updating the Plan

C. Preparing PERT COST Reports

D. Evaluating Status

Each of these elements is described below. The Operating Phase data flow for two different methods of Air Force program contracting is also outlined.

A. Accumulating Actual Costs

Costs are accumulated by the work authorization charge number and normally reflect a further identification of the performing unit and the type of resource expended. Actual costs may be collected against more detailed accounts than PERT COST requires for budgets or estimates.

Both expenditures and specified unliquidated commitments are incorporated in the term "actual costs." PERT COST does not distinguish between expenditures and commitments but reports only "aggregate" actual costs. A practical difficulty, as in other cost systems, is the reporting of a cost as both an expenditure and a commitment.

Since the PERT COST reports must be timely, actual cost figures must be accepted prior to audit and formal release of accounting data. The small loss in accuracy that results is more than compensated for by the timeliness of the data. Previous report periods will be updated to reflect the final audit of actual cost for that period.

B. Updating the Plan

As a development project progresses, activities are added or deleted, work is completed behind or ahead of schedule and over or under budget, and time and cost estimates for unfinished work are revised. Rapid updating of estimates-to-complete based on the work yet to be done and subsequent comparison against plan are necessary to insure the success of a management information system. This updating and comparison process constantly focuses management attention on the work to be done and on potential problems.

PERT COST provides systematic updating by:

- requiring reestimates-to-complete for work in progress or work not yet performed;
- establishing specific review dates;
- requiring the assignment of responsibility for estimate preparation and revisions;
- supplying the current schedule and cost status to the individuals responsible for developing revised estimates; and
- furnishing specific forms for transmittal of updated information. These forms are preprinted with the latest pertinent schedule data to facilitate estimating.

As significant program changes occur, it may also be necessary to revise:

- work packages;
- network logic of detailed and/or summary networks;
- program breakdown structure.

The updating process may indicate a need to revise funds. The System Program Office will indicate the specific items on

the program breakdown structure below which reallocation may be made by the contractor without System Program Office approval. Reprogramming of funds at higher levels must be approved.

C. Preparing PERT COST Reports

The basic information generated in the PERT COST System is summarized in several ways for program management reporting. The PERT COST output reports are presented in Chapter VII. The System Program Office specifies in the contract which of these reports are to be submitted periodically by the contractors. However, the System Program Office reserves the right to receive, on an exception basis, additional detail below the reporting level to analyze specific problem areas. The contractor may use any of the reports for internal management. The submission of reports to the System Program Office is normally planned to correspond to the contractor's accounting period.

The System Program Office identifies the specific items on the program breakdown structure for which PERT COST reports are required. It is not necessary that these items be on one level of the structure. The reporting level will vary in each area, depending on such factors as complexity of technical problems, dollar value, pacing items, type of report, etc.

When determining the items for PERT COST reporting, the System Program Office will attempt to keep the amount of reporting detail to a minimum. However, the level of reporting is often determined by the nature of the item; e.g., high-risk items may require considerably more reporting detail than low-risk items.

It is the responsibility of the contractor to establish the instructions necessary for his subcontractor to operate a compatible PERT COST System. When the subcontractor's PERT COST reports are merged with the contractor's reports, they must both have been prepared with common guidance on a compatible framework.

D. Evaluating Status

The output reports present the necessary data for problem identification and the determination of program status. However, before management decisions are made, this data must be analyzed to:

- validate the data;
- rank problems; and
- identify possible solutions.

When the reports are analyzed and prepared for review, this data may become the basis for recommending any of the following program changes:

- trading off resources from noncritical areas to problem areas where they may be used more effectively;
- replanning the effort in a manner to obviate the problem. This replanning might include more concurrence of activities than originally planned;
- modifying the technical objectives and, therefore, the work content of the work packages; and
- changing the projected total program cost and/or scheduled completion date.

If the contemplated solution is complex, the complete effect of the proposed changes may not be readily apparent. As an aid to the analyst, the proposed changes can be computer simulated until a feasible solution is reached.

E. Data Flow

The methods of implementing the steps in the Operating Phase are necessarily different in an IAC (Integrating, Assembly, and Checkout) contractor relationship than in a prime contractor relationship. Figures IV-1 and IV-2 outline the Operating Phase data flow in each type of contract.

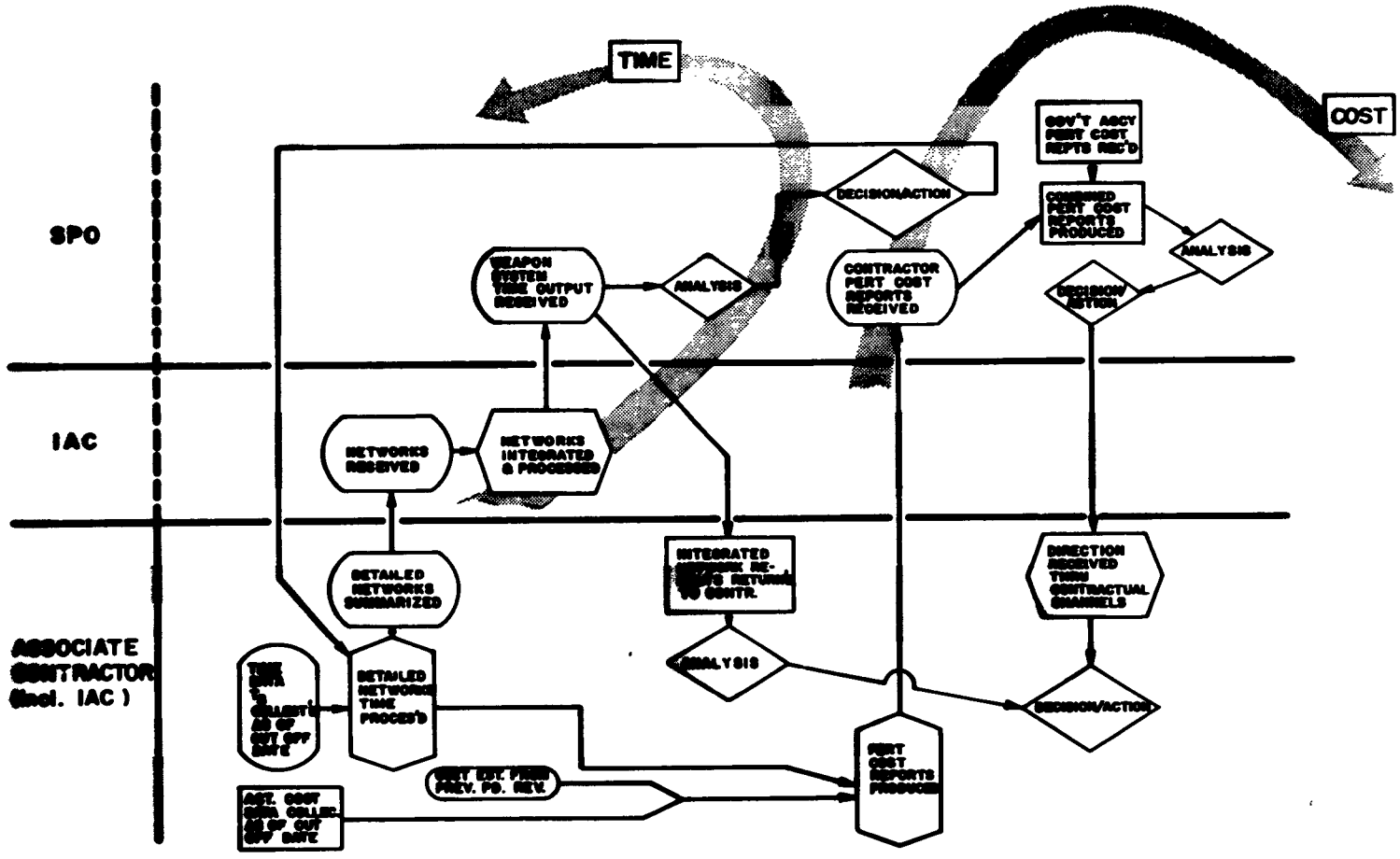

FIGURE IV-1—DATA FLOW - ASSOCIATE CONTRACTOR PROGRAM

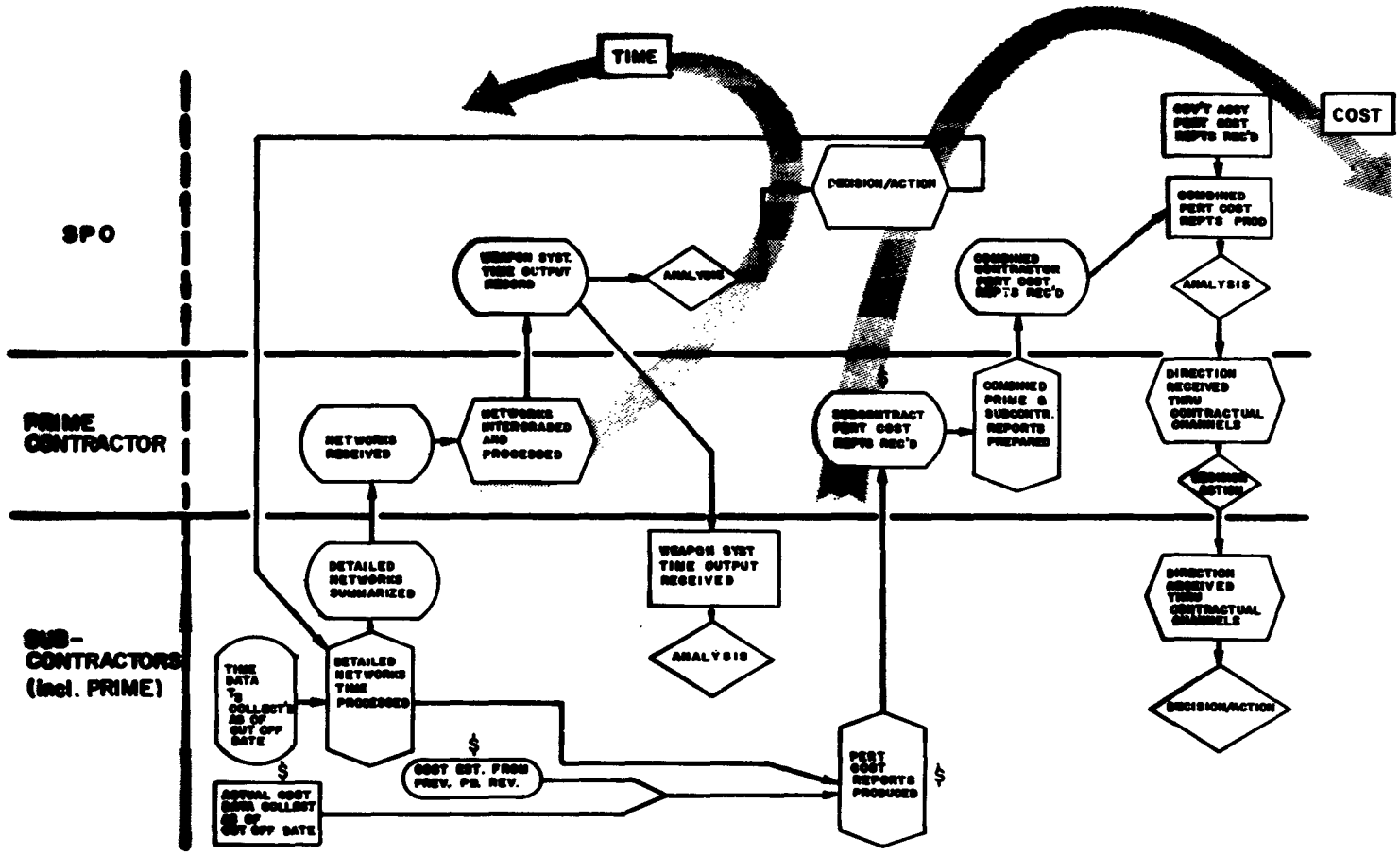

FIGURE IV-2 — DATA FLOW - PRIME CONTRACTOR PROGRAM

CHAPTER V

DATA INPUT

CHAPTER V

DATA INPUT

The data input necessary to produce the output reports shown in Chapter VII is presented in this chapter in the input formats used by the USAF PERT COST computer program. The following data input is discussed:

- Time Input
- Cost Estimating and Updating Form
- Cost Estimating Input Form
- Work Package/Activity Report
- Budget Authorization and Updating Form
- Budget Authorization Input Form
- Actual Cost Form
- Work Breakdown Form
- Activity to Charge Number Input Form
- Rate Table Form
- Manpower and Cost Category Forms
- Other Forms

The USAF PERT COST input forms are accompanied by a generalized description which identifies their function and relationship to input data, but which does not present enough detail to guide the user in the preparation of the forms for actual computer processing. A detailed treatment is contained in USAF PERT, Volume IV, Part I, dated December 1963.

Contractors who develop their own PERT COST data processing routines will not necessarily use these specific formats. They will, however, be guided by the uniform Data Elements (Chapter VI) and the uniform PERT COST Output Reports (Chapter VII).

TIME INPUT

The USAF PERT COST computer program derives its schedule information from an externally generated PERT TIME tape, either manually prepared or the direct output of a PERT TIME computer program. The PERT COST program will accept this tape in a variety of formats.

The format of any PERT TIME tape which is to be accepted must be described on the PERT TIME Tape Description Input Forms.[1]

The following information can be accepted by the PERT COST computer program for each network activity on the PERT TIME tape:

- Beginning Event Number
- Ending Event Number
- Earliest Completion Date (S_E) or Expected Date (T_E)
- Latest Completion Date (S_L) or Latest Allowable Date (T_L)
- Scheduled Completion Date (T_S) or Actual Completion Date (T_A)
- Scheduled/Actual Flag
- Scheduled Elapsed Time (t_s) or Expected Time (t_e)
- Activity Slack
- Activity Description
- Charge Number (if any)

---

[1]These forms are described in USAF PERT, Volume IV, Part I, dated December, 1963.

PERT COST

Cost Estimating and Updating Form

The Cost Estimating and Updating Form, Figure V-1, is a computer generated input form which aids the cost estimator by displaying for each work package, the previous cost estimates and some current status information.

The form is used by the estimator as a "markup sheet" to show revisions which should be made to resource estimates and/or the work package schedule. After approval, this data is normally transmitted to data processing on the Cost Estimating Input Form, Figure V-2.

The following information describes the fields of data on the Cost Estimating and Updating Form. The circled annotations reference Figure V-1. An asterisk indicates information which is computer produced on the original form.

(1) *PROGRAM

The weapon system program name.

(2) *REPORTING ORGANIZATION

Name of the contractor or government agency preparing cost estimates. This information is applicable when a contractor elects to use the data processing services of another contractor or the Air Force.

(3) *CONTRACT NUMBER

The identification of the contract to which costs for the work package are estimated and charged. If necessary, this number can be changed on the form.

(4) REPORT DATES:

TERM (SPAN) - The beginning and ending date for the total increment being covered in the report. For example:

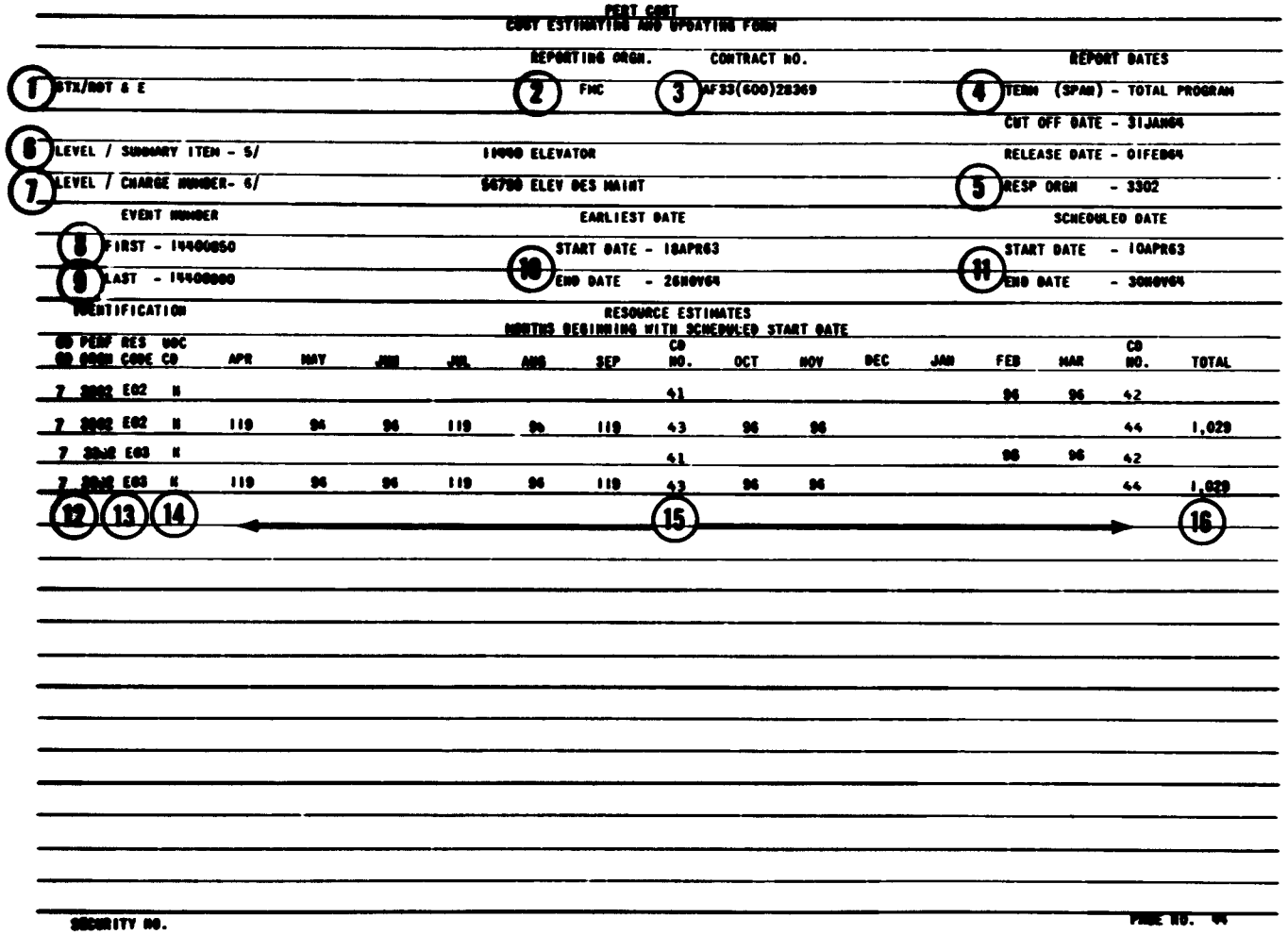

FIGURE V-1— PERT COST COST ESTIMATING AND UPDATING FORM

1 Jan 62 to 31 Dec 62
Total Program
Contract

CUT OFF DATE - The accounting cut off date for the period of actual costs being reported.

RELEASE DATE - The date that the report is to be released to management. In the event of subsequent rerun and redistribution of reports, it is permissible to suffix the report release date with a revision number.

(5) *RESPONSIBLE ORGANIZATION

The code of the contractor organization responsible for the accomplishment of the work package.

(6) *LEVEL/SUMMARY NUMBER

The identification of the lowest item in the program breakdown into which the work package time and cost data are summarized.

(7) *LEVEL/CHARGE NUMBER

The contractor's number (shop order, work order) used to identify a work package for purposes of budgeting, estimating, and accumulating costs.

(8) *FIRST EVENT NUMBER

The number of the earliest event, in time, for all activities in the work package. This event defines the beginning of the work package in relation to the network.

(9) *LAST EVENT NUMBER

The number of the latest event, in time, for all activities in the work package. This event defines the end of the work package in relation to the network.

⑩ *EARLIEST DATE - START DATE/END DATE

The earliest completion dates (S_E) for the Beginning Event (8) and Ending Event (9). These dates define the earliest calculated beginning and end of the work package.

⑪ *SCHEDULED DATE - START DATE/END DATE

The scheduled start and end dates (T_S) established by management for the work package. If no scheduled dates have been established, this column is blank.

⑫ PERFORMING ORGANIZATION

The code of a contractor organization performing work or contributing resources to the work package.

⑬ RESOURCE CODE

A code to indicate the type of resource applied to the work package by the performing organization, as determined by the contractor's resource coding scheme.

⑭ UDC CD (UNITS OR $ CODE)

A code to indicate the type of resource estimate (units or dollars). This code is:

H = Man-hours
M = Man-months
D = Direct Dollars
T = Total Dollars
U = Other Units

An "H," "M," or "U" will cause an appropriate conversion factor to be applied to the estimates to convert them to direct dollars. The conversion factor for a particular performing organization/resource code combination is entered on the Rate Table Form. The conversion routine will also

convert manhours to direct dollars, and subsequently to total dollars. Estimates which are entered in the form of total dollars are not converted.

(15) RESOURCE ESTIMATES

The value, by month, of the resource estimates for each performing organization/resource code combination applied to the work package. The first month column represents the month during which the work package is scheduled to start (11). If no scheduled start date has been entered for the work package on the charge or summary number identification input form (figure V-11), the first month column will be the month derived from the PERT TIME data. If it is necessary to enter estimates beyond 12 months, they should be entered in the next lower row of the form. The identification information is left blank in this row.

(16) TOTAL

The total of the individual resource estimates shown for the remaining months for each performing organization/resource code combination.

PERT COST

Cost Estimating Input Form

The Cost Estimating Input Form is used to transmit, to data processing, the estimated hours and costs for the various summary items and work packages with their corresponding performing organization/resource code combinations.

This data may have originally been prepared by an estimator on the Cost Estimating and Updating Form, Figure V-1; however, input cards can be key punched more accurately if the data is placed in the format of the Cost Estimating Input Form.

The circled annotations on the fields of data in Figure V-2 are keyed to their counterparts on the Cost Estimating and Updating Form, Figure V-1.

USAF PERT COST SYSTEM

COST ESTIMATING INPUT FORM

Prepared By ________ Page ____ of ____ Date ________

CARD CODE	IDENTIFICATION: CHARGE NUMBER	PERFORMING ORGN.	RESOURCE CODE	H/D	RESOURCE ESTIMATES IN MONTHLY INCREMENTS						TYPE CODE	CARD CODE	CHG CODE
1	2–19	20–25	26–29	30	31–36	37–42	43–48	49–54	55–60	61–66	78	79	80
7											4		
7	(7)	(12)	(13)				(15)				4		
7				(14)							4		
7											4		
7	56790	3302	E02	H					96	96	4	2	A
7					119	96	96	119	96	119	4	3	A
7					96	96					4	4	A
7			E03	H					96	96	4	2	A
7					119	96	96	119	96	119	4	3	A
7						96	96				4	4	A
7	87952	4417	T12	D	11572	11500	11600	11800			4	1	A
7			T13	D			2680	2680	2680		4	1	A
7			T14	D			95782				4	1	A
7		4818	G17	H			85	95		876	4	1	A
7					900	900	900				4	2	A
7						700	400	800			4	3	A
7			E01			70	70	70	70	70	4	1	A
7					70	70	70				4	2	A
7			E02			80	80	80	80	80	4	1	A
7					80	80	80				4	2	A
7	87953	4417	T12	D				9500	8000		4	1	A
7				D	6000		7500				4	2	A
7				D				2200	150	2500	4	3	A
7				D		2000	18000				4	4	A
7				D	2000						4	5	A
7		4818	E01	H				20	40	80	4	1	A
7				H	100	200	500	500	400	100	4	2	A
7				H	50					50	4	3	A
7				H	100	50			50	200	4	4	A
7				H	400	100					4	5	A
7		5202	M18	D			15000	15000			4	1	A
7				D			6000				4	2	A
7													

FIGURE V-2—PERT COST COST ESTIMATING INPUT FORM

Work Package/Activity Report

The Work Package/Activity Report, Figure V-3, provides a cost estimator with detailed schedule information associated with a work package to assist him in preparing cost estimates. The report lists the activities which contribute to a work package and provides significant time information about these activities. The sources of information for the report are the PERT TIME data and the Activity to Charge Number Input Form.

The following information describes the Work Package/Activity Report. The circled annotations reference the sample form.

(1) PROGRAM

The weapon system program name.

(2) REPORTING ORGANIZATION

Name of the contractor or government agency preparing cost estimates.

(3) CONTRACT NUMBER

The identification of the contract to which costs for the work package are estimated and charged.

(4) RESPONSIBLE ORGANIZATION

The code of the contractor organization responsible for the accomplishment of the work package.

(5) LEVEL/CHARGE NUMBER

The contractor's number (shop order, work order) used to identify a work package for purposes of estimating and accumulating costs, and the level of the work breakdown structure at which it appears.

(6) DESCRIPTION

A description (title, nomenclature) of the work package identified by the charge number.

PERT COST
WORK PACKAGE/ACTIVITY REPORT
BY CHARGE NO., PRED, SUCC

DESP ORGN 3302

(1) STX/ROT & E

REPORTING ORGN. (2) FMC

CONTRACT NO. (3) AF33(600)28369

REPORT DATES (7) TERM (SPAN) - TOTAL PROGRAM

CUT OFF DATE - 31JAN64

(5) LEVEL / CHARGE NUMBER- 6/ (6) 56787 TESTING

RELEASE DATE - 01FEB64

ACTIVITIES PRED EVENTS	ACTIVITIES SUCC EVENTS	ACTIVITY DESCRIPTION	(10) ELAPSED TIME	COMPLETION DATE (11) EXPECTED (SE)	(12) LATEST (SL)	(13) SCHD OR ACTUAL	(14) ACTIVITY SLACK (SL-SE)
[illegible]	14400425	FLIGHT TEST REPORT	2.0	12NOV64	26NOV64		2.0
[illegible]	14400430	FLIGHT TEST MONITORING	12.0	29OCT64	12NOV64		2.0
[illegible]	14400445	ENVR TEST REPORT	2.0	29OCT64	26NOV64		4.0
[illegible]	14400450	ELEVATOR ENVR TESTING	10.0	15OCT64	12NOV64		4.0
[illegible]	14400460	DEV TEST REPORT	4.0	01OCT64	01OCT64		0.0
[illegible]	14400480	ELEVATOR DEVELOPMENT TESTING	12.0	03SEP64	03SEP64		0.0
[illegible]	14400575	TEST PLANNING				21NOV63A	
(8)		(9)					

SECURITY NO.

PAGE NO. 29

FIGURE V-3— PERT COST WORK PACKAGE/ACTIVITY REPORT

⑦ **REPORT DATES**

TERM (SPAN) - The beginning and ending date for the total increment being covered in the report. For example:

1 Jan 62 to 31 Dec 62
Total Program
Contract

CUT OFF DATE - The accounting cut off date for the period of actual costs being reported.

RELEASE DATE - The date that the report is to be released to management. In the event of subsequent rerun and redistribution of reports, it is permissible to suffix the report release date with a revision number.

⑧ **ACTIVITIES - PREDECESSOR EVENT/SUCCESSOR EVENT**

The predecessor and successor event numbers for each activity contributing to the work package.

⑨ **ACTIVITY DESCRIPTION**

The description (title, nomenclature) for each contributing activity.

⑩ **SCHEDULED ELAPSED TIME**

The scheduled elapsed time, in weeks, for each activity.

⑪ **EXPECTED COMPLETION DATE (S_E)**

The earliest completion date for each activity.

⑫ **LATEST COMPLETION DATE (S_L)**

The lastest completion date for each activity.

⑬ **SCHEDULED OR ACTUAL COMPLETION DATE**

A scheduled date (T_S) established by management or the actual completion date (T_A) of the activity.

(14) ACTIVITY SLACK ($S_L - S_E$)

The slack, in weeks, for each activity, based on S_L minus S_E.

PERT COST

Budget Authorization and Updating Form

The PERT COST Budget Authorization and Updating Form is a computer-generated input form which:

- initially inputs monthly budget or planned cost figures for a charge number (work package);
- revises existing budget figures.

The data on this form is the source of information appearing in the PERT COST reports as "Contract Estimate."

A separate form is prepared for each work package identified by a charge number and description. Distribution of the form is made to the responsible organization (responsible for budgeting). Since other groups (performing organization) may contribute effort to this accomplishment, the form will accept a separate line of monthly budget figures for each of these groups and for any skill (resource code) categories for which separate identification and control are desired. Resource budgets, by month, are made in terms of manpower (man-hours, man-months, or other units may be used, but must be used consistently) and other resources (materials, travel, subcontracts, fixed-price services, etc.) in units or dollars.

The Budget Authorization and Updating Form is used as both an input and an output form. When a charge number is defined, a budget form will be printed by the computer. The work package identifying data is preprinted on the form. The budget figures developed for the work package are hand printed on the form which is then sent to data processing. During the subsequent computer run, a budget form is machine produced as an output. Data originally hand printed on the input form is now machine printed on the output form. The machine-printed output form will, on the next computer run, be used as an input form to revise, if necessary, budget data within the existing charge number record. Changes to existing budgets are made on the form by hand printing the new data above the preprinted data which is to be updated.

An illustration of the PERT COST Budget Authorization and Updating Form is shown in Figure V-4. The form has been scaled

PERT COST
BUDGET AUTHORIZATION AND UPDATING FORM

	REPORTING ORGN.	CONTRACT NO.	REPORT DATES
(1) STI/RDT & E	(2) FHC	(3) AF33(600)28369	(4) TERM (SPAN) - TOTAL PROGRAM
			CUT OFF DATE - 31JAN64
(6) LEVEL / SUMMARY ITEM - 6/	60000 ELEVATOR		RELEASE DATE - 01FEB64
(7) LEVEL / CHARGE NUMBER - 7/	60700 ELEV OES MAINT		(5) RESP ORGN - 3302
	BUDGET REVISION NUMBER		SCHEDULED DATE
(10) APPROVED BY	(9) 3		(8) START DATE - 10APR63
DATE -			END DATE - 30NOV64

IDENTIFICATION — RESOURCE ESTIMATES — MONTHS BEGINNING WITH SCHEDULED START DATE

CD PERF RES CODE	WBC CD	APR	MAY	JUN	JUL	AUG	SEP	CD NO.	OCT	NOV	DEC	JAN	FEB	MAR	CD NO.	TOTAL
7 [illegible] E02	H							51					86	86	52	
7 [illegible] E02	H	107	86	86	107	86	107	53	86	86					54	923
7 [illegible] E03	H							51					86	86	52	
7 [illegible] E03	H	107	86	86	107	86	107	53	86	86					54	923

(11) (12) (13) (14) (15)

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FIGURE V-4— PERT COST BUDGET AUTHORIZATION INPUT FORM

to be compatible with the type bar spacing (120 characters per line) on the output printer. Hand-printed characters are printed in the space above the preprinted data.

The following information describes the fields of data on the Budget Authorization and Updating Form. The circled annotations reference the sample form. An asterisk indicates information which is computer produced on the original form output by the computer.

(1) *PROGRAM

The weapon system program name.

(2) *REPORTING ORGANIZATION

Name of the contractor or government agency preparing cost estimates.

(3) *CONTRACT NUMBER

The identification of the contract to which costs for the work package are estimated and charged. If it is necessary to change this number, the Cost Estimating and Updating Form is used.

(4) *REPORT DATES

TERM (SPAN) - The beginning and ending date for the total increment being covered in the report. For example:

1 Jan 62 to 31 Dec 62
Total Program
Contract

CUT OFF DATE - The accounting cut off date for the period of actual costs being reported.

RELEASE DATE - The date that the report is to be released to management. In the event of subsequent rerun and redistribution of reports, it

is permissible to suffix the report release date with a revision number.

⑤ *RESPONSIBLE ORGANIZATION

The code of the contractor organization responsible for establishing a budget for the work package or summary item.

⑥ *LEVEL/SUMMARY ITEM

The identification of the lowest item in the program breakdown into which the work package time and cost data are summarized, and its level number on the work breakdown structure.

⑦ *LEVEL/CHARGE NUMBER

The contractor's number (shop order, work order) used to identify a work package for purposes of budgeting, estimating, and accumulating costs, and its level number on the work breakdown structure.

⑧ *SCHEDULED START DATE/SCHEDULED END DATE

The scheduled start and end dates established by management for the work package. Changes to these dates are accepted either from the PERT TIME input or from the Charge or Summary Number Identification Input Form.

⑨ BUDGET REVISION NUMBER

A reference number which may be established to identify budget changes.

⑩ APPROVED BY

Space for contractors to indicate what approvals they wish for budget control according to their own policies.

⑪ PERFORMING ORGANIZATION

The code of the contractor organization performing work or contributing resources to the work package.

(12) RESOURCE CODE

A code to indicate the type of resource applied to the work package by the performing organization as determined by the contractor's resource coding scheme.

(13) *UDC CD (UNITS OR $ CODE)

A code to indicate the type of resource estimate in units with which the resource is measured (units or dollars). The code is:

H = Man-hours
M = Man-months
D = Direct Dollars
T = Total Dollars
U - Other Units

An "H," "M," or "U" will cause an appropriate conversion factor to be applied to the budget figures to convert them to direct dollars and subsequently to total dollars. Budgets which are entered in the form of total dollars are not converted.

(14) RESOURCE ESTIMATES (BUDGET)

The value, by month, of the resources budgeted for each performing organization/resource code combination applied to the work package. The first month column represents the month during which the work package is scheduled to start. Changes to these figures are made on this form.

(15) TOTAL

The total of the individual month resource budgets for each performing organization/resource code combination applied to the work package.

The PERT COST Program Breakdown Form provides the information necessary to produce the Budget Authorization and Updating Form for preparing original budgets. The budget form is sent to the organization responsible for preparing budgets. The form has the work package identifying information preprinted on it. Only original budget figures have to be hand printed

on the form. After approval, this data is transmitted to data processing, normally on the Budget Authorization Input Form, Figure V-5.

The form is then output on the next computer cycle with all existing budget figures preprinted. If revisions are to be made, the revised figures are hand printed above the old figures.

PERT COST

Budget Authorization Input Form

The Budget Authorization Input Form, Figure V-5, is used to transmit, to data processing, the planned cost for the program summary items and/or work packages.

This data may have originally been prepared by management on the Budget Authorization and Updating Form, Figure V-4. However, input cards can be key punched more accurately when the data is placed in the format of the Budget Authorization Input Form.

The circled annotations on the fields of data in Figure V-5 are keyed to their counterparts on the Budget Estimating and Updating Form, Figure V-4.

USAF PERT/COST SYSTEM

BUDGET AUTHORIZATION INPUT FORM

Prepared by _____ Page _____ of _____ Date _____

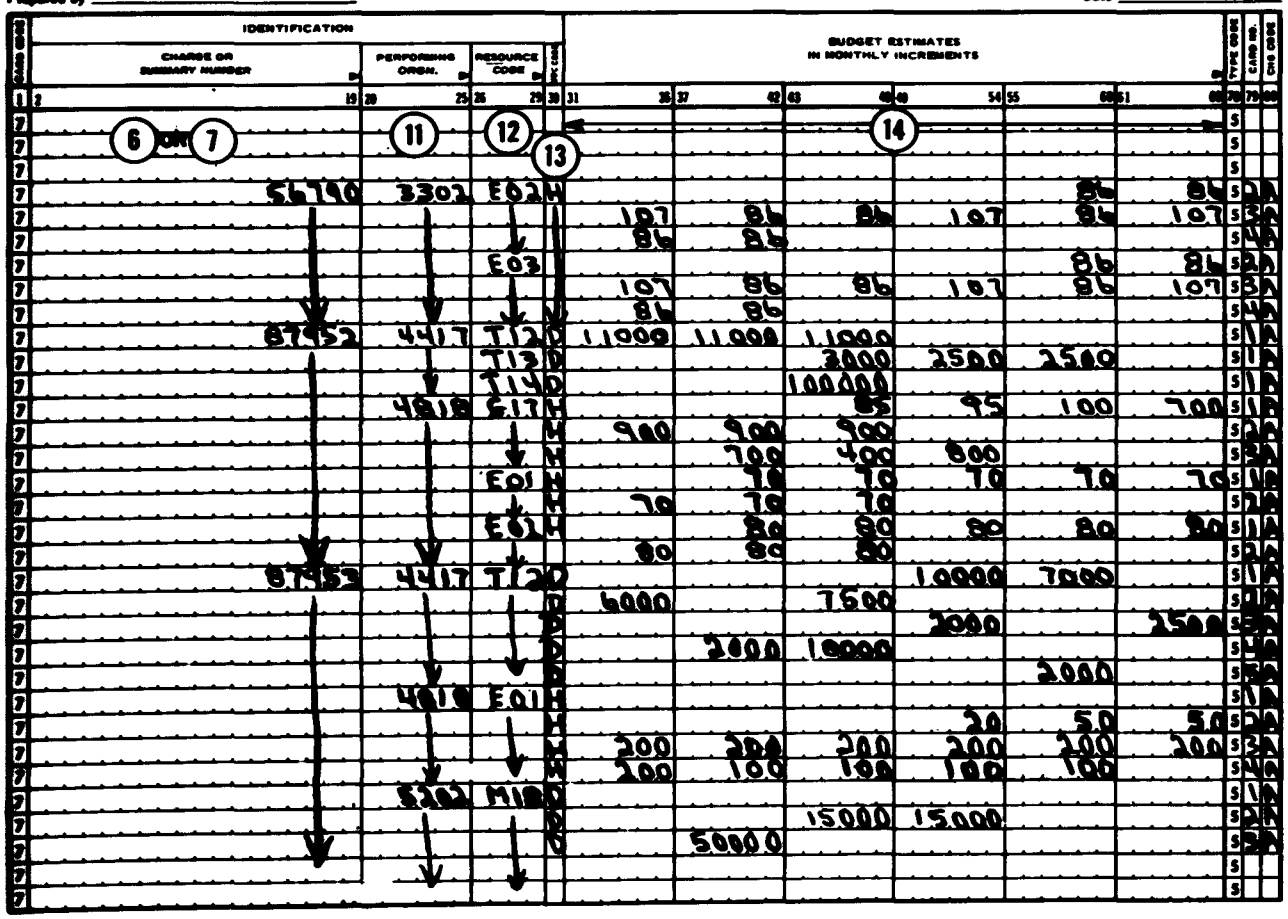


FIGURE V-5— PERT COST BUDGET AUTHORIZATION INPUT FORM

Actual Cost Form

The Actual Cost Form, Figure V-6, is an input form which defines the elements of actual cost data which a contractor's accounting system must provide for PERT COST output reports. The data on this form is the source for information appearing in the PERT COST reports as "Actuals."

On a monthly basis, the contractor will enter actual costs, collected by his existing accounting system, into the PERT COST program. The form shown in Figure V-6 provides for manual input of actual cost data if the contractor cannot automatically provide input from his EDP system. For each active charge number, actual costs will be collected as of the date the contractor closes his accounting period.

The following information describes the fields of data on the Actual Cost Form. The circled annotations reference the sample form:

(1) CHARGE NUMBER

The contractor's number (shop order, work order) used to identify the work package to which each line entry of actual cost applies.

(2) PERFORMING ORGANIZATION

The code of the contractor organization performing work or contributing resources to the work package.

(3) RESOURCE CODE

A code to indicate the type of resources applied to the work package by the performing organization as determined by the contractor's resource coding scheme.

(4) UDC CODE (UNITS OR $ CODE)

A code to indicate the type of actual costs reported. The code is:

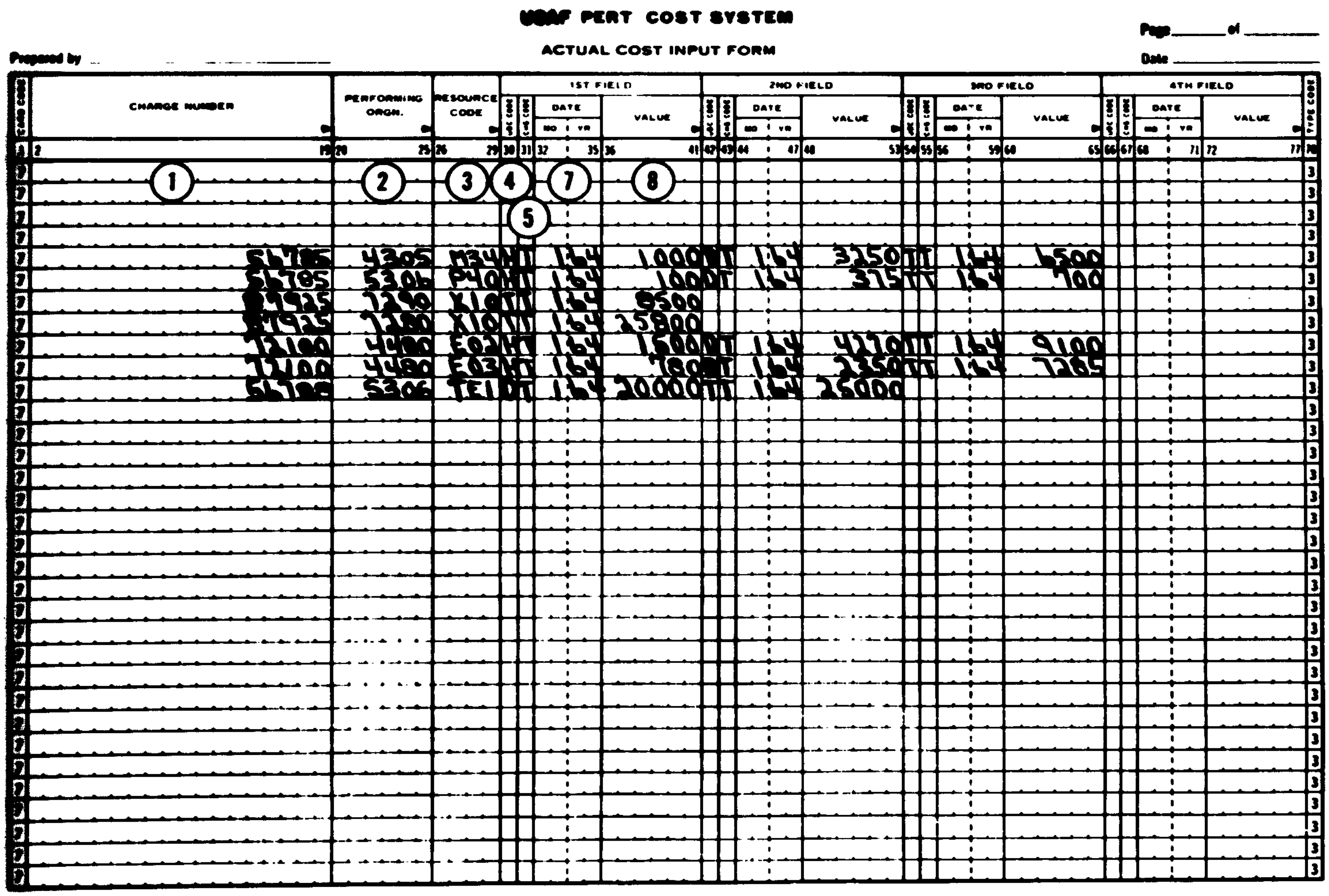


FIGURE V-6 — PERT COST ACTUAL COST INPUT FORM

H = Man-hours
M = Man-months
D = Direct Dollars
T = Total Dollars
U = Other Units

See definition (13) in the Budget Authorization and Updating Form for explanation of these codes.

(5) CHARGE CODE

This column is coded to distinguish between:

- new or revised actual cost category entries to the system; or
- additional cost entries to established categories.

(7) DATE

The month and year for which an actual cost is being reported.

(8) VALUE

The actual cost reported in units indicated by the UDC Code (4). This value may be either positive or negative.

The additional three sets of columns for reporting actual costs are used if more than one actual cost figure is reported for a particular performing organization/resource code combination. Besides the entering of the actual figures for the present month, updating changes and adjustment to actual figures reported on previous cycles can be written on the same line.

PERT COST

Work Breakdown Structure Input Form

The Work Breakdown Structure Input Form, Figure V-7, is used to enter the work breakdown structure into the system. This form permits summary and charge numbers to be assigned to the work breakdown structure in random order. It forms the basis for the summarization of time and cost information for reporting to different levels of management. This form is initially prepared when the program breakdown is defined. Thereafter, the form is used only to provide changes to the breakdown.

The following information describes the fields of data on the form. The circled annotations reference the sample form.

(1) CHARGE OR SUMMARY NUMBER

The charge or summary number for a work package or summary item on the program breakdown.

(2) DESCRIPTION

The description of the work package or summary item listed.

(3) RESPONSIBLE ORGANIZATION

The code of the organization responsible for the accomplishment of the item listed.

(4) PARENT SUMMARY NUMBER

The summary number of the next higher item on the program breakdown into which the time and cost data for the item in (1) are summarized.

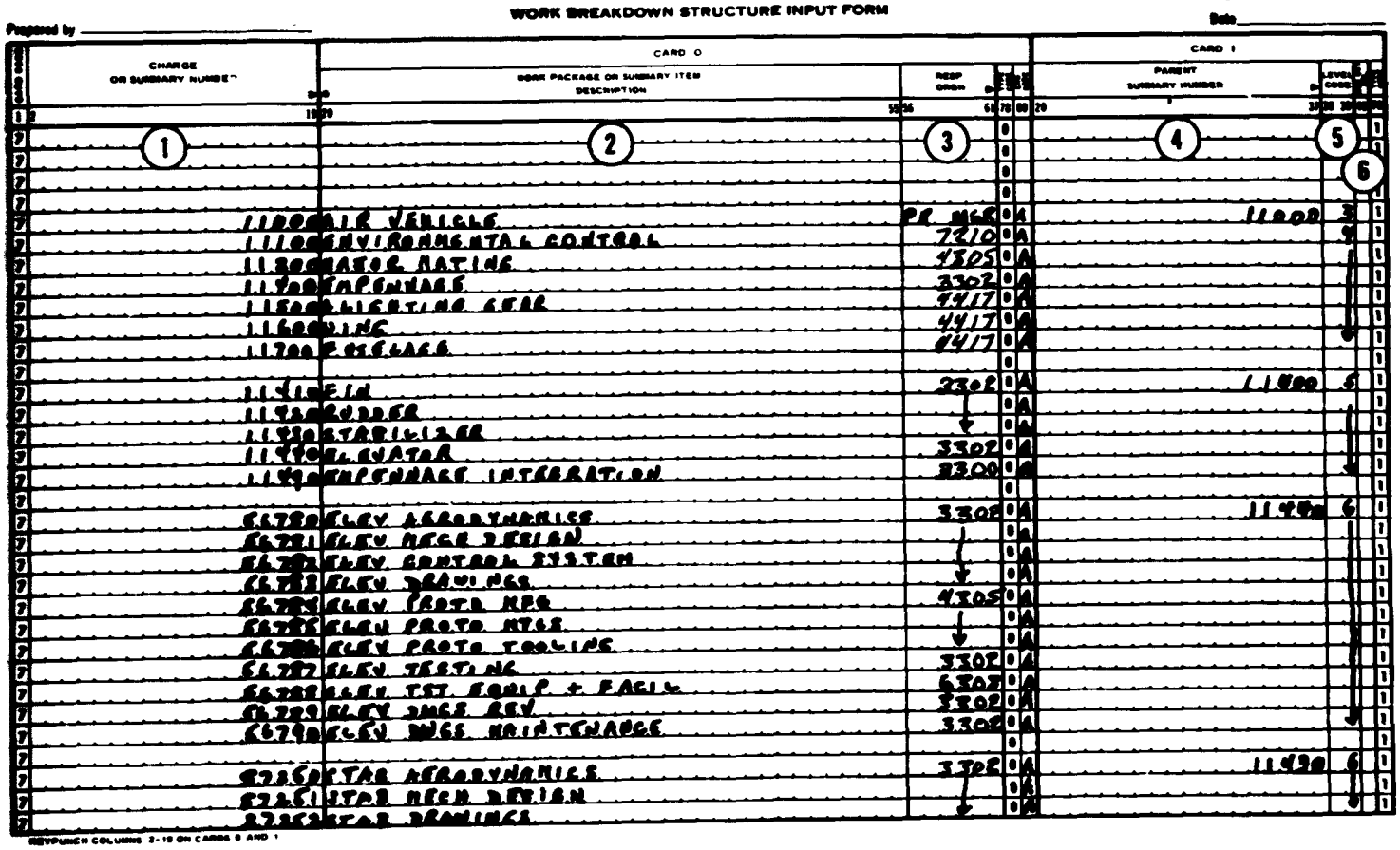
(5) LEVEL CODE

The level of summary on the program breakdown for the item listed in fields 1 and 2 .

USAF PERT COST SYSTEM

WORK BREAKDOWN STRUCTURE INPUT FORM

Prepared by _____ Page _____ of _____ Date _____



CHARGE OR SUMMARY NUMBER	CARD 0 — WORK PACKAGE OR SUMMARY ITEM DESCRIPTION	RESP ORGN	CARD 1 — PARENT SUMMARY NUMBER	LEVEL CODE
(1)	(2)	(3)	(4)	(5) (6)
11000	AIR VEHICLE	PR MGR	11000	3
11100	ENVIRONMENTAL CONTROL	7210		4
11300	MAJOR RATING	4305		
11400	EMPENNAGE	3302		
11500	LIGHTING GEAR	4417		
11600	WING	4417		
11700	FUSELAGE	4417		
11800				
11810	FIN	3302	11800	5
11820	RUDDER			
11830	STABILIZER			
11900	ELEVATOR	3302		
11990	INTEGRATION	3300		
11991				
61780	FLEX AERODYNAMICS	3302	11990	6
61781	FLEX MECH DESIGN			
61782	FLEX CONTROL SYSTEM			
61783	FLEX DRAWINGS			
61784	FLEX PROTO MFG	4305		
61785	FLEX PROTO MTLS			
61786	FLEX PROTO TOOLING			
61787	FLEX TESTING	3302		
61788	FLEX TST EQUIP + FACIL	4305		
61789	FLEX DMGS REV	3302		
61790	FLEX DMGS MAINTENANCE	3302		
61791				
61792	STAB AERODYNAMICS	3302	11990	6
61793	STAB MECH DESIGN			
61794	STAB DRAWINGS			

KEYPUNCH COLUMNS 2-19 ON CARDS 0 AND 1

FIGURE V-7— PERT COST WORK BREAKDOWN STRUCTURE INPUT FORM

⑥ MANAGEMENT SUMMARY REPORT OUTPUT SELECTOR

The Management Summary Report output selector. Only those items coded in this column will appear in a special Management Summary Report.

Activity to Charge Number Input Form

The Activity to Charge Number Input Form, Figure V-8, is used to group the network activities into discrete work packages having unique charge or summary numbers. A link is thereby established between the user's PERT TIME System and the PERT COST program.

The following information describes the fields of data on the Activity to Charge Number Input Form. The circled annotations reference the sample form.

(1) NETWORK CODE

A code to identify the network in which the activity (2) - (3) is located.

(2) PREDECESSOR EVENT NUMBER

The beginning event number of the activity which identifies this line entry.

(3) SUCCESSOR EVENT NUMBER

The ending event number of the activity which identifies this line entry.

(4) CHARGE NUMBER

The charge number with which the activity (2) - (3) is associated.

USAF PERT COST SYSTEM

ACTIVITY TO CHARGE NUMBER INPUT FORM

Page ____ of ____

Prepared by _____ Date _____

CARD CODE	NETWORK CODE	ACTIVITY IDENTIFICATION: PREDECESSOR EVENT NUMBER	ACTIVITY IDENTIFICATION: SUCCESSOR EVENT NUMBER	CHARGE NUMBER	CHG CODE
1	7 12	13 21	22 30	31 46	80
2	(1)	(2)	(3)	(4)	
2					
2					
2		1.1.4.4.0.0.8.5.0	1.1.4.6.0.0.8.4.9	5.6.7.8.0	
2		8.4.8	8.4.7		
2		8.2.6	8.2.1		
2		7.9.9	7.9.8		
2		7.4.9	7.2.2		
2		7.0.3	7.0.0		
2		7.0.0	6.9.9		
2		6.9.0	6.8.9	5.6.7.8.1	
2		6.8.9	6.8.8		
2		6.8.8	6.7.1		
2		6.7.1	6.7.0		
2		6.2.1	6.1.5		
2		6.1.5	6.0.0		
2		8.5.0	6.4.9		
2		6.4.9	6.4.8	5.6.7.8.2	
2		6.4.9	6.3.5		
2		6.3.0	6.2.9		
2		6.2.9	6.2.5		
2		8.5.0	8.3.0		
2		8.3.0	8.2.0	5.6.7.9.0	
2		6.0.0	5.9.9	5.6.7.9.9	
2		5.9.9	5.9.8	5.6.7.8.8	
2		5.9.8	5.9.1		
2		5.9.8	5.9.3		
4		5.9.8	5.9.5		
2		5.9.5	5.7.2		
2		5.9.5	5.7.7		
2		5.9.5	5.8.2		
2		5.2.2	5.2.6		
2		5.2.8	[illegible]		

FIGURE E-8— PERT COST ACTIVITY TO CHARGE NUMBER INPUT FORM

Rate Table Input Form

A computer routine uses these rates for converting the resource estimates appearing on the Budget Authorization Input Form and the Cost Estimating Input Form. The unit rate is used for converting man-hours (H), man-months (M), and other units (U) into direct dollars. The overhead rate is used for converting direct dollars (D) into total dollars. The table accepts rates for several time periods, in either quarters or years.

The following information describes the fields of data on the Rate Table Input Form, Figure V-9. The circled annotations reference the sample form.

(1) PERFORMING ORGANIZATION/RESOURCE CODE

The combination of Performing Organization and Resource Code which is the identification for each line entry of rate data.

(2) QUARTER

A code in this column identifies the quarter of the year (3) for which rate entries (4) and (5) are made. If these rates apply to the full year, this column is blank.

(3) YEAR

The year during which the rates (4) and (5) are applicable.

(4) UNIT RATE

A rate used by the computer to extend unit resource figures (man-hours, man-months, or other units) to direct cost for the performing organization/resource code combination.

(5) OVERHEAD RATE

A rate used by the computer to extend direct cost to total

USAF PERT COST SYSTEM

RATE TABLE INPUT FORM

Prepared by _____ Page _____ of _____ Date _____

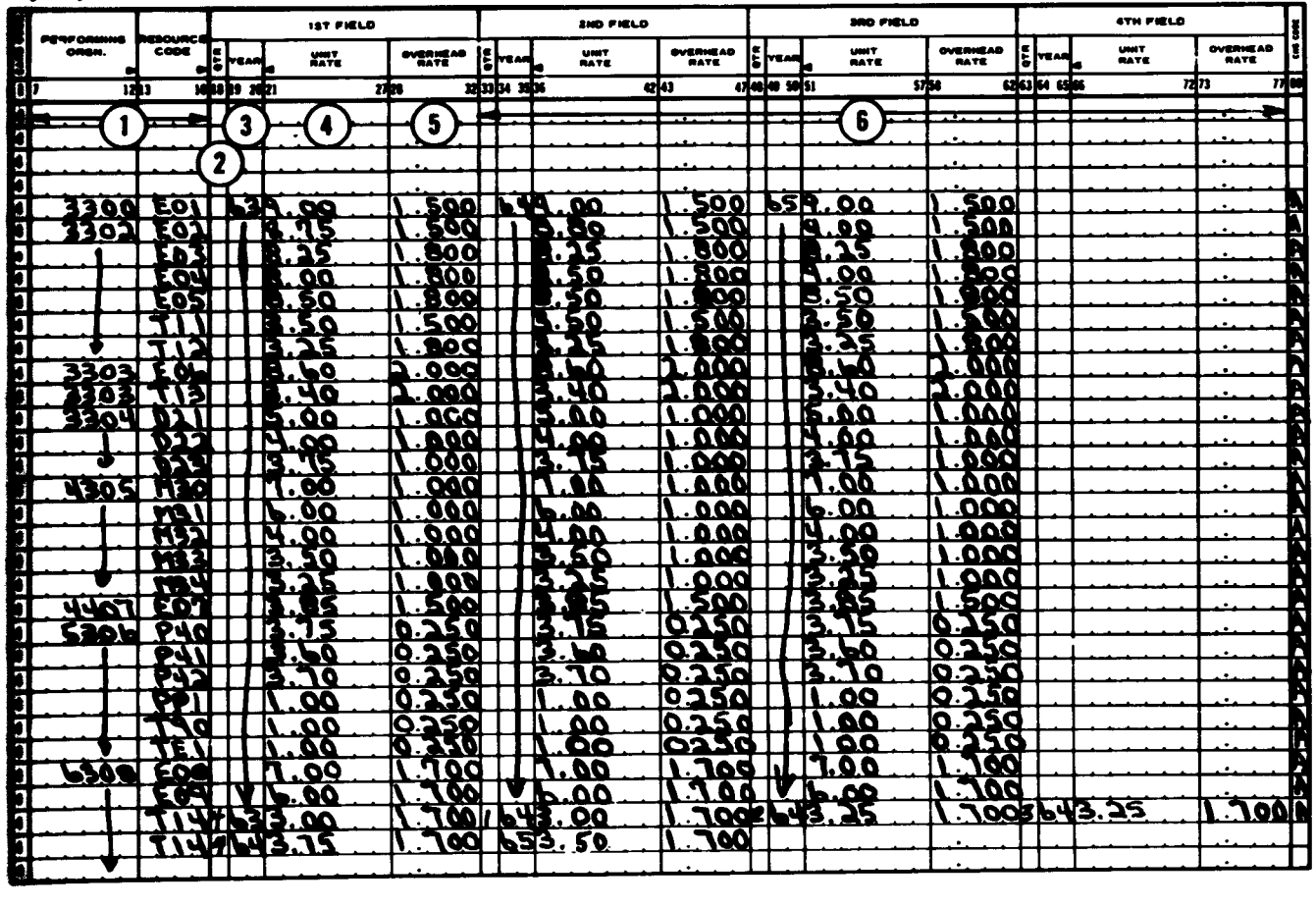


FIGURE V-9— PERT COST RATE TABLE INPUT FORM

cost for the performing organisation/resource code combination.

⑥ ADDITIONAL RATES

Rates entered for other time periods.

Manpower and Cost Category Input Forms

The two input forms shown in Figure V-10 both perform the function of grouping resouce codes into separate categories for summarization:

- The Resource Code/Cost Category Input Form establishes this relationship for the Cost Category Status Report and the Summary Financial Forecast.
- The Manpower Skill/Rainbow Category Input Form establishes this relationship for the Rainbow Category Report.

The following information describes the fields of data on the forms:

(1) COST (OR RAINBOW) CATEGORY

A code name for the category into which the resource code (2) will be grouped.

(2) RESOURCE (OR SKILL) CODES

Any combination of from one to thirteen resource codes which should be summarized into the category (1) of each line entry. Additional lines may be used.

USAF PERT COST SYSTEM

Prepared by _____ **MANPOWER SKILL / RAINBOW CATEGORY INPUT FORM** Page _____ of _____ Date _____

RAINBOW CATEGORY	SKILL CODES 1ST	2ND	3RD	4TH	5TH	6TH	7TH	8TH	9TH	10TH	11TH	12TH	13TH
(1)							(2)						
ENGR SUPPORT	E05	E07	E09	T05	T07	Q15	Q17						
SCIENTIFIC & ENGR	E03	E04	E06	E06	E07	E09	E09	E0N	E	E31	E33	E35	
MGMT & ADMINISTRATION	E01	X81	T01	C01	A01	F01							
SHOPS & PRODUCTION	M31	M32	M33	M34									
OTHER	PP1	PP2	M46	M47	M48	M49	M51	R02	R04	R06	Z02	Z04	Z06
OTHER	Z08	Z0N											

V.34

USAF PERT COST SYSTEM

Prepared by _____ **RESOURCE CODE / COST CATEGORY INPUT FORM** Page _____ of _____ Date _____

COST ELEMENT DESCRIPTION	RESOURCE CODES 1ST	2ND	3RD	4TH	5TH	6TH	7TH	8TH	9TH	10TH	11TH	12TH	13TH
(1)							(2)						
MANUFACTURING	M30	M31	M32	M33	M34								
DEVELOPMENT	T13	X81	X82	X83									
TOOLING	E07	P41	T90										
PLANNING	E01												
ENGINEERING	E05	E03	E09										
TESTING	E08	E09	T19	P42									
MATERIAL	T01	T90	M46	M47	M48	M49	M50	M51					
PURCHASED PARTS	PP1	PP2											

FIGURE V-10 — MANPOWER/COST CATEGORY INPUT FORMS

Other Input Forms

The control and computer "housekeeping" input forms shown in Figure V-11 are discussed in detail in USAF PERT, Volume IV, Part I.

The Control Card Input Form establishes dates and program identifications, selects and determines report formats and sort sequences, identifies the PERT TIME tape which will be incorporated in the processing, and establishes a conversion factor for converting man months to manhours. It further identifies functions to be performed by the computer tape handling units when fewer than the ideal number are connected to the computer, and it inserts and controls sequential security numbering.

The Charge or Summary Number Identification Input Form is used for entering the following types of data in the system:

- Network code for each charge or summary number which is not network oriented. This optional code permits the inclusion of charge or summary numbers in the output reports which are sequenced by network code.

- Contract number and reporting organization for all charge and summary numbers.

- Start and end dates for any of the charge and summary numbers in the system. These dates establish the time references for the budgeted and estimated values of the performing organization - resource codes associated with the corresponding charge or summary numbers.

USAF PERT COST SYSTEM

CONTROL CARD INPUT FORM

Prepared by ____________ Page ____ of ____ Date ____

MAIN CONTROL CARD

REPORT SELECTION CARD

VARIABLE REPORT SELECTION FIELD

PROJECT SELECTION CARD

OMIT THIS CARD TO PROCESS ALL PROJECTS

TAPE REASSIGNMENT CARD

SECURITY NUMBER CONTROL CARD

SECURITY NUMBER

PROGRAM NAME CHANGE CONTROL CARD

OLD PROGRAM NAME

USAF PERT COST SYSTEM

CHARGE OR SUMMARY NUMBER IDENTIFICATION INPUT FORM

Prepared by ____________ Page ____ of ____ Date ____

CARD CODE	CHARGE OR SUMMARY NUMBER	START DATE DAY	START DATE MONTH	START DATE YEAR	END DATE DAY	END DATE MONTH	END DATE YEAR	CONTRACT NUMBER	REPORTING ORGN CODE	NETWORK CODE	TYPE CODE
1	2 19	23 24	25 27	28 29	30 31	32 34	35 36	37 54	56 58	60 69	70
7	56783	25	JUL	63	26	DEC	63	AF33(660)28369	FMC		2
7	56784	2	APR	64	6	AUG	64	↓	↓		2
7	56785	21	OCT	63	28	JAN	64				2
7	56786	26	DEC	63	2	APR	64				2
7	56787	11	JUN	64	13	NOV	64				2
7	56788	21	OCT	63	11	JUN	64				2
7	56789	1	OCT	64	31	DEC	64				2

FIGURE V-11 — OTHER PERT COST INPUT FORMS

CHAPTER VI

DATA PROCESSING

CHAPTER VI

DATA PROCESSING

The Air Force will supply the USAF PERT COST computer program upon request to all its contractors. However, because of the close relationship between contractor accounting systems, existing program control systems, and the PERT COST System, it is often more feasible for a contractor to use his own computer program, data processing routines, and/or manual report assembly techniques to prepare his PERT COST reports. For either case, this chapter outlines the basic data processing requirements: the USAF PERT COST computer program and the minimum required data elements which must be present in a contractor-designed system.

A. USAF Computer Program

The USAF PERT COST computer program available as of 1 January 1964, is designed for use on the IBM 7090/7094 computer with a 32K word memory.[1]

Since PERT COST data will normally be processed by the contractor, the PERT COST processing technique is not oriented toward a specific make or model of electronic computer. However, so that uniformity is assured in PERT COST reporting to the Air Force, the basic data elements, Figure VI-1, and the standard output reports shown in Chapter VII, must be the basis for any computer program design.

B. Time/Cost Integration in the USAF Computer Program

The USAF PERT computer program provides separate time and cost processing. A network may be processed for time data first and then merged with work package cost data to produce integrated PERT COST reports. This dual processing concept enabled the Air Force to develop PERT COST computer programs which perform the function of integrating time and cost data,

---

[1] USAF PERT COST computer processing is fully described in USAF PERT, Volume IV.

but which must be used in conjunction with a PERT TIME computer program.[1]

The concept of independent time and cost modules in the approach to computer development has the following advantages:

- Many contractors have their own PERT TIME Systems. The modular approach permits incorporating PERT COST capability without imposing immediate and extensive revisions to these existing systems.

- The objective of the Department of Defense is a uniform PERT COST System throughout the services and their contractors. Independent time and cost modules permit the desired uniform PERT COST approach despite presently dissimilar PERT TIME Systems.

- Provisions must be made to accommodate future modifications of PERT COST. Independent modules eliminate the necessity to modify the time module when the cost module is modified.

C. USAF Computer Program Phases

The USAF PERT COST computer program is constructed in four computer phases. These phases, illustrated in Figure VI-1, are generalized as follows:

Phase I: Input Edit and Sort

In Phase I, the program reads in all of the input data. Each card is edited for error, and these errors are written on the output tape. An edited data tape is produced and subsequently sorted into card number sequence. The final product of Phase I is a sorted data tape.

---

[1] USAF PERT TIME processing for the Air Force is fully described in USAF PERT, Volume II.

Phase II: Activity to Charge Number Merge

In Phase II, the link between the PERT TIME System and the PERT COST module is formed. The PERT COST Secondary Master File contains the network activities and their associated charge numbers, but no time information such as T_E, T_L, slack, etc. This time information is provided by the user's PERT TIME tape.

In Phase II a sorted time tape and a new Secondary Master File are generated in the following manner:

- The program reads in the new PERT TIME parameter cards from the sorted data tape. If there are no parameter cards, then this information is read in from the PERT COST Secondary Master File.

- The user's PERT TIME tape is read into the system through the use of parameter data. If the PERT TIME tape is not in the proper sequence, then each record is written in a prescribed format on another tape. This tape is then sorted into the proper sequence.

- The program then proceeds to merge these three tapes; that is, the sorted data tape, the user's PERT TIME tape, and the secondary master tape are matched one activity at a time.

- Activity/Charge Number cards, if present on the sorted data tape, are used to update the old PERT COST Secondary Master File, as the new master is being generated.

- Wherever an activity on the secondary master matches an activity on the user's PERT TIME tape, that activity with its associated charge number and time information is placed on an activity-time tape.

- This process continues until all of the activities on the new secondary master

have been matched with the user's PERT TIME tape. This process results in the generation of an activity-time tape and a new secondary master tape.

- The activity-time tape is then sorted into charge number sequence to be used in Phase III.

Phase III: PERT COST Master Update

In Phase III the PERT COST Master File is either established or updated from the data contained in the sorted activity-time tape and the sorted data tape. This phase also generates, in the following manner, a sorted report tape which contains all of the data necessary for the final reporting phase:

- A record is read into the system from each of the three tapes; i.e., the information relating to one charge number is read in from each of the three tapes: the PERT COST master, the sorted data tape, and the sorted activity-time tape.

- The old PERT COST master is updated, and a new PERT COST master is generated. The sorted activity-time tape is interrogated to obtain all time information associated with each activity assigned to the current charge number.

- This time and cost data are written on the report tape. The report tape is then sorted, to be used in Phase IV.

Phase IV: Output Reports

In Phase IV the output reports are generated and written on the output tape.

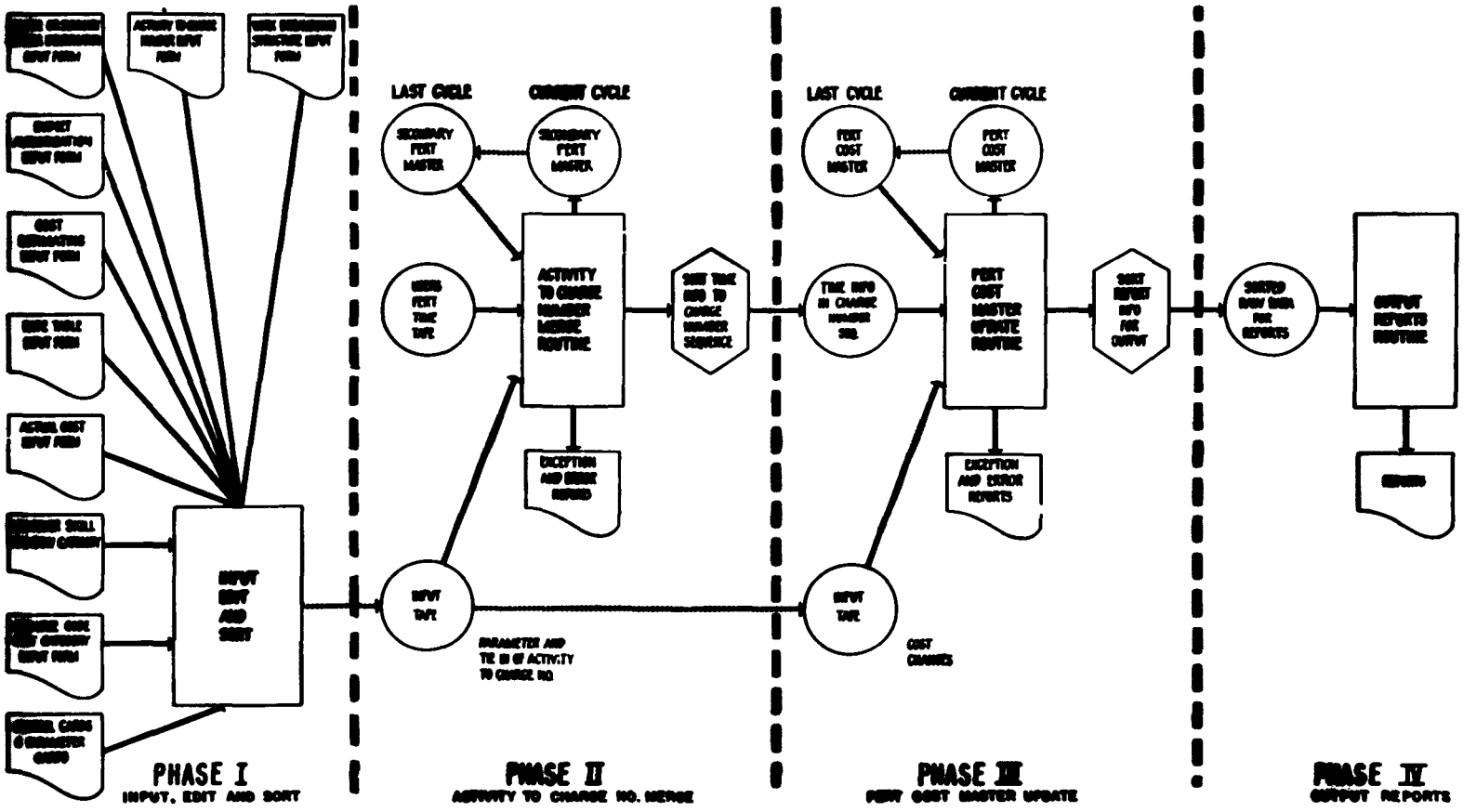


FIGURE VI-1 - COMPUTER LOGIC FLOW

CHAPTER VII

OUTPUT REPORTS

CHAPTER VII

OUTPUT REPORTS

The reports shown in this section are the specific printouts available from the USAF PERT COST computer program, and the displays which are commonly prepared from them. The report formats are in accordance with the uniform PERT COST reports approved by the Department of Defense (Bureau of Budget No. 22-R-226) for all future applications of PERT COST.

It is not mandatory that a PERT COST operation use all the reports generated. The reports submitted to the government will be selected from this group. This does not, however, restrict contractors from generating any other reports desired for internal use.

Calendar dates shown in the output reports of the USAF PERT COST computer program have been calculated by use of a calendar routine. This calendar routine excludes weekends and holidays from its computations, based on the assumption that these days have been excluded from the elapsed time estimates (t_e, t_s) in the PERT TIME System.

This chapter is presented in two sections:

A. Machine Prepared Reports

- Management Summary Report
- Program/Project Status Report
- Organization Status Report
- Financial Plan and Status Report
- Summary Financial Forecast
- Manpower Loading Report
- Cost Category Status Report

B. Manually Prepared Reports

- Cost of Work Report
- Cost Outlook Report
- Problem Analysis (a part of the Management Summary Report)
- Schedule Outlook Report
- Manpower Loading Display

A. Machine Prepared Reports

The following reports may be computer prepared by using the USAF PERT COST computer program. The format used in presenting each report includes a brief description of the report, an annotated example of the report format, an example of the report format with sample data included, and definitions of the headings appearing in the formats.

PERT COST

Management Summary Report

The PERT COST Management Summary Report, Figure VII-1, shows current and projected schedule and cost status of the total program and of each of the major component items or elements within the program. The report may be prepared for any level(s) of the work breakdown structure and for all contracts or a specified combination of contracts, depending upon the needs of management.

The first line of each report shows total costs and significant schedule information for the summary item shown in title block (2). Subsequent lines show each subdivision of that summary item at the next lower level of the work breakdown structure; thus, each page of the report shows the time and cost status and all the next level backup information for a single summary item. Since each page of the report is a concise summary of one element of the program, the report is usually divided for distribution to appropriate government and contractor managers.

The manually prepared Problem Analysis must accompany this report to explain potential problem areas.

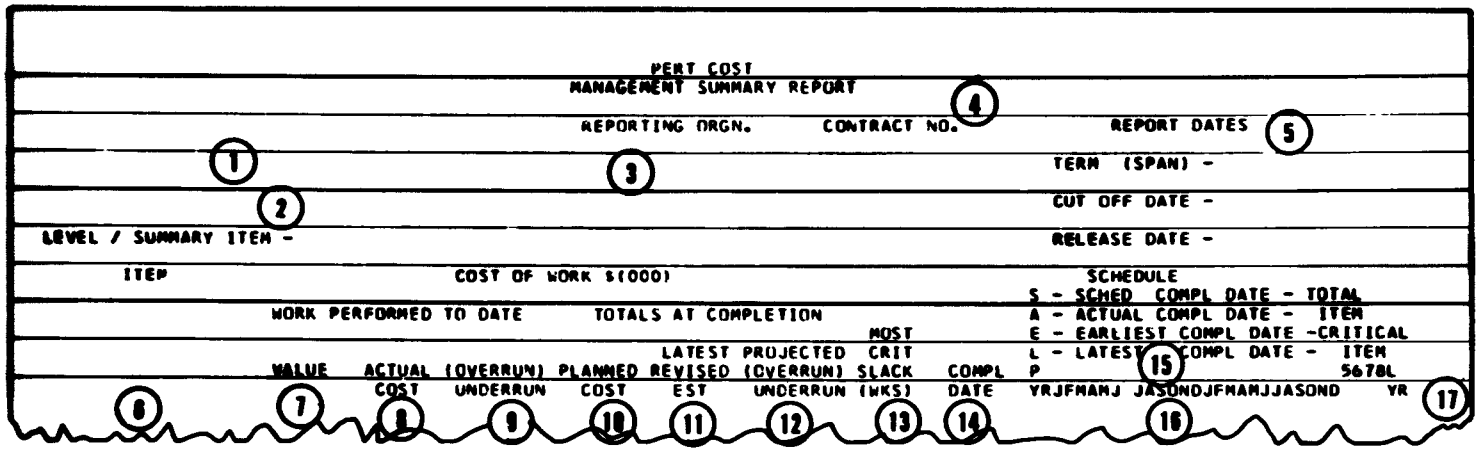


FIGURE VII-1 — PERT COST MANAGEMENT SUMMARY REPORT FORMAT

PERT COST
MANAGEMENT SUMMARY REPORT

	REPORTING ORGN.	CONTRACT NO.	REPORT DATES
SYS/PROJ/R&D/T & E	FMC	AF33(600)28369	TERM (SPAN) - TOTAL PROGRAM
			CUT OFF DATE - 31JAN64
LEVEL / SUMMARY ITEM - 3/	AN11000 AIRFRAME		RELEASE DATE - 01FEB64

ITEM — COST OF WORK $(000)

SCHEDULE
S - SCHED COMPL DATE - TOTAL
A - ACTUAL COMPL DATE - ITEM
E - EARLIEST COMPL DATE - CRITICAL
L - LATEST COMPL DATE - ITEM
P 1964 1965 6789L
YRJ FMAMJJASONDJFMAMJJASOND YR

ITEM		WORK PERFORMED TO DATE			TOTALS AT COMPLETION					
		VALUE	ACTUAL COST	(OVERRUN) UNDERRUN	PLANNED COST	LATEST REVISED EST.	PROJECTED (OVERRUN) UNDERRUN	MOST CRIT SLACK (WKS)	COMPL DATE	SCHEDULE
AIR FRAME LEV 4	11000	41,600	42,650	(.04) (1050)	105,000	115,500	(.10) (10,500)	-8.0	11JUN65 15JUN64 20APR64	S E L
ENVIRONMENT CONTR LEV 5	11100	3,700	3,900	(.05) (200)	10,000	10,100	(.01) (100)	-1.0	10MAY65 20APR65 23APR65	S E L
MAJOR MATING LEV 5	11300	2,500	2,700	(.08) (200)	18,000	17,600	.02 400	-8.0	11JUN65 15JUN65 20APR65	S E L
EMPENNAGE LEV 5	11400	5,500	5,700	(.05) (200)	12,000	13,200	(.10) (1,200)	0.0	20APR65 10FEB64 10FEB64	S E L
ALIGHTING GEAR LEV 5	11500	4,000	4,370	(.09) (370)	11,000	11,300	(.03) (300)	1.0	10MAY65 03MAY65 10MAY65	S E L
WING LEV 5	11600	9,000	9,800	(.09) (800)	22,000	27,100	(.23) (5,100)	-8.0	20APR65 15JUN64 20APR64	S E L
FUSELAGE LEV 5	11700	16,300	16,100	.01 200	32,000	36,200	(.13) (4,200)	-0.6	20APR65 23APR65 20APR65	S E L

SECURITY NO. PAGE NO. 8

FIGURE VII-2 — MANAGEMENT SUMMARY REPORT

DEFINITIONS

Management Summary Report

(1) PROGRAM

The designation of the total (or part of the total) system program that is identified with the reporting organization. For example, if reporting organization XYZ has the Missile and the GHE part of weapon system ABC, the program definition would read: ABC - Missile and GHE

(2) LEVEL/SUMMARY ITEM

The level number, noun description, and summary number of the summary item for which the report is being prepared.

(3) REPORTING ORGANIZATION

The name or identification of the organization responsible for the work identified in the Contract Number (4) and Program (1) blocks.

(4) CONTRACT NUMBER

The numeric designation of the contract(s) or agreement(s) included in each report (e.g., 33(600)28369A). When a report is prepared for a large program, several contracts may be included. Therefore, each contract number (or its representative code) would be indicated in this space. It may be noted that by sorting on contract number, a report can be prepared for each individual contract.

(5) REPORT DATES

TERM (SPAN) - The beginning and ending date for the total increment being covered in the report. For example:

1 Jan 62 to 31 Dec 62
Total Program
Contract

CUT OFF DATE - The accounting cut off date for the period of actual costs being reported.

RELEASE DATE - The date that the report is to be released to management. In the event of subsequent rerun and redistribution of reports, it is permissible to suffix the report release date with a revision number.

(6) ITEM

The level number, noun description, and summary number of each summary item on the work breakdown structure for which time information and cost information are presented in the report. The first item shown is the highest item for which the particular report is prepared and should be identical with the item named in the Level/Summary Item (2). Three lines are available for each item description, and if necessary, the top line may be extended into the Cost of Work columns (7) through (12).

(7) VALUE (WORK PERFORMED TO DATE)

The total planned cost for work completed within the summary item. This value is determined by summing the Planned Cost (10) for each completed work package. If a work package is in process, the part of its total planned cost which applies to work completed is approximated by applying the ratio of Actual Cost (8) to Latest Revised Estimate (11) for that work package. The value for any item on the work breakdown structure is the sum of the values computed for the work packages or summary items below it.

(8) ACTUAL COST (WORK PERFORMED TO DATE)

The actual expenditures incurred plus any unliquidated commitments charged or assigned to the work packages within the summary item.

(9) (OVERRUN) UNDERRUN (WORK PERFORMED TO DATE)

The Value (7) for the work performed to date minus the Actual Cost (8) for that same work. When value exceeds actual cost, an underrun condition exists. When actual cost exceeds value, an overrun condition exists. The (overrun)

underrun is also expressed as a percentage of the value of work performed to date immediately above the dollar amount. Parentheses are used as a notational device to indicate overruns. (Overruns) underruns in excess of one billion dollars print as 999,999.

(10) PLANNED COST (TOTALS AT COMPLETION)

The approved planned cost for the total summary item. This amount is the total of the planned costs for all work packages within the summary item.

(11) LATEST REVISED ESTIMATE (TOTALS AT COMPLETION)

The latest estimate of cost for the total summary item. This estimate is the sum of the actual costs plus estimates-to-complete for all the work packages in the summary item. This estimate is also known as anticipated final cost. For a completed item, the latest revised estimate equals the Actual Cost (8).

(12) PROJECTED (OVERRUN) UNDERRUN (TOTALS AT COMPLETION)

The Planned Cost (10) minus the Latest Revised Estimate (11) for the total summary item. When planned cost exceeds latest revised estimate, a projected underrun condition exists. When latest revised estimates exceed planned cost, a projected overrun condition exists. The projected (overrun) underrun is also expressed as a percentage of the planned cost immediately above the dollar amount. Parentheses are used as a notational device to indicate (overruns) (Overruns) underruns in excess of one billion dollars print as 999;999.

(13) MOST CRITICAL SLACK (WEEKS)

The slack, in weeks, associated with the "E" and "L" notations shown in the Schedule Completions (16). This figure represents the worst slack (least algebraic) with respect to designated program end points for any of the activities within the summary item.

(14) COMPLETION DATE

The day, month, and year of the "S," "A," "E," and "L" positions shown in the Schedule Completions (16).

(15) SCHEDULE CALENDAR

A calendar time reference for display of schedule completions. The calendar contains one division for all prior years, two years divided by months, four years by years, and one division for all later years. When the calendar is printed by a computer, one space is left between the months before and after the Cut Off Date (5). A "Time Now" line is printed in this space. If the cut off date falls between the 10th and the 30th of a month, that month is considered to be the "past month," and it appears to the left of the Time Now line. If the cut off date falls between the 1st and 10th of a month, that month is considered to be the "next future month" and it appears to the right of the Time Now line. Each year the calendar is adjusted so that two years, by months, appear ahead of the Time Now line.

(16) SCHEDULE COMPLETIONS

Two types of schedule completions are displayed in this section:

> The scheduled (S) or actual (A) completion of all work contained within the summary item shown in the Item column (6).
>
> The earliest (E) and latest (L) completion for the most critical schedule element or effort with respect to designated program end points within that summary item.

The symbol "S" is used to show the scheduled completion date of all work within the item. The "S" is located under the calendar position of the directed date (T_D) or the scheduled completion date (T_S). The scheduled date used is derived from one of the following sources in a priority sequence beginning with the first listed source:

- The latest scheduled activity completion date (T_S) received from the PERT TIME data which is associated with that item.
- The latest calculated activity completion date (based on S_E) received from the PERT TIME data which is associated with that item.

If all activities associated with the item are reported complete by PERT TIME an "A" is printed in the position of the latest of these dates, and no "S" is printed.

The "E" and "L" symbols represent the earliest completion date (S_E) and latest completion date (S_L) for the most critical schedule element or effort within the item with respect to designated program end points. The most critical element within an item may or may not be the same as the last scheduled item. This will depend on whether there are critical interfaces within the item which pose more serious constraints from a program point of view than the completion of a total item itself. The most critical element is the one with the worst slack (least algebraic) within the item. The "E" and "L" positions, therefore, portray the earliest completion date and the latest completion date for that activity within the summary item with the worst slack status. When several activities have the same worst slack condition (for instance, when they are all on the same path), the "E" and "L" positions reflect the last activity on that path.

(17) REMARKS

Notations made by an analyst to indicate critical cost and schedule conditions within summary items. Reference may be made, by paragraph number, to the Problem Analysis Report for a detailed analysis of the critical conditions. The heading for this area of the report is not computer printed.

PERT COST

Program/Project Status Report

The Program/Project Status Report is a comprehensive computer-produced output report. It is organized to reflect the end-item work breakdown structure and provides time and cost information from the work package level up to the top of the program.

For each work package and summary item shown on the report, there is a line of item description followed by a line of significant time and cost information. The first line presents data for the summary item shown in title block (2). Subsequent lines show all subdivisions of that item down to the work package levels. (Work packages may appear at different levels of the work breakdown structure.)

The primary purpose of the Program/Project Status Report is to back up the Management Summary Report. The two reports contain similar information, but where the Management Summary Report highlights information for a manager, this report retains detail for an analyst. The Management Summary Report is divided for distribution and the Program/Project Status Report remains intact as reference material for the entire portion of the program for which reports are prepared.

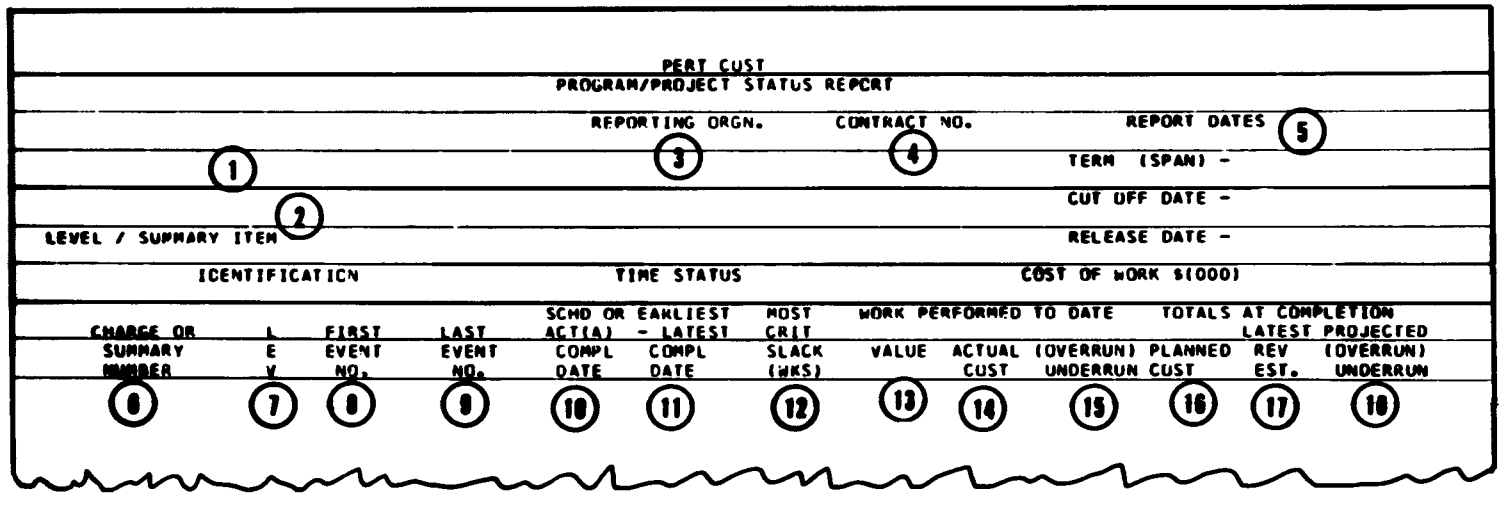


FIGURE III-3— PERT COST PROGRAM/PROJECT STATUS REPORT FORMAT

PERT COST
PROGRAM/PROJECT STATUS REPORT

SYS/RDT & E	REPORTING ORGN. FMC	CONTRACT NO. AF33(600)28369	REPORT DATES TERM (SPAN) - TOTAL PROGRAM CUT OFF DATE - 31JAN64 RELEASE DATE - 01FEB64
LEVEL / SUMMARY ITEM - 5/	11440 ELEVATOR		

IDENTIFICATION				TIME STATUS			COST OF WORK $(000)					
							WORK PERFORMED TO DATE			TOTALS AT COMPLETION		
CHARGE OR SUMMARY NUMBER	LEV	FIRST EVENT NO.	LAST EVENT NO.	SCHD OR ACT(A) COMPL DATE	EARLIEST - LATEST COMPL DATE	MOST CRIT SLACK (WKS)	VALUE	ACTUAL COST	(OVERRUN) UNDERRUN	PLANNED COST	LATEST PROJECTED REV EST.	LATEST PROJECTED (OVERRUN) UNDERRUN
ELEVATOR 11440	5	14400050	14400400	20NOV64	13DEC64	0.0 14400530	470	540	(.15) (70)	910	1025	(.13) (114)
ELEV AERODYNAMICS 56780	6	14400050	14400700	13JUN63A	13JUN63		49	66	(.36) (17)	49	66	(.33) (16)
ELEV MECH DESIGN 56781	6	14400700	14400800	31OCT63A	31OCT63		108	137	(.26) (28)	108	137	(.26) (28)
ELEV CONTROL SYSTEM 56782	6	14400050	14400600	10SEP63A	19SEP63		72	86	(.19) (14)	72	86	(.19) (14)
ELEV DRAWINGS 56783	6	14400025	14400550	20DEC63A	20DEC63		61	69	(.13) (8)	61	69	(.13) (8)
ELEV PROTO MFG 56784	6	14400530	14400500		06AUG64 20AUG64	0.0 14400530				83	86	(.04) (3)
ELEV PROTO MTLS 56785	6	14400400	14400530	18JAN64A	23JAN64		85	87	(.02) (2)	85	87	(.02) (2)
ELEV PROTO TOOLING 56786	6	14400550	14400530		02APR64	0.0 14400530	18	17	(.06) 1	52	61	(.17) (9)
ELEV TESTING 56787	6	14400540	14400425		12NOV64	0.0 14400540				118	126	(.07) (8)
ELEV TST EQP & FACIL 56788	6	14400600	14400540		11JUN64	0.0 14400470	34	31	.08 3	83	65	.22 18
ELEV DWGS REV 56789	6	14400400	14400400		31DEC64	0.0 14400400				107	154	(.46) (49)
ELEV DES MAINTENANCE 56790	6	14400050	14400800		30NOV64	5.0 14400400	41	47	(.15) (6)	84	94	(.12) (10)

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FIGURE VII-4 — PROGRAM/PROJECT STATUS REPORT

DEFINITIONS

Program/Project Status Report

①-⑤

Standard data as listed in the Management Summary Report Definitions.

⑥ CHARGE OR SUMMARY NUMBER

The noun description and charge or summary number of each work package or summary item for which time information and cost information are presented in the report. For a work package, the charge number is the contractor or government charge number (shop order number, work order number) used to identify the work package for purposes of estimating and accumulating costs. The title or short description of the charge number is printed immediately above the number itself. For the summary item, the summary number is the identification of an end item on the work breakdown structure above the work package level. The title or description of the summary item is also printed directly above the summary number.

⑦ LEVEL

The number of the level on the work breakdown structure at which the charge or summary number appears.

⑧ FIRST EVENT NUMBER

The number of the first event in time for the work package or summary item. This event number defines the beginning of the work package or summary item in relation to the network.

⑨ LAST EVENT NUMBER

The number of the last event in time (based on S_E) for the work package or summary item. This event number defines the end of the work package or summary item in relation to the network.

(10) SCHEDULED OR ACTUAL (A) COMPLETION DATE

The calendar date on which all the work contained in the work package or summary item is scheduled for completion or was actually completed. The scheduled completion date (T_S) is established by management as an internal control on the completion of the work. If no scheduled completion date has been established for the work package or summary item, the column is blank. The actual completion date (T_A) is the date on which all work in the work package or summary item has been completed. When the date in this column is an actual completion date, an "A" is printed in front of the date.

(11) EARLIEST-LATEST COMPLETION DATE

The earliest calendar date (S_E) on which the work package or summary item can be completed and the latest completion date (S_L) on which the work package or summary item can be scheduled for completion without delaying the completion of the program. When the work package or summary item has been completed, this column is blank.

The earliest completion date (S_E), printed on the upper line, is calculated in the PERT TIME System by:

- summing the scheduled elapsed time (t_s) values for activities on the longest path from the beginning of the program to the end of the work effort; and
- then adding this sum to the calendar start date of the program.

The latest completion date (S_L), printed on the lower line, is calculated by:

- summing the scheduled elapsed time (t_s) values for activities on the longest path from the end of the work effort to the end of the program; and
- then subtracting this sum from the calendar end date of the program.

If the longest path contains activities which are not scheduled, expected elapsed time (t_e) values for the unscheduled activities will be processed as scheduled elapsed time (t_s) values in the calculation of S_E and S_L.

(12) MOST CRITICAL SLACK (WEEKS)

The worst (least algebraic) slack with respect to the designated program end points, in weeks, for any of the activities within the work package or summary item. This slack is based on a comparison of S_L minus S_E for each activity. The slack indicated will not necessarily be the difference between the S_L and S_E for the end of a work package or summary item since the worst slack situation may be associated with an activity within the work package or summary item. The number of the network event at the end of the worst slack path within the work package is printed below the slack value. If the work package or summary item has been completed, this column is blank.

(13) VALUE (WORK PERFORMED TO DATE)

The total planned cost for work completed within the summary item or work package. This value is determined by summing the Planned Cost (16) for each completed work package. If a work package is in process, the part of its total planned cost which applies to work completed is approximated by applying the ratio of Actual Cost (14) to Latest Revised Estimate (17) for that work package. The value for any item on the work breakdown structure is the sum of the values computed for the work packages below it.

(14) ACTUAL COST (WORK PERFORMED TO DATE)

The actual expenditures incurred plus any unliquidated commitments charged or assigned to a work package. For summary items, the appropriate work package data is summed.

(15) (OVERRUN) UNDERRUN (WORK PERFORMED TO DATE)

The Value (13) for the work performed to date minus the Actual Cost (14) for that same work. Where value exceeds actual cost, an underrun condition exists. Where actual cost exceeds value, an overrun condition exists. The (overrun) underrun is also expressed as a percentage of

the value of work to date immediately above the dollar amount. Parentheses are used as a notational device to indicate overruns.

(16) PLANNED COST (TOTALS AT COMPLETION)

The approved planned cost for the total work package. For summary items, the appropriate work package data is summed.

(17) LATEST REVISED ESTIMATE (TOTALS AT COMPLETION)

The latest estimate of cost for the total work package. This estimate is the sum of actual costs plus estimates-to-complete for each work package. For summary items, the appropriate work package data is summed. This estimate is also known as anticipated final cost. For a completed work package or summary item the latest revised estimate equals the Actual Cost (14).

(18) PROJECTED (OVERRUN) UNDERRUN (TOTALS AT COMPLETION)

The Planned Cost (16) minus the Latest Revised Estimate (17). When planned cost exceeds latest revised estimate, a projected underrun condition exists. When latest revised estimate exceeds planned cost, a projected overrun condition exists. The projected (overrun) underrun is also expressed as a percentage of the planned cost immediately above the dollar amount. Parentheses are used as a notational device to indicate overruns.

PERT COST

Organization Status Report

The Organization Status Report, Figure VII-5, provides operating level contractor managers with detailed information breakdown from the available store of data in the PERT COST computer program. Several types of reports may be produced within this format by changing the sorting sequence of the Network Code, Charge Number (6), Responsible Organization (7), Performing Organization (8), and Resource Code (9) as follows:

- Performing Organization 1, Charge Number 2, Responsible Organization 3, Resource Code 4 (Figure VII-6)
- Resource Code 1, Charge Number 2, Responsible Organization 3, Performing Organization 4
- Charge Number 1, Responsible Organization 2, Performing Organization 3, Resource Code 4 (Figure VII-7)
- Responsible Organization 1, Charge Number 2, Performing Organization 3, Resource Code 4
- Network Code 1, Performing Organization 2, Charge Number 3, Responsible Organization 4, Resource Code 5
- Network Code 1, Resource Code 2, Charge Number 3, Responsible Organization 4, Performing Organization 5
- Network Code 1, Charge Number 2, Responsible Organization 3, Performing Organization 4, Resource Code 5
- Network Code 1, Responsible Organization 2, Charge Number 3, Performing Organization 4, Resource Code 5

Totals are shown on the reports for the first and second sort categories only.

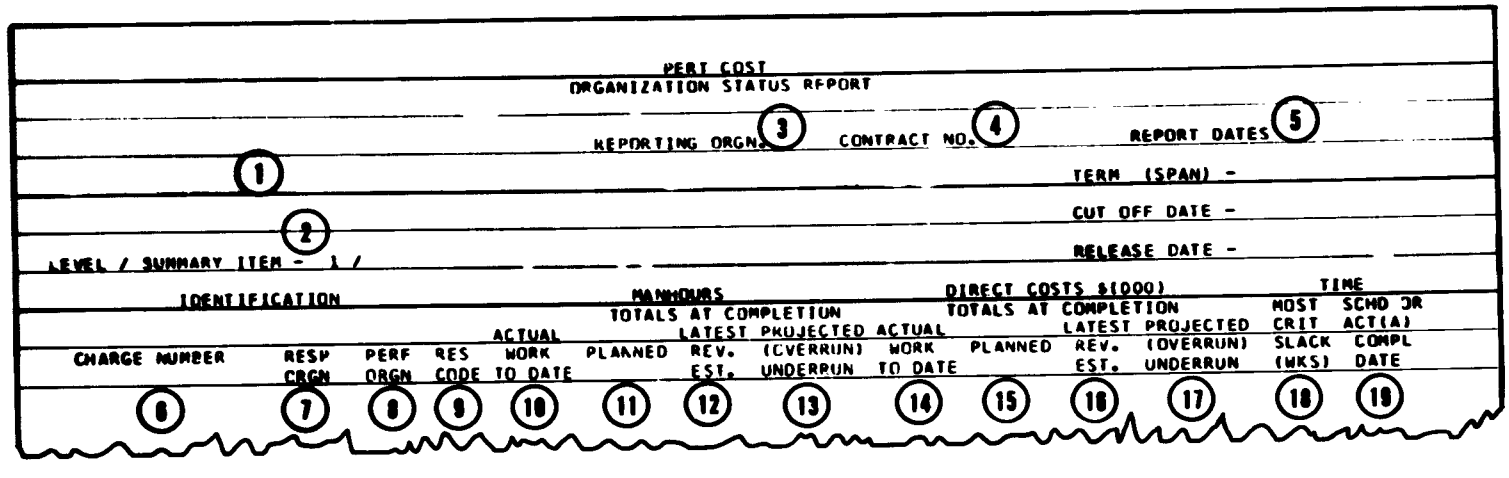

FIGURE VII-5 — PERT COST ORGANIZATION STATUS REPORT FORMAT

FIGURE VII-5

CPFF COST
ORGANIZATION STATUS REPORT
BY PERF ORGN, CHARGE NUMBER, RESP ORGN, RES CODE

REPORTING ORGN. FNC | CONTRACT NO. AF33(600)28369 | REPORT DATES

STR/RDT & E | TERM (SPAN) - TOTAL PROGRAM

CUT OFF DATE - 31JAN64

LEVEL / SUMMARY ITEM - 3/ 61000 AIRFRAME | RELEASE DATE - 01FEB64

IDENTIFICATION | MANHOURS TOTALS AT COMPLETION | DIRECT COSTS $(000) TOTALS AT COMPLETION | TIME

CHARGE NUMBER	RESP ORGN	PERF ORGN	RES CODE	ACTUAL WORK TO DATE	PLANNED	LATEST REV. EST.	PROJECTED (OVERRUN) UNDERRUN	ACTUAL WORK TO DATE	PLANNED	LATEST REV. EST.	PROJECTED (OVERRUN) UNDERRUN	MOST CRIT SLACK (WKS)	SCHD OR ACT(A) COMPL DATE
ELEV AERODYNAMICS											(.31)		
56700	3302	3302	E05	2,000	1,500	2,000	(500)	17	13	17	(4)	0.0	
											(.50)		
			T12	2,000	1,500	2,000	(500)	7	5	7	(2)		
											(.33)		
TOTAL									18	24	(6)		
ELEV MECH DESIGN											(.25)		
56781	3302		E05	3,000	2,400	3,000	(600)	25	20	25	(5)	0.0	
											(.25)		
			E04	3,000	2,400	3,000	(600)	24	19	24	(5)		
TOTAL									39	49			
ELEV DWGS REV											(.42)		
56799	3302		E05		1,500	2,000	(500)		12	17	(5)	0.0	
											(.33)		
			E04		1,500	2,000	(500)		12	16	(4)		
TOTAL									24	33			
WING AERODYNAMICS (1)											(.25)		
77700	6417		E02	10,000	20,000	25,000	(5,000)	85	170	212	(42)	-8.0	
											(.10)		
			E00	10,000	20,000	22,000	(2,000)	83	165	182	(17)		
TOTAL									335	394			
WING MECH DESIGN (1)											(.25)		
77781	6417		E05	8,000	12,000	15,000	(3,000)	66	90	124	(25)	-5.6	
											.50		
			E04	9,000	30,000	20,000	10,000	72	160	80	80		
TOTAL									250	204			

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FIGURE VII-6 — ORGANIZATION STATUS REPORT—BY PERFORMING ORGANIZATION

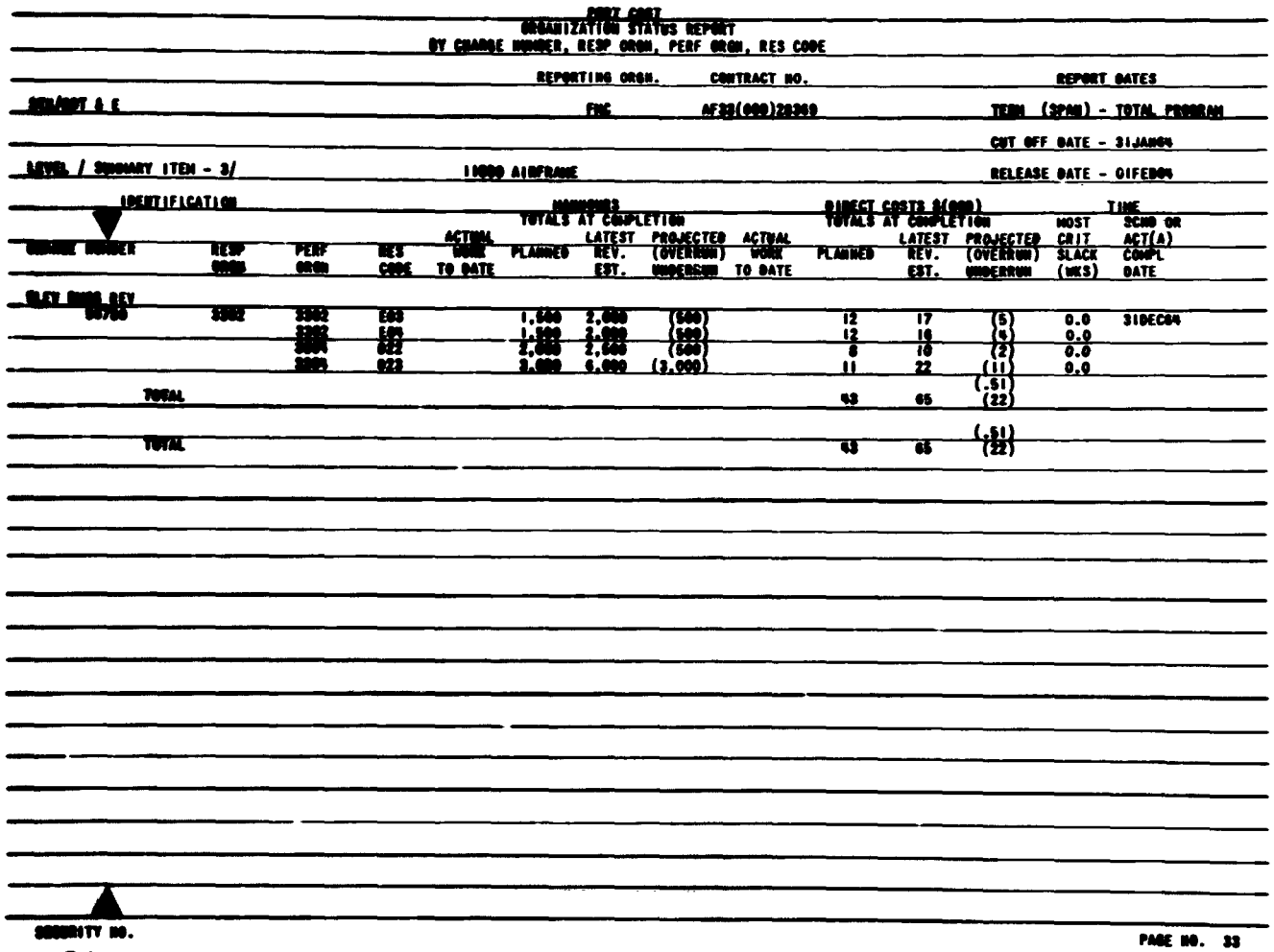

FIGURE VII-7— ORGANIZATION STATUS REPORT— BY CHARGE NUMBER

DEFINITIONS

Organization Status Report

①-⑤

Standard data as listed in the Management Summary Report Definitions.

⑥-⑨ IDENTIFICATION

The sorting sequence for these identification columns is indicated in the report title. Information will appear only in those columns listed in the title.

⑥ CHARGE NUMBER

The noun description and charge number for each work package for which time information and cost information are presented in the report. This is the contractor's charge number (shop order number, work order number) used to identify the work package for purposes of estimating and accumulating costs. The title or short description of the charge number is printed immediately above the number itself.

⑦ RESPONSIBLE ORGANIZATION

The contractor's organization responsible for management of the work package ⑥.

⑧ PERFORMING ORGANIZATION

The contractor's department or organization which will perform work on the work package.

⑨ RESOURCE CODE

The contractor's code for a particular manpower skill or material type.

⑩ - ⑬ MAN-HOURS

Cost information shown in this area of the report may be

used for services and facilities, such as computer usage, as well as for direct labor. No totals are shown in these columns.

(10) ACTUAL WORK TO DATE

The actual man-hour expenditures assigned to a work package or work package subdivision.

(11) PLANNED (TOTALS AT COMPLETION)

The approved planned man-hours for the work package or work package subdivision.

(12) LATEST REV. EST. (TOTALS AT COMPLETION)

The latest estimate of man-hours for the work package or work package subdivision. This estimate is the sum of actual man-hour expenditures plus estimates-to-complete. This estimate is also known as anticipated final cost. For a completed work package or work package subdivision the latest revised estimate equals the Actual Work to Date (10).

(13) PROJECTED (OVERRUN) UNDERRUN (TOTALS AT COMPLETION)

The Planned Man-hours (11) minus the Latest Revised Estimate (12). When planned man-hours exceed latest revised estimate, a projected underrun condition exists. When latest revised estimate exceeds planned man-hours, a projected overrun condition exists. Parentheses are used as a notational device to indicate overruns.

(14) - (17) DIRECT COSTS $(000)

Cost information in this area of the report represents materials and other direct costs as well as the direct labor dollar value of costs shown in (10) through (13). Total dollar costs may be used when they are more appropriate to a contractor's normal operation than direct costs.

(18) ACTUAL COST (WORK TO DATE)

The actual expenditures incurred plus any unliquidated commitments charged or assigned to a work package or work package subdivision.

(15) PLANNED (TOTALS AT COMPLETION)

The approved planned cost for the work package or work package subdivision.

(16) LATEST REVISED ESTIMATE (TOTALS AT COMPLETION)

The latest estimate of cost for the work package or work package subdivision. This estimate is the sum of actual costs plus estimates-to-complete from time now to end of program. This estimate is also known as anticipated final cost. For completed work the latest revised estimate equals the Actual Cost (14).

(17) PROJECTED (OVERRUN) UNDERRUN (TOTALS AT COMPLETION)

The Planned Cost (15) minus the Latest Revised Estimate (16). When planned cost exceeds latest revised estimate, a projected underrun condition exists. When latest revised estimate exceeds planned cost, a projected overrun condition exists. The projected (overrun) underrun is also expressed as a percentage of the planned cost immediately above the dollar amount on total lines. Parentheses are used as a notational device to indicate overruns.

(18) MOST CRITICAL SLACK (WEEKS)

The worst (least algebraic) slack with respect to designated program end points, in weeks, for any of the activities within the work package (6). Slack pertains only to the work package (charge number) itself, not to the further cost element breakouts shown in this report. If the work package has been completed, this column is blank.

(19) SCHEDULED OR ACTUAL (A) COMPLETION DATE

The calendar date on which all the work contained in the work package is scheduled for completion or was actually completed. The scheduled completion date (T_S) is established by management as an internal control on the completion of the work. If no scheduled completion date has been established for the work package, the column is blank. The actual completion date (T_A) is the date on which all work in the work package has been completed. When the date in this column is an actual completion date, an "A" is printed in front of the date. Completion date pertains only to the work package (charge number) itself, not to the further cost element breakouts shown in this report.

PERT COST

Financial Plan and Status Report

The Financial Plan and Status Report, Figure VII-8, provides data for a monthly comparison (at any given level) of actual costs and/or latest revised estimates against planned costs, and thus serves as a tool for monitoring the financial plans. It shows historical (prior month) cumulative costs and both incremental and cumulative costs for each future month within the time period identified in the Report Dates (5).

The report is available in two formats:

- by Month, and Charge Number (Figures VII-9), an operating level report for use in detailed analyses of cost;
- by Month (Figures VII-10), a higher level summary which shows only totals by month, for the summary item identified in block (2).

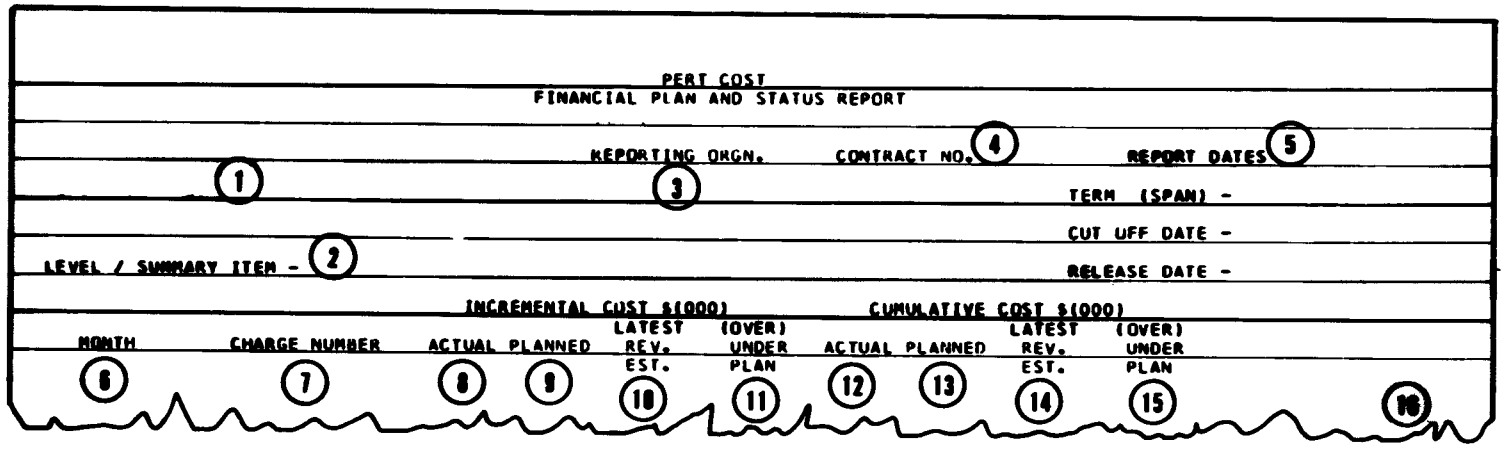

FIGURE VII-8 — PERT COST FINANCIAL PLAN AND STATUS REPORT FORMAT

FIRST COST
FINANCIAL PLAN AND STATUS REPORT
BY MONTH, CHARGE NUMBER

STS/MOT & E	REPORTING ORGN. FMC	CONTRACT NO. AF23(600)-8369	REPORT DATES TERM (SPAN) - TOTAL PROGRAM
			CUT OFF DATE - 31JAN64
LEVEL / SUMMARY ITEM - 5/	11960 ELEVATOR		RELEASE DATE - 01FEB64

MONTH	CHARGE NUMBER	INCREMENTAL COST $(000) ACTUAL	PLANNED	LATEST REV. EST.	(OVER) UNDER PLAN	CUMULATIVE COST $(000) ACTUAL	PLANNED	LATEST REV. EST.	(OVER) UNDER PLAN
PRIOR	64700					66	49	66	(17)
	64701					127	100	127	(28)
	64702					86	72	86	(14)
	64703	13	11	13	(2)	69	61	69	(8)
	64705	3	3	3		84	81	84	(3)
	64706	10	10	10		19	21	19	2
	64708	5	4	5	(1)	41	36	41	(5)
	TOTAL	31	28	31	(3)	502	429	502	(73)
JAN64	64700	18	18	22	(4)	18	18	22	(4)
	64701	12	13	12	1	31	34	31	3
	64708	6	5	6	(1)	97	91	97	(6)
	TOTAL	36	36	40	(4)	96	93	100	(7)
FEB64	64700		15	17	(2)		33	39	(6)
	64701		10	8	2		44	39	5
	64708		4	5	(1)		55	61	(6)
	TOTAL		29	30	(1)		122	129	(7)

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FIGURE VII-9 — FINANCIAL PLAN AND STATUS REPORT BY MONTH, CHARGE NO.

PERT COST
FINANCIAL PLAN AND STATUS REPORT
BY MONTH

SYS/SUBT & E	REPORTING ORGN. FMC	CONTRACT NO. AF33(600)28369	REPORT DATES TERM (SPAN) - TOTAL PROGRAM
			CNT EFF DATE - 31JAN64
LEVEL / SUMMARY ITEM - 3/	11000 AIRFRAME		RELEASE DATE - 01FEB64

		INCREMENTAL COST $(000)				CUMULATIVE COST $(000)			
MONTH	CHARGE NUMBER	ACTUAL	PLANNED	LATEST REV. EST.	(OVER) UNDER PLAN	ACTUAL	PLANNED	LATEST REV. EST.	(OVER) UNDER PLAN
PRIOR						38,700	37,900	38,700	(800)
JAN64		3,950	2,900	3,950	(1,050)	42,650	40,800	42,650	(1,850)
FEB64			2,900	3,800	(700)		43,700	46,450	(2,750)
MAR64			4,950	6,100	(1,150)		48,650	52,550	(3,900)
APR64			5,000	6,300	(1,300)		53,650	58,850	(6,300)
MAY64			6,000	8,000	(2,000)		59,650	67,650	(8,000)
JUN64			6,000	6,500	(500)		65,650	74,150	(8,500)
JUL64			6,050	6,600	(550)		71,700	80,750	(9,050)
AUG64			6,100	6,500	(400)		77,800	87,250	(9,450)
SEP64			5,100	5,500	(400)		83,900	92,750	(8,850)
OCT64			5,100	5,500	(400)		89,000	98,250	(9,250)
NOV64			3,100	3,500	(400)		92,100	101,750	(9,650)
DEC64			3,100	3,500	(400)		95,200	105,250	(10,050)
JAN65			2,900	3,250	(350)		98,100	108,500	(10,400)
FEB65			2,400	2,500	(100)		100,500	111,000	(10,500)
MAR65			1,700	1,700			102,200	112,700	(10,500)
APR65			1,300	1,300			103,500	114,000	(10,500)

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FIGURE VII-10 — FINANCIAL PLAN AND STATUS REPORT BY MONTH

DEFINITIONS

Financial Plan and Status Report

(1)-(5)

Standard data as listed in the Management Summary Report Definitions.

(6) MONTH

The accounting time period for which (or through which) estimates and actuals are shown.

(7) CHARGE NUMBER

The contractor or government organization charge number (shop order number, work order number) used to identify the work package for purposes of estimating and accumulating costs.

(8) ACTUAL (INCREMENTAL COST)

The actual expenditures incurred plus any unliquidated commitments charged or assigned during the indicated Month (6). This value is shown for individual Charge Numbers (7) when they are included in the report. This column is used only for the month preceding "cut off date."

(9) PLANNED (INCREMENTAL COST)

The approved planned cost for the indicated Month (6). This value is shown for individual Charge Numbers (7) when they are included in the report. No information appears in this column for prior months.

(10) LATEST REVISED ESTIMATE (INCREMENTAL COST)

The latest estimate of cost for the indicated Month (6). This value is shown for individual Charge Number (7) when they are included in the report.

(11) (OVER) UNDER PLAN (INCREMENTAL COST)

The Planned Cost (9) minus the Latest Revised Estimate (10). When planned cost exceeds latest revised estimate, a projected underplan condition exists. When latest revised estimate exceeds planned cost, a projected overplan condition exists. Parentheses are used as a notational device to indicate an overplan condition. No information appears in this column for prior months.

(12) ACTUAL (CUMULATIVE COST)

The actual expenditures incurred plus any unliquidated commitments charged or assigned during the period from the beginning of the program to the end of the indicated Month (6). This value is shown for individual Charge Numbers (7) when they are included in the report.

(13) PLANNED (CUMULATIVE COST)

The approved planned cost during the period from the beginning of the program to the end of the indicated Month (6). This value is shown for individual Charge Numbers (7) when they are included in the report.

(14) LATEST REVISED ESTIMATE (CUMULATIVE COST)

The latest estimate of cost during the period from the beginning of a program to the end of the indicated Month (6). This value is shown for individual Charge Numbers (7) when they are included in the report. This estimate is the sum of actual costs plus estimates through the end of the indicated month. For the period prior to the cut off date, the latest revised estimate equals the Actual (12).

(15) (OVER) UNDER PLAN (CUMULATIVE COST)

The Planned Cost (13) minus the Latest Revised Estimate (14). When planned cost exceeds latest revised estimate, a projected underplan condition exists. When latest revised estimate exceeds planned cost, a projected overplan condition exists. Parentheses are used as a notational device to indicate overplan.

PERT COST

Summary Financial Forecast

The Summary Financial Forecast, Figure VII-11, presents actual and planned or budgeted costs, grouped by summary item or cost category, for any level of the work breakdown structure. The summary items are derived from the work breakdown structure; cost categories are derived from entries made on the Resource Code/Cost Category Input Form.

This report is available in four forms:

- by Summary Item by Year (Figure VII-12)
  This report presents the total cost for each of the summary items on a specified level.

- by Summary Item by Month
  This report presents the same information as the report above, but with the additional detail of costs by month.

- by Cost Category by Year
  This report presents hours, direct dollars, and total cost for each cost category entered in the system. (If resource codes are not associated with a cost category, their costs will appear in the "undefined category.") This report also shows totals for labor hours, direct labor dollars, direct dollars, overhead (including G&A Fee), and total dollars. ("Overhead G&A Fee" value is derived by subtracting direct costs from total dollars.)

- by Cost Category by Month (Figure VII-13)
  This report presents the same information as the above report, but with the additional detail of costs by month.

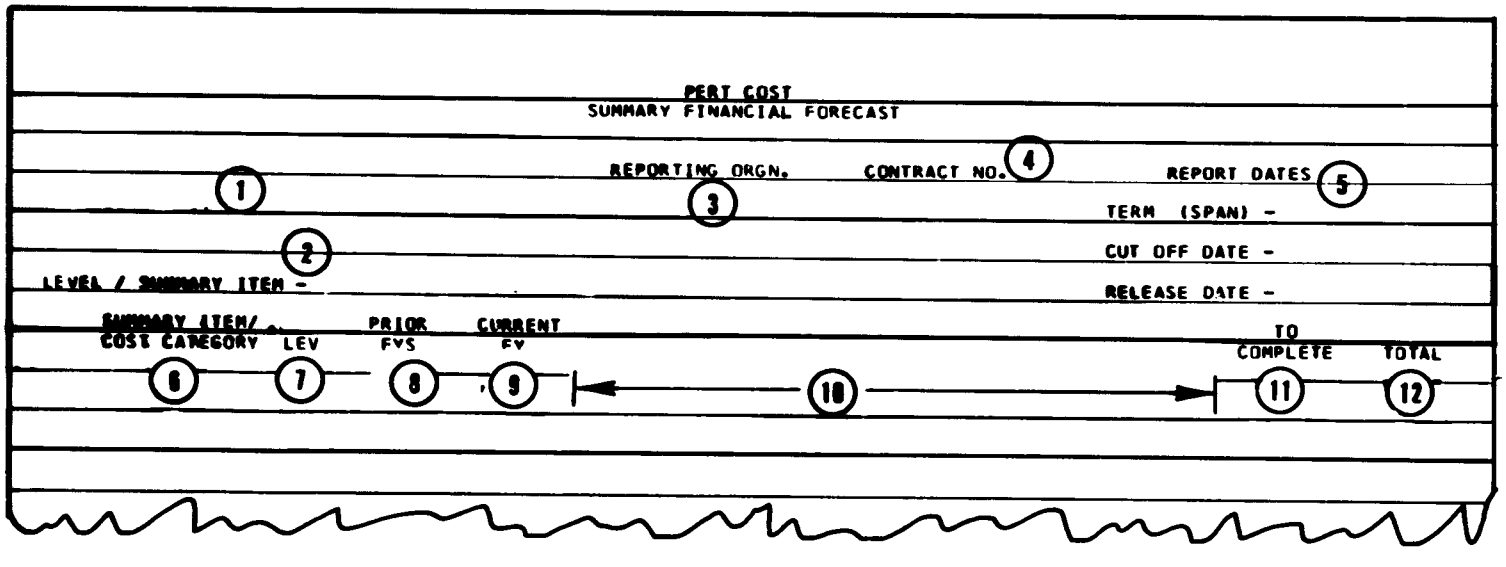

FIGURE VII-11— PERT COST SUMMARY FINANCIAL FORECAST FORMAT

PERT COST
SUMMARY FINANCIAL FORECAST
BY SUMMARY ITEM BY YEAR

SYS/SUBT & E | REPORTING ORGN. FMC | CONTRACT NO. AF33(600)28369 | REPORT DATES TERM (SPAN) - TOTAL PROGRAM; CUT OFF DATE - 31JAN64; RELEASE DATE - 01FEB64

LEVEL / SUMMARY ITEM - 3/ 11000 AIRFRAME

SUMMARY ITEM/ COST CATEGORY	LEV	PRIOR FYS	CURRENT FY	CURRENT FY+1	CURRENT FY+2	CURRENT FY+3	CURRENT FY+4	CURRENT FY+5	CURRENT FY+6	TO COMPLETE	TOTAL
AIRFRAME 11000	3	29,050	18,000	32,350	30,000						105,000
ENVIRONMENTAL CONTROL 11100	4	2,100	1,000	3,100	3,000						10,000
MAJOR MATING 11200	4	1,900	1,000	7,500	7,000						10,000
EMPENNAGE 11400	4	2,200	3,500	3,200	3,020						12,000
ALIGHTING GEAR 11500	4	2,100	2,270	3,600	3,000						11,000
WING 11600	4	4,250	5,000	6,200	6,000						22,000
FUSELAGE 11700	4	7,500	8,000	7,500	8,400						22,000

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FIGURE VII-12— SUMMARY FINANCIAL FORECAST BY SUMMARY ITEM BY YEAR

PERT COST
SUMMARY FINANCIAL FORECAST
BY COST CATEGORY BY MONTH

REPORTING ORGN.	CONTRACT NO.	REPORT DATES
[illegible] & E FMC	AF33(600)28369	TERM (SPAN) - TOTAL PROGRAM
		CUT OFF DATE - 31JAN64
MODEL/SUMMARY ITEM 3/ 11000 AIRFRAME		RELEASE DATE - 01FEB64

SUMMARY ITEM/ COST CATEGORY	LEV	CURRENT FY	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
AIRFRAME 11000	3	18,000	1,166	1,200	1,273	1,570	1,470	2,000	1,465	1,575	1,605	2,200	1,435	1,615
MAJOR SUBCONTRACT - TOT $		9,200	600	600	700	750	850	1,200	750	750	750	750	750	750
[illegible]FACTURING - HOURS		840,000	20,000	20,000	20,000	20,000	40,000	40,000	40,000	60,000	60,000	80,000	120,000	120,000
[illegible]ACTURING - TOT $		1,800	50	50	50	50	100	100	100	150	150	200	300	300
[illegible]AL - TOT $		800		100		300		200		100		100		100
[illegible]ING - HOURS		777,000	115,000	115,000	115,000	100,000	100,000	50,000	50,000	50,000	25,000	18,000	18,000	21,000
[illegible]ING - TOT $		1,400	250	250	250	200	200	100	100	100	50	30	30	40
[illegible] - HOURS		160,000	400	400	1,200	6,000	8,000	8,000	10,000	10,000	20,000	32,000	32,000	32,000
[illegible]TING - DIR $		162			2	6	8	8	11	11	21	32	32	32
[illegible] - TOT $		400	1	1	3	15	20	20	25	25	50	80	80	80
[illegible]ING - HOURS			1,800	1,800	7,000	1,800	11,100	18,000	38,000	3,800	1,800	7,600	9,200	9,200
[illegible]ING - TOT $		300	5	5	20	5	30	50	100	10	5	20	25	25
[illegible]FINED - HOURS		13,800,000	80,000	60,000	750,000	750,000	820,000	990,000	999,999	999,999	999,999	999,999	750,000	915,000
[illegible]FINED - DIR $		2,041	8C	80	108	106	121	147	182	201	279	482	106	141
[illegible]FINED - TOT $		4,400	200	200	250	250	270	330	390	440	600	1,100	250	320
TOTAL LABOR HOURS		15,377,000	197,200	197,200	893,400	877,800	979,100	999,999	999,999	999,999	999,999	999,999	929,200	999,999
TOTAL DIRECT LABOR$		2,204	80	80	108	112	278	338	193	212	300	524	138	173
TOTAL DIRECT DOLLARS		2,204	80	80	108	112	278	338	193	212	300	524	138	173
TOTAL BURD, G&A, FEE		16,396	1,026	1,120	1,165	1,458	1,192	1,662	1,27	1,363	1,305	1,756	1,297	1,442
TOTAL DOLLARS		18,600	1,166	1,200	1,273	1,570	1,470	2,000	1,465	1,575	1,605	2,200	1,435	1,615

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FIGURE VII-13 — SUMMARY FINANCIAL FORECAST BY COST CATEGORY BY MONTH

DEFINITIONS

Summary Financial Forecast

①-⑤

Standard data as listed in the Management Summary Report Definitions.

⑥ SUMMARY ITEM/COST CATEGORY

The item or category which identifies the line item of cost summarization. When data is identified by summary item, totals are presented for all summary items at the work breakdown level indicated in item ② of the header block. When data is identified by cost category, an additional identification is made of hours, direct cost, and total cost for each category.

⑦ LEVEL

The level on the work breakdown structure of the summary item in column ⑥. When costs are presented by cost category, this column identifies the type of cost for the line item (i.e., hours, direct dollars, total dollars), as well as the level of the summary item for which cost category totals are presented.

⑧ PRIOR FY

The cumulative cost for each line item up to, but not including, the current fiscal year. This column appears only in the reports which present a forecast by years.

⑨ CURRENT FY

The cumulative cost for each line item from the beginning of the fiscal year to the Cut Off Date ⑤.

⑩ FORECAST PERIODS

The time periods for which incremental cost forecasts are summarized for each line item. The two reports by year present individual "forecast" totals for each of six years

following the current fiscal year. The two reports by month present individual forecast totals for each of twelve months following the Cut Off Date (5).

(11) TO COMPLETE

The total forecast cost for each line item for all years beyond and including the seventh year after the current fiscal year. This column appears only in the reports which present a forecast by years.

(12) TOTAL

The total of all forecast and actual cost for each line item within the period of the Term (Span) (5). This column appears only in the reports which present a forecast by years.

PERT COST

Manpower Loading Report

The Manpower Loading Report, Figure VII-14, is intended for use by contractors to report manpower loading for various levels of summary within the program. The Manpower Loading Report lists actual, planned, and latest estimated monthly man-hours for the desired level of summary by the type of manpower.

The report is available to contractor management in two forms:

- by Resource, Month (Figure VII-15), as an aid in the analysis of the use of skills throughout the program organization. The resource report is normally useful only for selected resource codes which represent labor skills rather than services, facilities usage, or other costs which may be estimated in hours; and

- by Performing Organization, Month, Resource (Figure VII-16), as a more detailed aid in the analysis of departmental manpower loading.

For Air Force analysis of Contractor Manpower Loading, a standard manpower classification system of five categories has been adopted as representative of the major type of labor in the aerospace industry. These categories are:

- Engineering Support;
- Scientific and Engineering
- Management and Administration;
- Shops and Production; and
- Other

A labor summary for one category is shown in figure VII-17.

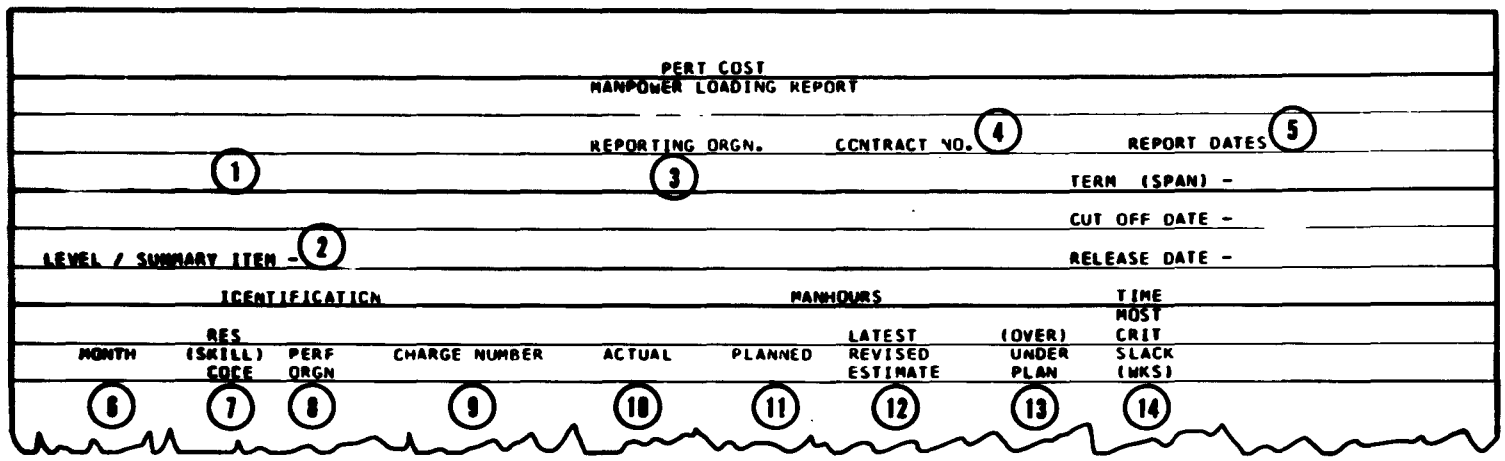

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FIGURE VII-14— PERT COST MANPOWER LOADING REPORT FORMAT

PERT COST
MANPOWER LOADING REPORT
BY RESOURCE, MONTH, PERF ORGN, CHARGE NO.

REPORTING ORGN. FHC | CONTRACT NO. AF33(600)28345 | REPORT DATES: TERM (SPAN) - TOTAL PROGRAM; CUT OFF DATE - 31JAN64; RELEASE DATE - 01FEB64

SYS/SUBT & E

LEVEL / SUMMARY ITEM - 3/ 19000 AIRFRAME

MONTH	IDENTIFICATION: RES (SKILL) CODE	IDENTIFICATION: PERF ORGN	IDENTIFICATION: CHARGE NUMBER	MANHOURS: ACTUAL	MANHOURS: PLANNED	MANHOURS: LATEST REVISED ESTIMATE	MANHOURS: (OVER) UNDER PLAN	TIME: MOST CRIT SLACK (WKS)
[illegible]	E02	3382	54780	1,000	800	1,000	(200)	5.0
			54787	2,500	2,500	2,500	500	0.0
		9417	90721	500		500	(500)	0.0
			90722	1,000	2,700	1,000	800	10.2
			90723	2,000	2,000	2,000		2.6
TOTAL				7,000	8,000	7,000	900	0.0
[illegible]		3382	54780	80	80	80		5.0
			54787	120	100	120	20	0.0
		9417	90721	90		90	(90)	0.0
TOTAL				290	180	290	(20)	0.0
[illegible]		3382	54780		96	96	(10)	5.0
TOTAL					96	96	(10)	5.0
[illegible]		3382	54780		96	96	(10)	5.0
TOTAL					96	96	(10)	5.0
[illegible]		3382	54780		107	119	(12)	5.0
TOTAL					107	119	(12)	5.0
[illegible]		3382	54780		96	96	(10)	5.0
TOTAL					96	96	(10)	5.0
[illegible]		3382	54780		96	96	(10)	5.0
TOTAL					96	96	(10)	5.0
[illegible]		3382	54780		107	119	(12)	5.0
TOTAL					107	119	(12)	5.0

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FIGURE VII-15— MANPOWER LOADING REPORT BY RESOURCE, MONTH

PERT COST
MANPOWER LOADING REPORT
BY PERF ORGN, MONTH, RESOURCE

REPORTING ORGN. FMC | CONTRACT NO. AF33(600)28369 | REPORT DATES TERM (SPAN) - TOTAL PROGRAM

STR/BDT & E | CUT OFF DATE - 31JAN64

LEVEL / SUMMARY ITEM - 3/ 11000 AIRFRAME | RELEASE DATE - 01FEB64

IDENTIFICATION				MANHOURS				TIME
MONTH	RES (SKILL) CODE	PERF ORGN	CHARGE NUMBER	ACTUAL	PLANNED	LATEST REVISED ESTIMATE	(OVER) UNDER PLAN	MOST CRIT SLACK (MOS)
[illegible]	E02	3202		70,000	100,000	70,000	30,000	
	E03			80,000	85,000	80,000	5,000	
	E04			35,000	40,000	35,000	5,000	
	E05			20,000	25,000	20,000	5,000	
	T12			85,000	90,000	85,000	5,000	
TOTAL				290,000	340,000	290,000	50,000	
[illegible]	E02				14,000	16,000	(2,000)	
	E03				10,000	10,000		
TOTAL					24,000	26,000	(2,000)	
[illegible]	E02				14,000	15,000	(1,000)	
	E03				10,000	10,000		
	E05				5,000	5,000		
TOTAL					29,000	30,000	(1,000)	
[illegible]	E02				14,000	14,000		
	E03				12,000	12,000		
TOTAL					26,000	26,000		
[illegible]	E02				14,000	14,000		
	E03				12,000	12,000		
TOTAL					26,000	26,000		

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FIGURE VII-16— MANPOWER LOADING REPORT BY PERFORMING ORGANIZATION

PERT COST
RAINBOW CATEGORY REPORT

	REPORTING ORGN.	CONTRACT NO.	REPORT DATES
SUB/SOT & E	FMC	AF33(600)28369	TERM (SPAN) - TOTAL PROGRAM
			CUT OFF DATE - 31JAN64
LEVEL / SUMMARY ITEM - 3 /	10000 AIRFRAME		RELEASE DATE - 01FEB64

IDENTIFICATION		MANHOURS			
MONTH	RAINBOW CATEGORY	ACTUAL	PLANNED	LATEST REVISED ESTIMATE	(OVER) UNDER PLAN
OCT63	SHOPS-PRODUCTION		200	1,200	(1,000)
NOV63			500	500	
DEC63			800	800	
JAN64			1,100	1,100	
FEB64			1,100	1,100	
MAR64			300	300	
APR64			300	300	
MAY64			600	1,350	(750)
JUN64			2,000	2,200	300
JUL64			2,500	2,600	(100)
AUG64			1,400	850	550
SEP64			900	900	
OCT64			900	900	
NOV64			180	200	(20)
DEC64			100	150	(50)
JAN65			1,500	1,400	100
FEB65			1,400	1,400	

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FIGURE VII-17— RAINBOW CATEGORY REPORT

DEFINITIONS

Manpower Loading Report

①-⑤

Standard data as listed in the Management Summary Report Definitions.

⑥-⑨ IDENTIFICATION

The sorting sequence for these identification columns is indicated in the report title. Information will appear in only those columns listed in the title.

⑥ MONTH

The accounting time period for which estimates and actuals are shown.

⑦ RESOURCE (SKILL) CODE

The contractor or government organization code for a particular manpower skill.

⑧ PERFORMING ORGANIZATION

The contractor or government organization which will perform work on the work package.

⑨ CHARGE NUMBER

The contractor or government organization charge number (shop order number, work order number) used to identify the work package for purposes of estimating and accumulating costs.

⑩ ACTUAL (MAN-HOURS)

The actual man-hour expenditures incurred or assigned to a work package or work package subdivision. This information may appear only as a total figure when charge numbers are not shown in the report.

(11) PLANNED (MAN-HOURS)

The man-hours planned for a work package or work package subdivision during the indicated month. This information may appear only as a total figure when charge numbers are not shown in the report.

(12) LATEST REVISED ESTIMATE (MAN-HOURS)

The latest estimate of man-hours for a work package or work package subdivision during the indicated month. This information may appear only as a total figure when charge numbers are not shown in the report.

(13) (OVER) UNDER PLAN (MAN-HOURS)

The Planned Man-hours (11) minus the Latest Revised Estimate (12). When planned man-hours exceed latest revised estimate, a projected underplan condition exists. When latest revised estimate exceeds planned man-hours, a projected overplan condition exists. Parentheses are used as a notational device to indicate an overplan condition.

(14) MOST CRITICAL SLACK (WEEKS)

The worst (least algebraic) slack with respect to designated program end points, in weeks, for any of the activities within the work package (9). Slack pertains only to the work package or charge number itself, not to the further cost element breakouts shown in this report. If the work package has been completed or if the charge number is not shown, this column is blank.

PERT COST

Cost Category Status Report

The Cost Category Status Report, Figure VII-18, presents a grouping of functional, hardware, or other significant cost elements in specified categories for reporting purposes.

These cost categories are established by relating work packages or elements of cost within work packages to the specified categories. Thus, no distortion of the work breakdown structure is required to segregate this data.

Any cost categories which satisfy this relationship to the work breakdown structure may be established for a program, but once established, they must remain as originally defined for the life of the program.

The Cost Category Status Report provides, for each cost category, a manpower and total dollar comparison of:

- planned versus actual expenditure to date;
- planned versus latest revised estimate at completion.

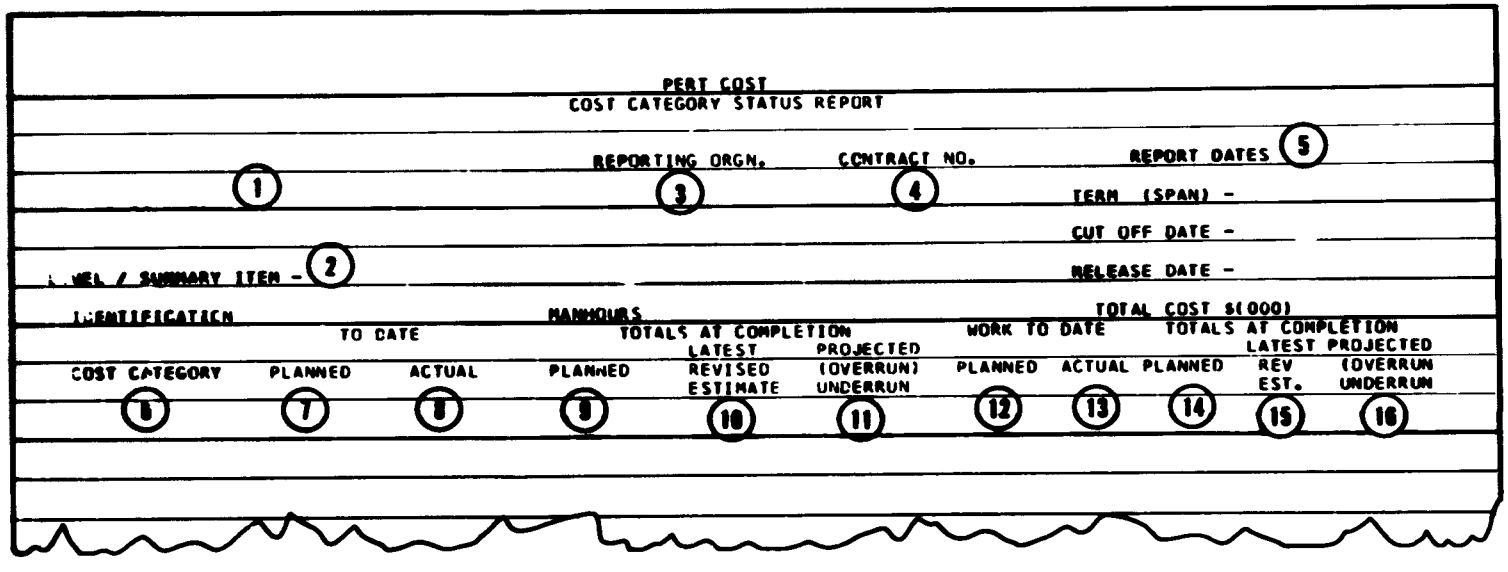

FIGURE VII-18 — PERT COST COST CATEGORY STATUS REPORT FORMAT

PERT COST
COST CATEGORY STATUS REPORT

REPORTING ORGN. | CONTRACT NO. | REPORT DATES

STL/RHT & E | AF33(600)28369 | YERN (SPAN) - TOTAL PROGRAM PR

CUT OFF DATE - 31JAN64

LEVEL / SUMMARY ITEM - 4/ M600 FLIGHT CONTROL | RELEASE DATE - 01FEB64

IDENTIFICATION | MANHOURS | TOTAL COST $(000)

	TO DATE		TOTALS AT COMPLETION			WORK TO DATE		TOTALS AT COMPLETION		
COST CATEGORY	PLANNED	ACTUAL	PLANNED	LATEST REVISED ESTIMATE	PROJECTED (OVERRUN) UNDERRUN	PLANNED	ACTUAL	PLANNED	LATEST REV EST.	PROJECTED (OVERRUN UNDERRUN
DEVELOPMENT					(.02)					(.02)
			15,050	15,350	(300)			451	459	(8)
MAJOR SUBCONTRACT					.00					(.13)
							30	252	289	(37)
MANUFACTURING					(.33)					(.26)
	4,000	38,888	73,730	110,268	(36,538)	24	197	498	673	(175)
MATERIAL					.00					(.31)
							48	109	158	(49)
PLANNING					(.33)					(.39)
		6,912	14,600	21,812	(7,212)		43	70	114	(44)
PURCHASED PARTS					.00					(.03)
								28	29	(1)
TESTING					(.31)					(.32)
		10,200	24,205	35,225	(11,020)		95	217	319	(102)
TOOLING					(.27)					(.24)
		4,724	14,200	19,424	(5,224)		31	109	144	(35)
TOTAL										(.21)
						24	442	1,734	2,184	(450)

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FIGURE VII-19 — COST CATEGORY STATUS REPORT

DEFINITIONS

Cost Category Status Report

(1)-(5)

Standard data as listed in the Management Summary Report Definitions.

(6) COST CATEGORY

The name and/or number of a functional, hardware, or other significant cost category for which costs are to be summarized.

(7)-(11) MAN-HOURS

Information shown in this area of the report may represent services and facilities usage, as well as direct labor. Totals are shown only for each cost category.

(7) PLANNED (TO DATE)

The approved planned man-hours assigned to all work packages or work package subdivisions identified with the indicated Cost Category (6) from the beginning of the Term (Span) (5) to the Cut Off Date (5).

(8) ACTUAL (TO DATE)

The actual man-hour expenditures incurred, charged, or assigned to all work packages or work package subdivisions identified with the indicated Cost Category (6).

(9) PLANNED (TOTALS AT COMPLETION)

The approved planned man-hours assigned to all work packages or work package subdivisions identified with the indicated Cost Category (6).

(10) LATEST REVISED ESTIMATE (TOTALS AT COMPLETION)

The latest estimate of man-hours for all the work packages or work package subdivisions identified with the indicated

Cost Category (6). This estimate is the sum of actual man-hour expenditures plus estimates-to-complete. When all work packages associated with the cost category are completed, Latest Revised Estimate (10) equals Actual (To Date) (8).

(11) PROJECTED (OVERRUN) UNDERRUN (TOTALS AT COMPLETION)

The Planned Man-hours (9) minus the Latest Revised Estimate (10). When planned man-hours exceed latest revised estimate, a projected underrun condition exists. When latest revised estimate exceeds planned man-hours, a projected overrun condition exists. The projected (overrun) underrun is also expressed as a percentage of the planned cost immediately above the number of man-hours. Parentheses are used as a notational device to indicate overruns.

(12) - (16) TOTAL COST $(000)

Cost information in this area of the report represents materials, other direct costs, labor dollar value of manpower (shown in (7) through (11)), and overhead.

(12) PLANNED (TO DATE)

The approved planned cost assigned to all work packages or work package subdivisions identified with the indicated Cost Category (6) from the beginning of the Term (Span) (5) to the Cut Off Date (5).

(13) ACTUAL (TO DATE)

The actual expenditures incurred plus any unliquidated commitments charged or assigned to work packages or work package subdivisions identified with the indicated Cost Category (6).

(14) PLANNED (TOTALS AT COMPLETION)

The approved planned cost assigned to all work packages or work package subdivisions identified with the indicated Cost Category (6).

(15) LATEST REVISED ESTIMATE (TOTALS AT COMPLETION)

The latest estimate of cost for all the work packages or work package subdivisions identified with the indicated Cost Category (6). This estimate is the sum of actual expenditures plus estimates-to-complete. When all work packages associated with the cost category are completed, Latest Revised Estimate (15) equals Actual to Date (13).

(16) PROJECTED (OVERRUN) UNDERRUN (TOTALS AT COMPLETION)

The Planned Cost (14) minus the Latest Revised Estimate (15). When planned cost exceeds latest revised estimate, a projected underrun condition exists. When latest revised estimate exceeds planned cost, a projected overrun condition exists. The projected (overrun) underrun is also expressed as a percentage of the planned cost immediately above the dollar amount. Parentheses are used as a notational device to indicate overruns.

B. Manually Prepared Reports

The following reports are manually prepared following analysis of the foregoing machine prepared reports.

PERT COST

Cost of Work Report

The Cost of Work Report, Figure VII-20, is a graphical equivalent of the Financial Plan and Status Report, with the additional feature of showing the distribution of actual costs and the value for work performed to "time now."

The Cost of Work Report is manually prepared each month from data contained in the Financial Plan and Status Report. The Cost of Work Report provides a comparison of:

- projected cost versus planned cost at completion;
- value for work performed versus actual cost to date;
- planned rate of expenditure versus actual rate of expenditure to date;
- planned rate of expenditure versus latest estimated rate of expenditure to completion.

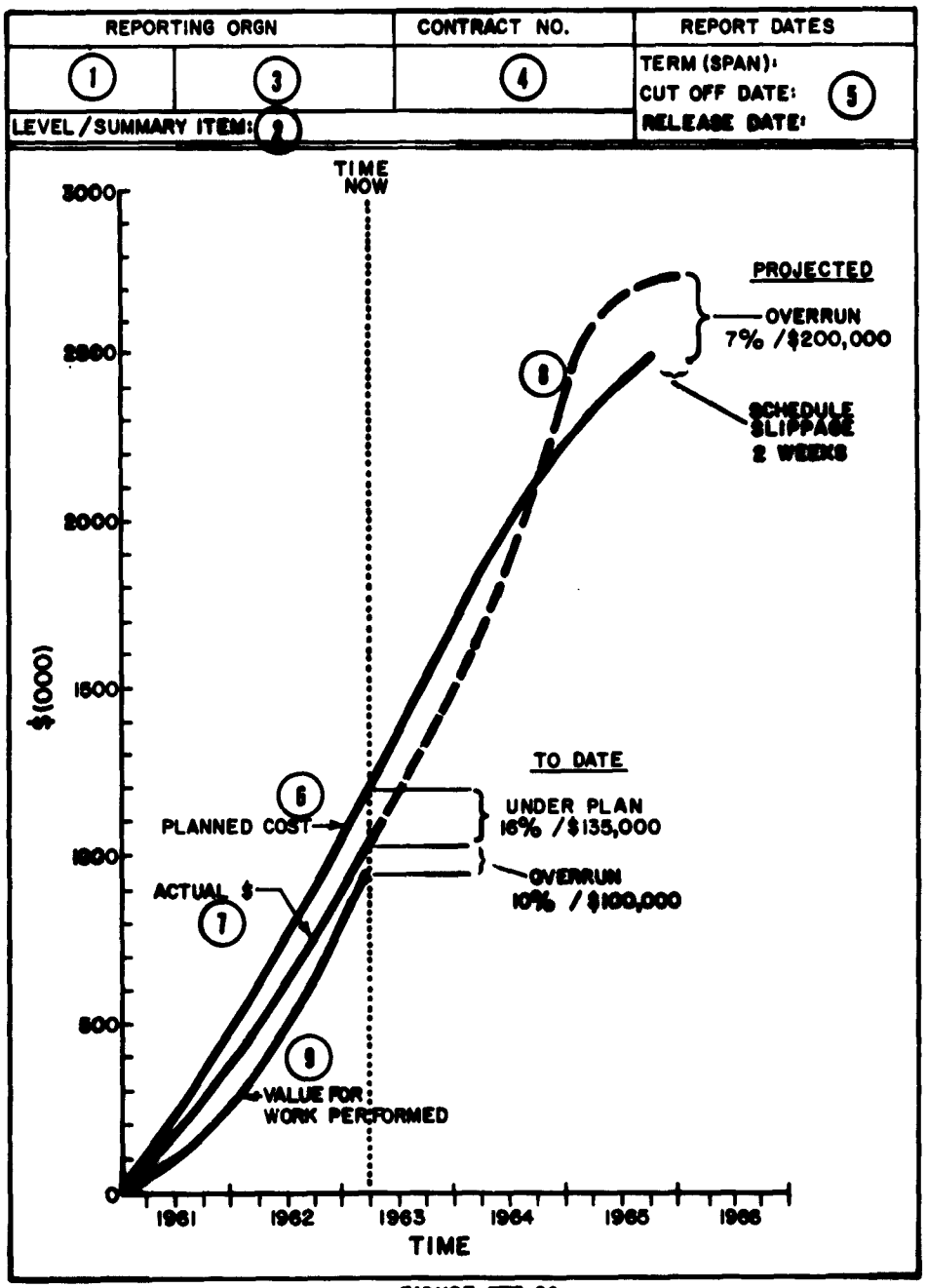

FIGURE VII-20

PERT COST — COST OF WORK REPORT

DEFINITIONS

Cost of Work Report

(1)-(5)

Standard data as listed in the Management Summary Report Definitions.

(6) PLANNED COST

The planned cost for the Summary Item (2), plotted cumulatively by month. Values are plotted each month from the Financial Plan and Status Report, column (13).

(7) ACTUAL

The actual cost for the Summary Item (2), plotted cumulatively by month. This line is developed by plotting, each month, the new cumulative actual cost from the Financial Plan and Status Report, column (12).

(8) LATEST REVISED ESTIMATE

The latest estimate of cost for the Summary Item (2), plotted cumulatively by month from "time now" to program completion. This value is available from the Financial Plan and Status Report, column (14).

(9) VALUE FOR WORK PERFORMED

The planned cost for work completed within the Summary Item (2), plotted cumulatively by month. This line is developed by plotting, each month, the new value of work performed to date from the Financial Plan and Status Report, Remarks (16) (or from the Program/Project Status Report (13)).

PERT COST

Cost Outlook Report

The Cost Outlook Report, Figure VII-21, shows (for any given level and summary item) the projected cost status at work completion. It also shows what the projected cost was at every cycle previous to the current one, thus providing for the recognition of trends.

Each month, new projections which provide new entries for the Cost Outlook Report are obtained from the Management Summary Report. The Cost Outlook Report is manually prepared by periodically plotting the projections obtained. These projections may be plotted by month for two years, after which the report is redrawn to show previous projections condensed by year.

Limit lines, established by the manager for each program, identify the values of (overrun) underrun which require a narrative analysis to be included in the Problem Analysis Report.

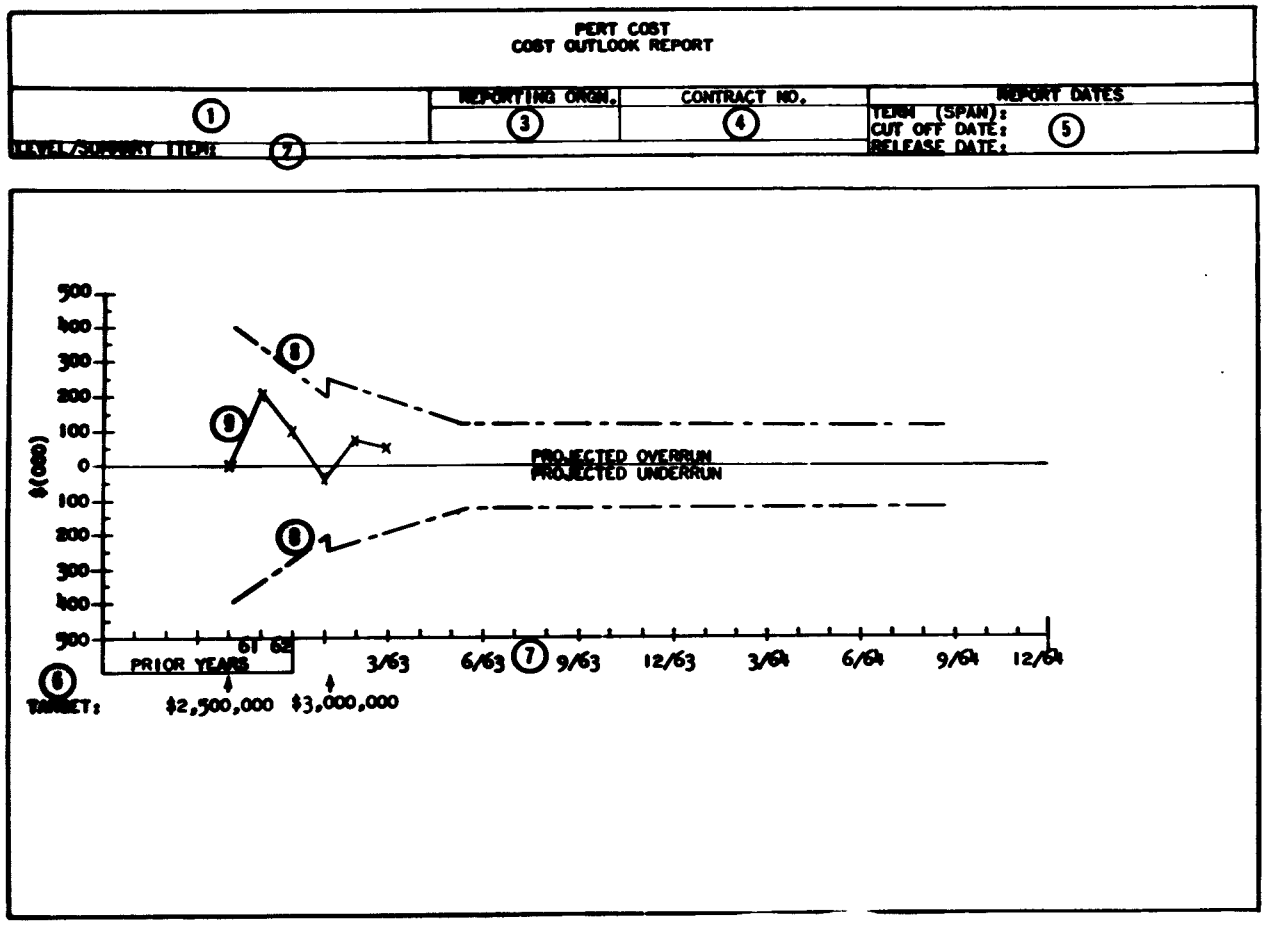

FIGURE VII-21 — PERT COST COST OUTLOOK REPORT

DEFINITIONS

Cost Outlook Report

(1)-(5)

Standard data as listed in the Management Summary Report Definitions.

(6) TARGET

The planned cost for the Summary Item (2) identified in the title block. An arrow indicates on the Calendar (7) the date when the target value was established.

(7) CALENDAR

The calendar shows two years of projected values by month and six years of condensed historical information. Managers may elect to use other time scales.

(8) LIMIT LINES

Limit lines, established for each program, identify the values of (overrun) underrun which require that a narrative analysis be included in the Problem Analysis Report.

(9) PROJECTED (OVERRUN) UNDERRUN

This value, from the Management Summary Report, Projected (Overrun) Underrun (12), is plotted each month.

PERT COST

Problem Analysis Report

The Problem Analysis Report is a narrative report prepared to supplement the Management Summary Report and other reports which identify significant problems.

The report contains three basic sections:

- a summary analysis of the contractor's portion of the program covered by the Management Summary Report;
- an analysis of the tasks in which current or potential problems exist. Problems may pertain to schedules, costs, technical performance, or combinations of these;
- a narrative description of:
  - the nature of the problem;
  - the reasons for cost and/or schedule variance;
  - the impact on the immediate task;
  - the impact on the total program; and
  - the corrective action: what action, by whom, when, and the expected effect.

Additional instructions for preparation of this report will be established by the government and the contractors for each program.

PERT COST

Schedule Outlook Report

The Schedule Outlook Report, Figure VII-22, shows (for any given level and summary item) the projected schedule status at work completion. It also shows what the projected schedule status was at every cycle previous to the current one, thus providing for the recognition of trends.

Each month, new projections are obtained from the Management Summary Report, which provide new entries for the Schedule Outlook Report. This report is manually prepared by periodically plotting the projections obtained. These projections may be plotted by month for two years, after which the Schedule Outlook Report is redrawn to show previous projections condensed by year.

This report may be prepared to reflect either of two kinds of trend information:

- A preselected significant milestone may be tracked for each item.

- The most critical activity in the item (for which E and L are shown on the Management Summary Report) may be plotted. As critical paths shift, this method will result in a "trend" line which portrays the history, not of a single milestone, but of the maximum slack value calculated for all events associated with the item.

Limit lines, established by the manager for each program, identify the values of schedule status which require a narrative analysis to be included in the Problem Analysis Report.

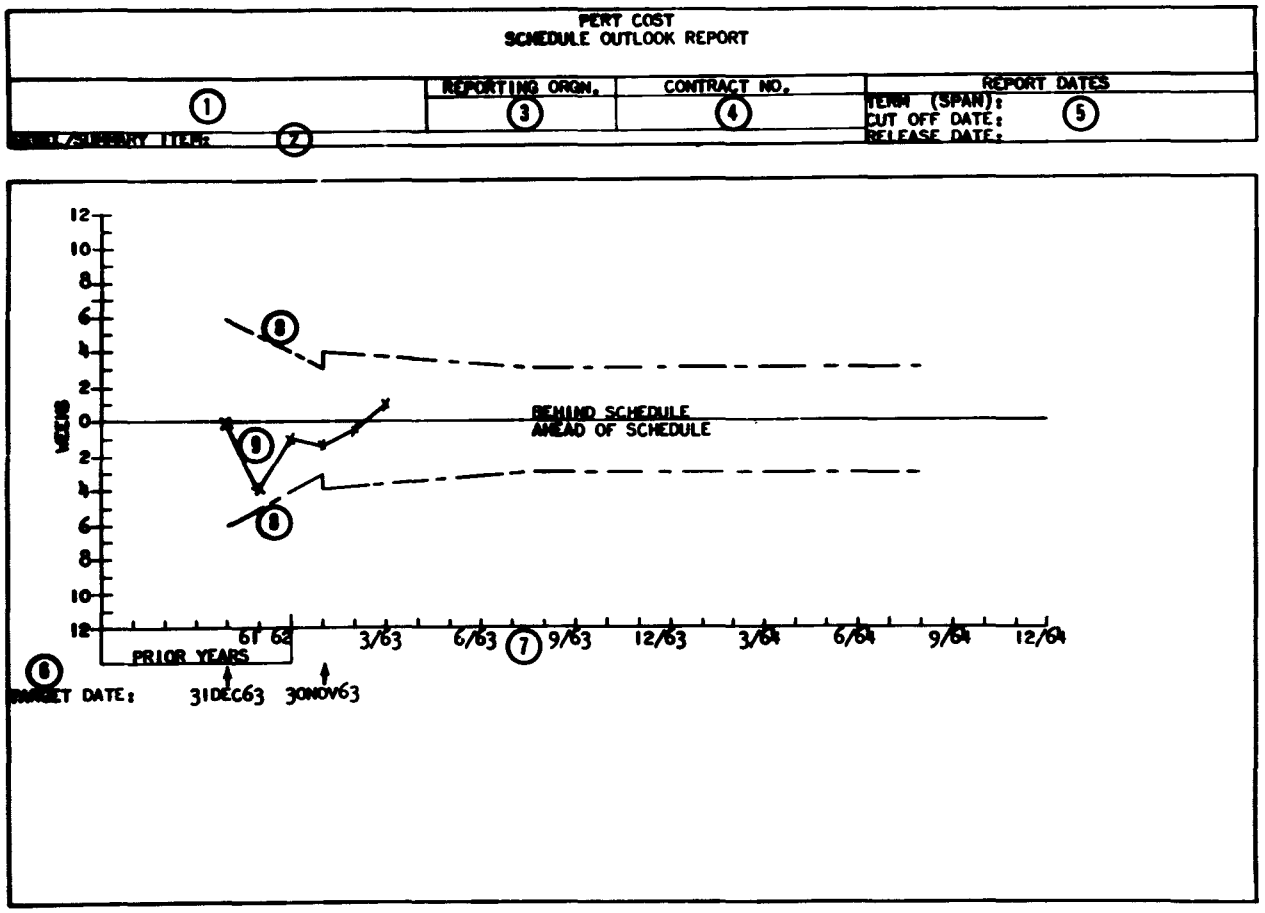

FIGURE VII-22 — PERT COST SCHEDULE OUTLOOK REPORT

DEFINITIONS

Schedule Outlook Report

(1)-(5)

Standard data as listed in the Management Summary Report Definitions.

(6) TARGET DATE

The planned scheduled completion date for the Summary Item (2) identified in the title block. An arrow indicates on the Calendar (7) the date when the target value was established.

(7) CALENDAR

The calendar shows two years of projected values to be plotted by month, and six years of condensed historical information. Managers may elect to use other time scales.

(8) LIMIT LINES

Limit lines, established for each program, identify the values of schedule slippage which require that a narrative analysis be included in the Problem Analysis Report.

(9) PROJECTED SCHEDULE STATUS

This value, from the Most Critical Slack (13) of the Management Summary Report, is plotted each month.

PERT COST

Manpower Loading Display

The Manpower Loading Display is a graphical presentation of the data contained in the Manpower Loading Report and is manually prepared. An example of a commonly used presentation format is shown in Figure VII-23. Data definitions in this figure are keyed to the definitions for the Manpower Loading Report.

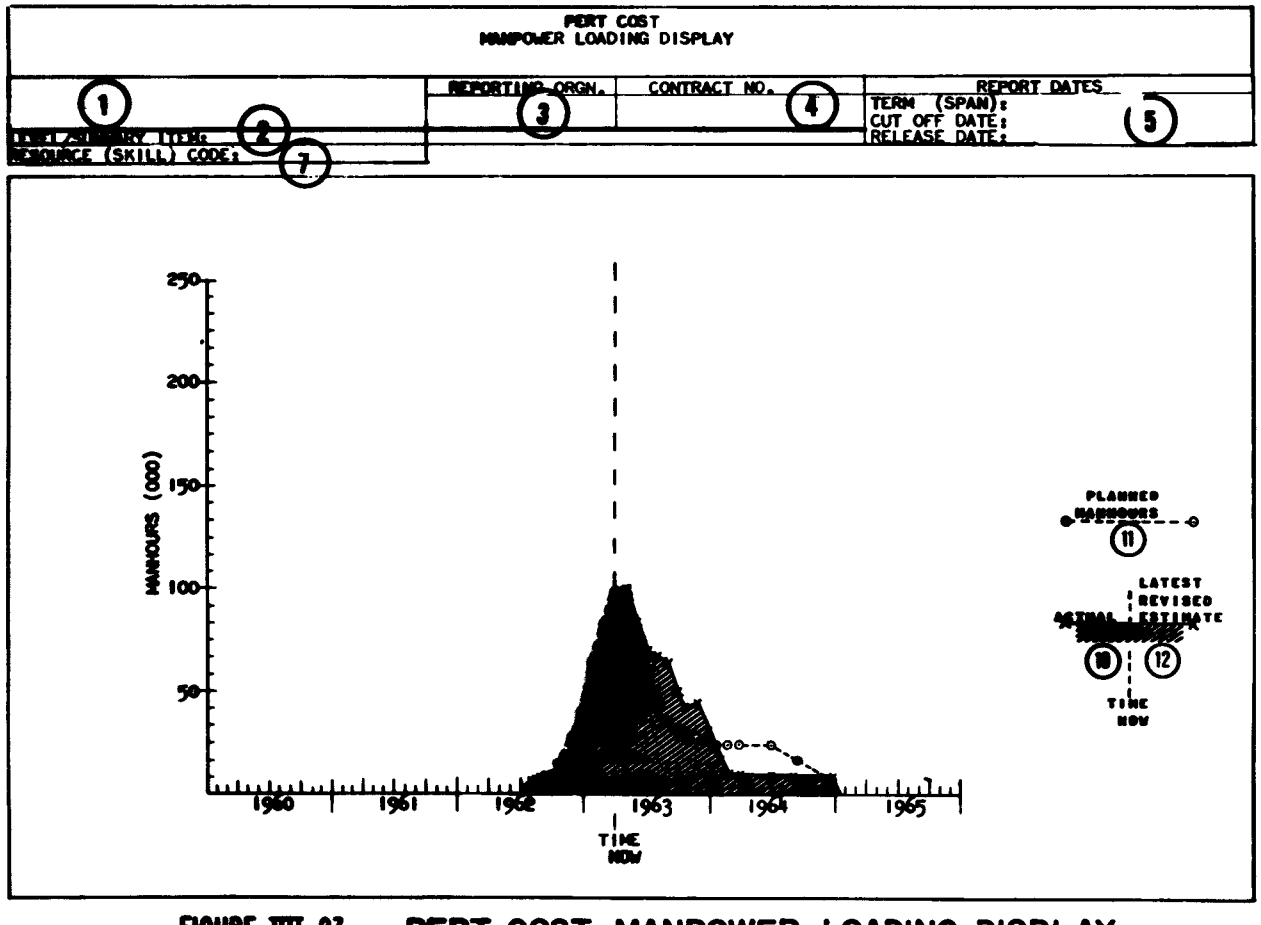

FIGURE VII-23 — PERT COST MANPOWER LOADING DISPLAY

CHAPTER VIII

ANALYSIS

CHAPTER VIII

ANALYSIS

Analysis of the PERT COST data prior to presentation of information to management is most important to the successful use of the PERT COST System. This chapter describes some of those areas in which a careful analysis is particularly important.

A. The Analysis and Presentation Functions

The PERT COST analysis must be concise, accurate, and significant for that level of management making use of it. It should:

- provide continual evaluation of current and projected program status;
- allow the preparation of program progress and problem reports to management on a cyclical basis; and
- be regularly used by management in the decision-making process and the taking of necessary corrective management action to secure timely accomplishment of program objectives within planned cost.

Program objectives and plans for their attainment are initially generated at the highest level and become progressively more detailed as they are communicated downward through the organizational structure. The reverse is true of progress reporting and evaluation, which become progressively less detailed as they are channeled upward through the organizational structure.

The analysis and the presentation of facts in consistent summary-type reports with explanations of problems provide higher levels of management with a basis for program decisions. Management confidence in these summary reports and evaluations depends upon the assurance that the information has been derived from a realistic data base. This realism

begins at the detailed work package level where estimates and actual measurements are based on relatively small, easily recognized work segments. It culminates with the ability of the analyst to interpret machine-prepared summary reports and to prepare, at each program level:

- a correct description of program status;
- an accurate description of the most critical program problems; and
- a listing of workable alternative solutions to these problems.

To provide this information, the analyst must examine each indicated potential problem area and:

- verify the reasonableness of the indication by using cross-checking methods designed to uncover data input or processing errors;
- validate the existence of the problem through discussions with the responsible organization;
- document alternate solutions through discussion with the responsible organization; and
- prepare management reports and displays which will present the problems and solutions in a format suitable to each management level.

Figure VIII-1 shows a possible format for presentation of this information to management.

The PERT COST System can produce machine prepared summary reports for several levels of management at the same time. In this way, the review of top level reports is not delayed by the lengthy process of sequential analysis at each level. The elimination of this delay, however, results in information which may not be as valid as that which has been subjected to sequential analysis. Therefore, the machine prepared reports must be directed to the analyst and should not be used by a manager before being validated.

The machine prepared reports are presented in a management display format to facilitate the analyst's preparation

of a final display after validation of the data. The following table identifies the machine prepared reports which are commonly used by the analysts to prepare three standard types of manually prepared management displays.

Machine Prepared Source Reports	Manually Prepared Reports
Management Summary Report, Project Status Report, Milestone Report, Summary Financial Forecast	Management Summary (Display and Problem Analysis)
Summary Financial Forecast, Financial Plan, Project Status Report, Prior Month Project Status Report	Cost of Work Report
Management Summary Report, Milestone Report, Summary Financial Forecast	Cost and Schedule Outlook Reports

B. Analysis of the Output Data

The following analyses are necessary in validating program status and problem indications. Each procedure discussed relates to analysis of the Management Summary Report.

1. Relationship between Time and Cost Variance

When both critical slack condition and a cost overrun are indicated for a summary item, the manager must be told whether the two indications are related. The critical slack could indicate either:

- an opportunity to apply additional resources to improve the total program schedule (unrelated to the cost overrun of this summary item); or

. a schedule slippage in the major effort of this summary item (related to the cost overrun indication).

The Schedule Option[1] is often used to facilitate this analysis operation. Significant milestones are chosen which represent the completion of the major effort in selected summary items in the near future. A scheduled date is assigned to each selected milestone, and the Schedule Option is exercised for the corresponding network event during processing by the USAF PERT computer program. Thus, the most critical path related to cost status of the summary item would be anchored to this significant milestone completion and would be easily detected.

2. Source of Cost Variance

The following analyses are typical of those required to identify indicated cost overruns and underruns:

. The Project Status Report or the lower-level Management Summary Reports are examined to identify the task(s) responsible for the variance.

. The Cost Outlook Report is examined to see if this indication is a sudden departure from the trend. If so, the responsible organization is consulted to validate the variance. (Reporting large actual expenditures to the PERT COST System prior to the calendar period for which they were planned often produces a temporary, but severe, overrun indication at summary levels.)

. The Manpower Loading Report and Financial Plan are examined to determine the time period in which the variance occurred. After consultation with the responsible organizations,

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[1]The Schedule Option allows slack calculations to be anchored on intermediate network events, treating them as network end events. A detailed explanation of Schedule Option can be found in USAF PERT, Volume I.

the plans which are susceptible to revision are identified and those dates before which revisions must be made to be effective are also identified.

3. Program Changes

Cost variance and schedule slippage indications frequently appear in reports as a result of program decisions or replanning. These situations should be identified by the analyst to avoid unnecessary management concern. Typical conditions are as follows:

- Engineering Change Proposal estimates entered in the system before budgets (planned cost) are established will cause an overrun indication.

- Trade-off decisions in other program areas may cause an overrun indication until budgets are adjusted.

- Entry of budgets into the system for calendar periods different from those for which estimates are prepared (e.g., quarters versus months, 4-4-5 versus months) may produce unmeaningful overrun or underrun indications, because the system has no valid basis for comparison of planned cost with the latest revised estimate.

The foregoing analysis examples are illustrative of the need for analysis of the machine prepared output reports prior to management use of the data. Additional description of analysis requirements is contained in USAF PERT, Volume V (USAF PERT Implementation Manual).

MANAGEMENT REVIEW AND ACTION			REPORT No. _____	
PERT ANALYSIS	ALTERNATIVES	RECOMMENDED ACTION	MANAGEMENT DECISION	DECISION RESULTS
PROBLEM: EFFECT:				
PROBLEM: EFFECT:				
PROBLEM: EFFECT:				

FIGURE VIII-1 — MANAGEMENT REVIEW AND ACTION FORMAT

APPENDIX A

PERT COST IN THE DEFINITION PHASE

APPENDIX A

PERT COST IN THE DEFINITION PHASE

The objectives of the Definition Phase are:

- to identify in detail the schedule, cost, and technical performance requirements of a weapon system before the start of full development;
- to establish firm and realistic specifications;
- to select the optimum technical approach;
- to identify high-risk areas; and
- to develop an adequate basis for a fixed price or incentive contract for the Design and Development Phase.

As a result of program definition, one of the following actions can be taken:

- negotiation of fixed price or incentive contracts for full-scale development (it is intended that CPFF contracts will be rare);
- undertaking of further exploratory advanced development of key components; or
- deferral or abandonment of the development effort.

A. Definition Phases

The Definition Phase is structured in three phases:

- Predefinition, Phase IA, encompasses the time from the Request for Approval to initiate a program to the award of Definition Phase contracts.

- Actual Definition, Phase IB, encompasses the time from award of Definition Phase contracts to submission of contractor Definition Phase reports and proposals for full-scale development.

- Decision and Phase II Contract Definitization, Phase IC, encompasses the time from submission of contractor Definition Phase reports and proposals to the award of a full-scale development contract.

The elements of these phases are listed below:

Phase IA - Predefinition

- preparation of RFP;
- solicitation of bidders;
- bidders' conference;
- exchange of information;
- evaluation of proposals;
- selection:
  - technical concepts
  - contractors
- debriefing of losers.

Phase IB - Actual Definition

- revision of specifications for Definition Phase contract;
- negotiation;
- contract awards;
- definition of:
  - concept
  - design detail

- . interface considerations
  - . management concepts
  - . schedules
  - . costs
  - . development proposal
  - . other

- . submission of final proposal;

- . provision of task assignments to contractors for Phase IC.

Phase IC - Decision and Phase II Contract Definitization

- . contractors' performance of assigned tasks;

- . department evaluation of proposals and Definition Phase reports;

- . department selection:

  - . concept
  - . contractor

- . forward of department decision to DDR&E with final TDP;

- . DDR&E approval or other action;

- . negotiation of definitized development contract;

- . announcement of winner;

- . debriefing of losers;

- . award of a definitized contract for Phase II development (note: no award of letter contract is planned).

B. PERT COST Requirements

When the Definition Phase is not used, the contractor prepares a single proposal between Request for Proposal and

contract negotiation. When the Definition Phase is used, two proposals are prepared: a firm proposal (during Phase IA) and a "planning purpose" proposal (during Phase IB).

The most detailed implementation of PERT during the Definition Phase occurs in Phase IB. During Phase IA, the contractor develops the PERT System in response to a specimen Work Statement only and, in general, the work performed is less detailed and less refined than it would be for a proposal under a non-Definition Phase procedure. During Phase IB, however, the work required to accomplish the end items of the program is defined in greater detail. Figure A-1 charts the differences among PERT COST application to three proposal phases.

	PROPOSAL PREPARATION		
	NO DEFINITION PHASE	DEFINITION PHASE	
		PHASE IA	PHASE IB
Work breakdown structure end-item subdivisions	Extended to lowest level to which the program is defined at this time.	Extended to lowest level to which the program is defined at this time.	Extended to level at which manageable units for planning and control exist.
Work packages	Not normally defined.	Not normally defined.	Work packages defined.
Networks and activity time estimates	Preliminary networks expanded.	Preliminary networks expanded.	Good detailed networks developed, suitable for integration into Operating Program Management Networks.
Schedules	Schedule comparisons made between program milestones and calculated event dates on preliminary networks.	Schedule comparisons made between program milestones and calculated event dates on preliminary networks.	Development of schedule dates sufficient to enable commitment on proposed completion dates and cost estimating at the work package level for summarization into firm proposal.
Cost estimates	Made at level of firm task definition (for summarization into proposal).	Made at level of firm task definition (for summarization into budgetary cost estimates).	Made at work package level (for summarization into proposal).

FIGURE A-1

DEGREE OF PERT COST APPLICATION TO CONTRACTOR PROPOSAL PREPARATION

APPENDIX B

GLOSSARY OF SYMBOLS AND TERMS

APPENDIX B

GLOSSARY OF SYMBOLS AND TERMS

SYMBOLS

A = An abbreviation for T_A used in graphic reports.

E = An abbreviation for T_E used in graphic reports.

L = An abbreviation for T_L used in graphic reports.

S = An abbreviation for T_S used in graphic reports.

S_E = Earliest completion date for an activity (based on t_s).

S_L = Latest completion date for an activity (based on t_s).

T_A = Actual date on which an event occurs or an activity is completed.

T_D = Directed date for an event.

t_e = Expected elapsed time for an activity.

T_E = The expected date on which an event will occur.

T_L = Latest allowable date for an event (based on t_e).

t_s = Scheduled elapsed time for an activity.

T_S = Scheduled completion date for an activity or event.

TERMS

Account Code Structure

The numbering system used to assign summary numbers to elements of the work breakdown structure and charge numbers to individual work packages.

Activity

A work effort of a program, which is represented on a network by an arrow. An activity may also simply represent a connection or interdependency between two events in the network. An activity cannot be started until the event preceding it has occurred.

Activity Slack (See Slack)

Actual Costs

The incurred expenditures plus any unliquidated commitments charged or assigned to a work effort.

Actual Date (T_A)

The calendar date on which an event occurred or an activity was completed. This date must not be later than the report date, and the beginning event must have occurred.

Beginning Event (BE) (Predecessor Event)

An event which signifies the beginning of one or more activities on a network.

Charge Number

A number used for identifying the costs charged to a work package.

Commitment

An obligation within a corporate or government organization to charge cost against a specific work package or summary item. This charge may be made in advance of a legal obligation against the contract.

Completion Date (See Actual Date)

Constraint

The relationship of an event to a succeeding activity wherein an activity may not start until the event preceding it has occurred, and the relationship of an activity to a succeeding event wherein an event cannot occur until all activities preceding it have been completed.

Contract Number

The assigned government contract code.

Cost Activity

An activity which employs resources, the costs of which are a direct charge to the program.

Cost Category

The name and/or number of a functional, hardware, or other significant identification for which costs are to be summarized.

Critical Path

That particular sequence of events and activities in a path that has the greatest negative or least positive slack; therefore, the longest path through the network.

Direct Cost

Costs charged directly to the contract (see ASPR 15-202).

Directed Date for an Event (T_D)

Date for a specific accomplishment, directed by USAF, DOD, or similar top level authority.

Earliest Completion Date (S_E)

The earliest calendar date on which a work effort (activity, work package, or summary item) can be completed. This date is calculated by:

- summing the scheduled elapsed times (t_s) for activities on the longest path from the beginning of the program to the end of the work effort; and
- then adding this sum to the calendar start date of the program.

For distant time effort where scheduled elapsed times (t_s) have not been established, expected elapsed times (t_e) will be used to calculate S_E.

Ending Event (EE) (Successor)

The event which signifies the completion of one or more activities.

Estimate-to-Complete

The estimated man-hours, costs, and time required to complete a work package or summary item (includes applicable overhead except where only direct costs are specified).

Event

A specific, definable accomplishment in a program plan, recognizable at a particular instant in time. Events do not comsume time or resources.

Event Slack (See **Slack**)

Expected Date (T_E)

The calendar date on which an event is expected to occur. It is calculated by adding to the date of each start event or completed event of the network the activity times along each possible path up to the event under consideration. The latest of these computed dates is the expected date of completion for the event.

Expected Elapsed Time (t_e)

The statistically derived estimate of the time an activity is expected to consume. (See USAF PERT, Vol. I)

Expenditure

Actual disbursement of funds for in-plant or subcontract expense against a contract.

First Event Number

The number of the first event in time for a work package or summary item. This event number defines the beginning of the work package or summary item in relation to the network.

Indirect Cost

Cost which is prorated or allocated to a contract (see ASPR 15-203).

Labor (Direct)

Direct man-hours or dollars expended by personnel involved in direct labor activities which affect the accomplishment of contract articles.

Last Event Number

The number of the last event in time (based on S_E) for a work package or summary item. This event number defines the end of the work package or summary item in relation to the network.

Latest Allowable Date (T_L)

The latest date on which an event can occur without creating an expected delay in the completion of the program. The T_L value for a given event is calculated by subtracting the sum of the expected elapsed activity times (t_e) for the activities on the longest path from the given event to the end event of the program from the latest date allowable for completing the program.

Latest Completion Date (S_L)

The latest calendar date on which a work effort (activity or work package) can be scheduled for completion without creating a delay in the completion of the program. This date is calculated by:

- summing the scheduled elapsed times (t_s) for activities on the longest path from the end of the work effort to the end of the program; and then
- subtracting this sum from the calendar end date of the program.

For distant time effort, where scheduled elapsed times (t_s) have not yet been established, expected elapsed times (t_e) will be used to calculate S_L.

Latest Revised Estimate

The sum of the actual incurred costs plus the latest estimate-to-complete for a work package or summary item as currently reviewed and/or revised (including applicable overhead except where only direct costs are specified).

Major Subcontractor

A subcontractor so identified by mutual agreement between the System Program Office and the prime or associate weapon system contractor.

Material Cost

Cost of material and purchased parts (including semi-fabricated) consumed in in-plant manufacturing processes and charged directly to the contract. This amount specifically excludes subcontract costs.

Most Critical Slack (Weeks)

The worst (least algebraic) slack with respect to designated program end points for any of the activities within the work package or summary item. This slack is based on $S_L - S_E$ for each activity. The slack indicated will not necessarily be the difference between the S_L and S_E for the end of a work package or summary item, since the worst slack situation may be associated with an activity within the work package or summary item, rather than at the end of the work package.

(Over) Under Plan

The planned cost to date minus the actual cost to date. When planned cost exceeds actual cost, a projected under-

plan condition exists. When actual cost exceeds planned cost, a projected over-plan condition exists.

(Overrun) Underrun (Projected)

(See Projected (Overrun) Underrun)

(Overrun) Underrun (Work Performed to Date)

The value for the work performed to date minus the actual cost for that same work. Where value exceeds actual cost, an underrun condition exists. When actual cost exceeds value, an overrun condition exists.

Planned Cost

The cost approved by management for a work package or a summary item. For a work package, this cost may be derived by direct estimate or by breakout of a planned cost for a larger item. For a summary item, this cost may be derived by a direct estimate or by summing planned cost of subordinate items. The sum of all planned costs for work packages and summary items should equal the total planned cost for the program.

Program Breakdown Structure

Used interchangeably with work breakdown structure (see Work Breakdown Structure).

Projected (Overrun) Underrun

The planned cost minus the latest revised estimate for a work package or summary item. When planned cost exceeds latest revised estimate, a projected underrun condition exists. When latest revised estimate exceeds planned cost, a projected overrun condition exists.

Resource Code

A code to indicate the type of resource applied to the work package by the performing organization.

Scheduled Completion Date (T_S)

A date assigned for completion of an activity or accomplishment of an event for purposes of planning and control within an organization.

Scheduled Elapsed Time (t_s)

The period of time scheduled for the performance of an activity.

Slack

Activity Slack - The activity's latest completion time minus its earliest completion time. The activity slack is always greater than or equal to the slack of the activity's ending event.

Event Slack - The time difference between the latest and expected dates for an event ($T_L - T_E$).

Slack may be positive, zero, or negative.

Subcontract Costs

Costs of the work of a manufacturer other than the reporting contractor in accordance with designs, specifications, or direction of the reporting contractor, and designed specifically for the subsystem being reported.

Summary Item

An item appearing in the work breakdown structure and

used for the purpose of summarizing cost.

Summary Level

The number of the tier or level on the work breakdown structure at which a summary number appears.

Summary Number

A number which identifies a summary item.

Unliquidated Commitment

That portion of a commitment for which payment has not been made.

Value (Work Performed to Date)

The planned cost for completed work, including that part of work in process which has been finished. This value is determined by summing the planned cost for each completed work package. If a work package is in process, the part of its total planned cost which applies to work completed is approximated by a method such as an application of the ratio of actual cost to latest revised estimate for that work package.

Work (Program) Breakdown Structure

An orderly program definition which depicts the end items of the program, their subdivisions, and their interrelationships. The work breakdown structure establishes the framework for:

- defining the work to be accomplished;
- constructing a network plan; and
- summarizing the cost and schedule status of a program for progressively higher levels of management.

Work Package

The unit of work required to complete a specific job or process, such as a report, a design, a piece of hardware, or a service. The content of a work package may be limited to the work which can be performed by a single operating unit in an organization or may require the contributing services of several operating units. The overall responsibility for the work content of a work package should be assigned to a single organization or responsible individual. The work package is the basic unit for assigning schedule and cost responsibility to first level supervision and, as such, is the basic element in the PERT COST System.