SC-R-65-902
Conf-650327-2

MASTER

Sandia Corporation

REPRINT

NAMDA-A New Method of
Computerized Management Control

by

G. L. Morrisroe

APPROVED FOR PUBLIC RELEASE

JUNE 1965

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Issued by
Sandia Corporation,
a prime contractor to the
United States Atomic Energy Commission

LEGAL NOTICE

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

NAMDA

A NEW METHOD OF COMPUTERIZED MANAGEMENT CONTROL

By
G. L. Morrisroe, Supervisor
Tester and Facilities Application Div.
Sandia Corporation
Albuquerque, New Mexico

For presentation at The American Society of Tool and Manufacturing Engineer's annual Engineering Conference to be held in Cleveland, March 29 to April 2, 1965.

ABSTRACT

Programming and scheduling the development of hundreds of different types of product testers pose problems which do not lend themselves to conventional PERT methods. A new technique developed by Sandia Corporation to resolve these problems is known as NAMDA (Network Analysis in Multiple, Dissimilar Applications). This system employs the same IBM/PERT computer program used for weapon programming modified to standardize and separate all activities related to product tester development. Each tester is treated as a separate network, and the resulting reports compile data to show slack times and work loads at each stage of development. NAMDA has improved "on-time" deliveries of product testers, and refinements to the technique promise still further improvement.

NAMDA: A NEW METHOD OF COMPUTERIZED MANAGEMENT CONTROL

Introduction to NAMDA

NAMDA (Network Analysis in Multiple and Dissimilar Applications) is a new method of computerized management control for product tester development at Sandia Corporation. Under a prime contract with the Atomic Energy Commission, Sandia Corporation is responsible for the design of the non-nuclear portions of atomic weapons. Several hundred product tester designs, in various stages of development and modification, are continually in process. Only a few testers of each design are required. In addition, since testers are usually required with the beginning of production, simultaneous development of component and tester is required. The problem is made even more complex by changes in designs as development proceeds as new materials become available, etc. The result has been an almost insuperable task of managing the development and production of the testers.

To meet this challenge, a method was developed that has come to be termed NAMDA (which aptly enough is the Hindi word for "carpet" and is suggestive of the all-inclusive covering of product tester programming that NAMDA has been designed to perform). It is intended--and so far with much success--to apply computerized PERT techniques to programming and scheduling of hundreds of designs so that critical production schedules can be met.

A description of the NAMDA technique has appeared in The Tool and Manufacturing Engineer (October 1963). The following material presents some of the background information appearing in the article and adds refinements made to the method since the article was prepared. It also discusses innovations that are currently being planned.

History of NAMDA Development

About three years ago, Sandia Corporation became interested in PERT and decided to experiment with it as a programming tool in the development of weapon systems and components. Most network diagrams for Sandia products showed a path for the concurrent development of a product tester. Unfortunately, the number of activities shown for the product tester varied from product network to product network. That is, one engineer's idea of the detail required in networking his product would differ in complexity from the next engineer's, even though the same basic steps were involved. It was therefore decided to standardize on the activities to be used in networking product testers. With hundreds of testers in various stages of development at all times, it was necessary to keep the number of standard activities to a minimum. We in the programming organization chose five basic activities, each representing separate functions and organizations. In order to differentiate these activities from other activities in a product network, we assigned the prefix "X" to the basic numbers. Standard networks are used so that there is no need to prepare a new diagram for each tester as it enters development. Since all steps are standardized, confusion and misinterpretation of planning documents are minimized.

The standardized activities, or stations, in tester development are as follows:

- X 1 - Design sketch and advance ordering information (AOI)
- X 2 - Drawing release
- X 3 - Fabrication

- X 4 - Design audit (engineering review of the prototype to ensure compliance with the design intent)
- X 5 - Equipment qualification (a check out of the tester by the user's representative and others to functionally verify the calibration and operating procedures)

While similar to PERT, NAMDA offers some important differences. Usually in PERT, a great number of varied activities progress toward a single final objective called the terminal event. In NAMDA, many jobs are programmed simultaneously on a continuing basis, each job with a limited number of fixed activities and its own terminal event.

It is no problem to arrange a PERT network diagram for a specific tester. Figure 1 is a classic example of a network for a typical product tester. Its 41 activities may not be too detailed for a single project but are certainly far too complex when a continuous flow of several hundred product testers must be controlled. The X 1 thru X 5 steps are in effect a skeletonized network extracted from this typical network.

Figure 2 illustrates examples of our standard networks. (Note that the examples have extra activities "X 0" and "X 6." These are not really activities but extra places to add ordering information so that the printouts will be complete.)

Figure 3 shows examples of how the individual networks are fitted into subnets, which are normally used to provide interfaces. We use them to ensure that individual predecessor and successor event numbers will relate to the product tester number so that sequential sorting can be accomplished.

The "X 1" thru "X 5" steps are interchangeable between the NAMDA report and the product network diagrams. The true required date is predicated upon the date established by PERT in the network analysis of the product.

Because product test requirements may be refined after the product has been in production for some time, many testers are designed when no component network diagram is available. Nevertheless, we still use the same five basic steps for our input to the overall NAMDA computer program.

Problems Encountered in Developing NAMDA

Previous to NAMDA, several attempts had been made to automate the compilation of data and to record and report status. Before the application of PERT to product testers, completion estimates were reported on typed multi-lith masters. Typing and reproduction workloads caused considerable delay between the final report date and the publication of the report.

A system of punch card recording was then developed which showed some improvement but had many drawbacks because of the codes necessary for the input data. Coding made the reports difficult to decipher, and consequently these reports were not well received by the users of the report.

Another attempt using punched cards was more successful but still left much to be desired. Although we were able to record all activity promises and completions on a single card for each product tester and were able to sort in many different ways, the method was limited in that it had no capability for calculating slack time.

When we started to work on the PERT applications, we were not sure that it would be possible to show several hundred different paths, each with a common dummy start event and with separate end events.

After experiments with a program obtained from an aircraft company, an attempt was made to apply PERT techniques to the product tester problem by means of a PERT program specially developed by IBM for the IBM 7090, which is in use at Sandia on weapon system programs. Even though this program is

sophisticated, fast, and flexible, it first appeared to have a serious limitation as far as our problem was concerned. The program has a capacity for 100 subnets of 750 activities each. However, product tester designs, which are numbered in sequence, now exceed 1400. Product tester designs might have anywhere from one to hundreds of subseries. A problem therefore arose in assigning subnets so that sufficient activities would be available for the required computation. This problem was solved by assigning groups of lightly populated series to a single subnet, with its 750 activities, and assigning many subnets to the heavily populated series. Once this obstacle was overcome, we were able to proceed more decisively. The computer program takes our time estimates and converts them into dates which show positive and negative slack based on the differences between the expected completion date (determined by the computer) and the requested delivery date. Since each tester network has its own terminal event, each network is its own path (critical or noncritical), independent of all others.

Printouts are available in a variety of sorts and can become extremely voluminous. We had to be careful to submit reports to the various organizations that were tailored strictly to their needs or the system would suffer criticism. For example, if we submit to the design group a printout of all activities for all product testers in process, that group may claim that it was being overwhelmed with paper. Since we have three separate design groups, we separate the sorts by group so that each design group receives reports only on those testers for which it is responsible.

The NAMDA report is updated and published twice a month. Input is received from nine different organizations: three design groups (who also report on Design Audit), two drafting groups, two fabrication groups, one Equipment Qualification group, and the ordering group who report on subcontracted jobs. In addition to these groups, we supply the published reports to 23 other groups who represent the requesting organizations.

Interpretation of Printouts

Although we have tried to keep codes to a minimum, a few still must be used by the computer and require explanation. (See Fig. 4.) In the columns labeled "Completion Dates," some of the dates have a prefix letter. The letter "A" indicates all accomplished activity. The letter "X" indicates all activity which is past due, and the letter "D" indicates a date due to occur within the next 30 working days. Those dates without a prefix are not due to occur until after 30 days.

In addition, we have added an asterisk on the activity line which shows the station at which the tester is currently available for work. This acts as a signal to the station supervisor indicating to him the jobs on which he can proceed. Those without the asterisk are at an earlier station.

Note that no time estimates appear if the activity has been completed and that no time estimates are needed in the "X 0" and "X 6" activities which as previously stated are used for ordering information.

The "X 0" thru "X 6" activities are shown as the last two digits in the extreme right-hand column labeled "Dept." This column also shows a two-letter code in some cases to indicate the name of our suppliers. If a job is planned to be subcontracted, we use the word "open" to show that the contract has not yet been placed.

The different types of sorts which we have found useful are:

1. By successor event number (lists all product testers

- numerically with all activities), Fig. 5.
2. By slack (lists all product testers with all activities, starting with the greatest amount of negative slack, then proceeding to the greatest amount of positive slack, or "float"), Fig. 6.
 3. By due date within department (lists all product testers chronologically in the station responsible for the activity, i.e., a design group would get only a listing of design activities, a drafting group would get only a listing of drafting activities, etc.). This sort also deletes completed activities and lists only those activities that have already started or are due to start within the next 30 working days. Figure 7 is a composite of tab runs for each of several typical stations.

The IBM/PERT computer program is designed to print in double spacing, which makes the report easier to read when unrelated activities are listed. However, since NAMDA uses standard activities X 1 thru X 5, several reports have been programmed in groups of five activities in single spacing--the groups being separated by double spaces. The reports are therefore concise and readable in spite of the hundreds of testers and activities listed.

For the purpose of clarity we delete predecessor and successor event numbers in those tab runs. Fig. 8.

A unique management summary report was developed after the flaws in the initial system had been eliminated. This report is referred to as the "Dear Bill" report. Bill, the head of the product tester design group had argued that the regular tab runs were too bulky. He felt that such a highly sophisticated computer as the IBM 7090 should be able to send him a letter telling him of all trouble and potential trouble areas. The programmer obliged by providing him with an automated report (Fig. 9) which starts off:

"Dear Bill:

According to the NAMDA report, with a data date of 15 Oct. '64, some product testers are falling behind expectations. The following testers have not completed design within 3 months from date of initiation, . . .

Yours truly,

IBM 7090"

In addition, another report is generated for Bill's subordinate supervisors which forewarns them of testers which will be listed in the next Dear Bill letter unless they take corrective action in the meantime. Fig. 10.

This system has worked so well that we plan to use it for drafting, fabrication, and equipment qualification in which case, the new letters will begin: Dear Fred, Dear Bob, and Dear Doc.

Updating the Reports

One of our biggest problems in this system is updating. Because our work on product testers lies largely in developing prototypes, we are subject to constant design revisions. Consequently, time estimates are continually being changed. It is very difficult to determine when an activity is really declared completed. For example, the design engineer's estimate for completion of a design may change during the design process, thus

forcing him to redesign after he has turned the job over to drafting. Drafting claims that the start date given them is invalid because of the redesign and their time estimates must therefore change. The same thing may occur after Drafting has released the job to Fabrication; the Fabrication people claim that they no longer have as much time to do the job as originally estimated and so on.

We now use a production traveler form to advise the programming people of activity completions, although we must rely on weekly meetings to adjust time estimates.

This system does not attempt to plan each station's shop load, but it does focus attention on the number of jobs assigned to each shop (station) and on its estimates for completing them. With some historical data, another step has been taken to relate performance with predictions in order to help arrive at more factual estimates. Several jobs were reviewed which had been initiated during development of the new system. This analysis revealed some interesting figures. Some groups were consistently optimistic in their time estimates, and some were almost equally pessimistic. To counter this tendency, we have started to use only the optimistic time estimate for those stations which have been repeatedly too early on their jobs and the pessimistic time estimate for those stations which have been too late. The computer accepts the single time estimate as if it were "most likely", thus we arrive at more reliable delivery promises. It is obvious that considerable coaching of the individuals making the time estimates was needed in order to become more precise. The results of these efforts are starting to show. More realistic estimates are being received from the functional organizations. These estimates are reflected in more accurate delivery promises to ultimate users. Backlogs at all stations are reduced. The jobs take just as long to do, but, because of the general awareness of the total workload at all stations, work can be subcontracted when it becomes evident that the backlog is getting too high. The supervisors at the individual stations avoid accumulating work that they cannot finish in time.

The IBM/PERT program referred to is a PERT/TIME/COST Program. An additional capability is PERT/MANPOWER. Since our problems have been chiefly in getting reliable time estimates, the PERT/MANPOWER aspect offers some possible solutions. We have explored this area but have not launched a full program as yet. One of the most difficult problems confronting us is gaining acceptance by the principals involved. Salaried personnel, particularly engineers, resist any system that requires a precise recording of time spent on a job. This seems too much like punching a time clock, and they object. Nevertheless, we continue to experiment with the system in the hope that when we can present some successful working models our plan will become more acceptable. It is obvious to those of us in the programming organizations that to optimize time estimates we would require accurate time allocations. With time allocations subtracted from available times, we could then demonstrate anticipated overload or underload whether it be in the Design, Drafting, or Fabrication shop.

The input requirements for the IBM/PERT/MANPOWER program require that each job be designated as a skill. Each worker has a skill code which must be used in reporting work accomplished.

After studying available information regarding a few Manpower Allocation Systems, we have come to the conclusion that most methods deal with production line application and are designed for total system application. One system which came close to suiting our needs was RAMPS (Resource Allocation and Multi-Project Scheduling) which is put out by C.E.I.R. Although

this offers many desirable features, we felt that we would be better off to use the manpower capability of our existing IBM/PERT/COST program since it is handling the NAMDA aspect of our program.

Another type of management report is under development. This will give supervision at each station a list of all jobs whose schedules have been extended, how many times they have been extended, how many weeks they have been extended, and the responsible organization.

The continuing development of these various kinds of reports has paid off in a more orderly flow of product testers to the users. We have attempted to solve the most critical problems with automated reports. As these problems are resolved, we attack the next most critical ones with similar techniques. The result has been very encouraging. More product testers are delivered on time, and frantic effort to meet schedules is minimized. With testers designed and built in a calmer atmosphere, quality has improved. The design engineer has a greater opportunity to prepare a better and more sophisticated design--and in many cases with an advance in technology. Development and application of NAMDA has been accomplished with no increase in manpower and shows promise of even greater rewards as techniques are improved.

A CLASSIC EXAMPLE OF A DETAILED NETWORK FOR A PRODUCT TESTER

FIG. 1

STANDARD NETWORK DIAGRAMS FOR PRODUCT TESTERS

FIG. 2

EXAMPLES OF PRODUCT TESTER SUB NET DIAGRAMS

NOTE: DIFFERENCE BETWEEN "EQ & SHIP" DATE AND REQ'D DATE EQUALS SLACK TIME (POSITIVE OR NEGATIVE).

FIG. 3

FIG. 4

ACTIVITY TIME STATUS REPORT										PAGE 10	
PROGRAM PT NAMDA REPORT			(PT NET)				RUN DATE- 01SEP64 DATA DATE 31AUG64 (BY SUCCESSOR)				
LEVEL	DETAIL		CONTRACT NO.	NONE		COMPLETION DATES		SCHED.	DEPT.		
PRECE EVENT	SUCC. EVENT	C	ACTIVITY DESCRIPTION	TIME ESTIMATES		SLACK	COMPLETION DATES	DATE			
				A	M	B	PRIMR	SECON	EXPECTED	LATEST	
030745	030745		307-466/1 SKETCH/ADI(BX)	.	.	.	+	2.2	A14MAY64 X29MAY64	2452X1	
66010	66011		307-466/1 ISSUE 1 DRGS	.	.	.	+	2.2	A14MAY64 X29MAY64	BX X2	
030745	030745		307-466/1 FABRICATE W/AUD	.	.	.	+	2.2	A17AUG64 X01SEP64	BX X3	
66012	66013		307-466/1 CHECK BX AUDIT	1.0	2.0	3.0	+	2.2	X31AUG64 D16SEP64	2452X4	
030745	030745		307-466/1 EQ AND SHIP	1.0	2.0	3.0	+	2.2	D15SEP64 D30SEP64	2513X5	
66013	66014		307-466/1 021691	.	.	.	+	2.2	D15SEP64 D30SEP64 30SEP64	BX X6	
030745	030745										
00002	66020		307-466/2 W/R 5084 CF1018	.	.	.	+	2.2	A14MAY64 X29MAY64	1511X0	
030745	030745		307-466/2 SKETCH/ADI(BX)	.	.	.	+	2.2	A14MAY64 X29MAY64	2452X1	
66020	66021		307-466/2 ISSUE 1 DRGS	.	.	.	+	2.2	A14MAY64 X29MAY64	BX X2	
030745	030745		307-466/2 FABRICATE W/AUD	.	.	.	+	2.2	A17AUG64 X01SEP64	BX X3	
66021	66022		307-466/2 CHECK BX AUDIT	1.0	2.0	3.0	+	2.2	X31AUG64 D16SEP64	2452X4	
030745	030745		307-466/2 EQ AND SHIP	1.0	2.0	3.0	+	2.2	D15SEP64 D30SEP64	2513X5	
66022	66023		307-466/2 Q 3728	.	.	.	+	2.2	D15SEP64 D30SEP64 30SEP64	QA X6	
030745	030745										
00002	67010		307-467/1 W/R 5093 CS103	.	.	.	+	2	A27MAY64 X28MAY64	7437X0	
030745	030745		307-467/1 SKETCH/ADI	.	.	.	+	2	A27MAY64 X28MAY64	2453X1	
67010	67011		307-467/1 ISSUE 1 DRGS	.	.	.	+	2	A26JUN64 X29JUN64	4411X2	
030745	030745		307-467/1 FABRICATE	6.0	9.0	10.0	+	2	X31AUG64 X01SEP64	4234X3	
67011	67012		307-467/1 DES AUDIT	1.0	2.0	3.0	+	2	D15SEP64 D16SEP64	2453X4	
030745	030745		307-467/1 EQ AND SHIP	1.0	2.0	3.0	+	2	D29SEP64 D30SEP64	2513X5	
67012	67013		307-467/1 NP-100307	.	.	.	+	2	D29SEP64 D30SEP64 30SEP64	7437X6	
030745	030745										
00002	68010		307-468/1 W/R 5093 CS1031	.	.	.	+	4	A27MAY64 X29MAY64	7437X0	
030745	030745		307-468/1 SKETCH/ADI	.	.	.	+	4	A27MAY64 X29MAY64	2453X1	
68010	68011		307-468/1 ISSUE 1 DRGS	.	.	.	+	4	A26JUN64 X30JUN64	4411X2	
030745	030745										
68011	68012										

FIG. 5

ACTIVITY TIME STATUS REPORT										PAGE 1	
PROGRAM PT NAMDA REPORT			(PT NET)					RUN DATE- 01SEP64 DATA DATE 31AUG64 BY PRIMARY SLACK			
LEVEL	DETAIL		CONTRACT NO.		NONE		COMPLETION DATES		SCHED.	DEPT.	
PRECE EVENT	SUCC. EVENT	C	ACTIVITY DESCRIPTION	TIME A	ESTIMATES - M B	SLACK PRIMR	SECOND	COMPLETION EXPECTED	DATES LATEST		
135000	135000		START SUBNET 135000	.	.	.	-22.0	A31JUL62	X23FEB62	2625	
00000	00002	S									
135000	135000		1374 / 1W/R 5127 MET CR	.	.	.	-22.0	A09JUL64	X03FEB64	1123X0	
00002	74010							D03SEP64	X31MAR64	2452X1	
135000	135000		1374 / 1SKETCH/ADI	8.0	8.0	8.0	-22.0				
74010	74011										
135000	135000		1374 / 1ISSUE 1 DRGS	10.0	10.0	10.0	-22.0	16NOV64	X10JUN64	4411X2	
74011	74012										
135000	135000		1374 / 1FABRICATE	12.0	16.0	20.0	-22.0	12MAR65	D02OCT64	4234X3	
74012	74013										
135000	135000		1374 / 1DES AUDIT	2.0	3.0	3.0	-22.0	01APR65	22OCT64	2452X4	
74013	74014										
135000	135000		1374 / 1EQ AND SHIP	1.0	1.0	2.0	-22.0	09APR65	30OCT64	2513X5	
74014	74015										
135000	135000		1374 / 1NEED ORDER	.	.	.	-22.0	09APR65	30OCT64 30OCT64	1123X6	
74015	74016										
135000	135000		1374 / 1PT COMPLETION	.	.	.	-22.0	09APR65	30OCT64 30OCT64	DUMMY	
74016	00000	E									
120000	120000		START SUBNET 120000	.	.	.	-11.6	A31JUL62	X08MAY62	2625	
00000	00002	S									
120000	120000		1241 / 2 ORDER REC S41195	.	.	.	-11.6	A10JUN63	X19MAR63	2544X0	
00002	41020										
120000	120000		1241 / 2 SKETCH/ADI (GL)	.	.	.	-11.6	A09JUL63	X16APR63	2453X1	
41020	41021										
120000	120000		1241 / 2 ISSUE 1 DRGS	.	.	.	-11.6	A29NOV63	X06SEP63	4411X2	
41021	41022										
120000	120000		1241 / 2 FABRICATE W/AUD	48.0	49.0	50.0	-11.6	17NOV64	X25AUG64	GUL X3	
41022	41023										
120000	120000		1241 / 2 CHECK GL AUDIT	2.0	3.0	4.0	-11.6	09DEC64	D16SEP64	2453X4	
41023	41024										
120000	120000		1241 / 2 EQ AND SHIP	1.0	2.0	3.0	-11.6	23DEC64	D30SEP64	2513X5	
41024	41025										
120000	120000		1241 / 2 PE-4015	.	.	.	-11.6	23DEC64	D30SEP64 30SEP64	2544X6	
41025	41026										
120000	120000		1241 / 2 PT COMPLETION	.	.	.	-11.6	23DEC64	D30SEP64 30SEP64	DUMMY	
41026	00000	E									
110000	110000		START SUBNET 110000	.	.	.	-10.0	A31JUL62	X18MAY62	2625	
00000	00002	S									
110000	110000		1163 / 1 W/R 4077TRFMR	.	.	.	-10.0	A31JUL62	X18MAY62	2544X0	
00002	63010										
110000	110000		1163 / 1 SKETCH/ADI (BX)	.	.	.	-10.0	A31JUL63	X20MAY63	2453X1	
63010	63011										

FIG. 6

ACTIVITY TIME STATUS REPORT									
(PT NET)									
PAGE 2									
PROGRAM PT NAMDA REPORT									
CONTRACT NO. NONE									
RUN DATE- 01SEP64									
DATA DATE 31AUG64									
DUE EXP/LAT DATE									
LEVEL	DETAIL								
PRECE	SUCC.		ACTIVITY	TIME ESTIMATES	SLACK	COMPLETION DATES	SCHED.		
EVENT	EVENT	C	DESCRIPTION	A M B	PRIMR SECD	EXPECTED LATEST	DATE	DEPT.	
090000	090000								
64510	64511		964 CHG W/R5089 DESIGN*	13.0 14.0 15.0 + 2.2		X31AUG64 D16SEP64		2453X1	
030745	030745								
90010	90011		307-490/1 SKETCH/AOI	4.0 4.0 4.0 + .2		X01SEP64 D02SEP64		2453X1	
130000	130000								
10100	10101		1318 CBL/1 SKETCH/AOI	4.0 4.0 4.0 + .2		X01SEP64 D02SEP64		2453X1	
130000	130000								
080000	080000								
83501	83502		883 CHG W/R5078 DRAFT*	11.0 13.0 15.0 + .		X31AUG64 X31AUG64		4411X2	
090000	090000								
58101	58102		958FIXT/1 ISSUE 1 DRGS	5.0 6.0 7.0 + 2.4		X31AUG64 D17SEP64		4411X2	
090000	090000								
64531	64532		964 CHG W/R5115 DRAFT*	3.0 4.0 5.0 + .		X31AUG64 X31AUG64		4411X2	
135000	135000								
66011	66012		1366 /1 ISSUE 1 DRGS	3.0 4.0 5.0 - 5.6		X31AUG64 X22JUL64		4411X2	
135000	135000								
030745	030745								
67012	67013		307-467/1 FABRICATE	8.0 9.0 10.0 + .2		X31AUG64 X01SEP64		4234X3	
030745	030745								
69012	69013		307-469/1 FABRICATE	8.0 9.0 10.0 + .2		X31AUG64 X01SEP64		4234X3	
030745	030745								
71012	71013		307-471/1 FABRICATE	8.0 9.0 10.0 + .2		X31AUG64 X01SEP64		4234X3	
130000	130000								
030745	030745								
59013	59014		307-459/1 CHECK PT AUDIT	1.0 2.0 3.0 + .2		D15SEP64 D16SEP64		2453X4	
030745	030745								
67013	67014		307-467/1 DES AUDIT	1.0 2.0 3.0 + .2		D15SEP64 D16SEP64		2453X4	
030745	030745								
69013	69014		307-469/1 DES AUDIT	1.0 2.0 3.0 + .2		D15SEP64 D16SEP64		2453X4	
030745	030745								
110000	110000								
79114	79115		1179CBLQ/1 EQ AND SHIP	1.0 2.0 3.0 - 4.0		D29SEP64 X31AUG64		2513X5	
110000	110000								
80114	80115		1180CBLQ/2 EQ AND SHIP	1.0 2.0 3.0 - 4.0		D29SEP64 X31AUG64		2513X5	
120000	120000								
49014	49015		1249 /1 EQ AND SHIP	1.0 2.0 3.0 - 2.0		D29SEP64 D15SEP64		2513X5	
130000	130000								
135000	135000								
62015	62016		1362 /1 NP-100298	. . . - 4.4		15OCT64 D15SEP64 15SEP64		7437X6	
130000	130000								
48015	48016		1316 /4 NP-100007	. . . - 7.2		21OCT64 X31AUG64 31AUG64		7437X6	
135000	135000								
62025	62026		1362 /2 NP 100305	. . . - 5.2		05NOV64 D30SEP64 30SEP64		7437X6	

FIG. 7

ACTIVITY TIME STATUS REPORT									
(PT NET)									
PAGE 14									
PROGRAM PT NAMDA REPORT									
CONTRACT NO. NONE									
RUN DATE- 16OCT64									
DATA DATE 15OCT64									
TESTER NUMBER SEQUENCE									
LEVEL	DETAIL								
PRECE	SUCC.		ACTIVITY	TIME ESTIMATES	SLACK	COMPLETION DATES	SCHED.		
EVENT	EVENT	C	DESCRIPTION	A M B	PRIMR SECD	EXPECTED LATEST	DATE	DEPT.	
1187	/5 ORDER RECONC	1090		. . . + 4.2		A06AUG64 X04SEP64		SU X0	
1187	/5 FABRICATE			11.0 12.0 13.0 + 4.2		D30OCT64 02DEC64		UN X3	
1187	/5 CHECK OR AUDIT			1.0 2.0 3.0 + 4.2		D16NOV64 16DEC64		2453X4	
1187	/5 EQ AND SHIP			1.0 2.0 3.0 + 4.2		D11DEC64 31DEC64		2513X5	
1187	/5 23201-65			. . . + 4.2		D1DEC64 31DEC64		31DEC64 SU X6	
1240	/2 ORDER REC	S1129		. . . - 3.6		A05MAR63 X06PEB63		2544X0	
1240	/2 ISSUE 1 DRGS			. . . - 3.6		A15NOV63 X21OCT63		4411X2	
1240	/2 FABRICATE W/AUD			. . . - 3.6		A29SEP64 X07SEP64		GUL X3	
1240	/2 CHECK GL AUDIT			3.0 4.0 5.0 - 3.6		D27OCT64 X01OCT64		2453X4	
1240	/2 EQ AND SHIP			1.0 2.0 3.0 - 3.6		D10NOV64 X15OCT64		2513X5	
1240	/2 PE-3918			. . . - 3.6		D10NOV64 X15OCT64		15OCT64 2544X6	
1241	/1 ORDER REC	S1195		. . . - 4.4		A10JUN63 X08MAY63		2544X0	
1241	/1 SKETCH/AOI			. . . - 4.4		A09JUL63 X06JUN63		2453X1	
1241	/1 ISSUE 1 DRGS			. . . - 4.4		A29NOV63 X20OCT63		4411X2	
1241	/1 FABRICATE W/AUD			. . . - 4.4		A28SEP64 X28AUG64		GUL X3	
1241	/1 CHECK GL AUDIT			4.0 5.0 6.0 - 4.4		D02NOV64 X01OCT64		2453X4	
1241	/1 EQ AND SHIP			1.0 2.0 3.0 - 4.4		D17NOV64 X15OCT64		2513X5	
1241	/1 PE 4015			. . . - 4.4		D17NOV64 X15OCT64		15OCT64 2544X6	
1241	/2 ORDER REC	S1195		. . . + 1.0		A10JUN63 X17JUN63		2544X0	
1241	/2 SKETCH/AOI (GL)			. . . + 1.0		A09JUL63 X16JUL63		2453X1	
1241	/2 ISSUE 1 DRGS			. . . + 1.0		A29NOV63 X06DEC63		4411X2	
1241	/2 FABRICATE W/AUD			48.0 49.0 50.0 + 1.0		D17NOV64 D24NOV64		GUL X3	
1241	/2 CHECK GL AUDIT			2.0 3.0 4.0 + 1.0		J9DEC64 16DEC64		2453X4	
1241	/2 EQ AND SHIP			1.0 2.0 3.0 + 1.0		23DEC64 31DEC64		2513X5	
1241	/2 PE-4015			. . . + 1.0		23DEC64 31DEC64		31DEC64 2544X6	
1241	CHG W/R5032	MC1585		. . . - 3.2		A08APR64 X17MAR64		2544X0	
1241	CHG W/R5032	DES/PL		27.0 28.0 29.0 - 3.2		D26OCT64 X02OCT64		2453X1	
1241	CHG W/R5032	DRAFTN		3.0 4.0 5.0 - 3.2		D24NOV64 D30OCT64		GUL X2	
1241	CHG W/R5032	SIGV		. . . - 3.2		D24NOV64 D30OCT64		30OCT64 2544X6	
1243	FIX/1 W/R	5179 MC1585		. . . -10.6		A06AUG64 X21MAY64		2544X0	
1243	FIX/1 SKETCH/AOI			. . . -10.6		A03SEP64 X19JUN64		2453X1	
1243	FIX/1 ISSUE 1 DRGS			. . . -10.6		A20OCT64 X05AUG64		4411X2	
1243	FIX/1 FABRICATE			4.0 6.0 8.0 -10.6		D3DEC64 X17SEP64		4234X3	
1243	FIX/1 DES AUDIT			1.0 2.0 3.0 -10.6		17DEC64 X01OCT64		2452X4	
1243	FIX/1 EQ AND SHIP			1.0 2.0 3.0 -10.6		04JAN65 X15OCT64		2513X5	
1243	FIX/1 WELD ORDER			. . . -10.6		04JAN65 X15OCT64		15OCT64 2544X6	

FIG. 8

DEAR BILL..

ACCORDING TO THE PERT REPORT WITH A DATA DATE OF 31 AUG 64 SOME PRODUCT TESTERS ARE FALLING BEHIND EXPECTATIONS.

THE FOLLOWING TESTERS HAVE NOT COMPLETED SKETCH/AOI OR DESIGN WITHIN THREE MONTHS SINCE START DATE..*

964	CH	1100-1	/1	1100-2	/1	1150	CH	1163	CH	1241	CH	1258	/1	1268	CH
1299	/1	1301	CH	1364	/1	1365	/1	1812	CH						

13

AND THESE TESTERS ARE NOT EXPECTED TO COMPLETE SKETCH/AOI OR DESIGN WITHIN 3 MONTHS FROM DATE OF INITIATION..*

2

1349 CH 0000000000

FURTHERMORE THE FOLLOWING INCOMPLETE ACTIVITIES HAVE GONE PAST THEIR EXPECTED COMPLETION DATES BY MORE THAN A WEEK..*

26

1364	/1	SKETCH/AOI (BX)	832	/4	FABRICATE W/AUD *	832	/3	FABRICATE W/AUD *	832	/2	FABRICATE W/AUD *
1299	/1	SKETCH/AOI (BX)	1365	/1	SKETCH/AOI GM	1377	/2	SKETCH/AOI EGG	307-482/1	SKETCH/AOI	
307-477/1	SKETCH/AOI	307-483/1	SKETCH/AOI	307-476/1	SKETCH/AOI	307-484/1	SKETCH/AOI	307-486/1	SKETCH/AOI		
307-475/1	SKETCH/AOI	307-485/1	SKETCH/AOI	307-474/1	SKETCH/AOI	307-486/1	SKETCH/AOI	307-473/1	SKETCH/AOI		
307-487/1	SKETCH/AOI	307-488/1	SKETCH/AOI	307-489/1	SKETCH/AOI	307-481/1	SKETCH/AOI	1100-2	/1	SKETCH/AOI (OR)	
307-491/1	SKETCH/AOI	307-478/1	SKETCH/AOI								
1100-1	/1	SKETCH/AOI (OR)	1377	/1	SKETCH/AOI						

ALSO THE FOLLOWING UNITS IN DESIGN AUDIT WERE NOT COMPLETED ON THEIR EXPECTED COMPLETION DATES..

7

552C8 Q/2	552C9 Q/1	552C100/1	1271	/2	1310	/3	307-466/2	307-466/1
-----------	-----------	-----------	------	----	------	----	-----------	-----------

THE FOLLOWING PROTOTYPES HAVE BEEN WORKED FOR MORE THAN A YEAR..*

29

1100-1	/1	1100-2	/1	1163	CH	1163	/1	1178CBLQ/1	1179CBLQ/1	1241	/1	1249	/1
1255	/1	1256	/1	1257	/1	1258	/1	1268	/1	1269	/1	1271	/1
1283	/1	1288	/1	1295	/1	1299	/1	1301	CH	1302	/1	1306	/1
1314	/1	1326	/1	1347	/1	1813	/1	1814	/1			1312	/1

AND THE FOLLOW-UPS LISTED BELOW HAVE ALSO BEEN WORKED FOR MORE THAN A YEAR..*

32

832	/2	832	/3	832	/4	1100	/13	1100	/11	1100	/12	1100	/13	1100	/4
1100	/5	1100	/6	1100	/7	1120	/8	1100	/9	1180CBLQ/2	1240	/2	1241	/2	
1271	/2	1272	/2	1273	/2	1288	/2	1309	/2	1309	/3	1309	/4	1310	/3
1310	/4	1310	/5	1311	/2	1311	/3	1311	/4	1323	/2	1363	/4	1905TVP1/2	

THE EXPECTED COMPLETION DATES OF THE FOLLOWING TESTERS ARE LATER THAN THEIR SCHEDULED DATES BY ONE WEEK OR MORE

76

(THAT IS, THEY HAVE NEGATIVE SLACKS OF ONE WEEK OR MORE)

1374	/1	1241	/2	1163	/1	1349	/3	1349	/2	1813	/1	1312	/1	1806ADAP/1	
1163	CH	1346	/4	1806ADAP/2	1272	/2	1309	/4	1015-2 Q/5	1366	/1	1362	/2		
1240	/2	1122P17	/1	1122P16	/1	552C110/2	1814	/1	1283	CH	1362	/1	1364	/1	
1273	/2	1329 FIX/2	1178CBLQ/1	1180CBLQ/2	1179CBLQ/1	307-442/1	1271	/1	1283	/1	1283	/1	1283	/1	
1288	/1	1309	/2	1311	/2	1241	CH	1276	/1	1361	/1	832	/4	832	/3
832	/2	1255	/1	1314	/1	1329 FIX/1	1349	CH	1301	CH	1288	/2	1344	/1	
1346	/2	1257	/1	1306	/1	1349	/1	1346	/3	1350	/1	1343	CH	1249	/1
552C8 Q/2	552C9 Q/1	552C100/1	1371	/1	1100	/2	1326	/1	1310	/5	1310	/5	1310	/4	
1309	/3	1256	/1	1347	/1	1271	/2	1351	/2	1351	/3	1243	FIX/1	1295	/1
1363	/4	1329	/1	1355	/1	1100	/3								

YOURS TRULY

IBM 7090

*PS. THREE MONTHS MEANS 65 WORKING DAYS. ONE WEEK MEANS 5 WORKING DAYS. ONE YEAR MEANS 253 WORKING DAYS.

FIG. 9

PROJECTED PRODUCT TESTER EXCEPTION REPORT FOR DIVISION 2452.

THE DATA DATE IS 31 AUG 64.

TESTERS THAT HAVE NOT COMPLETED SKETCH/AOI OR DESIGN WITHIN ELEVEN WEEKS FROM START DATE.

1349 CH

ACTIVITIES THAT WILL BE MORE THAN ONE WEEK PAST THEIR EXPECTED COMPLETION DATES IN TWO WEEKS UNLESS COMPLETED IN THE MEAN TIME

1374	/1	SKETCH/AOI	•	1349	/3	DESIGN AUDIT	•	1349	/2	DESIGN AUDIT	•	1015-2 Q/5	CHECK PT AUDIT	•	
1255	/1	EQ AND SHIP	•	1349	CHG W/R5097	DESIGN	•	1301	CHG W/R4786	DESIGN	•	1301	CHG W/R4789	DESIGN	•
1349	/1	DES AUDIT	•	1243	FIX/1	SKETCH/AOI	•	1017	CHG W/R5087	DRAFTN	•	1302	/1	EQ AND SHIP	•
1338	/3	EQ AND SHIP	•	1338	/2	EQ AND SHIP	•	307-466/2	CHECK BX AUDIT	•	307-466/1	CHECK BX AUDIT	•		

TESTERS IN DES AUDIT THAT WILL BE PAST THEIR EXPECTED COMPLETION DATES IN TWO WEEKS UNLESS COMPLETED IN THE MEAN TIME

1349	/3	1349	/2	1015-2 Q/5	1349	/1	826B16	/1	926B17	/1	826 B18/1
------	----	------	----	------------	------	----	--------	----	--------	----	-----------

TESTERS THAT WILL HAVE BEEN WORKED ON FOR MORE THAN ONE YEAR TWO WEEKS FROM NOW UNLESS COMPLETED IN THE MEAN TIME

0000000000

FIG. 10