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STUDENT FLOW SIMULATION FOR THE CONSOLIDATED NAVY ELECTRONIC WA--ETC(U)
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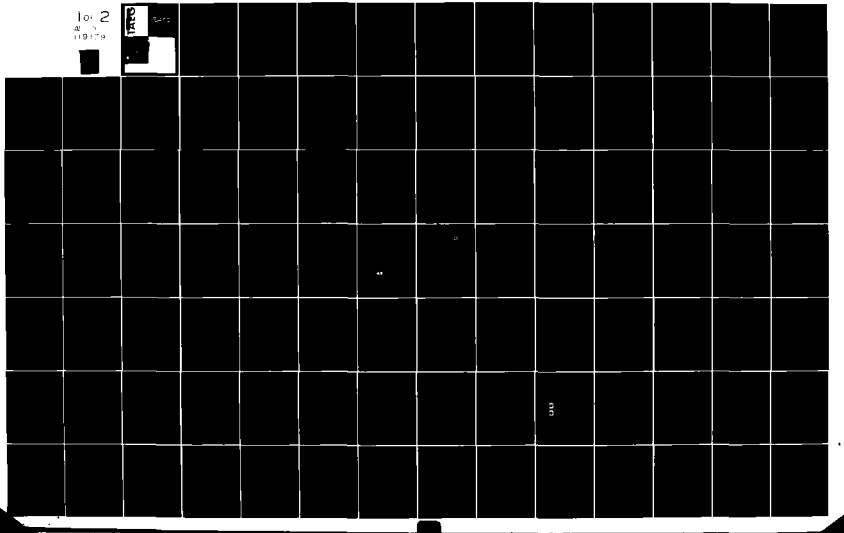

TECHNICAL REPORT 114

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STUDENT FLOW SIMULATION FOR THE CONSOLIDATED NAVY ELECTRONIC WARFARE SCHOOL

JULY 1982

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Technical Report 114

STUDENT FLOW SIMULATION FOR THE CONSOLIDATED NAVY ELECTRONIC WARFARE SCHOOL

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Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER Technical Report 114	2. GOVT ACCESSION NO. AD-A119179	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) STUDENT FLOW SIMULATION FOR THE CONSOLIDATED NAVY ELECTRONIC WARFARE SCHOOL		5. TYPE OF REPORT & PERIOD COVERED 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Gary C. Whitehouse, Enrique J. Baboin-Rojas, Thinh T. Dong, Lucy C. Morse, Morris G. Middleton		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS University of Central Florida Orlando, FL 32816		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Training Analysis and Evaluation Group Department of the Navy Orlando, FL 32813		12. REPORT DATE July 1982 13. NUMBER OF PAGES 159
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution is unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Computer Simulation
Student Flow Simulation
Simulation Language Alternative Method Model

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report is a detailed discussion of a computer simulation model that has been developed for the complex student flows and training resources utilization pattern through a multi-track, mixed group-paced and self-paced training curriculum. The model was developed utilizing as a baseline the 1980 curriculum of the Consolidated Navy Electronic Warfare School (CNEWS). The simulation language for alternative modeling (SLAM) was used as the modeling technique. This report provides an insight
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S/N 0102-LF-014-6601

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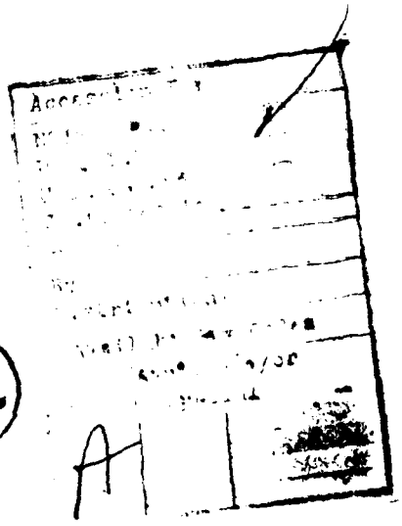
20. ABSTRACT (continued)

into using SLAM for multi-path network modeling for a Navy pipeline sequence of courses.



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PRECIS

The model presented in this report is the culmination of an effort devoted to aiding managers in planning, developing and scheduling training courses for the Consolidated Navy Electronic Warfare School (CNEWS). Based on a system analysis of the maintenance and operator training requirements of the CNEWS,[1] the Simulation Language Alternative Method (SLAM)[2] was selected for modeling the CNEWS. A central component of the model was the 40 student station EW operator training device (Device 10H1) providing computer controlled instruction in electronic support measures (ESM) and electronic countermeasures (ECM). A series of technical problems in the development of Device 10H1 and problems associated with the school environment dictated revisions in course sequencing and student flow. As a consequence of these unforeseen difficulties, the model design was "frozen" as of September 1980.

Accordingly, the model described in this report does not reflect the current CNEWS training system. However, the conceptual design, structure, and detail of the model may be of significant value for resource allocation determinations in future CNEWS development. The present documentation will preserve this capability.

[1]T. E. Pearson, C. S. Parks, J. H. Gardner, and L. R. Mac Keraghan. Student Flow Simulation Model for Navy Consolidated Electronic Warfare Training. TAEG Report No. 80, May 1980. Training Analysis and Evaluation Group, Orlando, FL 32813 (AD A086882).

[2]A. A. B. Pritsker and C. D. Pegden. Introduction to Simulation and SLAM. New York: John Wiley and Sons, Inc., 1979.

Of equal significance is that this document will be of interest to a wider audience. The model and the technique by which it was developed has general utility for people concerned with resource planning, particularly in situations involving high student throughputs and limited resources.

The model is also of conceptual value to managers in that it indicates a range of "what if" questions that most often need resolution as a prelude to decisions on resource allocations.

I. INTRODUCTION

This report presents the development of a computer simulation model describing the student flow and training resource utilization patterns for the proposed Electronic Warfare (EW) School. The model considers the problems associated with a multitrack, mixed group-paced and self-paced training curriculum.

A. BACKGROUND

The Consolidated Navy Electronic Warfare School (CNEWS) at the Naval Technical Training Center (NAVTECHTRACEN), Corry Station, Pensacola, Florida, conducts basic and advanced operator and maintenance training for 25 categories/types of students, both officers and enlisted. The training includes 14 separate student pipelines with various combinations of training courses.

In May 1977, the Chief of Naval Education and Training (CNET) assigned the Training Analysis and Evaluation Group (TAEG) the system responsibility for developing a new consolidated EW operator training curriculum for CNEWS. The concept was to provide a new operator training system including individualized instruction using a variety of training resources such as programmed instruction; narrative texts, sound-slide programs; random-access, interactive videotape programs; classroom and laboratory instruction; training devices and operational equipment. The curriculum as proposed would be managed by the Navy's Computer Managed Instruction (CMI) system.

In the proposed curriculum, students would be assigned selected learning modules, and proceed through the learning tracks tailored to their specific instructional needs and their next duty assignments. A central component of the EW operator training system is a 40 student station generalized EW operator training device (Device 10H1). The device provides computer-aided instruction in general system familiarization, operator skills development, operating techniques, EW capabilities and limitations, and EW watchstanding and tactical exercises.

As curriculum development progressed, it became apparent that the complexity of the task dictated the need for a management planning tool. The tool would aid CNEWS planners in the early identification of the likely impacts of the new curriculum on the other operator courses and also maintenance training courses which were being taught and those that will continue to be taught after institutionalizing the individualized curriculum.

The problem confronting TAEG and the CNEWS planners was twofold: (1) provide group-paced instruction in a variety of operator, maintenance, and technology courses using the school's current resources and (2) concurrently plan for the development and implementation of Device 10H1 and the new individualized EW operator curriculum.

The CNEWS training curriculum (1980) for enlisted students, which includes the majority of the students attending the school, consists of Basic Operations (CDP 602A), EW Preventive Maintenance Technology

(CDP 602B) courses, followed by one of the equipment operations courses as appropriate (AN/WLR-1 (CDP 015A), AN/SLQ-32 (CDP 016A), AN/SLQ-17 (CDP 017A), or AN/WLP-8 (CDP 018A)). All students then take the 3M Test Course (CDP 602C), and appropriate equipment-specific preventive maintenance course, Advanced Operations (CDP 602D), and finish their training at CNEWS with one of the appropriate equipment-specific tactical operations courses determined by their subsequent duty assignment. In the 1980 curriculum, all courses are group-paced (lock-step) except for the Basic Operations course (CDP 602A) which is individualized (self-paced).

The proposed EW operator curriculum to be implemented with Device 10H1 involves individualized/self-paced instruction. The major difference between the group-paced operator curriculum and the individualized curriculum is the self-pacing of students through each curriculum module and lesson topic. Each lesson topic is completed by the student in either a classroom, a learning center with multimedia learning carrels, or a laboratory using one of the Device 10H1 student stations. The learning carrels consist of individual study booths equipped with various combinations of sound-slide equipment and/or random-access, interactive video-tape equipment. The student is given support with lesson topic narratives and/or programmed materials or other types of individualized learning materials. Utilizing Device 10H1, students will progress through three phases. In phase I (basic operations), students will complete a series of academic or off-line (non-10H1) modules in learning centers and then receive a series of modules and lesson topics using Device 10H1 to complete that portion of the curriculum. The basic operations phase of

the individualized curriculum using Device 10H1 is planned to be common-core; i.e., each category of student (officer and enlisted) will take the phase I courses.

Phase II (advanced operations) consists of a series of six modules and a number of lesson topics together with the number of hours each student is estimated to spend in the learning centers and in Device 10H1. Unlike the phase I student traffic flow, the student's path through phase II will consist of a series of sessions in the learning center for each module followed by a number of training sessions in Device 10H1. As a student completes each/module on Device 10H1, he/she will proceed to the next assigned module taking a series of lesson topics in the learning center followed by an appropriate number of hours/lesson topics using Device 10H1 until the module is complete.

When the student reaches phase III (watchstanding and tactical operations) on Device 10H1, training will become more equipment-oriented and will consist of two parts. Part A is a series of exercises oriented to the type of equipment the student will operate in the duty assignment. Part B is a series of exercises or lesson topics in the form of mission scenarios using the equipment from part A of phase III. Student flow through phase III will consist of Device 10H1 training in parts A and B on the respective EW equipment modules and lesson topics appropriate to military specialty and/or next duty assignment.

B. SLAM MODEL

The forecasting, planning, scheduling, and resources management problems facing CNEWS planners precludes solution by traditional methods. This set of interrelated problems, however, is ideally suited to solution by computer simulation. Several techniques for modeling/programming were available. After considerable study and analysis it was decided that the SLAM would offer the most flexibility for model development. The objective of the model is to account for each different category/type of student in the various pipelines, whether in group-paced or individualized training courses, and to gather statistical data on each student in order to determine the CNEWS resource utilization patterns, as well as to identify likely problem areas such as student queues or excessive waiting times. Specifically, the information requirements include:

1. The maximum, minimum, and mean expected times-to-train for each type student pipeline in the CNEWS curriculum.

2. Identification and definition of classrooms/learning center/training device on equipment resource demand situations or the courses in the CNEWS curriculum over a multi-year planning horizon.

3. Identification and definition of training resource/facility requirements to achieve a smooth flow of students through the CNEWS curriculum including group-paced and individualized

courses of instruction in terms of existing school capacity and planned capacity. Major variables include:

a. the number and types of students

b. course convening frequency

c. instructional materials, media, training devices, and/or operational equipment.

4. Determination of the impact upon the school in terms of:

a. changes in student input distribution and on-board arrival times

b. the addition of new instructional resources such as audio-visual equipment, learning carrels, or training devices (e.g., Device 10H1)

c. the incremental conversion of courses in a curriculum from group-paced to individualized training and in some cases establishment of common-course training.

The model was developed in the following eight increments in order to determine the impact of implementing the three phases of the Device 10H1 curriculum.

1. CNEWS Current Operator and Maintenance curriculum (No Device 10H1)

2. CNEWS Current Curriculum with Device 10H1 Phase I (Basic Operations) Implemented and Replacing Existing Basic Operations Courses

3. CNEWS Current Curriculum with Device 10H1 Phase II (Advanced Operations) Implemented and Replacing Existing Advanced Operations Courses

4. CNEWS Current Curriculum with Device 10H1 Phase III (Watchstanding-Tactical Operations) Implemented and Replacing Existing Tactical Operations Courses

5. CNEWS Current Curriculum with Device 10H1 Phases I and II Implemented and Replacing Existing Basic and Advanced Operations Courses

6. CNEWS Current Curriculum with 10H1 Phases I and III Implemented and Replacing Existing Basic and Tactical Operations Courses

7. CNEWS Current Curriculum with Device 10H1 Phases II and III Implemented and Replacing Existing Advanced and Tactical Operations Courses

8. CNEWS Current Curriculum with Device 10H1 Phases I, II, and III Implemented and Replacing Existing Basic, Advanced, and Tactical Operations Courses.

The process orientation of SLAM employs a network structure comprised of specialized symbols for arrivals, assignments, queues, servers, decision points, etc. The modeling task consists of combining these symbols into a network of nodes and branches which represent the flow of students through the school. The network representation of the system is then transcribed into equivalent statements for input to the SLAM program.

The model described here (when modified to include changes to the curriculum since 1980) will provide insights into the likely impacts of alternatives to meet changes in training requirements prior to having to make large and often long-term investments in time and resources. Such an insight, for example, might be "optimizing" the changeover from lock-step to an individualized curriculum. The "optimization" might take place in terms of altering course convening frequencies to minimize competition for available resources or identifying potential course conflicts so that alternatives could be considered (e.g., course restructuring or the use of double shift operations for a limited time period).

C. ORGANIZATION OF THE REPORT

In addition to this introduction, the report contains six additional sections and eight appendices. Each of these sections presents detailed

discussions of the model. Section II presents the information flow of the model, how the model is initialized, and the operation of the gates associated with single and double shift operation. Section III presents the student flow and statistics that are available as outputs of the model. Sections IV, V, and VI present subroutines that are required for model operation. Section VII describes the necessity for the preprocessor model. Appendices A through H provide information deemed necessary for future expansion of the model.

II. INFORMATION FLOW

A. INITIALIZATION OF THE SYSTEM

1. Initialization of Global Variables

This is the first step in the simulation, and it is executed at time zero. During this step an initial value is assigned to each of the Global Variables (GV's) involved in the simulation. These GV's could be assigned new values as the simulation progresses.

General representation of GV: XX(I), I = 1,2,3,4, ... 600

Example: Time = TTBEG = 0

INTLC,XX(I)=2.00,XX(2)=3.25, ... XX(5)=7.25.

The Global Variables can be used at any portion of the network and their values are independent of the entity arriving at the ASSIGN node. For a GV to take a new value, it is necessary that an entity pass through the ASSIGN node that specifies the change. In the EW training simulation network 511 G.V.s have been used and they represent:

a. Parameters associated with the CDP courses such as minimum number of students to open a course, maximum number of students allowed in a CDP course, CDP time duration.

b. Input rate of students by year and by student types.

c. The number of Learning Center facilities.

d. The number of 10H1 devices.

e. As time indicators--either to indicate the current simulation time or to specify the duration of an activity.

Appendix A provides a complete list of the G.V.'s used in the system and the parameters they represent.

2. Initial Condition for Gates and Resources

Gates are the controlling switches that are used to control the opening and closing of the courses in the EW simulation flow network. There are 26 gates in the model and each one represents a group-paced course. Their initial condition is CLOSEd. This means no one is allowed to go into any of the courses while the CLOSEd condition persists. There is a file number associated with each of the gates and it is used to collect statistics for the students waiting to take that course. The first 26 files of the system have been reserved for these gates.

Resources are special entities available for service and they can be used by normal entities (students) moving together through other stationary service activities. In the EW network there are two types of resources: LC identifies the Learning Center facilities with an initial capacity of zero at the beginning of the simulation; 1OH1 identifies the device 1OH1 also with an initial capacity of zero at the beginning of the simulation. The zero capacity for these two types of resources means that no one can use them until their capacity is increased to any integer value greater than zero. The availability of any resource may be changed at any moment in the system by means of an ALTER node. The resource in consideration is increased if positive or decreased if negative by the new value assigned in the ALTER node. There is also a file number associated with each resource. This file keeps statistics for the student waiting to use the resource.

Example: GATE/C1, CLOSE, 1;

GATE C1 represents the CDP course 1C

Status: CLOSE, no one is allowed to take 1C course

File 1, Statistics for the students waiting to take the 1C course are recorded in this file.

RESOURCE/LC(0),28,29;

LC represents the Learning Center facilities.

(0), initial capacity equal zero

File 28, Statistics for the students waiting to use the Learning Center facilities when Device 10H1 is not operating.

File 29, Statistics for the students waiting to use the Learning Center facilities when Device 10H1 is operating either for phase I or II.

RESOURCE/10H1(0),27;

10H1 represents the 10H1 stations

(0), Initial capacity equal to zero

File 27, Statistics for the students waiting to use the device 10H1 in any of the three phases I, II, III.

Appendix B shows all the gates, their course representation, and their files.

3. Initial Condition for Each Simulation Year

Each year consists of 50 time units, each unit representing one week. The total simulation time is 350 time units. The initial working conditions are set after the students have been created beginning at time zero. These working conditions are related to: the input rate of students and the student status for using the Device 10H1. The Learning Center facilities is initialized at the beginning of the simulation and its capacity is not altered during the rest of the process. These working conditions persist for the first 100 time units (2 years) and also for the next 50 time units after the filling-out period. This next period of 50 time units is the first year of simulation that statistics are collected (first year with statistics (w/s)).

At the beginning of week 151 (beginning of second year w/s) new working conditions are set, and they persist for the next 50 weeks. The same situation occurs at the beginning of weeks 201, 251 and 301 (beginning of

third, fourth and fifth years w/s). At the end of each of the last five years, statistics are collected and the system is immediately CLEARED. This process leaves the system filled with students at the end of each year but the statistics associated with the year ending do not affect the statistics for the year beginning.

The model handles this situation by creating one entity at time zero. Immediately after the CREATE node, 27 branches representing 27 different activities divide the entity into 27 new entities. One of them is used for setting the initial conditions for the simulation years. The remaining 26 entities are used to control the 26 GATES responsible for opening and closing the group-paced courses. The time between creations is infinite (∞), which means no more entities are created at this CREATE node.

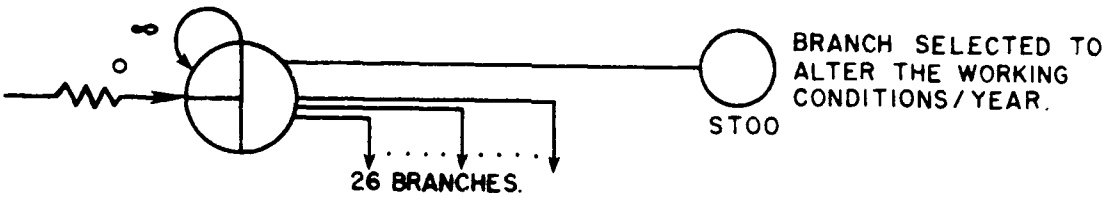


Figure 1. Creation of Initial Conditions

a. First Year (beginning of simulation)

Simulation time: TNOW = 0

The capacity of LC is altered by the value of XX(387).

The parameters for the individualized activities are set

(ACTIVITY TIME $\pm$ 10%)

XX(391)=0.9 = (90%) XX(392)=1.1 = (110%)

The parameters for the LC without 10H1 (A602) are set

(ACTIVITY TIME = XX(398) $\pm$ 10%)

Other working factors are set right after the CREATE node for the student types:

The student input rate is exponentially distributed and the mean value is determined by the value of GV's XX(I), where I=201 to 376, increment=5; i.e. XX(201), XX(206), XX(211), ... XX(371),XX(376).

The student status for using the Device 10H1 is set by means of ATRIB(4). This attribute identifies eight different types of students:

1.	USN6YOs	ATRIB(4)= XX(401)
2.	USN4YOs	ATRIB(4)= XX(406)
3.	USN3X6s	ATRIB(4)= XX(411)
4.	USN Late Conv.	ATRIB(4)= XX(416)
5.	USNR4X10	ATRIB(4)= XX(421)
6.	FLT. Returnee Ope. only	ATRIB(4)= XX(426)
7.	Flt. Returnee Ope. maint	ATRIB(4)= XX(431)
8.	OFFICERS (All)	ATRIB(4)= XX(436)

ATRIB(4) may take eight different values from 1 to 8 and depending on these values the students take a specific route that may include using Device 10H1.

Student Status

ATRIB(4) Value	Route
1	No 10H1 at all
2	PHASE I
3	PHASE II
4	PHASE III
5	PHASES I and II
6	PHASES I and III

7 PHASES II and III

8 PHASES I, II and III

This process is set at time zero. The next step in initializing the first year of simulation is to assign the time to fill out the system which is done by means of G.V. XX(388), i.e. ACT,XX(388). During this time the entire system is in motion, more students are created and they start going to the different activities and finally leave the system. At the end of this 100 week period, the system is CLEARed out by means of a FORTRAN subroutine called EVENT (1). A summary of the students in the system at that moment is also provided by this subroutine.

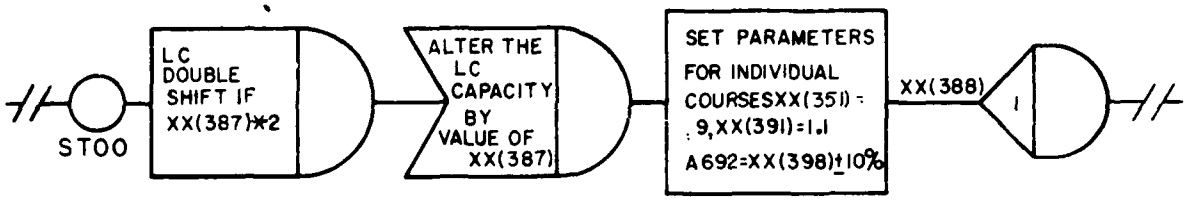


FIGURE 2. Slam Model of First Year Initialization

SUBROUTINE EVENT (1):

Clear statistics at this point of time.

Summary of the students in the system at the end of the period.

These students keep their attribute vector and their values.

b. First Year of Simulation Collecting Statistics (first year w/s)

Week 101 through week 150.

Simulation time: TNOW = 100

Global Variable XX(400) is used as the time indicator for the number of weeks statistics have been collected. GV XX(400) = 0.00

All the working conditions that were set during the initial period remain. The only change is the introduction of Device 10H1. Its initial capacity is altered by the value of GV XX(381). The program is set for the 10H1 to use a double shift. XX(381)*2. (If only single shift is specified, see appendix F.)

The student status for using the 10H1 is not set at this point of the network. The EVENT (4) subroutine takes care of this process. This subroutine is called right before the students go to any of the three phases where the 10H1 is used. Through this mechanism any change in status at the beginning of a new year is reflected immediately in the students already in the network. Students who were in the process at this time with old status follow the new status in the event they have to use the 10H1. All these changes are set at the beginning of the year and after that an activity with a duration of 50 weeks is set. The activities performed in the system during this period are counted for the year in consideration and at the end of these 50 weeks the EVENT (2) subroutine is called to provide a summary of the statistics collected during the period. The statistics are then CLEARed out and the system is ready for a new simulation year.

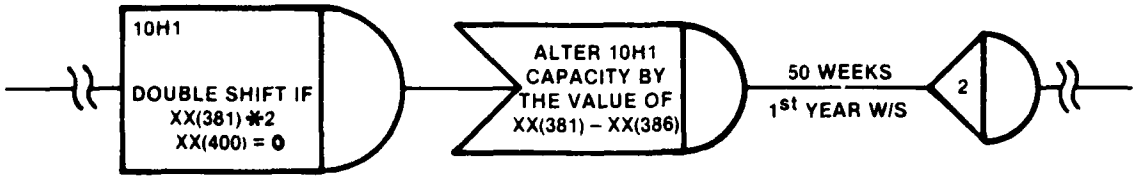


Figure 3. Slam Model of First Year with Statistics Initialization

c. Second Year of Simulation Collecting Statistics (second year w/s)

Week 151 through week 200.

Simulation time: TNOW = 150

Total simulation time w/s GV XX(400) = 50.

Double shift for the 10H1 = XX(382)*2.

New conditions are set for the student input rates, GV's XX(202) to XX(272), INC = 5. These G.V.s reassign new values to the original G.V.s XX(201) to XX(271), INC = 5.

Example: XX(201) = XX(202)

XX(206) = XX(207)

.

.

XX(271) = XX(272)

Alter the capacity of the 10H1 by the value of G.V. XX(382).

Set activity for the length of the new period: ACT,50;.

At the end of this period the EVENT(2) subroutine is called to provide a summary of the statistics collected during this period, then the statistics are CLEARed out and the system is ready for a new simulation year.

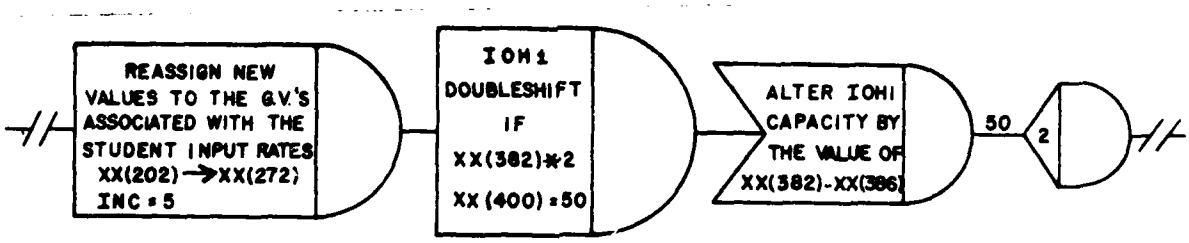


Figure 4. Slam Model of Second Year with Statistics Initialization

d. Third Year of Simulation Collecting Statistics (third year w/s)

Week 201 through week 250.

Simulation time: TNOW = 200

Total simulation time w/s GV XX(400) = 100.

Double shift for the 10H1 = XX(383)*2.

New conditions are set for the student input rates, GV's XX(203) to XX(273), INC = 5. These GV's reassign new values to the original GV's XX(201) to XX(271), INC = 5.

Example: XX(201) = XX(203)

XX(206) = XX(208)

.

.

XX(271) = XX(273)

Alter the 10H1 capacity by the value of G.V. (383). Set activity for the length of new period: ACT, 50;.

At the end of this period (third year w/s) the EVENT (2) subroutine is called to provide a summary for the ending year. Then the statistics are CLEARed and the system is ready for fourth year w/s.

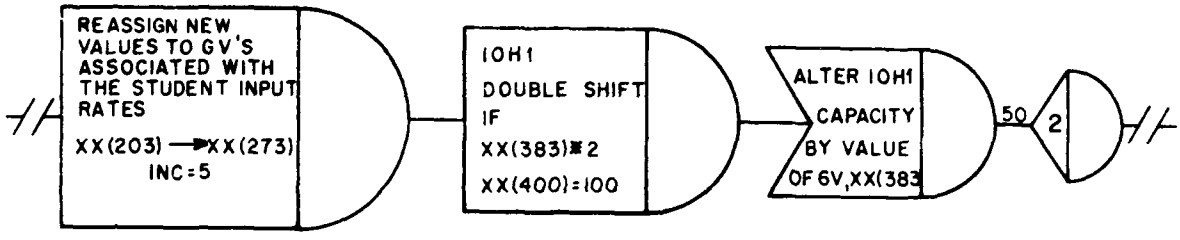


Figure 5. Slam Model of Third Year with Statistics Initialization

e. Fourth Year of Simulation Collecting Statistics (fourth year w/s)

Week 251 through week 300.

Simulation time: TNOW = 250

Total simulation time w/s GV XX(400) = 150

Double shift for the 10H1 = XX(384)*2.

New conditions are set for the student input rate, GV's XX(203) to XX(273), INC = 5. These GV's reassign new values to the original GV's XX(201) to XX(271), INC = 5.

Example: XX(201) = XX(203)

XX(206) - XX(208)

.

.

XX(271) = XX(273)

Alter the 10H1 capacity by the value of GV XX(384). Set activity for the length of the new period: ACT, 50.

At the end of this period (fourth year w/s) the EVENT (2) subroutine is called to provide a summary for the ending year. Then the statistics are CLEARed and the system is ready for fourth year w/s.

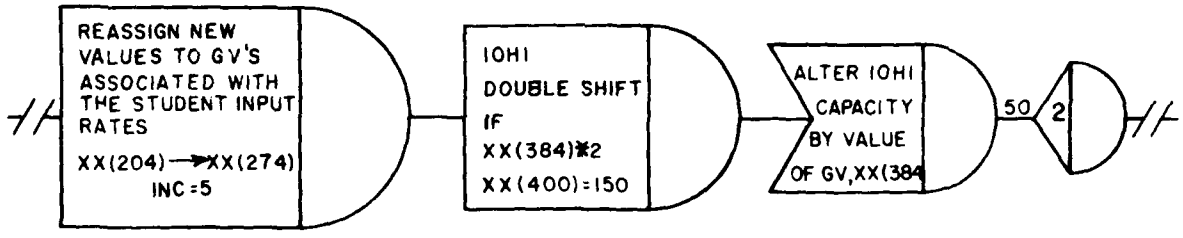


FIGURE 6. Slam Model of Fourth Year with Statistics Initialization

f. Fifth Year of Simulation Collecting Statistics (fifth year w/s)

Week 301 through week 350

Simulation time: TNOW = 300

Total simulation timew/s GV XX(400) = 200

Double shift for the 10H1 = XX(385)*2

New conditions are set for the student input rates, GV's (XX205) to XX(275), INC = 5. These GV's reassign new values to the original GV's XX(201) to XX(271), INC = 5.

Example: XX(201) = XX(205)

XX(206) = XX(210)

. .

. .

XX(271) = XX(275)

Alter the 10H1 capacity by the value of GV XX(385). Set activity for the length of the next period: ACT, 50.

At the end of this period (fifth year w/s) the EVENT (3) subroutine is called to provide a summary for the ending year. Because this is the last simulation year, it is not necessary to clear the statistics. Finally, GV XX(400) is set to the total simulation time w/s XX(400) = 250 and the entity is removed from the network.

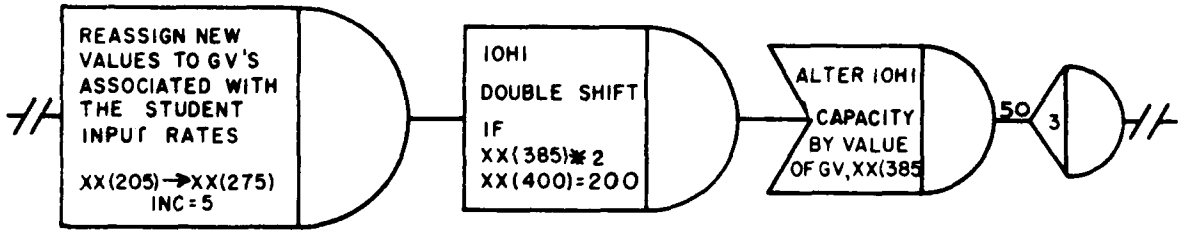


Figure 7. Slam Model of Fifth Year with Statistics Initialization

B. GATES ASSOCIATED WITH CDP COURSES

GATE nodes are used to stop the flow of entities at a specific spot in the network until certain conditions in other parts of the network are met. Entities flowing through a specific branch of the network can be routed to an AWAIT node that requires a specific GATE to be OPENed before they can proceed through.

If the condition of the GATE associated with the AWAIT node is CLOSEd, the students remain in the file associated with that AWAIT node and statistics are collected. They remain in that file until the condition of the gate changes to OPEN. The initial condition of a GATE is established at the beginning of the process by means of a GATE block. (See Initial condition for Gates and Resources.) Changing the condition of the GATE requires that an entity pass through an OPEN node if the GATE is closed or through a CLOSE node if the GATE is open.

In the EW student flow network, GATES are the controlling switches that allow students to go into a specific course. There is a specific GATE for each group-paced course. Its label name is the reverse of the Course Data Processing (CDP) name. (The GATE associated with the CDP 412M is labeled M412.) Appendix B provides a complete list of the GATES and their CDP representation.

There are two types of group-paced courses: single shift and double shift. Single shift means that only one course is taught per convening period. Double shift means that two parallel courses are taught. Because of this the system will have two types of control GATES. These gates are offset so that the opening/closing process is in sequential ascending order. This process allows students leaving a course to take an advanced course before it is closed.

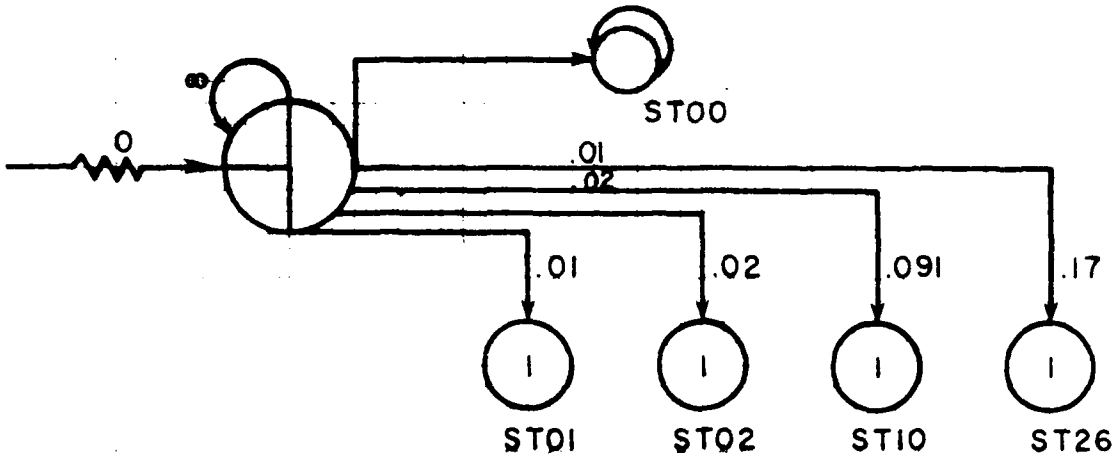
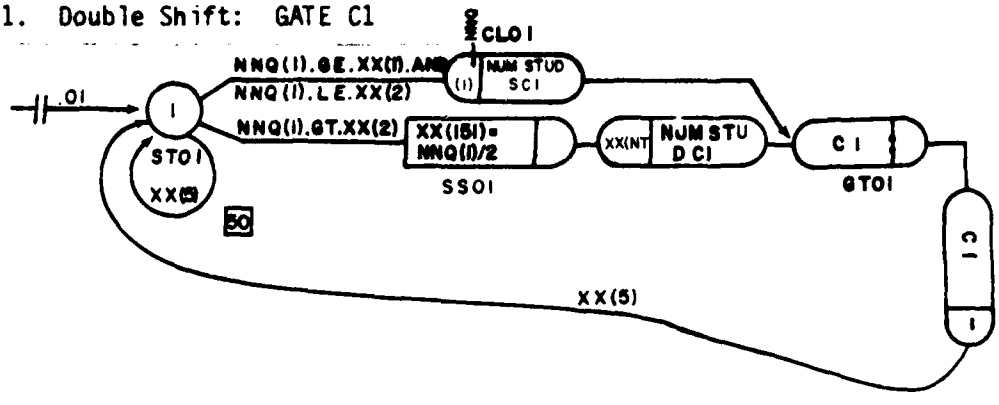


Figure 8. Slam Representation of Control Gates

As was explained earlier, there is an entity for each GATE and it is responsible for the opening and closing process as certain conditions are met. (See Initial Condition for Gates and Resources.) Two GATES will be used as an example, GATE C1 to explain the double shift process and GATE A18 to explain the single shift process.

1. Double Shift: GATE C1



XX(1) = minimum number of students to open the gate for a single shift
XX(2) = minimum number of students to open the gate for a double shift
XX(5) = convening time frequency
XX(151)= G.V. used to determine the number of students per class in a double shift process
NNQ(1) = File #1. of the AWAIT node associated with the GATE C1.
Act 50 = ACTIVITY 50

Figure 9. Double Shift: GATE C1

Double shift does not necessarily mean there are two parallel courses. It provides the possibility for a double shift if there are enough students.

The entity responsible for controlling the GATE C1 arrives at the GOON node ST01. This is a conditional GOON node, so the entity follows the route that meets the existing condition in file 1. Three conditions are possible for this GATE.

a. If the number of students in file 1 is greater than or equal to the value of the GV XX(1) but less than or equal to the value of the GV XX(2), the entity is routed to the collect node CL01. The number of students in file 1 is recorded for a single shift '1C' course. Immediately the entity is routed to the OPEN node GT01 where the gate C1 is opened. When the gate C1 is opened, all the students in file 1 pass through the AWAIT node without any restriction. Then they go into activity 2 where they remain for a period of time equal to the '1C' time duration. (G.V. XX(4.))

After the controlling entity passes the OPEN node GT01 it is routed to a CLOSE node and the gate C1 is closed. After the close node, the entity moves to an activity with a time duration equal to the value of G.V. XX(5). At the end of this time the controlling entity is routed back to the conditional GOON node ST01.

b. If the number of students in file 1 is greater than the value of the GV XX(2) the entity is routed to the ASSIGN node SS01. Moving through this branch means that there are enough students in file 1 to open two 1C courses. Theoretically both courses have the same number of students. In practice, it is possible that one course will have one student more. The GV XX(151) is used to record the number of students per course in a double shift section. After the ASSIGN node the entity moves to a COLLECT node where the number of students in file 1 divided by two is recorded for a

double shift course. After the COLLECT node, the entity is routed to the OPEN node ST01. From this node on, the process is the same as it was for the single shift.

c. If the number of students in file 1 is less than the value of the GV XX(1) neither of the two original conditions will be satisfied. That means that the minimum number of students required to offer the course was not satisfied.

Because of this, no class is offered during this period. In this case, the entity takes the last branch which is nothing more than an activity (ACT/50) with a length duration equal to the GV XX(5) equivalent to the convening time frequency. Then it is routed back to the same GOON node ST01. This process is repeated time after time for as long as the simulation lasts.

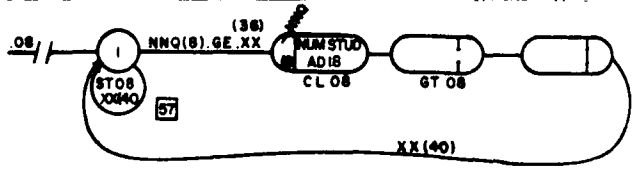
The above case is typical for any double shift course. The only differences are the label names and the GVs and their values.

A summary of the double shift courses and their gates are:

GATE	COURSE
C1	1C
C2	2C
C3	3C
A15	015A
C602	602C
D602	602A

Activity 50 keeps the statistics for the number of times the IC CDP was not offered per year.

2. Single Shift: GATE A018



XX(36) = minimum number of students to open the GATE
XX(40) = convening time frequency
NNQ(8) = file 8 of the AWAIT node associated with GATE A018
ACT 57 = ACTIVITY 57

Figure 10. Single Shift: Gate A018

The entity responsible for controlling the GATE A018 arrives 0.08 time units after it has been created. It moves directly to the conditional GOON node ST08. The controlling entity follows the branch that meets the existing conditions in file 8. Two conditions are possible for this case.

a. If the number of students in file 8 is greater than or equal to the value of the GV XX(36), the entity is routed to the COLLECT node CL08. This collect node records a single shift opening of the 018A, with a total number of students equal to the number in file 8. Immediately the entity is routed to the OPEN node GT08 where the GATE A018 is opened. When the gate is opened, all the students in file 8 pass through the AWAIT node AW8, without any restriction to activity 9, where they remain for a period of time equal to the 018A CDP, and the time duration is represented by GV XX(39).

After the controlling entity passes the OPEN node it moves to a CLOSE node and the gate A108 is closed. Finally, the entity moves to an activity with a time duration equal to the convening frequency for 018A CDP represented in the value of GV XX(40). At the end of this time the entity is routed back to the conditional GOON node ST08.

b. If the number of students in file 8 is less than the value of the GV XX(36), the original condition is not met. That means the minimum number of students required to offer the course 018A was not satisfied. In consequence, no class is offered during this period. In this case, the entity takes the last branch which is nothing more than an activity (ACT 57) with a length duration equal to the convening frequency GV XX(40). After that period, the entity is routed back to the conditional GOON node ST08. Activity 57 keeps record of the number of times the course 018A was not offered per year.

This process is repeated as long as the simulation lasts.

This case is typical for any single shift CDP course. The only differences are the label names and the GV's and their values. Any course which is not double shift is automatically single shift.

III. STUDENT FLOW

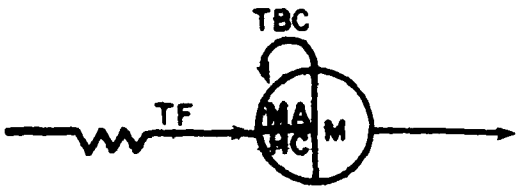
A. CREATION OF STUDENTS

The introduction of entities in a SLAM network is done at a CREATE node. Once an entity is created, it is routed into the system by means of branches representing activities. At the moment of the creation, all entities are identical but there are special marks called attributes that could be assigned to an entity so it would be possible to distinguish it from other entities. CREATE nodes are used to model the arrival of students into the EW flow system. Each student has its own attribute vector attached to it as it moves through the system. Through this vector, it is possible to identify students by types, by categories, by equipment tracks or suite and also by the route they may follow.

Two types of student input for the EW student flow network will be considered: OFFICERS and ENLISTED. They may be distinguished by the value of attribute six, ATRIB(6). There are seven categories of students for the officers and 11 different categories of students for the enlisted. They may be identified by the value of attribute two, ATRIB(2). Finally, there are seven different equipment tracks for the enlisted identifiable by the value of attribute three, ATRIB(3). Table 1 provides a summary of the CNEWS students.

The model has 29 CREATE nodes for the enlisted and seven CREATE nodes for the officers. At the CREATE node, the time for the first arrival is zero (TF = 0), the time between creations, TBC, is exponentially distributed and the mean value is represented by a GV attribute one, ATRIB(1), is the mark used to keep track of the student time in the system. No maximum number of creations is established and just one branch follows the CREATE node.

The mean value for the student input rates is reassigned each year w/s according to the available forecasted data. Global variables XX(201) through XX(380) are used for this purpose. Tables 2 and 3 show a list of these GV's for the officers and enlisted respectively.



TF = 0.00
TBC = EXPON (XX(I)), I = 201, - - -, 380
MA = 1 = ATRIB(1)
MC = INFINITE =
M = INFINITE =

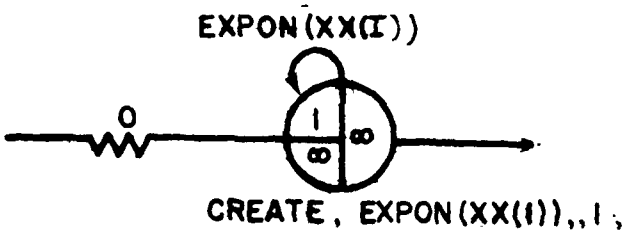


Figure 11. SLAM MODEL FOR A CREATE NODE (USED TO INTRODUCE THE STUDENT INTO THE EW STUDENT FLOW NETWORK)

TABLE 1.

CNEWS STUDENTS

Student Type: OFFICERS ATRIB(6) = 1

OFFICER CATEGORY	ATRIB(2)
1. VQ Pilot Navigator PIREP (EA6)	20
2. Aviation EW Officer (ASW/TACAIR)	21
3. EA-6B Fleet Replacement Pilot	22
4. Fleet Air Reconnaissance EW Evaluation (VQ)	23
5. EA6B Fleet Replacement NFO ECHO	24
6. VAQ-33 NFO Fleet EW	25
7. EA6 USMC Aviation EW	26

Student Type: ENLISTED ATRIB(6) = 0

Student Category	Equipment Track	ATRIB(2)	ATRIB(3)
1. USN 6YO	AN/WLR-1	1	1
USN 6YO	AN/SLQ-32	1	4
USN 6YO	AN/SLQ-17	1	3
USN 6YO	AN/WLR-8	1	2
2. USN 4YO	AN/WLR-1	2	1
USN 4YO	AN/SLQ-32	2	4
USN 4YO	AN/SLQ-17	2	3
USN 4YO	AN/WLR-8	2	2
3. USN 3X6	AN/WLR-1	3	1
USN 3X6	AN/SLQ-32	3	4
USN 3X6	AN/SLQ-17	3	3
USN 3x6	AN/WLR-8	3	2
4. USN Late Convertee	AN/WLR-1	4	1
USN " "	AN/SLQ-32	4	4
USN " "	AN/SLQ-17	4	3
USN " "	AN/WLR-8	4	2
5. USNR 4X10	AN/WLR-1	5	1
6. Fleet Returnee Operator Only	AN/SLQ-32	6	4
" " "	AN/SLQ-17	6	3
" " "	AN/WLR-8	6	2

7.	Fleet Returnee Operator Maint.	AN/SLQ-32	7	4
	" " "	AN/SLQ-17	7	3
	" " "	AN/WLR-8	7	2
	" " "	Digital	7	5
	" " "	AN/ULQ-6C	7	6
8.	USCG	AN/WLR-1	8	1
9.	USN CTM (CRYPTO)	AN/UYK-20	9	7
10.	ESN ETSU		11	-
11.	USN CTM 640		12	-

TABLE 2.

GLOBAL VARIABLES USED TO ASSIGN THE MEAN VALUE OF THE INPUT RATE FOR THE OFFICERS

Student Category	Track No.	GV XX(I), I = 1st year	2nd year	3rd year	4th year	5th year
VQ Pilot Navigator PIREP (EA6)	6474	341	342	343	344	345
Aviation EW Officer (ASW/TACAIR)	6475	346	347	348	349	350
EH-6B Fleet Replacement Pilot	9795	351	352	353	354	355
Fleet Air Reconnaissance EW Evaluator (VQ)	9797	356	357	358	359	360
EA6B Fleet Replacement NFO ECMO	9798	361	362	363	364	365
VAQ-33 NFO Fleet EW	9799	366	367	368	369	370
EA6 USMC Aviation EW	9928	371	372	373	374	375

TABLE 3

GLOBAL VARIABLES USED TO ASSIGN THE MEAN OF THE INPUT RATE FOR THE ENLISTED

Student Category	Track No.	GV XX(I), I = 1st year	2nd year	3rd year	4th year	5th year
USN 6YO	AN/WLR-1	201	202	203	204	205
USN 6YO	AN/SLQ-32	206	207	208	209	210
USN 6YO	AN/SLQ-17	211	212	213	214	215
USN 6YO	AN/WLR-8	216	217	218	219	220
USN 4YO	AN/WLR-1	221	222	223	224	225
USN 4YO	AN/SLQ-32	226	227	228	229	230
USN 4YO	AN/SLQ-17	231	232	233	234	235
USN 4YO	AN/WLR-8	236	237	238	239	240
USN 3X6	AN/WLR-1	241	242	243	244	245
USN 3X6	AN/SLQ-32	246	247	248	249	250
USN 3X6	AN/SLQ-17	251	252	253	254	255
USN 3X6	AN/WLR-8	256	257	258	259	260
USN Late Conv.	AN/WLR-1	261	262	263	264	265
USN " "	AN/SLQ-32	266	267	268	269	270
USN " "	AN/SLQ-17	271	272	273	274	275
USN " "	AN/WLR-8	276	277	278	279	280
USN 4X10	AN/WLR-1	281	282	283	284	285
Flt. Return OP Only	AN/SLQ-32	286	287	288	289	290
" " " " "	AN/SLQ-17	291	292	293	294	295
" " " " "	AN/WLR-8	296	297	298	299	300
Flt. Return OP Main.	AN/SLQ-32	301	302	303	304	305
" " " " "	AN/SLQ-17	306	307	308	309	310
" " " " "	AN/WLR-8	311	312	313	314	315
" " " " "	AN/ULQ-6C	316	317	318	319	320
" " " " "	Digital	321	322	323	324	325
USCG	AN/WLR-1	326	327	328	329	330
USN CTM (CRYPTO)	AN/UYK-20	376	377	378	379	380
USN ETSU		331	332	333	334	335
USN CTM 6YO		336	337	338	339	340

B. ATTRIBUTE VECTOR

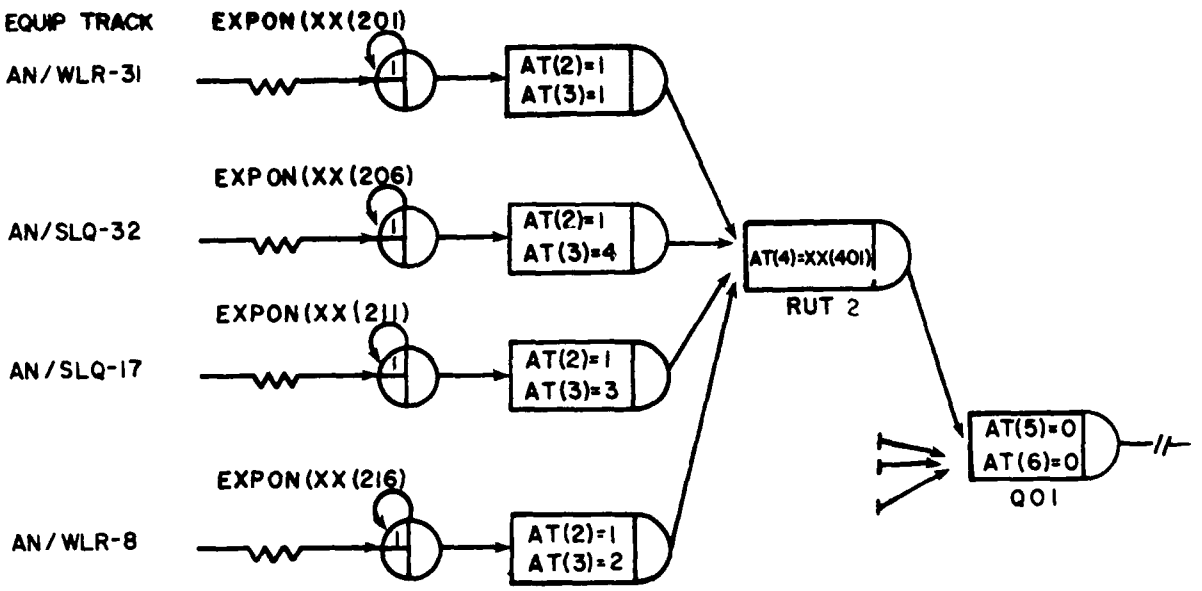
The attribute vector is attached to each student as it flows through the system. Nine attributes form the attribute vector of a student and as was pointed out earlier they are used to identify the students and also to determine the route they may follow after a conditioning node. A list of the attributes and their representation are:

ATRIB(1)	Time in the system
ATRIB(2)	Student category
ATRIB(3)	Equipment track
ATRIB(4)	Status for using the 1OH1
ATRIB(5)	Counter for setback/CDP course
ATRIB(6)	Student type
ATRIB(7)	1OH1 Phase (I, II, III)
ATRIB(8)	1OH1 Module address
ATRIB(9)	Counter for the number of modules in Phases II and III.

USN 6YO students are used to illustrate an example of the assigning of attributes as shown in Figure 12.

Student Type:	ENLISTED
Student Category:	USN 6YO
Student Equipment Track:	AN/WLR-1 AN/SLQ-32 AN/SLQ-17 AN/WLR-8

The first student arrives at time = 0. For those students who are assigned to the equipment track AN/WLR-1 the input rate is exponentially distributed with a mean equal to XX(201) for the first two years of simulation and for the first year w/s. At the beginning of the second year w/s the value of XX(201) is changed by the value of XX(202). At the beginning of the third




```
        CREATE, EXPON(XX(201)),,1;                  USN6YO/WLR-1
        ASSIGN, ATRIB(2)=1, ATRIB(3)=1;
        ACT,,, RUT1;
        CREATE, EXPON(XX(205)),,1;                  USN6YO/SLQ-32
        ASSIGN, ATRIB(2)=1, ATRIB(3)=4;
        ACT,,,RUT1;
        CREATE, EXPON(XX(211)),,1;                  USN6YO/SLQ-17
        ASSIGN, ATRIB(2)=1, ATRIB(3)=3;
        ACT,,, RUT1;
        CREATE, EXPON(XX(216)),,1;                  USN6YO/WLR-8
        ASSIGN, ATRIB(2)=1, ATRIB(3)=2;
        ASSIGN, ATRIB(4)=XX(401);
RUT1    ACT,,,Q01;
Q01     ASSIGN, ATRIB(5)=0, ATRIB(6)=0;
```

Figure 12. SLAM MODEL OF THE USN 6YO STUDENT
(Creation and the first six attributes)

year w/s the value of XX(201) is changed by the value of XX(203). At the beginning of the fourth year w/s it is changed by the value of XX(204) and at the beginning of the fifth year w/s by the value of (205), i.e., assuming the following situation:

INTLC, XX(201) = 1.25, XX(202) = 1.47, XX(203) = 1.35, XX(204) = 1.28 XX(205) = 1.55. The same logic is applied to the other students.

The 1 in the create statement CREATE, EXPON, (XX(201)),, 1 indicates that the time of creation is stored in ATRIB(1).

USN 6YO students have attribute 2 assigned to be 1, (ATRIB(2)=1). Students assigned to the equipment track AN/WLR-1 are attributed with the value of 1 for ATRIB(3). The value 2 is used for those students assigned to AW/WLR-8. The values 3 and 4 are used for equipment tracks AN/SLQ-17 and AN/SLQ-32 respectively. Those attributes are assigned immediately after the CREATE node. (See Figure 12.)

Attribute 4 has any value between 1 and 8 inclusive, and that value is the status of the students who want to use the Device 10H1. The next statement in the above graphical example ATRIB(5) = 0 represents the number of setbacks for this student for the following CDP (A602 or PHASE I). ATRIB(6) = 0 means student type ENLISTED.

The other attributes ATRIB(7), ATRIB(8) and ATRIB(9) are assigned in other portions of the network where they are required.

After the students have been created and assigned some of their attribute values, they are routed to the corresponding courses.

C. CDP COURSE MANIPULATION

All courses offered at CNEWS are identified by CDP codes. The actual curriculum of the CNEWS is categorized by group-paced (lock-step) operator courses. A typical curriculum for many of the enlisted students is shown in figures 13 and 14. The new curriculum under development by the CNEWS consists of individualized (self-paced) instruction. The Device 10H1 is implemented for this purpose and the EW students follow each curriculum module individually. Figure 15 shows the EW student flow for the FLEET RETURNEE students, the Coast Guard students and the CTM-UYK-20 students. The shaded areas show the different CDP courses that will be modified and converted to self-paced courses in the new curriculum under development.

Facility resources are a major factor in the construction of the EW student flow model. In most of the cases these facilities are fixed so the ability to manipulate some of the variables used in the model are constrained by these fixed resources.

In order to model a course it is necessary to consider all the factors that affect the performance. A list of these factors are:

1. Minimum number of students to open a course
2. Minimum number of students to open a double session
3. Maximum number of students for a course
4. Class duration
5. Convening frequency

The minimum number of students to open a single or a double session course is determined by the CNEWS policy. The maximum number of students is determined by the minimum of all the maximum resource capacities, i.e., assuming a class has the following constraints:

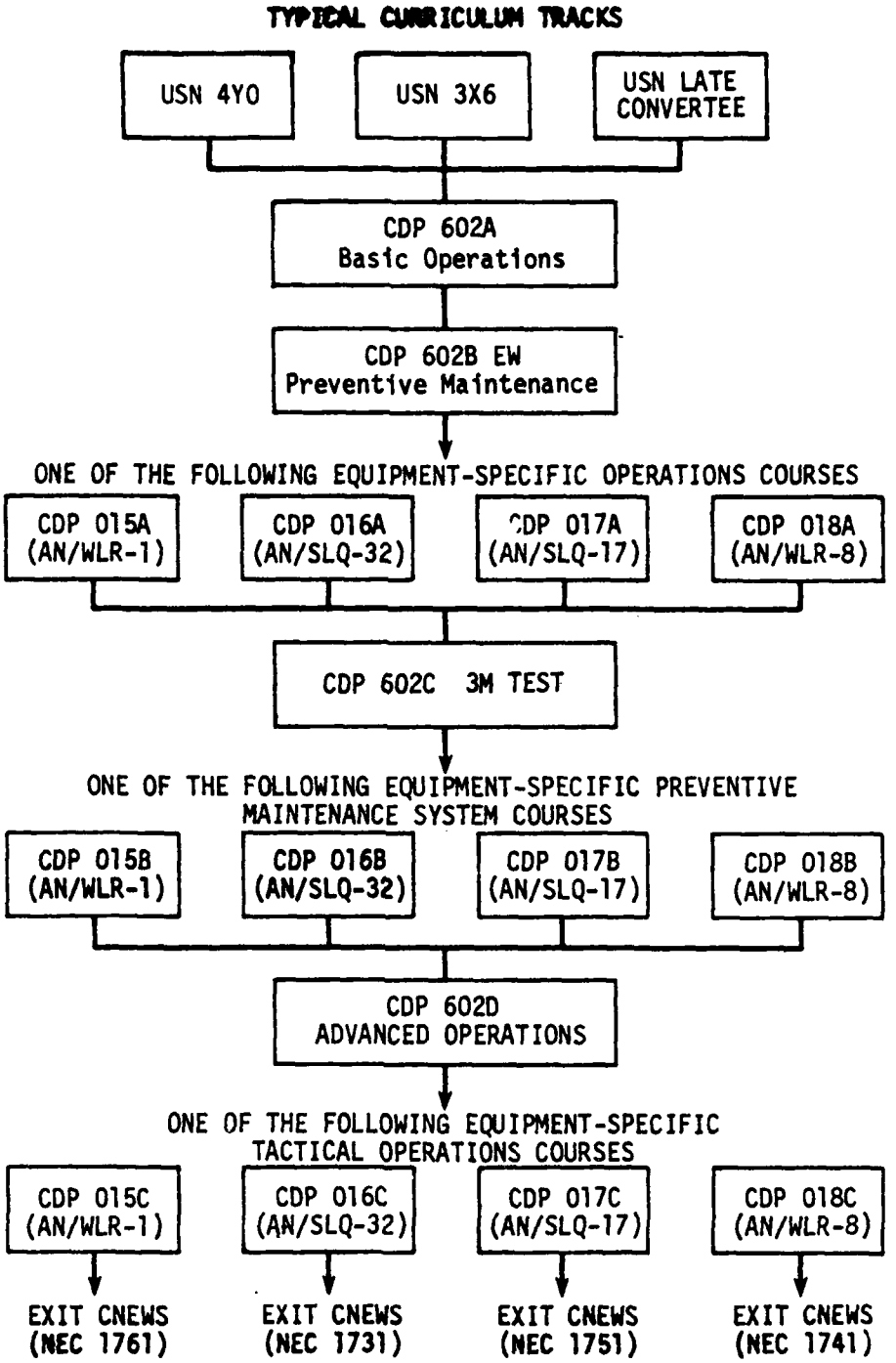
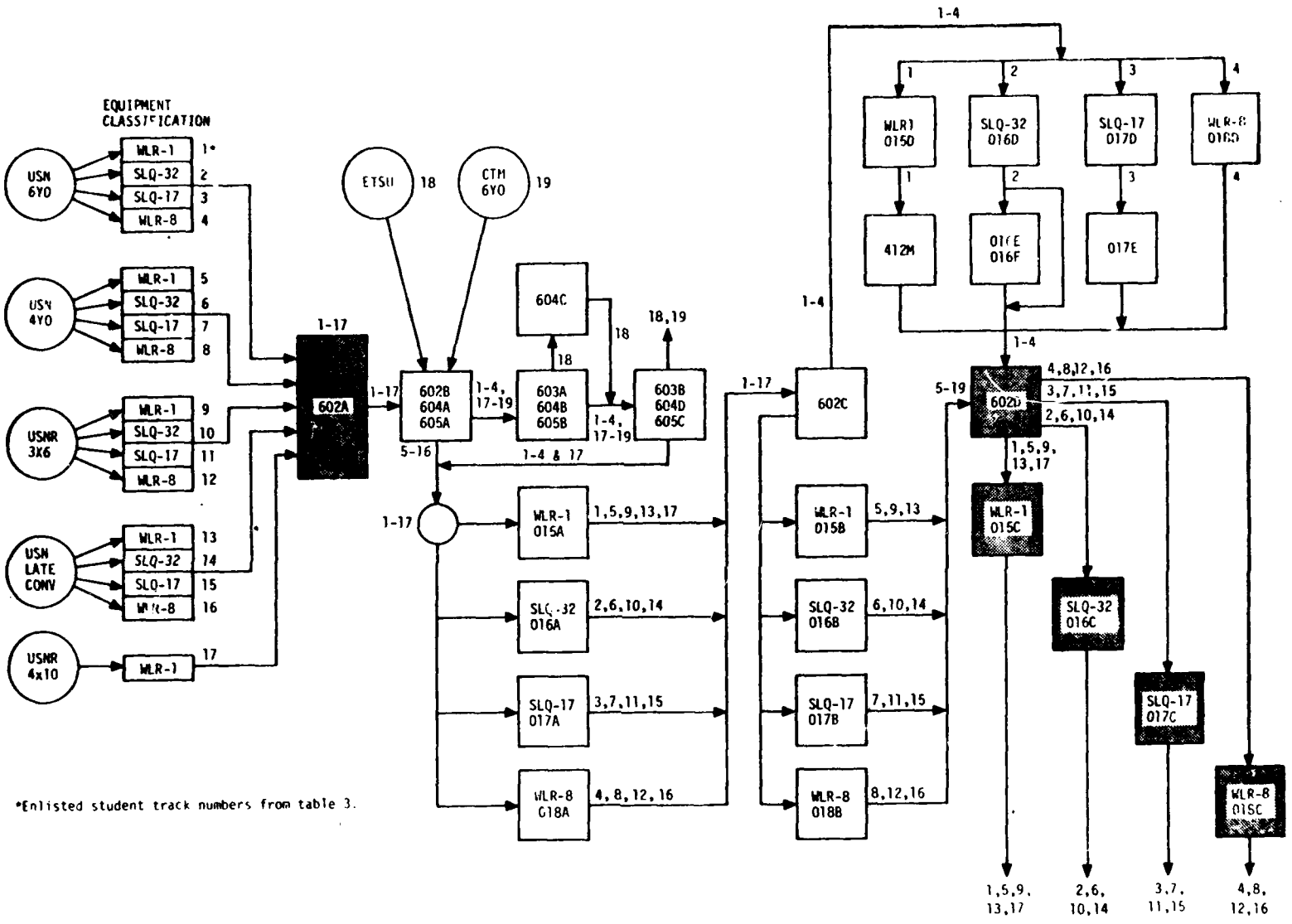


Figure 13. CNEWS General Curriculum Track for Enlisted Students



*Enlisted student track numbers from table 3.

Figure 14. CNEWS Student Flow by Tracks and Courses (Part A)

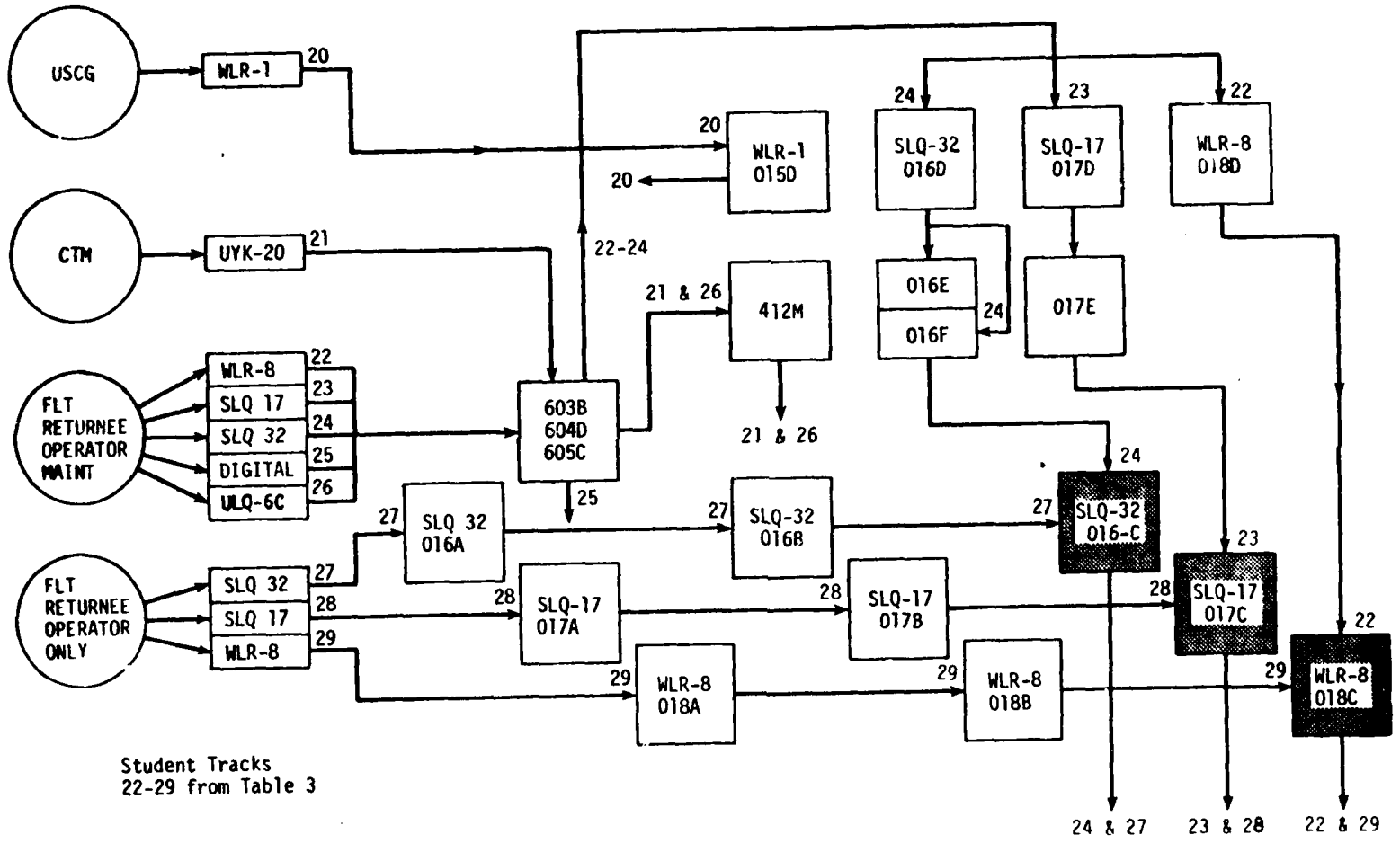


Figure 15. CNEWS Student Flow by Tracks and Courses (Part B)

a. CLASSROOM: Maximum number of students = 20

b. INSTRUCTOR: Maximum number of students = 16

c. LABORATORY: Maximum number of students = 12

Maximum class size = Min(Max(a), Max(b), Max(c)) = 12

Hence, for modeling purposes the maximum number of students allowed to take this course at one time equals 12. The reader must be familiar with the CNEWS data base in order to process modeling of the courses.

1. Individualized Curriculum

The Basic Operations Course (602) is considered a special case in the actual CNEWS curriculum because it provides individualized curriculum. Students in this course use the Learning Center (LC) facilities (learning carrels). The learning carrels consist of individual study booths equipped with audio-visual equipment supported with narrative lessons and other types of materials used for individualized learning.

The LC is used to instruct students in the following courses.

CDP602A (Basic Operations) Actual curriculum

PHASE I (Basic Operations) New curriculum

PHASE II (Advanced Operations) New curriculum

It has been established that the capacity of the LC is altered during the simulation just one time and that is at the beginning of the first year of

simulation. Students who are required to take CDP 602A are routed to the assign node Q01 where ATRIB(5) (ATRIB(5) = 0, means no setback at this portion of the network) and ATRIB(6) (ATRIB(6) = 0, means ENLISTED) are not equal to zero.

After this node the students are routed to the EVENT 4 node NOA where the status for taking the 10H1 is adjusted for any changes that have occurred while the students were in the system.

Students who take the CDP 602A must have the value of ATRIB(4) equal to 1 or 3 or 4 or 7. (See Figure 16)

When ATRIB(4) = 1 no 10H1 at all

When ATRIB(4) = 3 Phase II only

When ATRIB(4) = 4 Phase III only

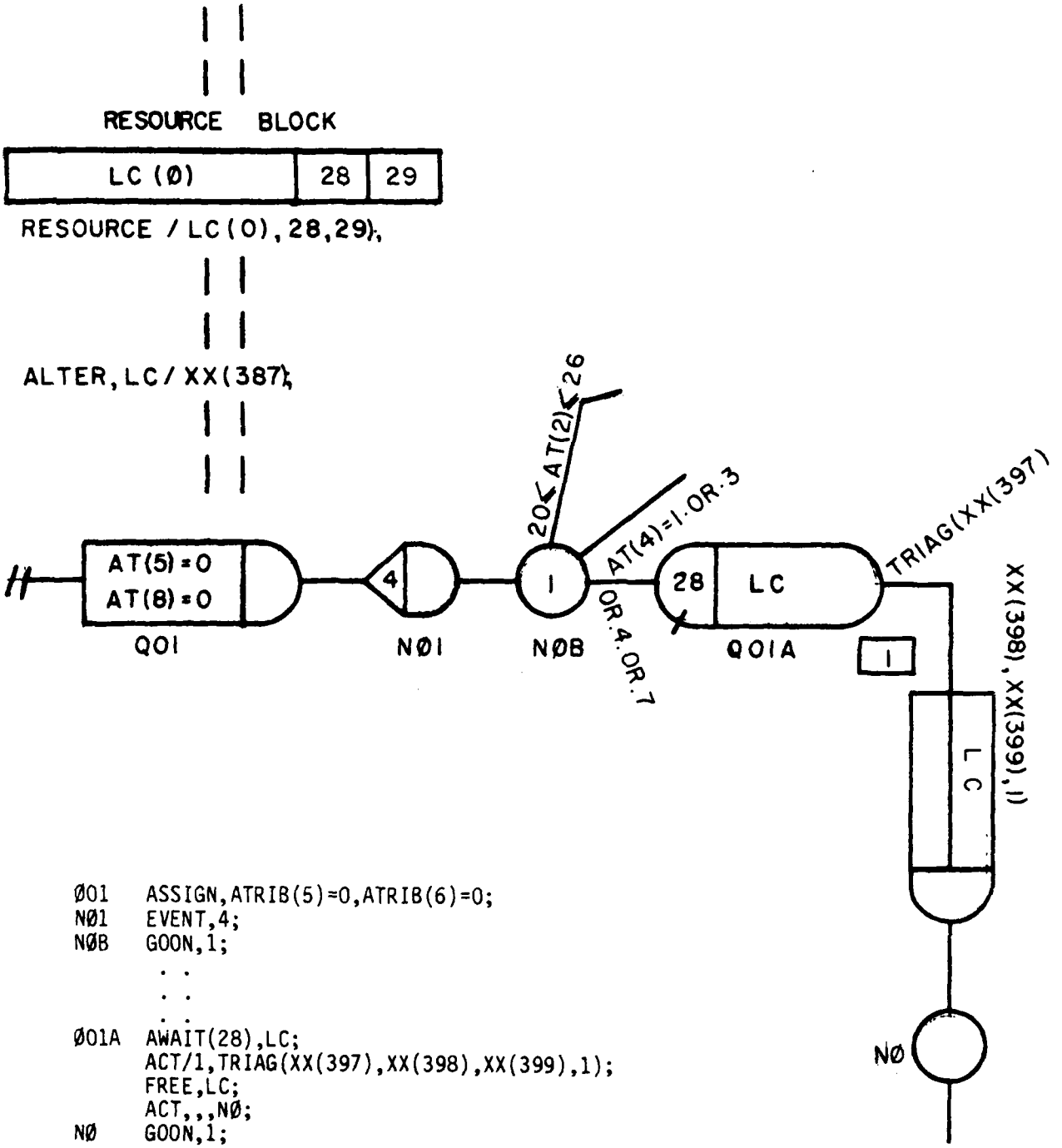
When ATRIB(4) = 7 Phase II and III only

Students with these values for ATRIB(4) are routed to the AWAIT node Q01A (AWAIT (28), LC)

This AWAIT node is associated with LC and file 28.

Students arriving at this node wait in file 28, if there is no LC resource available.

When a LC resource is released, the student who has the greatest waiting time in file 28 is allowed to pass through the await node (AWAIT (28), LC) and takes the available LC resource. Immediately he follows a branch activity (ACTIVITY 1).




```
Ø01    ASSIGN,ATRIB(5)=0,ATRIB(6)=0;
NØ1    EVENT,4;
NØB    GOON,1;
        . .
        . .
        . .
Ø01A   AWAIT(28),LC;
       ACT/1,TRIAG(XX(397),XX(398),XX(399),1);
       FREE,LC;
       ACT,,,NØ;
NØ     GOON,1;
        . .
```

FIGURE 16. Slam Model of CDP 602A

This activity (ACT 1) represents the CDP 602A. The length is determined by the student performance and it is triangularly distributed with a mean equal to the value of XX(398) and a deviation of ± 10%. The value of GV XX(397) accounts for the minimum time (optimistic value). The value of GV XX(399) accounts for the maximum time (pessimistic value). The SLAM main processor is responsible for the access of the respective functions and brings the time values for the triangular function. That value is the time the student spends in the course 602A. The SLAM main processor also records an entry for activity 1 and keeps record of the elapsed time, the maximum number of users and the total number of users.

Once the student spends his assigned time in ACT 1 he moves to a FREE node where he releases the LC resource and continues his flow to node NO. There is also the possibility that the arriving student will find a LC resource available. In this case he takes the LC resource without any waiting time and immediately proceeds through Activity 1. The AWAIT node (AWAIT (28), LC) could be compared with the office where students check in to use the LC. If there is no learning carrel available, students write their names on a waiting list (file 28).

When a learning carrel is released the student at the top of the list (student with the greatest waiting time) is allowed to use the LC carrel. The facility is kept busy until the student finishes his lessons (Act 1).

The next step is the release of the learning carrel (FREE,LC) and the student is ready to take advanced courses.

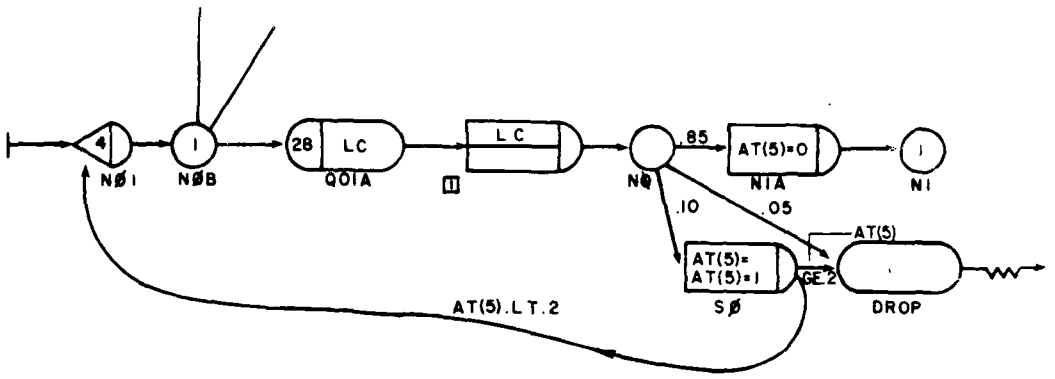
Seven CNEWS courses delineate attrition and setback rates, they are:

CDP courses

602A	Attrition rate = 5%
1C	
602C	Setback rate = 10%
015B	
2C	
3C	
015D	

Thus, the next step consists of modeling the attrition and the set-back rates for CDP 602A. (See Figure 17.)

After the students leave ACT 1 and release the LC resource, they move to a GOON node where 85% continue to take advanced courses while 5% of the students drop out and leave the model. Finally 10% of the students are routed to the ASSIGN node SØ. ASSIGN node SØ is a conditional node. The value of ATRIB(5) is increased by one unit. Then the student is routed back to the EVENT (4) node to retake CDP 602A, if the value of ATRIB(5) is less than two. (The maximum times any student is allowed to take the same course is two.) If the value of ATRIB(5) is equal to two, the student is removed from the system. Collect node DROP is used to collect the number of students who drop out and those removed from the system. Those students who passed the CDP 602A course are routed to the ASSIGN node N1A where the value of ATRIB(5) is reset to zero.




```
NØ      GOON;
        ACT,,.1,SØ;
        ACT,,.85,N1A;
        ACT,,.Ø5,DROP;
SØ      ASSIGN, ATRIB(S)=ATRIB(5)+1,1;
        ACT,,ATRIB(5).GE.2,DROP;
        ACT,,,NØA;
N1A     ASSIGN, ATRIB(5)=Ø;
        ACT;
N1      GOON,1;
         . .
         . .
         . .
DROP    COLCT,INT(1),DROPOUTS;
         . .
```

FIGURE 17. Slam Model of CDP 602A With Attrition-rate and Set-back Rate.

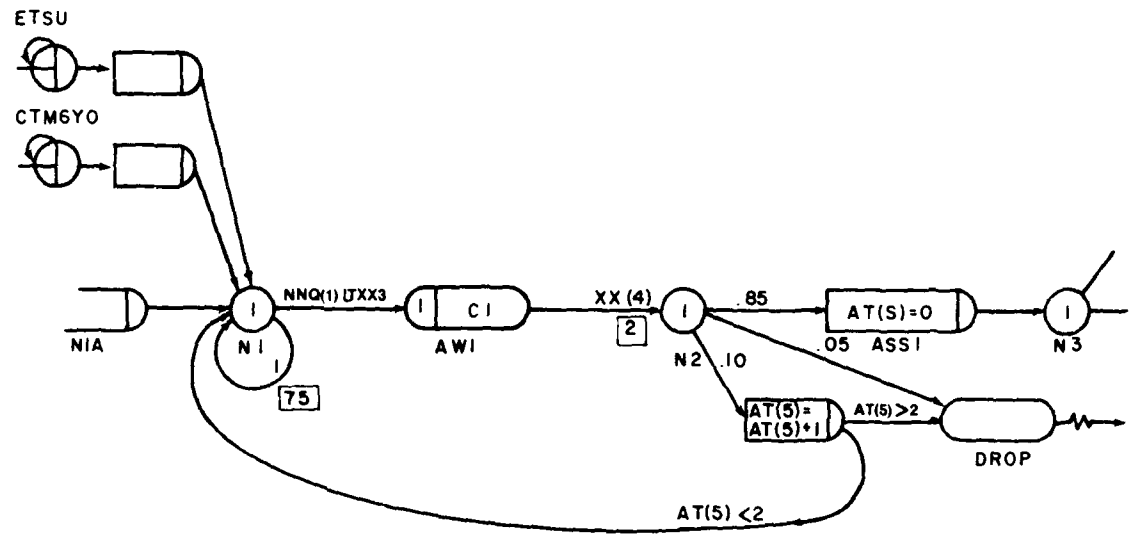
2. Group-paced (lock-step) Courses

The EW student flow model has 26 group-paced (lock-step) courses. The modeling of this process is explained using as an example CDP 1C in figure 18.

Students who satisfactorily passed CDP 602A join ETSU and CTM 6YO in the conditional GOON node N1. Once the students reach node N1 they try to reach the AWAIT node AW1, moving through the first branch. The students are allowed to go through the first branch only if the number of students in file 1 is less than the value of GV XX(3). If the number of students in file 1 is greater or equal to the value of XX(3), students are routed to activity 75 where they spend one week. Upon completion of ACT 75 they are routed back to the GOON node N1 and they try another time to reach AWAIT node AW1. If the condition for moving through the first branch is not met by the students, they are allowed to take the second branch unconditionally and spend one more week before attempting another try. (Global variable XX(3) represents the maximum number of students allowed to take CDP 1C.)

Students who wish to take CDP 1C must register in file 1. Those students registered in file 1 are the only ones allowed to take the 1C courses when the next period of classes begins. Students in ACT 75 must reach file 1 before taking the CDP 1C course.

The SLAM main processor keeps statistics for the maximum number of




```
N1      GOON,1;
        ACT,,NNQ(1).LT.XX(3),AW1;
        ACT/75,1,,N1;
AW1     AWAIT(1),C1;
        ACT/2,XX(4);
N2      GOON:
        ACT,,.10,S1;
        ACT,,.85,ASS1;
        ACT,,.05,DROP;
S1      ASSIGN,ATRIB(5)=ATRIB(5)+1,1;
        ACT,,ATRIB(5).GE.2,DROP:
        ACT,,,N1;
ASS1    ASSIGN,ATRIB(5)=0.;
        ACT,,,N3;
```

FIGURE 18. Slam Model of CDP 1C

students in ACT 75, the total number of entries and the average time for the students in that activity. Students in file 1 are kept in this file while the CLOSE condition for GATE C1 persists. (An AWAIT node is used in the gate mode.)

The information contained in file 1 is the condition for routing the entity that controls the GATE C1 (see GATES AND RESOURCES ASSOCIATED WITH CDP COURSES) to perform one of the three possible alternatives.

a. If the number of students in file 1 is greater or equal to XX(1), but less or equal to XX(3): OPEN double shift 1C course.

b. If the number of students in file 1 is greater than XX(2), but less or equal to XX(2): OPEN single shift 1C course.

c. If the number of students in file 1 is less than XX(2): CLOSE condition persists for one more period and 1C course is not offered.

As soon as the simulation process begins the model tries to OPEN all the GATES that meet the open condition. Then the process automatically tries to OPEN a GATE any time the convening frequency time has elapsed. For GATE C1 this convening frequency time is represented by the value of XX(5).

Assuming the condition for OPEN GATE C1 is met and the convening frequency time has elapsed, GATE C1 is OPENED. All the students in file 1 pass through the AWAIT node AW1 , and are immediately routed to branch (ACT 2). GATE C1 is CLOSED, only allowing those students who were in file 1 before the opening to pass. File 1 is now available to receive more students.

ACTIVITY 2 represents the 1C course. Students in this activity are delayed for a period of time equal to the time length of 1C. This value is represented in the model by XX(4). Once again

the SLAM main processor automatically keeps track of the statistics in ACT 2. After the XX(4) time has elapsed (end of the course) the students are moved to a conditional GOON node N2 for the attrition and setback process. This process is the same as the one explained in CDP 602A (see Attrition Rate and Set-Back Rate).

a. 85 percent of the students pass the 1C course successfully in one time

b. 5 percent of the students drop out of the school

c. 10 percent of the students are routed back for another and last chance to retake the 1C course.

Students who successfully passed 1C are routed to the ASSIGN node ASS 1 where the value of ATRIB(5) is reset to zero. After this ASSIGN node they keep moving through the system until they reach the GOON node N3.

3. Routing Students Through the Network

Not all the enlisted students in the EW model have to follow the same curriculum. After the EW Preventive Maintenance course, CDP 1C, some students go directly to one of the equipment track courses 015A, 016A, 017A or 018A. Others go to additional EW preventive maintenance courses before taking the equipment courses. (See Figure 19.)

A brief summary of these preventive maintenance courses is shown here without any attempt to explain the way they were modeled:
USN6YO students go to 2C and 3C before going to the equipment courses. USNR 4X10 students go to the 2C before going to the equipment course 015A. ETSU students go to the 2C, 504C and 3C before they leave the system. CTM 6YO students go to the 2C and 3C before leaving the system. 2C and 3C are modeled exactly the same way as 1C was modeled.

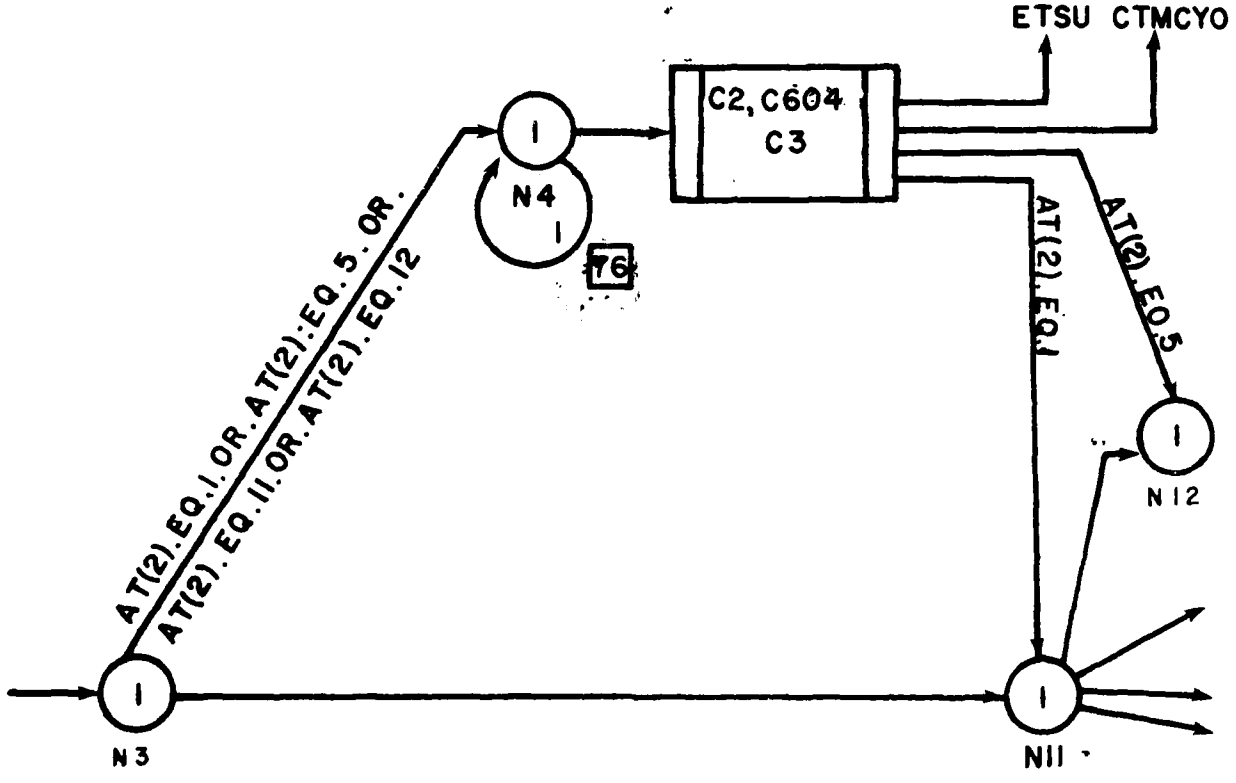
Three of the prime attributes attached to each enlisted student are used to identify them for routing purposes. ATR1B(6) is used to identify enlisted from officers. ATRIB(2) is used to identify the students by category. Hence, it is possible to separate a specific category of students and route them to a selected node. ATRIB(3) is used to identify students by the equipment track they have to follow. Here different students of different categories are combined to take the same equipment operations courses.

a. Routing by Student Category

All students arriving at the GOON node N3 are enlisted.
All the students belonging to the following categories are routed to the GOON node N4.

USN 6YOs	ATRIB(2) = 1
USNR 4X10	ATRIB(2) = 5
USN ETSU	ATRIB(2) = 11
CTM 6YO	ATRIB(2) = 12

All other categories are routed unconditionally to the GOON node N11.



Note that CDP's 2C, 604C and 3C (C2, C604, C3) are not described in this model.

```
N3    GOON, 1
      ACT,, ATRIB(2). EQ.1. OR. ATRIB(2). EQ. 5. OR. ATRIB(2). EQ. 11. OR.
      ATRIB(2). EQ.12, N4;
      ACT,,, N11;
```

Figure 19. SLAM model of Conditional Activities (routing by category).

b. Routing by Equipment Track

Students arriving at the GOON node N11 belong to all categories except USN ETSU and CTM6YO who left the system after the 3C course.

A brief summary of the student categories arriving at node N11 and their precedent node follows:

STUDENT CATEGORY	ATRIB(2)	PRECEDENCE
USN 6YO	1	ASSIGN node ASS3 (after CDP 3C)
USN 4YO	2	GOON node N3
USN 3X6	3	GOON node N3
USN Late Conv.	4	GOON node N3
Flt. Returnee Operator only	6	Introduced in the system at this point. (See STUDENT FLOW flowchart)

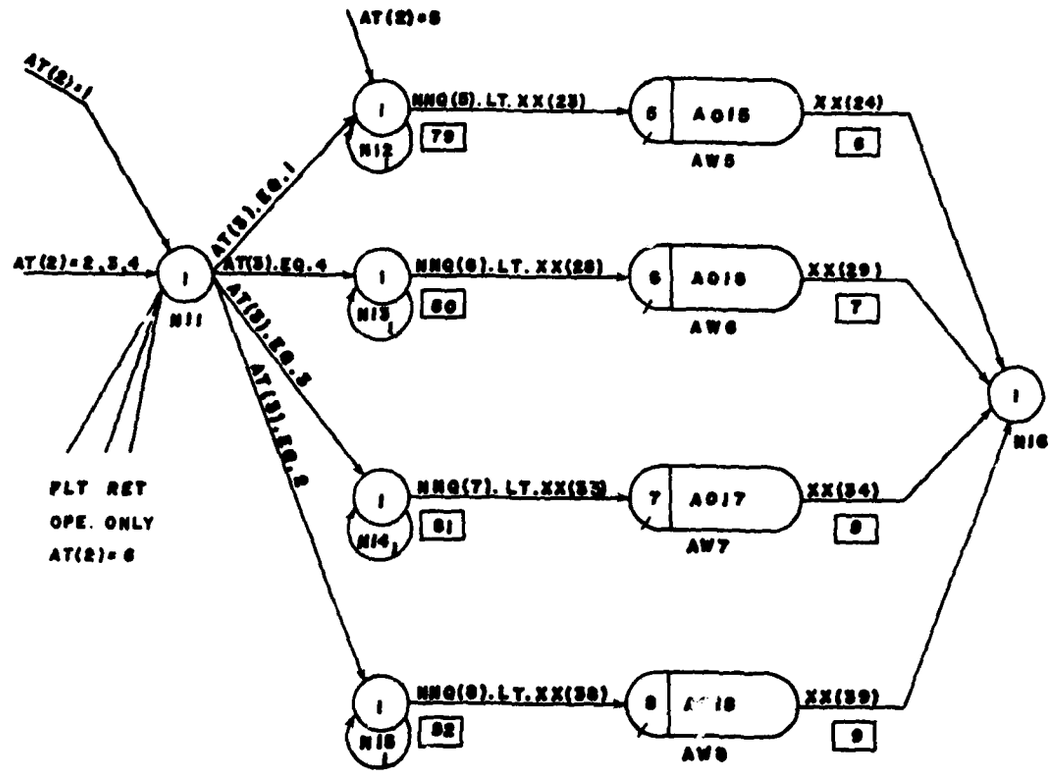
Note a) USNR 4X10 were routed directly to GOON node N12.

Note b) FLT RETURNEE-OPERATOR MAINTENANCE were introduced in the model and routed to GOON node N8 to take the CDP course 3C (C3). (See STUDENT FLOW flowchart). They are routed directly to GOON node N18.

As was explained earlier, there are four different equipment operations courses (015A, 016A, 017A and 018A). There is a relation between these courses and the equipment tracks that will be considered in the model.

COURSE	EQUIPMENT TRACK	ATRIB(3)
CDP 015A	AN/WLR-1	1
CDP 016A	AN/SLQ-32	4
CDP 017A	AN/SLQ-17	3
CDP 018A	AN/WLR-8	2

Figure 20 shows the SLAM representation of this routing process and also shows the SLAM representation of the four equipment operations CDP courses 015A, 016A, 017A and 018A.




```
N11     GOON,1;
        ACT,,ATRIB(3).EQ.1,N12;
        ACT,,ATRIB(3).EQ.2,N15;
        ACT,,ATRIB(3).EQ.3,N14;
        ACT,,ATRIB(3),EQ.4,N13;
N12     GOON,1;
        ACT,,NNQ(5).LT.XX(23),AWS;
        ACT/79,1,,N15;
AW5     AWAIT(5),AØ15;
        ACT/6,XX(24),,N16;
```

FIGURE 20. Slam Model of Some Routing Activities (Routing by Equipment Track) and CDP's 015A, 016A, 017A, and 018A).

ATRIB(3) is used to identify the students by track. Hence, those students who have the equipment track AN/WLR-1 and ATRIB(3) = 1 are routed to the GOON node N12 before going to CDP 015A. Those students who have the equipment track AN/SLQ-32 and ATRIB(3) = 4 are routed to GOON node N13 before going to the CDP 016A. Those students who have the equipment track AN/SLQ-17 and ATRIB(3) = 3 are routed to GOON node N14 before going to the CDP 017A. Those students who have the equipment track AN/WLR-8 and ATRIB(3) = 2 are routed to GOON node N15 before going to the CDP 018A.

The flow for all students represented in Figure 20 is the same, CDP 018A flow is typical and is as follows. Students arriving at node N15 are conditionally routed to the AWAIT node AW 8 (AWAIT (8), A018). If the number of students in file 8 is less than the value of XX(38) new students are allowed to take the first branch and reach the AW8 node. If the number of students in file #8 is greater or equal to the value of XX(38) students are denied access to the AW8 node. Instead they are routed unconditionally to the second branch. This second branch represents ACT 82. Students are delayed one week in this activity and routed back to the GOON node N15 where they make another attempt to reach the AWAIT node AW8. A negative attempt means they take the second branch, spend an additional week in ACT 82, and keep trying until the AW8 node is accessible.

The AWAIT node (AWAIT(8),A018)is associated with file 8 and GATE A018. Students arriving at this node are kept in file 8 while the CLOSE condition of GATE A018 persists.

The information in file 8 is evaluated by the entity which controls the Opening and Closing of this GATE A018. At the beginning of the simulation file 8 is tested to OPEN GATE A018. After that it is evaluated each convening frequency time. At the moment of the evaluation GATE A018 is OPENED if the following conditions are met.

(1) The number of students in file 8 must be greater or equal to the value of GV XX(36) but less than or equal to the value of GV XX(38).

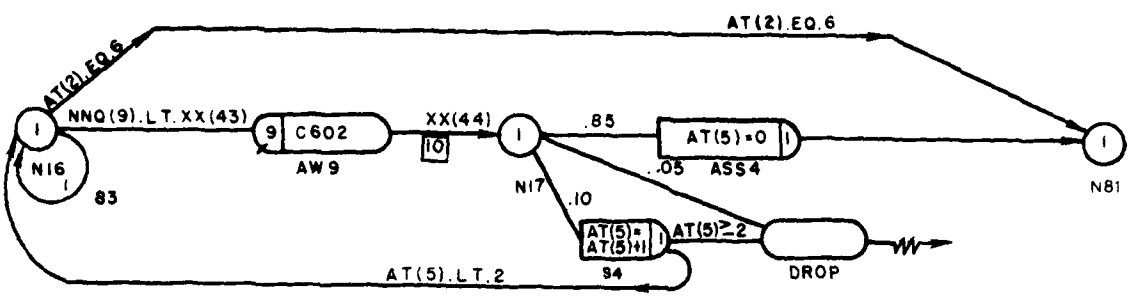
(2) If the number of students in file 8 is less than the value of XX(36) GATE A018 stays CLOSED for a period equal to the convening frequency time. Until that time, no other attempt is made to OPEN GATE A018.

Assuming the number of students in file 8 is greater than or equal to XX(36) but less than or equal to XX(38): GATE A018 is OPENED. All students in file 8 are allowed to pass through AWAIT node AW8 (AWAIT (8), A018). GATE A018 is CLOSED immediately. These students flow directly to the branch following the AWAIT node (ACTIVITY 9).

Activity 9 represents in the model CDP 018A and the XX(39) time represents the length duration for this CDP. When the XX(39) time has elapsed the students leave the Activity branch (end of CDP A018) and are routed to GOON node N16 where, with the exception of the Fleet Returnee, they move conditionally to take the 3M Test Course (CDP 602C).

Fleet Returnee students at GOON node N16 are routed directly to the conditional GOON node N18. The rest of the students try to reach the AWAIT node AW 9 (AWAIT(9), C602). If the number of students in file 9 is less than the value of GV XX(43) they are allowed to reach the await node AW9 where they are kept in file 9 while the CLOSE condition for GATE C602 persists. If the number of students in file 9 is greater or equal to the value of GV XX(43), an attempt for new students to reach the AWAIT node is denied. They are routed unconditionally to the second branch (ACTIVITY 83) where they are delayed for a period of one week, before another attempt to reach the AW9 node. As soon as the CLOSE condition for GATE C602 changes to OPEN, students in file 9 move ahead and take the following branch (ACTIVITY 10) where they are delayed for a period of time equal to the CDP 602C's length duration represented by the GV XX(44).

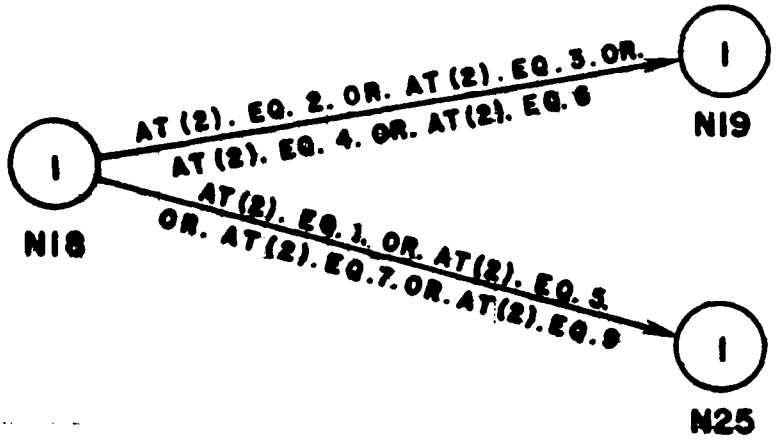
This course shows attrition and set-back rates, so 85% of the students are routed ahead to GOON node N18, 10% are routed back to retake for a second and last time CDP 602C, and 5% are dropped from the system.




```
N16       GOON, 1;
          ACT,, ATRIB(2).EQ.6.OR.ATRIB(2).EQ.7,N18;
          ACT,, NNQ(9) LT. XX(43), AW 9;
          ACT/83,1,,N16;
AW9       AWAIT (9),C602;
          ACT/10,XX(44),,N17;
N17       GOON, 1;
          ACT,,,1,54;
          ACT,,85,ASS4;
          ACT,,05.DROP;
S4        ASSIGN, ATRIB(5) = ATRIB(5)+1,1;
          ACT,,ATRIB(5).GE.2,DROP;
          ACT,,,N16;
ASS4      ASSIGN, ATRIB(5) = 0;
```

Figure 21. Flow Chart and SLAM Statements for the 3M Test Course (CDP 602C).

Students who pass successfully the course 602C are moved to the conditional GOON node N18 where they are routed by student categories to GOON nodes N19 and N25.




```
N18     GOON,1;
        ACT,, ATRIB(2).EQ.2.OR.ATRIB(2). EQ.3.OR. ATRIB(2). EQ.4.OR.
              ATRIB(2). EQ. 6, N19;
        ACT..ATRIB(2). EQ. 1.OR.ATRIB(2).EQ.5.OR. ATRIB(2). EQ.7.OR.
              ATRIB(2). EQ. 9,N25;
```

Figure 22. Flow Chart and SLAM Statements for Routing by Student Categories.

The following student categories are routed to GOON N19.

Student Category	Atrib(2)
USN 4YOs	2
USN 3X6s	3
USN Late Convs.	4
FLT. Returnee Operator Only	6

Once these students reach the N19 node they are rerouted by equipment track to one of the following Equipment Specific Preventive Maintenance Service Courses with CDP 015B showing attrition and set-back rates.

CDP 015B	(AN/WLR-1)
CDP 016B	(AN/SLQ-32)
CDP 017B	(AN/SLQ-17)
CDP 018B	(AN/WLR-8)

As soon as the students finish their respective CDP courses they are moved ahead to EVENT node N36, (EVENT, 4).

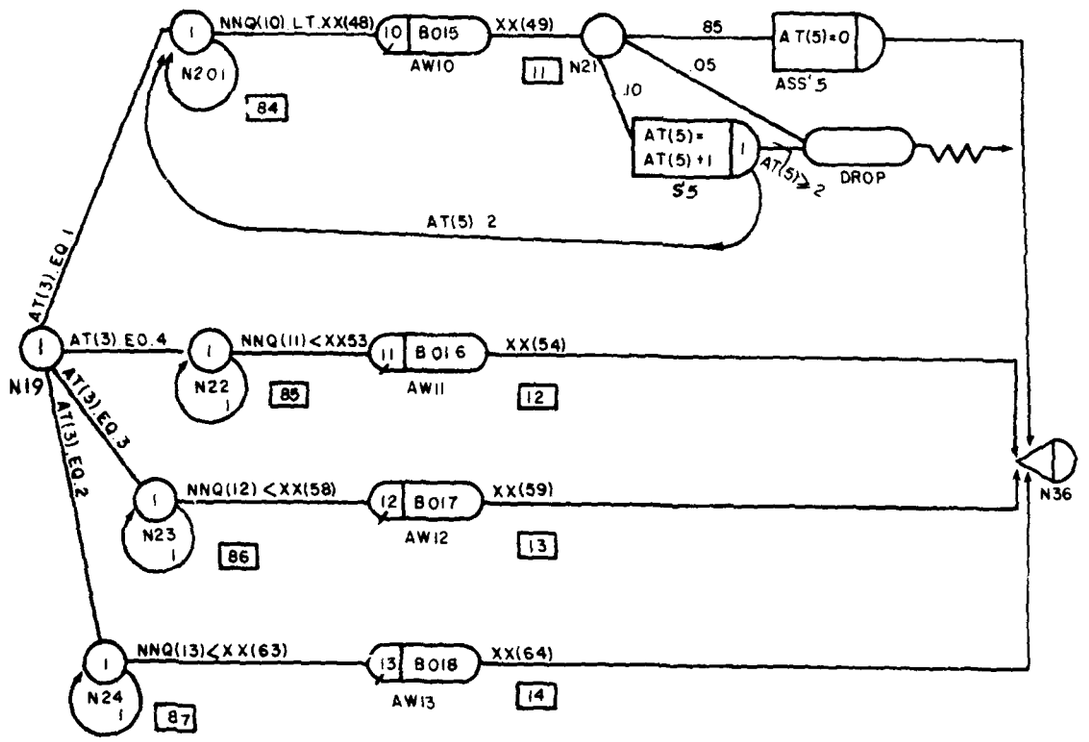


Figure 23A. Flow Chart for Routing Students by Equipment Track and Courses 015B, 016B, 017B, and 018B.

```
N19     GOON,1;
        ACT,,ATRIB(3). EQ. 1, N20;
        ACT,,ATRIB(3).EQ.4,N22;
        ACT,,ATRIB(3).EQ.3,N23;
        ACT, ATRIB(3).EQ.2.N24;
N20     GOON,1;
        ACT,,NNQ(10).LT.XX(48),AW10;
        ACT/84,1,,N20;
AW10    AWAIT (10),B015;
        ACT/11,XX(49),,N21;
N21     GOON;
        ACT,,,1,S5;
        ACT,,,85,ASS5;
        ACT,,.05,DROP;
S5      ASSIGN, ATRIB(5) = ATRIB(5) +1,1;
        ACT,,ATRIB(5).GE.2,DROP;
        ACT,,N20;
ASS5    ASSIGN, ATRIB(5)=0;
        ACT,,,N36;
N22     GOON,1;
        ACT,,NNQ(11).LT.XX(53),AW11;
        ACT/85,1,,N22;
AW11    AWAIT (11),B016;
        ACT/12,XX(54),,N36;
N23     GOON,1;
        ACT,,NNQ(12).LT.XX(58),AW12;
        ACT/86,1,,N23;
AW12    AWAIT(12),B017;
        ACT/13,XX(59),,N36;
N24     GOON,1;
        ACT,,NNQ(13).LT.XX(63),AW13;
        ACT/87,1,,N24;
AW13    AWAIT(13), B018;
        ACT/14,XX(64),,N36;
```

Figure 23B. SLAM statements for Routing Students by Equipment Track and Courses 015B, 016B, 017B and 018B.

The following student categories are routed to GOON N25:

Student Category	ATRIB(2)
USN 6YOs	1
USNR 4X10s	5
Fleet Returnee Operator Maintenance	7
USN CTM(CRYPTO)	9

Once these students reach the N25 node they are rerouted by [illegible] track to the following Equipment Specific Preventive Maintenance Service Courses with CDP 015D showing attrition and set back rates.

CDP 015D - 412M	(AN/WLR-1)
CDP 016D-016E/016F	(AN/SLQ-32)
CDP 017D-017E	(AN/SLQ-17)
CDP 018D	(AN/WLR-8)

USNR 4X10 students are routed directly to EVENT 4 node N36 after they take the 015D course.

Fleet Returnee Operator Maintenance students and USN CTM (CRYPTO) students are routed directly from GOON N25 to the CDP 412M. Fifty percent of the AN/SLQ-32 students take CDP-016E after taking CDP 016D. Fifty percent of the AN/SLQ-32 students take CDP 016F after taking CDP 016D. As soon as the students finish their respective courses they move ahead to EVENT node N36 (EVENT,4).

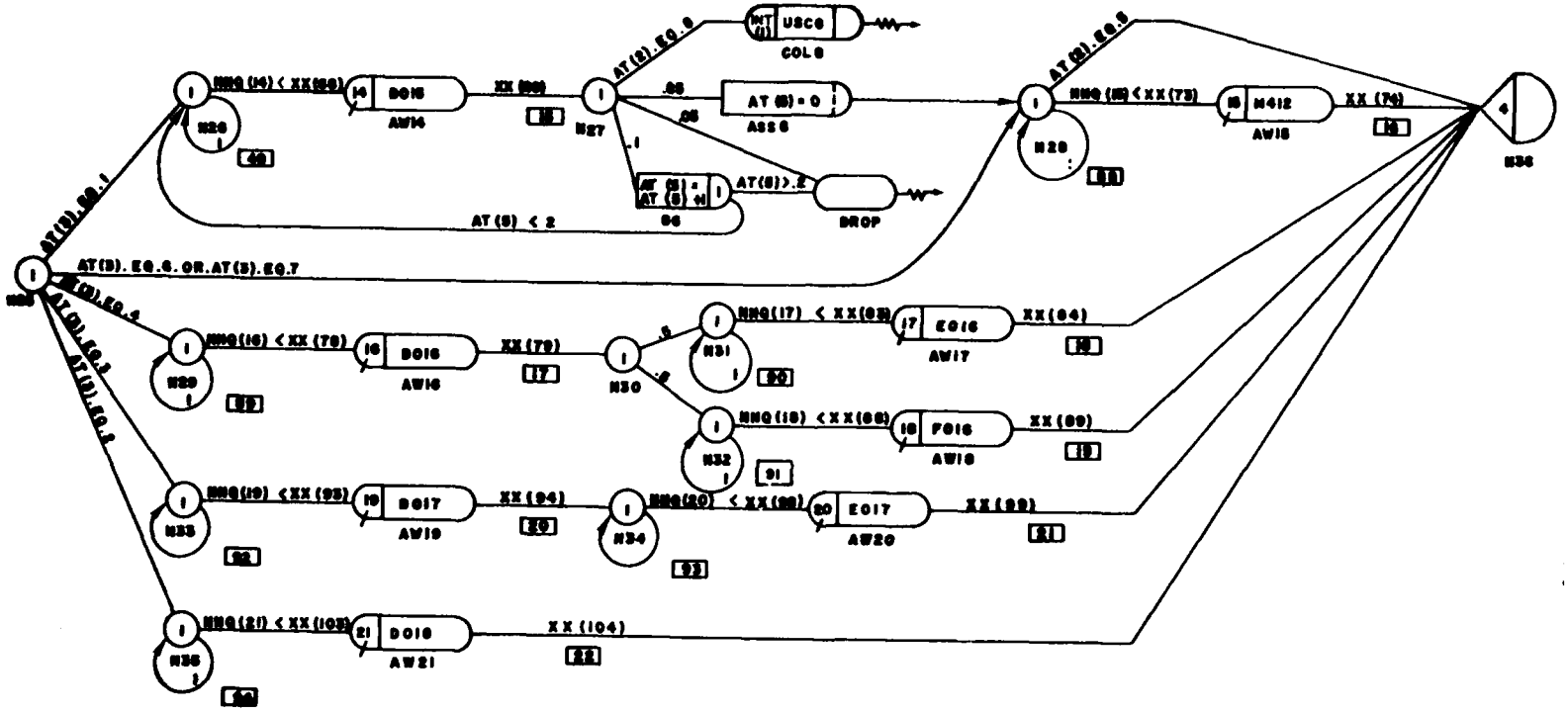


Figure 24A. Flow Cnart for Routing Students by Equipment Track and Courses 015D, 412M, 016D, 016E, 016F, 017D, 017E, 018D.

```
N25     GOON,1;
        ACT,,ATRIB(3).EQ.1,N26;
        ACT,,ATRIB(3).EQ.6. OR.ATRIB(3).EQ.7,N28;
        ACT, ATRIB(3).EQ.4,N29;
        ACT,,ATRIB(3).EQ.3,N33;
        ACT,,ATRIB(3).EQ.2,N35;
N26     GOON,1;
        ACT,,NNQ(14).LT.XX(68),AW14;
        ACT/49,1,,N26;
AW14    AWAIT(14),D015;
        ACT/15,XX(69),,N27;
N27     GOON,1;
        ACT,,ATRIB(2).EQ.8,COL8;
        ACT,,1,S6;
        ACT,,,85,ASS6;
        ACT,,.05,DROP;
S6      ASSIGN,ATRIB(5)=ATRIB(5) +1,1;
        ACT,,ATRIB(5).GE.2,DROP;
        ACT,,,N26;
ASS6    ASSIGN,ATRIB(5)=0;
        ACT,,,N28;
N28     GOON,1;
        ACT,,ATRIB(2).EQ.5,N36;
        ACT,,NNQ(15).LT.XX(73),AW15;
        ACT/88,1,,N28;
AW15    AWAIT(15),M412;
        ACT/16,XX(74),,N36;
N29     GOON,1;
        ACT,,NNQ(16).LT.XX(78),AW16;
        ACT/89,1,,N29;
AW16    AWAIT(16),D016;
        ACT/17,XX(79),,N30;
N30     GOON,1;
        ACTG,,,5,N31;
        ACT,,.50.N32;
N31     GOON,1;
        ACT,,NNQ(17).LT.XX(83),AW17;
        ACT/90,1,,N31;
AW17    AWAIT(17),E0.16;
        ACT/18.XX(84),,N36;
N32     GOON,1;
        ACT,,NNQ(18),LT.XX(88),AW18;
        ACT/91,1,,N32;
AW18    AWAIT(18),F016;
        ACT/19,XX(89),,N36;
N33     GOON,1;
        ACT,,NNQ(19).LT.XX(93),AW19;
        ACT/92,1,,N33;
AW19    AWAIT(19),D017;
        ACT/20,XX(94),,N34;
N34     GOON,1;
        ACT,,NNQ(20).LT.XX(98),AW20;
        ACT/93,1,,N34;
AW20    AWAIT(20),E017;
        ACT/21,XX(99),,N36;
N35     GOON,1;
        ACT,NNQ(21).LT.XX(103),AW21;
        ACT/94,1,,N35;
AW21    AWAIT(21),D018;
        ACT/22,XX(104),,N36;
```

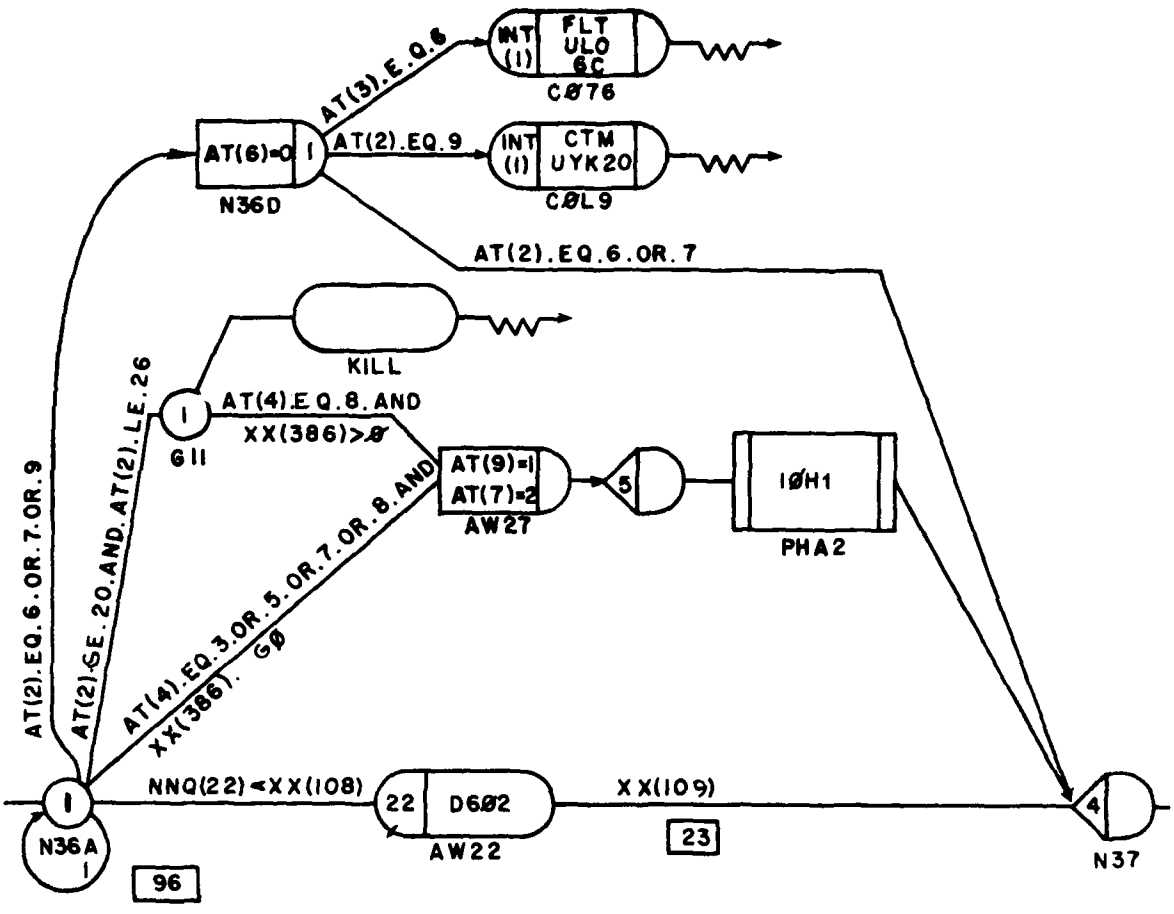
Figure 248. SLAM Statements for Routing Students by Equipment Track and Courses 015D, 412M, 016D, 016E, 016F, 017D, 017E,018D

EVENT node N36 (EVENT,4) updates the student status for taking the Device 10H1. Students who take the course 602D must have the value of ATRIB(5) equal to 1,2,4 or 6. (No 10H1 for Phase II.)

With the exception of the Fleet Returnee students all the enlisted take the Advanced Operations Course (CDP 602D). Fleet Returnee students are routed to the N36D Assign node where the value of ATRIB(6) is set to zero. Fleet Returnees (ULQ-6C) and CTM (CRYPTO, UYK-20) leave the system at this point of the network.

Students in File 22 are routed to ACTIVITY 23 when the condition of GATE D602 changes to OPEN. GV XX(109) represents the elapsed time for this course. After finishing ACTIVITY 23 students are moved ahead to EVENT node N37, (EVENT,4).

Note that even though the officers have not been considered at this point, every time there is a possibility to take the 10H1 the model routes them to the Device 10H1.




```
N36       EVENT,4;
          ACT;
N36A      GOON,1;
          ACT,,ATRIB(2).EQ.6.OR.ATRIB(2).EQ.7.OR.ATRIB(2).EQ.9,N36D;
          ACT,,ATRIB(2).GE.20.AND.ATRIB(2).LE.26,G11;
          ACT,,ATRIB(4).EQ.3.OR.ATRIB(4).EQ.5.OR.ATRIB(4). EQ.6.OR.
          ATRIB(4).EQ.8.AND.XX(386).GT.0,AW27;

          ACT/96,1,,N36A;
G11       GOON,1;
          ACT,,ATRIB(4).EQ.8.AND.XX(386). GT.0,AW27;
          ACT,,,KILL;
AW27      ASSIGN,ATRIB(9)=1,ATRIB(7)=2;
          EVENT,5;
          ACT,,,AW34;
N36D      GOON,1;
          ACT,,ATRIB(3).EQ.6, C076;
          ACT,,ATRIB(2).EQ.9, COL9;
          ACT,,,N37;
AW22      AWAIT(22),D602;
          ACT/23,XX(109),,N37;
```

Figure 25. SLAM Statements and Flow Chart for the Advanced Operations Course (CDP 602D)

Once the 602D course has been completed students are routed by equipment track to take one of the following Equipment Specific Tactical Operation Courses.

CDP 015C (AN/WLR-1)

CDP 016C (AN/SLQ-32)

CDP 017C (AN/SLQ-17)

CDP 018C (AN/WLR-8)

After these courses students are routed to collect nodes before they exit the system.

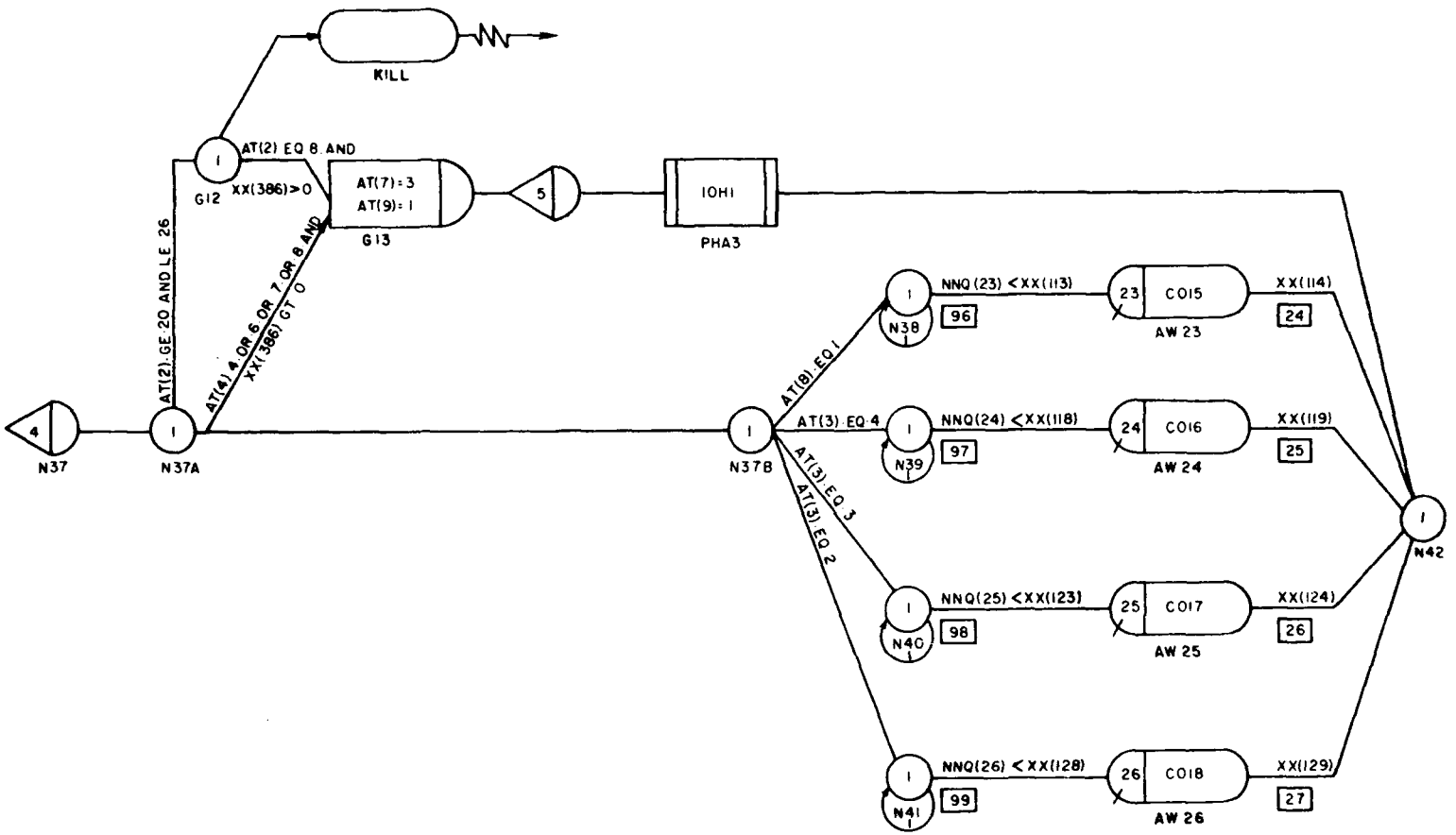


Figure 26A. Flow Chart for the Equipment Specific Tactical Operation Courses (CDP's 015C, 016C, 017C, 018C).

```
N37       EVENT,4;
          ACT;
N37A      GOON,1;
          ACT,,ATRIB(2).GE.20.AND ATRIB(2).LE.26,G12;
          ACT,,ATRIB(4).EQ.4. OR.ATRIB(4). EQ.6.OR. ATRIB(4). EQ.7.OR.
          ATRIB(4). EQ. 8. AND. XX(386). GT.0,G13;
          ACT,,,N378;
G12       GOON,1;
          ACT,,ATRIB(4) EQ. 8. AND. XX(386). GT.0,G13;
          ACT,,,KILL;
G13       ASSIGN,ATRIB(7)=3;
          EVENT,5;
          ACT,,,BACK;
N37B      GOON,1;
          ACT,,ATRIB(3).EQ.1,N38;
          ACT,,ATRIB(3).EQ.4,N39;
          ACT,,ATRIB(3).EQ.3,N40;
          ACT,,ATRIB(3).EQ.2,N41;
N38       GOON,1;
          ACT,,NNQ(23),LT.XX(113),AW23;
          ACT/96,1,,N38;
AW23      AWAIT(23),C015;
          ACT/24,XX(114), N42;
N39       GOON,1;
          ACT,,NNQ(24).LT.XX(118),AW24;
          ACT/97,1,,N39
AW24      AWAIT(24),C016
          ACT/25,XX(119),,N42;
N40       GOON,1;
          ACT,,NNO(25).LT.XX(123),AW25;
          ACT/98,1,,N40;
AW25      AWAIT(25),C017;
          ACT/26,XX(124),,N42
N41       GOON,1;
          ACT,,NNQ(26).LT.XX(128),AW26;
          ACT/99,1,,N41;
AW26      AWAIT(26),C018;
          ACT/27,XX(129),,N42;
```

Figure 26B. SLAM statements for the Equipment Specific Tactical Operation Courses (CDPs 015C, 016C, 017C, 018C).

4. Self-paced LC/10H1

The EW operator curriculum under development to be implemented with the Device 10H1 consists of individualized lessons through each curriculum module. Device 10H1 is a multi-station training computer-controlled device which provides operator training in electronic support measures (ESM) and electronic countermeasures (ECM). The device is modular in design and consists of 60 student stations which operate as independent trainee units.

Three different curriculum phases are identified in the new EW Operator curriculum.

PHASE I	Basic Operations
PHASE II	Advanced Operations
PHASE III	Watchstanding and Tactical Operation Exercises

Figure 27 shows the projected flow for all the student categories through the three phase curriculum using the Learning Center (LC) and Device 10H1. Figure 28 shows a typical path for the students through the different phases.

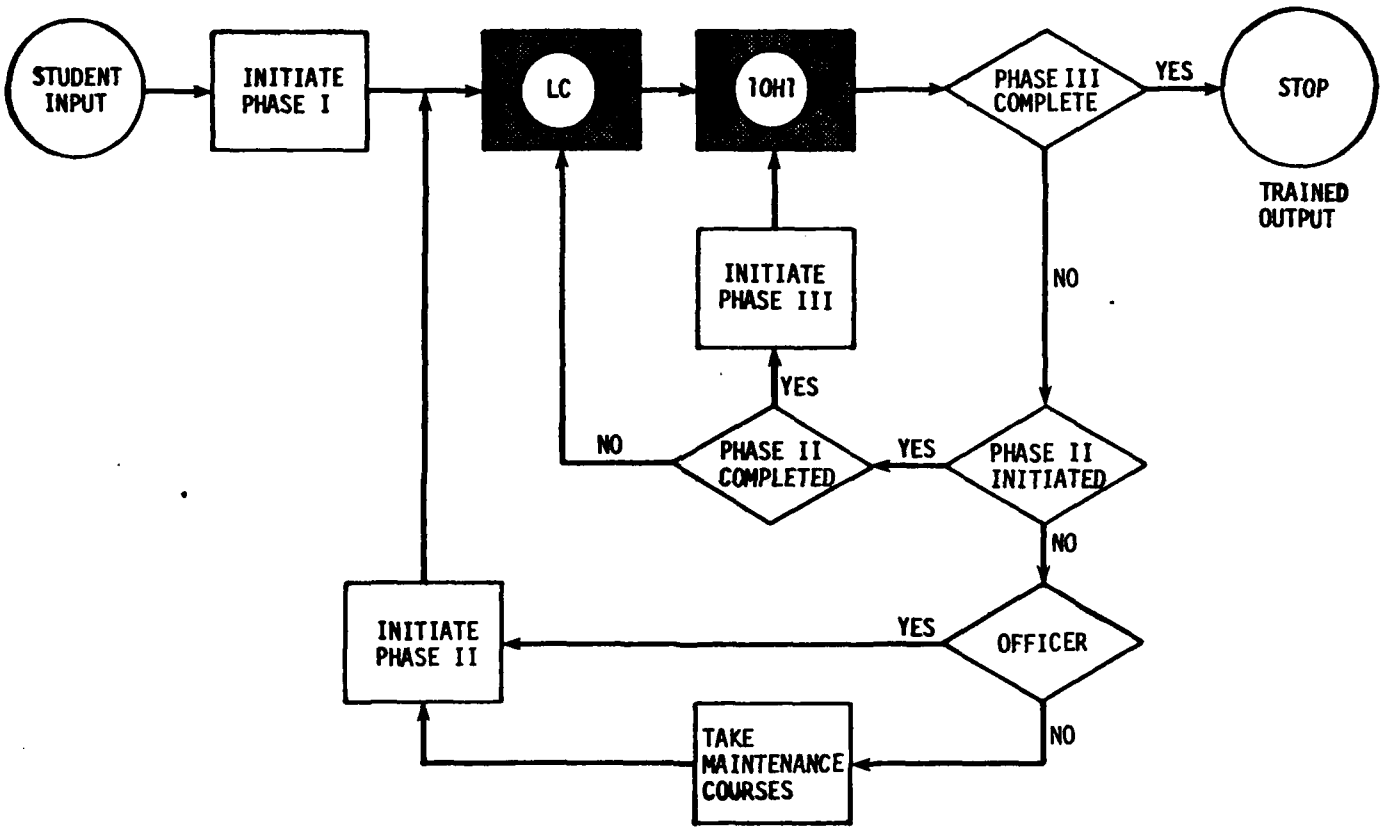


Figure 27. Proposed Macro EW Training Model With Device 10H1 Curriculum Phases

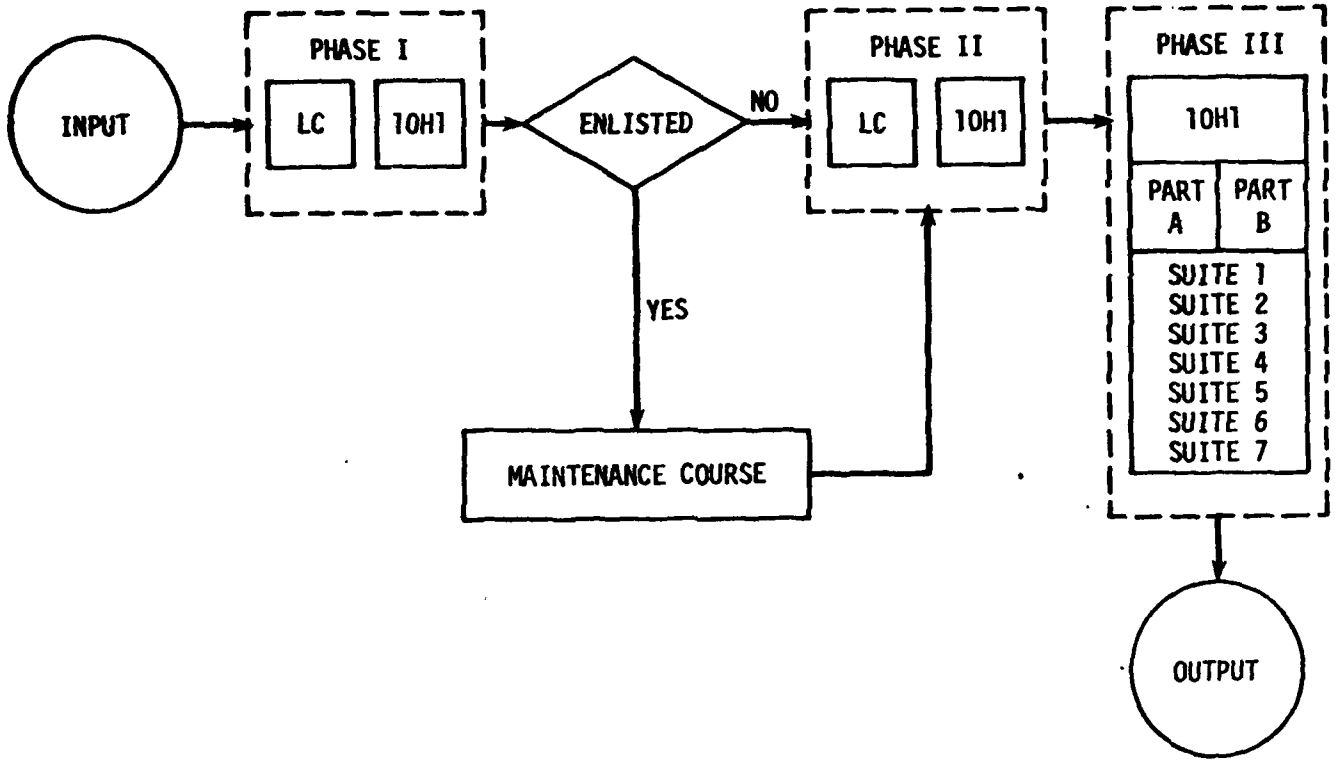


Figure 28. Consolidated EW Operator Training Student Flow with Device 10H1

a. Introduction Of Officers In The EW Network Model

Even though the officers might be introduced in the model without any restriction, they are allowed to flow through the system if, and only if, the new curriculum using Device 10H1 is in operation and all three phases are implemented (ATRIB(4) for all the officers must be equal to 8).

Once the officers have been created as shown in Figure 29 they are assigned values for ATRIB(2) according to their categories (See Table 1). They are then routed to the OFFO ASSIGN node where the value of ATRIB(6) is set to 1 and the status for using the 10H1 is also set by means of GV XX(436);(ATRIB(4) = XX(436)).

Note that the seven categories of officers are equivalent to the seven track numbers; henceforth, there is no need to differentiate them by equipment track (ATRIB(3) is not required).

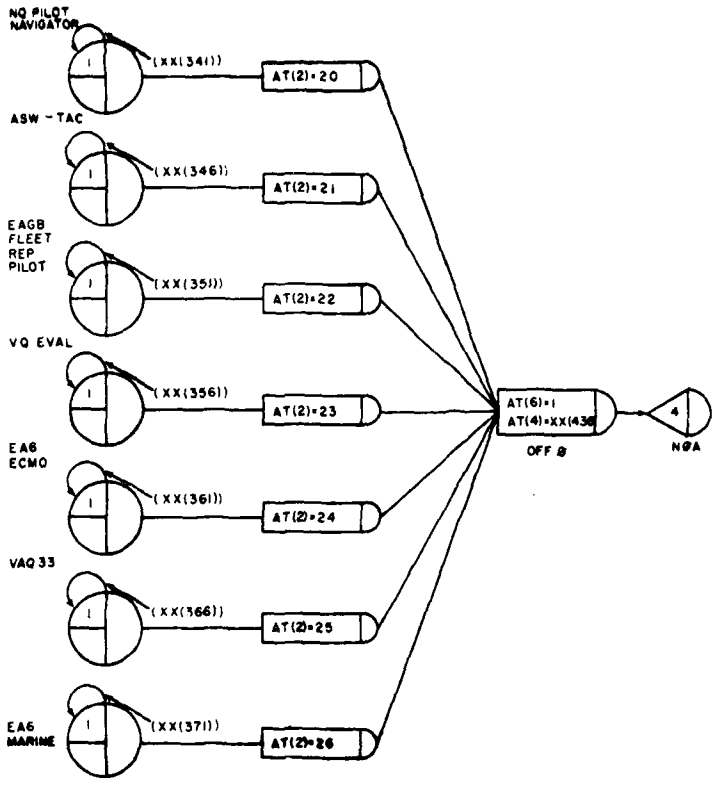
After the OFFO ASSIGN node the officers are moved ahead to EVENT 4, node NOA.

TRACK No.	Officer Category
6474	VQ-PILOT NAVIGATOR PIREP (EA6)
6475	AVIATION EW OFFICER (ASW/TACAIR)
9795	EH-6B FLEET REPLACEMENT PILOT
9797	FLEET AIR RECONNAISSANCE EW EVALUATOR (VQ)
9798	EA6B FLEET REPLACEMENT NFO ECMO
9799	VAQ-33 NFO FLEET EW
9928	EA6 USMC AVIATION EW

b. Phase I (Basic Operations)

Phase I in the new curriculum is equivalent to CDP 602A Basic Operations course in the actual CNEWS curriculum. According to the student status (ATRIB(4) value) students are routed to either one of the two curricula as seen in Figure 30.

Both officers and enlisted students arrive at EVENT 4 node NOA, which accesses a subroutine EVENT(I) (I=4 for this case) where the student status for using the 10H1 is updated.




```
      ACT,,,N1;
      CREATE, EXPON(XX(341)),,1:                NQ Pilot Navigator
      ASSIGN,ATRIB(2)=20;
      ACT,,,OFFO;
      CREATE,EXPON(XX(346)),,1;                 ASW-TAC
      ASSIGN,ATRIB(2)=21;
      ACT,,,OFFO;
      CREATE,EXPON(XX(351)),,1;                 EA6B FLEET REP. PILOT
      ASSIGN,ATRIB(2)=22;
      ACT,,,OFFO;
      CREATE,EXPON(XX(356)),,1;                 VQ EVAL
      ASSIGN,ATRIB(2)=23;
      ACT,,,OFFO;
      CREATE,EXPON(XX(361)),,1;                 EA6 ECMO
      ASSIGN,ATRIB(2)=24;
      ACT,,,OFFO;
      CREATE,EXPON(XX(366)),,1;                 VAQ 33
      ASSIGN,ATRIB(2)=25;
      ACT,,,OFFO;
      CREATE,EXPON(XX(371)),,1;                 EA6 MARINE
      ASSIGN,ATRIB(2)=26;
      ACT,,,AFFO;
OFFO  ASSIGN,ATRIB(6)=1,ATRIB(4)=XX(436);
      ACT,,,NØA;
```

Figure 29. Flow charts and SLAM Statements for the Officers (Creation and the first six attributes)

The value of the attribute responsible for the student status (ATRIB(4)) is updated at the beginning of the simulation (TNOW=0) and at the beginning of the last four simulation years w/s. The new values are passed to the students who reach EVENT, 4.

After the node NØA the students are moved to the conditional GOON node NØB.

(1) Officers are removed from the NØB node and routed to GOON node G1 where the status for using the device 1OH1 is tested; if the value of ATRIB(4) is not equal to 8 and/or the number of 1OH1 stations is equal to zero, the officers are removed from the system without collecting any statistics. If the value of ATRIB(4) for the officers is equal to 8 and the number of 1OH1 stations is greater than zero, students are routed to ASSIGN node AW33.

(2) Enlisted students are routed to AWAIT Node QØ1A if the value of ATRIB(4) is equal to 1,3,4 or 7 and/or the number of 1OH1 stations is equal to zero.

(3) Enlisted students are routed to ASSIGN node AW33 if the value of ATRIB(4) is equal to 2,5,6 or 8 and the number of 1OH1 stations is greater than zero.

Students at the AW33 node are assigned the value of 1 for ATRIB(7) indicating they are going to take PHASE I and then move ahead to EVENT, 5 node. This EVENT,5 node accesses the subroutine EVENT(I) (I = 5 for this case).

Subroutine EVENT (I=5) tests the value of ATRIB(7) of the arriving students to determine what phase they are trying to take. For Phase I all the officers are separated into one group and the value of ATRIB(8) is

set equal to 2. All the enlisted are also separated in another group and the value of ATRIB(8) is set equal to 1. ATRIB(8) represents the address in USERF(I) where the students receive the mean figure value equivalent to the expected time to be spent in the LC modules in PHASE I.

Once the value of ATRIB(8) has been assigned, the students are routed to AWAIT node 34 (AWAIT(29), LC) associated with the Learning Center facilities (LC) and file 29. Students are kept at file 29 if there is no LC resource available, otherwise they are moved through the following branch to a conditional GOON node. For PHASE I the students are routed to ASSIGN node G2 where the value of ATRIB(8) is passed to the integer GV II (II=ATRIB(8)).

After the assign node officers are separated from the enlisted and routed to GOON node G4 where they are routed unconditionally to ACTIVITY 30. Students at this activity are delayed for a period equal to the value of USERF (II).

Enlisted students arriving to the G2 node immediately take the ACTIVITY 33 where they are delayed for a period of time equal to USERF (II). USERF (II) time for the officers is independent of the USERF(II) time for the enlisted. When an officer arrives at ACTIVITY 30 or an enlisted arrives at ACTIVITY 33, they pass their value of ATRIB(8) to the User Function USERF(II).

Example: OFFICERS: ATRIB(8) = 2
II = ATRIB(8) = 2
ACTIVITY 30 TIME = USERF(2)
ENLISTED: ATRIB(8) = 1
II = ATRIB(8) = 1
ACTIVITY 33 TIME = USERF(1)

User Function USERF(II) has been developed in such a way that

* Interger GV II represents the address level number in USERF(1)

where the required time for the activity has been stored.

The time officers are delayed in ACTIVITY 30 is triangularly distributed with a mean value equal to XX(395) + 10% deviation. The time enlisted are delayed in ACTIVITY #33 is triangularly distributed with a mean value equal to XX(393) $\pm$ 10% deviation.

As soon as the students leave their activities they move to FREE node FG1 where the LC resources they have been using are released and made available for the new students. Students leaving the FG1 node are routed to AWAIT node BACK (AWAIT (27), 10H1) associated with the Device 10H1.

The students arriving at AWAIT node BACK are kept in file 27 if there is not 10H1 station resource available. When a 10H1 station is available the student with the greatest waiting time in file 27 is allowed to pass through the AWAIT node and take the available station. There he leaves the AWAIT node and reaches a conditional GOON node.

For PHASE I (ATRIB(7) = 1) the students are routed to ASSIGN node PHA1, where the value of ATRIB(8) is incremented by 30. This new value is passed to Integer GVII. Once again ATRIB(8) specifies the new address in the User Function USERF (II) where the time in the 10H1 station for Phase I is stored.

Example: Officers have the value of ATRIB(8) = 2
when they use the LC facilities. Once they take
one of the 10H1 stations the value of ATRIB(8) is
increased by 30 in ASSIGN node PHA1.
ATRIB(8) = ATRIB(8) + 30 = 2 + 30 = 32
II = ATRIB(8) = 32

This value of 32 is the new address where the time to be spent by the students in the 10H1 station Phase I is located.

The same procedure is applied for the enlisted

ATRIB(8) = ATRIB(8) + 30 = 1 + 30 = 31

II = 31

After the assign node PHA1 the officers are separated from the enlisted and routed unconditionally to ACTIVITY 32. Students at this activity are delayed for the period of time equal to USERF(II=32). Enlisted students leaving the PHA1 node move ahead to ACTIVITY 34 where they are delayed for a period of time equal to USERF(II=31). Once again these two times are independent of each other. The User Function USERF(II) is accessed when a student arrives at either Activity 32 or Activity 34 and the value of the Integer GV II is passed to the function representing the address where the time for those activities is stored.

The time officers are delayed in ACTIVITY 32 is triangularly distributed with an expected value equal to XX(396) $\pm$ 10% deviation. The time enlisted are delayed in ACTIVITY 34 is triangularly distributed with an expected value equal to XX(394) $\pm$ 10% deviation.

When the students leave their activities they are routed to FREE node FG3 where the 10H1 station resources they have been using since BACK node are released and made available for new students. Officers leaving the node FG3 are routed directly to EVENT 4 node N37 before going into Phase II. Enlisted leaving the node FG3 are routed to GOON node NØ to continue the main flow through the maintenance courses. Note that enlisted students who take the Basic Operations course CDP 602A reach the same GOON Node NØ after completion of the course.

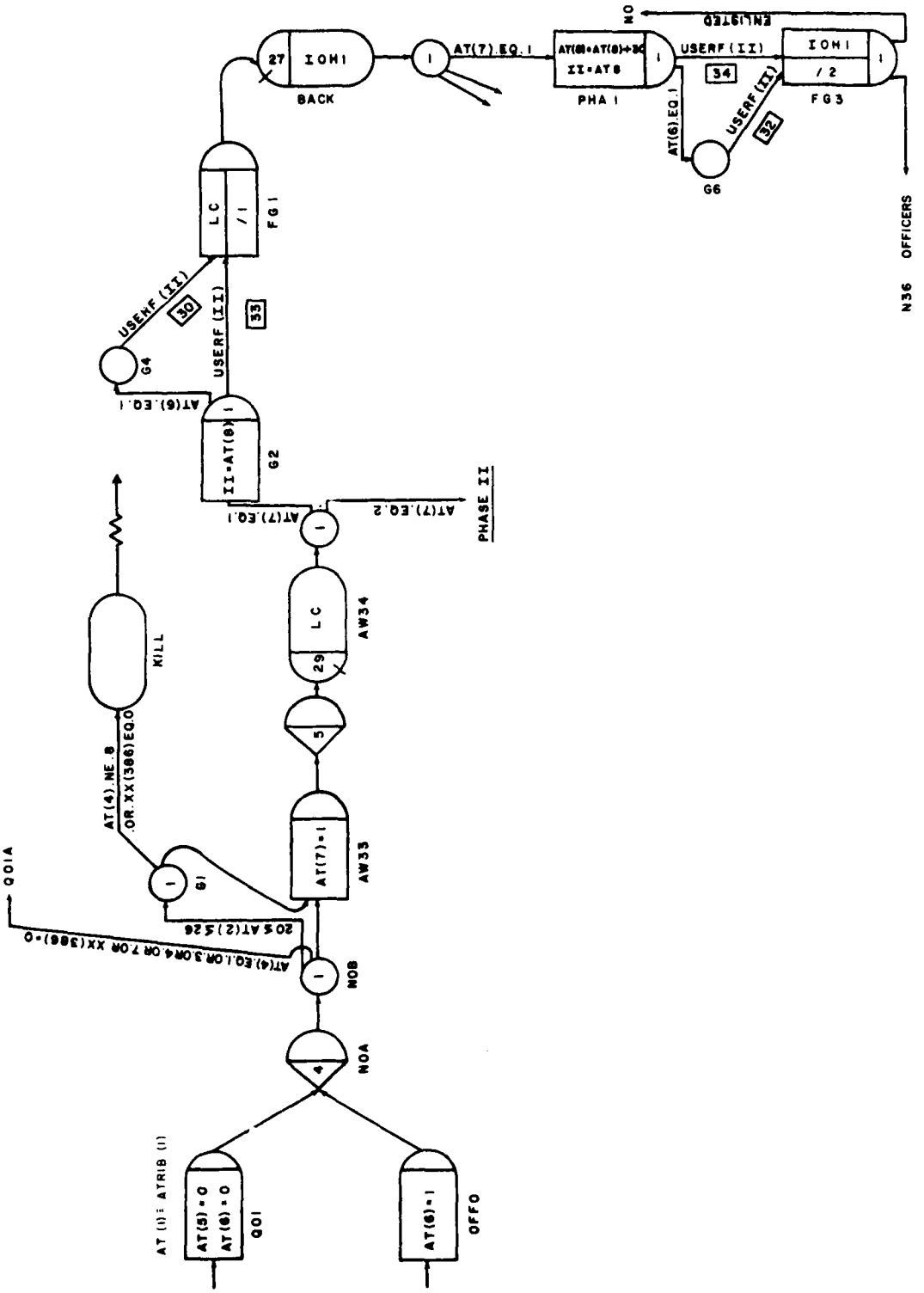


Figure 30A. Slam Model for Phase I.

```
NOA         EVENT,4;
            ACT,,,NOB;
NOB         GOON,1;
            ACT,,ATRIB(2).GE.20 AND.ATRIB(2).LE.26,G1;
            ACT,,ATRIB(4).EQ.1.OR.ATRIB(4).EQ.3.OR.ATRIB(4).EQ.4.OR.
                ATRIB(4).EQ.7.OR.XX(386).EQ.0,Q01A;
            ACT,,,AW33;
G1          GOON,1;
            ACT,,ATRIB(4).EQ.8.AND.XX(386).GT.0, AW33;
            ACT,,,KILL;
AW33        ASSIGN,ATRIB(7)=1;
            EVENT,5;
            ACT;
AW34        AWAIT(29),LC;
            ACT;
            GOON,1;
            ACT,,ATRIB(7).EQ.1,G2;
            ACT,,ATRIB(7).EQ.2,G3;
G2          ASSIGN,II=ATRIB(8),1;
            ACT,,ATRIB(6).EQ.1,.G4;
            ACT/33,USERF(II),,FG1;
G4          GOON;
            ACT/30,USERF(II);
FG1         FREE,LC;
            ACT,,,BACK;
BACK        AWAIT(27),10H1;
            ACT;
            GOON 1;
            ACT,,ATRIB(7).EQ.1, PHA1;
            ACT,,ATRIB(7).EQ.2, PHA2;
            ACT,,ATRIB(7).EQ.3, PHA3;
PHA1        ASSIGN,ATRIB(8)+30,ATRIB(9)=ATRIB(9)+1,
            II=ATRIB(8),1;
            ACT,,ATRIB(6).EQ.1,G6;
            ACT/34,USERF(II),,FG3;
G6          GOON;
            ACT/32,USERF(II);
FG3         FREE,10H1,1;
            ACT,,ATRIB(2).GE.20 AND.ATRIB(4).LE.26,N36;
            ACT,,,NO;
```

Figure 30B. SLAM Statements for Phase I

c. Phase II (Advanced Operations)

Phase II in the new curriculum is equivalent to the Advanced Operations course CDP 602D in the actual curriculum. According to the student status (ATRIB(4) value), students are routed to either of the two curricula.

Enlisted students coming from the different Equipment Specific Preventive Maintenance System courses arrive at EVENT, 4 node N36. Officer students coming from PHASE I arrive at the same node. The value of ATRIB(4) is updated at this node, then the students move to GOON node N36A. At this stage officers are routed to GOON node G11. Enlisted students are routed to ASSIGN node AW27 (Phase II) if the value of ATRIB(4) is equal to 3,5,6 or 8 and the value of GV XX(386) is greater than zero. If the value of ATRIB(4) is equal to 1,2,4 or 7 or the value of GV XX(386) is equal to zero enlisted students are routed to AWAIT node AW22 (group-paced). Fleet Returnee students are routed to ASSIGN node N36D.

Officers at GOON node G11 are routed to ASSIGN node AW27 (Phase II) if the value of ATRIB(4) for them is equal to 8 and the value of GV XX(386) is greater than zero. If these two conditions are not met they are removed from the system without collecting any statistics.

Students at node AW27 are assigned the value of 2 for ATRIB(7) indicating they are in PHASE II, then they move ahead to EVENT 5 node.

EVENT 5

Subroutine EVENT(I=5) first tests the value of ATRIB(7). If the value equals 2 the students are routed to address level number 52 where the value of ATRIB(9) is tested.

ATRIB(9) is used to determine the number of lesson modules in PHASE II the students have gone through. The total number of lesson modules for Phase II is six and for each of these the students go first to the Learning Center facilities (LC) then to the Device 10H1. This process of going back and forth from the LC to the 10H1 for each module is performed until the

six lesson modules are finished. In cases where the number of modules the students have to go through is less than six, the value of zero time may be assigned for the excess lessons.

ATRIB(9)	MODULE	LC	10H1
1	1st	X	X
2	2nd	X	X
3	3rd	X	X
4	4th	X	X
5	5th	X	X
6	6th	X	X

Consider the case of just four lesson modules: students will have to take the six modules but the time value for the last two equals zero.

ATRIB(9)	MODULE	LC	10H1
1	1st	X	X
2	2nd	X	X
3	3rd	X	X
4	4th	X	X
5	5th	0	0
6	6th	0	0

For each keyed address there is a corresponding lesson module and after the value of ATRIB(9) has been determined the students are routed to one of these specific addresses.

For PHASE II the students are separated into four different groups and each receives a different value for ATRIB(8). (ATRIB(8) contains the address number the students have to go to in Function USERF(I), where the time they spend in the modules is stored.)

ACTIVITY 28 where they are delayed for a period of time equal to USERF(II) where: II = 3 for MODULE NO. 1. (LC)

II = 7 for " 2 "

II = 11 for " 3 "

II = 15 for " 4 "

II = 19 for " 5 "

II = 23 for " 6 "

Once the USERF(II) time has elapsed the students are routed to FREE node FG2 where they release the LC resource they have been using since AW34. node. After this node the students move to AWAIT node BACK (AWAIT (27),1OH1). If there is no 1OH1 resource available students are kept in file 27. As soon as a 1OH1 resource is available the student with the greatest waiting time in file 27 takes it and moves ahead to a conditional GOON node where he is rerouted to ASSIGN node PHA2 according to his ATRIB(7) value.

Students of ASSIGN node PHA3 are assigned values for their attributes 8 and 9. ATRIB(8) is incremented by 30. This new value is passed to the Integer GV II. Once again ATRIB(8) or GV II specifies the new address in Function USERF(II), where the time in the 1OH1 station for each of the modules is stored. ATRIB(9) is incremented by 1 indicating a new module after completion of the lesson module in process.

After the PHA2 node officers are routed conditionally to GOON node G7 according to the value of ATRIB(6). Officers of goon node G7 move unconditionally to ACTIVITY 35 where they are delayed for a period of time equal to USERF(II) where:

II = 34,35, or 36 for Module No. 1. (10H1)

II = 38,39, or 40 for " 2 "

II = 42,43, or 44 for " 3 "

II = 46,47, or 48 for " 4 "

II = 50,51, or 52 for " 5 "

II = 54,55, or 56 for " 6 "

After the PHA2 node enlisted students are routed to ACTIVITY 36 where they are delayed for a period of time equal to USERF(II), where

II = 33 for Module No. 1. (10H1)

II = 37 for " 2 "

II = 41 for " 3 "

II = 45 for " 4 "

II = 49 for " 5 "

II = 53 for " 6 "

After the activities the students go to FREE node FG4 where they release the 10H1 station they have been using since node BACK. The students leave the FREE node and move conditionally to either N37 GOON node or AW34 AWAIT node. If the value of ATRIB(9) is greater than 6 the student has already taken the six lesson modules, and students are routed ahead to GOON node N37. If the value of ATRIB(9) is less or equal to 6, meaning that more lesson modules are required to finish PHASE II, the students are routed back to AWAIT node AW34.

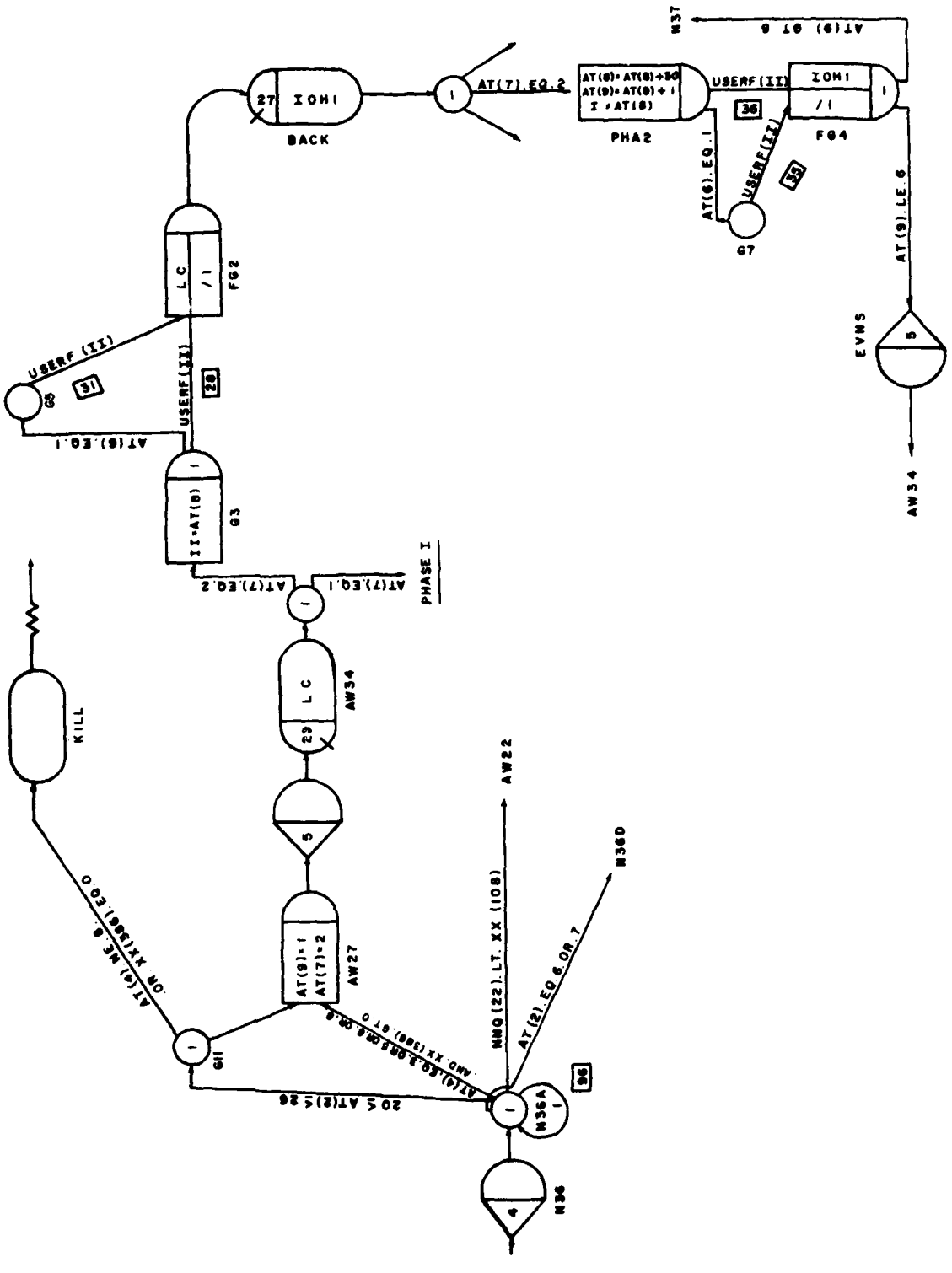


Figure 31A. Slam Model for Phase II.

```
N36     EVENT,4;
        ACT;
N36A    GOON,1;
        ACT,,ATRI   ).EQ. 6.OR.ATRIB(2).EQ. 7.OR ATRIB(2).EQ. 9,N36D;
        ACT,,ATRIB(2).GE.20.AND.ATRIB(2).LE.26,G11;
        ACT,,ATRIB(4).EQ.3.OR.ATRIB(4).EQ. 5.OR.ATRIB(4).EQ.7.OR.
        ATRIB(4).EQ.8.AND.XX(386).GT.0.AW27;
        ACT,,NNQ(22).LT.XX(108),AW22;
        ACT/95,1,,N36A;
G11     GOON,1;
        ACT,,ATRIB(4).EQ.8.AND.XX(386).GT.0,AW27;
        ACT,,,KILL:
AW27    ASSIGN,ATRIB(9)=1,ATRIB(7)=2;
        EVENT,5;
        ACT,,,AW34;
         :     :
         :     :
AW34    AWAIT(29);LC:
        ACT;
        GOON,1;
        ACT,,ATRIB(7).EQ.1,G2;
        ACT,,ATRIB(7).EQ.2, G3;
G2      ASSIGN,II=ATRIB(8),1;
        ACT,,ATRIB(6).EQ.1,G4;
        ACT/33,USERF(II),,FG1;
G4      GOON;
        ACT/30,USERF(II);
FG1     FREE,LC;
        ACT,,,BACK;
G3      ASSIGN,II=ATRIB(8),1;
        ACT,,ATRIB(6).EQ.1,G5;
        ACT/28,USERF(II),,FG2;
G5      GOON;
        ACT/31,USERF(II);
FG2     FREE,LC;
        ACT,,,BACK;
BACK    AWAIT(27),10H1:
        ACT;
        GOON,1;
        ACT,,ATRIB(7).EQ.1,PHA1;
        ACT,,ATRIB(7).EQ 2,PHA2;
        ACT,,ATRIB(7).EQ.3,PHA3;
         :     :
PH2     ASSIGN,ATRIB(8) = ATRIB(8)+30,ATRIB(9) = ATRIB(9)+1,
        II=ATRIB(8),1;
        ACT,,ATRIB(6).EQ.1,G7;
        ACT/36,USERF(II),,FG4;
G7      GOON;
        ACT/35,USERF(II);
FG4     FREE,10H1,1;
        ACT,,ATRIB(9).LE.6,EVN5;
        ACT,,ATRIB(9).GT.6,N37;
EVN5    EVENT,5;
        ACT,,,AW34;
```

Figure 31B. SLAM Statements for PHASE II.

d. Phase III (Watchstanding and Tactical Operations Exercises)

Phase III in the new curriculum is equivalent to the Equipment Specific Tactical Operations Courses in the actual curriculum (CDP's 015C, 016C, 017C and 018C). According to the student status (ATRIB(4) value) students are routed to either one of the two curricula.

Enlisted students coming either from PHASE II and/or from ACTIVITY 23 arrive at EVENT 4 node N37. Fleet Returnee students come to node N37 from ASSIGN node N36D, and officer students come from PHASE II. First the value of ATRIB(4) is updated at this node then the students move to GOON node N37A. At this stage, officers are routed to GOON node G12. Enlisted students are routed to ASSIGN node G13 (PHASE III) if the value of ATRIB(4) for them is equal to 4, 6, 7 or 8 and the value of GV XX(386) is greater than zero. If this condition is not met, enlisted are routed to GOON node N37B (group-paced).

Officers at GOON node G12 are routed to ASSIGN node G13 (PHASE III) if the value of ATRIB(4) for them is equal to 8 and GV XX(386) is greater than zero. Otherwise officers are removed from the system without collecting any statistics.

Students at node G13 are assigned the value of 3 for ATRIB(7) and 1 for ATRIB(9). Then they move to EVENT 5, node.

EVENT 5

Subroutine EVENT (I = 5) tests the value of ATRIB(7). If this value is 3 the students are routed to address level number 53 within EVENT 5 where the value of ATRIB(2) is tested.

For PHASE III the students are divided into five groups and each of them receives a different value for ATRIB(8).

Group No. 1; Enlisted (Equip. Track: AN/WLR-1) ATRIB(8) = 27

Group No. 2	Enlisted (Equip. Track:	AN/SLQ-32)	
	" " "	AN/SLQ-17)	ATRIB(8) = 29
	" " "	AN/WLR-8)	
Group No. 3	Officers (Track No.	6474)	
	" "	6475)	ATRIB(8) = 28
	" "	9795)	
Group No. 4	Officers (Track No.	9799)	ATRIB(8) = 30
Group No. 5	Officers (Track No.	9797)	ATRIB(8) = 61
	" "	9798)	

From the EVENT, 5 node students are routed to AWAIT node BACK (AWAIT(27), 10H1), associated with the 10H1 stations and file 27. Students remain in this file if there is no 10H1 station resource available. As soon as there is a station available the student with the greatest waiting time in file 27 is allowed to take it and move ahead to a conditional GOON node. If the value of ATRIB(7) = 3, students are routed to ASSIGN node PHA3 where the value of ATRIB(8) is passed to the integer GV II. After this node, officers are routed to GOON node G8 before reaching ACTIVITY 37. Students at this activity are delayed for a period of time eo to USERF(II).

After the PHA3 assign node the enlisted students are routed to ACTIVITY 29 where they are delayed for a period of time equal to USERF(II). Students leaving activities 37 and 29 are routed to FREE node FG5 where the 10H1 stations they have been using since node BACK are released.

If the value of ATRIB(9) is greater than two for those students leaving node FG5 they are routed to GOON node N42. If the value of ATRIB(9) is equal to two, students are routed to ASSIGN node G10 where the value of ATRIB(8) is incremented by 30. After this node the students are routed back to AWAIT node BACK (AWAIT (27), 10H1) to complete Phase III.

Phase III is divided into parts (A and B) and in both parts Device 10H1 is used. The students take just one lesson module. Once they finish Part A they are routed back to take Part B.

Example: ENLISTED (EQUIP TRACK AN/WLR-1)

PART A: ATRIB(8) = 27

Address 27 in Function USERF(I=27) has the value for XMOD= XX(508)

TIME TO BE DELAYED IN ACTIVITY 29 is triangularly distributed with a mean equal to XX(508) $\pm$ 10% deviation.

PART B: ATRIB(8) = 27 + 30 = 57

Address 57 in FUNCTION USERF (I = 57) has the value of XMOD = XX(509).

TIME TO BE DELAYED IN ACTIVITY 29 (PART B) is triangularly distributed with a mean equal to XX(509) $\pm$ 10% deviation.

Example: OFFICER (TRACK No. 9799)

PART A: ATRIB(8) = 30

Address 30 in Function USERF (I = 30) has the value of XMOD = XX(504)

TIME TO BE DELAYED IN ACTIVITY 37 is triangularly distributed with a mean equal to XX(504) $\pm$ 10% deviation.

PART B: ATRIB(8) = 30 + 30 = 60

Address 60 in Function USERF (I = 60) has the value of XMOD = XX(505).

TIME TO BE DELAYED IN ACTIVITY 37 (PART B) is triangularly distributed with a mean equal to XX(505) $\pm$ 10% deviation.

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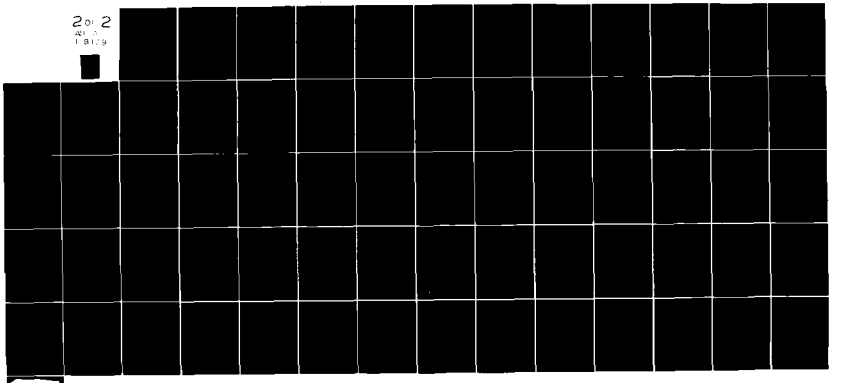

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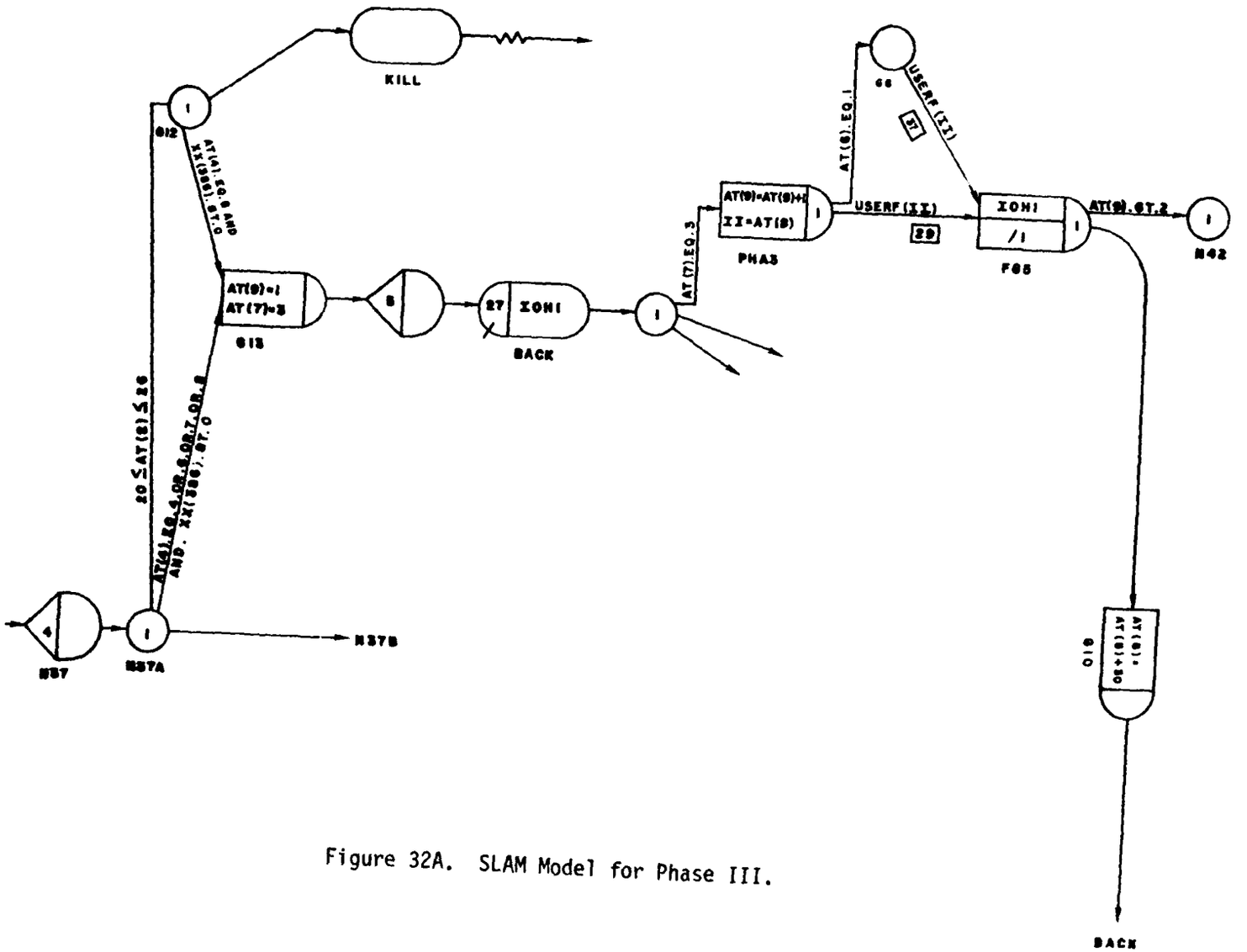


Figure 32A. SLAM Model for Phase III.

```
N37    EVENT,4
       ACT;
N37A   GOON,1;
       ACT,,ATRIB(2).GE.20.AND.ATRIB(2).LE.26,G12;
       ACT,,ATRIB(4).EQ.4.OR. ATRIB(4).EQ.6.OR.ATRIB(4).EQ.7.OR.
       ATRIB(4).EQ.8.AND. XX(386).GT.0,G13;
       ACT,,,N37B;
G12    GOON,1;
       ACT,,ATRIB(4).EQ.8.AND.XX(386).GT.0, G13;
       ACT,,,KILL;
G13    ASSIGN,ATRIB(9)=1,ATRIB(7)=3;
       EVENT,5;
       ACT,,,BACK;

BACK   AWAIT(27),IOH1;
       ACT;
       GOON,1;
       ACT,,ATRIB(7).EQ.1,PHA1;
       ACT,,ATRIB(7).EQ.2.PHA2;
       ACT,,ATRIB(7).EQ.3,PHA3;

PHA3   ASSIGN,ATRIB(9)=ATRIB(9)+1,II=ATRIB(8),1;
       ACT,,ATRIB(6).EQ.1,G8;
       ACT/29,USERF(II),,FG5;
G8     GOON;
       ACT/38,USERV(II);
FG5    FREE,IOH1,1;
       ACT,,ATRIB(9).EQ.2,G10;
       ACT,,ATRIB(9).GT.2,N42;
G10    ASSIGN,ATRIB(8)=ATRIB(8)+30;
       ACT,,,BACK;
```

Figure 32B. SLAM Statements for Phase III

D. GATHERING STATISTICS

1. TIME IN THE SYSTEM

Once the students have successfully completed the Equipment Specific Tactical Operation Courses (CDP's 015C, 016C, 017C, 018C) they are routed to GOON node N42. The students leave this node conditionally according to their category (Routing by Category) and move ahead to COLLECT nodes where statistics for their time in the system are collected.

When a SUMMARY REPORT, as shown in figure 33, is printed by the SLAM processor, the following statistics are described:

IDENTIFIER: Student category name, i.e., "TIME USN6YO, TIME USN4YO"

MEAN VALUE: Average time for that specific student category in the system.

STANDARD DEVIATION: Deviation from the average time.

COEFFICIENT OF VARIATION: Correlation between the mean and the standard deviation.

MINIMUM VALUE: Minimum time in the system for that specific student category.

MAXIMUM VALUE: Maximum time in the system for that specific student category.

The following list shows the different student categories for which time in the system statistics are collected:

ENLISTED	OFFICERS
USN6YO	VQ Pilot Navigator PIREP(EA6)
USN4YO	Aviation EW Officer (ASW/TACAIR)
USN 3X6	EA6B Fleet Replacement Pilot
USN Late Convertee	Fleet Air Reconnaissance EW Evaluator (VQ)
USNR 4X10	EA6B Replacement NFO ECMO
Flt. Returnee Operator only	VAQ-33 NFO Fleet EW
Flt. Returnee Operator Maintenance	EA6 USMC Aviation EW
USCG	
USN CTM(CRYPTO)	
USN ETSU	
USN CTM6YO	
Flt. Returnee Digital	
Flt. Returnee VLQ-6C	

DATE 1/ 1/2001 RUN NUMBER 1 OF 1

CURRENT TIME 0.3500E 03
STATISTICAL ARRAYS CLEARED AT TIME 0.3000E 03

STATISTICS FOR VARIABLES BASED ON OBSERVATION

	MEAN VALUE	STANDARD DEVIATION	COEFF. OF VARIATION	MINIMUM VALUE	MAXIMUM VALUE	NUMBER OF OBSERVATIONS
NUM STUD SC1		NO VALUES RECORDED				
NUM STUD DC1	0.1814E 02	0.2391E 01	0.1318E 00	0.1100E 02	0.2000E 02	25
NUM STUD SC2	0.1833E 02	0.1155E 01	0.6298E-01	0.1700E 02	0.1900E 02	3
NUM STUD DC2	0.1282E 02	0.2066E 01	0.1611E 00	0.1050E 02	0.1750E 02	20
NUM STUD C604	0.9615E 01	0.2256E 01	0.4018E 00	0.9000E 01	0.9000E 01	13
NUM STUD SC3	0.2133E 02	0.2550E 01	0.1195E 00	0.1600E 02	0.2400E 02	9
NUM STUD DC3	0.1577E 02	0.2672E 01	0.1695E 00	0.1250E 02	0.2300E 02	15
NUM STUD SA15	0.7000E 01	0.8165E 00	0.1166E 00	0.6000E 01	0.8000E 01	10
NUM STUD DA15	0.4929E 01	0.7319E 00	0.1485E 00	0.4500E 01	0.6000E 01	7
NUM STUD A16	0.1644E 02	0.4601E 01	0.2799E 00	0.6000E 01	0.2400E 02	25
NUM STUD A17	0.6857E 01	0.8997E 00	0.1312E 00	0.6000E 01	0.8000E 01	7
NUM STUD A18	0.7000E 01	0.8165E 00	0.1166E 00	0.6000E 01	0.8000E 01	4
NUM STUD SC602		NO VALUES RECORDED				
NUM STUD DC602	0.1224E 02	0.2398E 01	0.1960E 00	0.8000E 01	0.1500E 02	25
NUM STUD B015	0.1138E 02	0.7440E 00	0.6541E-01	0.1000E 02	0.1200E 02	8
NUM STUD B016	0.1255E 02	0.3532E 01	0.2815E 00	0.8000E 01	0.2000E 02	11
NUM STUD B017	0.9500E 01	0.5774E 00	0.6077E-01	0.9000E 01	0.1000E 02	4
NUM STUD B018	0.9000E 01	0.1414E 01	0.1571E 00	0.8000E 01	0.1000E 02	2
NUM STUD D015	0.1086E 02	0.8997E 00	0.8287E-01	0.1000E 02	0.1200E 02	7
NUM STUD M412	0.1625E 02	0.3694E 01	0.2273E 00	0.1100E 02	0.2000E 02	8
NUM STUD D016	0.1985E 02	0.5129E 01	0.2584E 00	0.1000E 02	0.2800E 02	13
NUM STUD E016	0.1115E 02	0.3051E 01	0.2735E 00	0.6000E 01	0.1700E 02	13
NUM STUD F016	0.9231E 01	0.3609E 01	0.3910E 00	0.6000E 01	0.1700E 02	13
NUM STUD D017	0.6667E 01	0.1155E 01	0.1732E 00	0.6000E 01	0.8000E 01	3
NUM STUD E017	0.6667E 01	0.1155E 01	0.1732E 00	0.6000E 01	0.8000E 01	3
NUM STUD D018	0.8000E 01	0.0000E 00	0.0000E 00	0.8000E 01	0.8000E 01	2
NUM STUD SD602		NO VALUES RECORDED				
NUM STUD DD602		NO VALUES RECORDED				
NUM STUD C015		NO VALUES RECORDED				
NUM STUD C016		NO VALUES RECORDED				
NUM STUD C017		NO VALUES RECORDED				
NUM STUD C018		NO VALUES RECORDED				
TIME USN6Y0	0.9125E 02	0.6643E 01	0.1296E 00	0.4193E 02	0.8087E 02	286
TIME 4Y0	0.3372E 02	0.4679E 01	0.1387E 00	0.2715E 02	0.4811E 02	96
TIME USNR 3X6	0.9720E 02	0.8724E 01	0.2345E 00	0.2739E 02	0.7155E 02	60
TIME LATE CONV	0.3762E 02	0.9025E 01	0.2412E 00	0.2738E 02	0.6764E 02	55
TIME USRN4X10	0.5208E 02	0.6650E 01	0.1277E 00	0.4562E 02	0.6615E 02	11
TIME FLT RTN	0.1024E 02	0.6069E 01	0.5927E 00	0.6476E 01	0.4493E 02	68
TIME FLT INPUT	0.9339E 02	0.1033E 02	0.3094E 00	0.1368E 02	0.5268E 02	41
TIME USCG	0.1448E 02	0.2418E 01	0.1670E 00	0.1207E 02	0.1685E 02	19
TIME CTM UYK20	0.1175E 02	0.2146E 01	0.1826E 00	0.8060E 01	0.1575E 02	52
TIME ETSU	0.2748E 02	0.3825E 01	0.1392E 00	0.2407E 02	0.4279E 02	65
TIME CTM6YC	0.2399E 02	0.4583E 01	0.1910E 00	0.2004E 02	0.3626E 02	63
TIME DIGITAL	0.5305E 01	0.6234E 00	0.1175E 00	0.4050E 01	0.5946E 01	8
TIME FLT ULO6C	0.1171E 02	0.2338E 01	0.1996E 00	0.8198E 01	0.1536E 02	26
TIME VQ PILOT	0.1159E 02	0.7538E 00	0.6503E-01	0.1044E 02	0.1306E 02	30
TIME ASW TAC	0.1171E 02	0.8345E 00	0.7128E-01	0.1021E 02	0.1371E 02	55
TIME EA6 REPLAC	0.1195E 02	0.1010E 01	0.8446E-01	0.1028E 02	0.1376E 02	26
TIME VQ EVAL	0.1171E 02	0.1102E 01	0.9414E-01	0.1025E 02	0.1412E 02	30
TIME EA6 ECMO	0.1167E 02	0.9151E 00	0.7839E-01	0.1014E 02	0.1309E 02	49
TIME VAQ 33	0.1206E 02	0.7767E 00	0.6441E-01	0.1103E 02	0.1293E 02	7
TIME EA6 MARINE	0.1171E 02	0.9777E 00	0.8350E-01	0.1051E 02	0.1305E 02	17
DROP OUT STUD	0.2161E 02	0.1051E 02	0.4906E 00	0.5194E 01	0.6605E 02	207
OFF, NOT IN SYS		NO VALUES RECORDED				

Figure 33. SLAM Summary Report

2. HISTOGRAMS

Histograms, as shown in figure 34A, are used in the EW simulation flow model to show a graphical representation of the time the students were in the system. They describe the following statistics:

OBSERVED FREQUENCY: Number of students with a time in the system greater than the preceding cell limit but less or equal to the cell limit assigned to that frequency.

RELATIVE FREQUENCY: When multiplied by 100 it shows the percentage of students belonging to that frequency.

CUMULATIVE FREQUENCY: When multiplied by 100 it shows the total percentage of students with a time in the system less or equal to the cell limit assigned to that frequency.

UPPER CELL LIMIT: It shows the maximum time in the system for a group of students belonging to a specific OBSERVED FREQUENCY: It also shows the minimum time in the system for the next OBSERVED FREQUENCY.

ASTERISKS (*) in the bar-chart represent the relative frequency.

CAPITAL Cs (C) in the bar-chart represent the cumulative frequency.

3. SLAM AUTOMATIC STATISTICS

Every time a SLAM SUMMARY REPORT is produced, there are some statistics the SLAM processor shows automatically even though the user does not require them.

a. ACTIVITIES

Activity number 1 through activity number 38 inclusive are used to control the number of students who passed through a CDP course. The following statistics which are provided in a SLAM SUMMARY REPORT are considered to be the most valuable to the analyst. (See figure 34B).

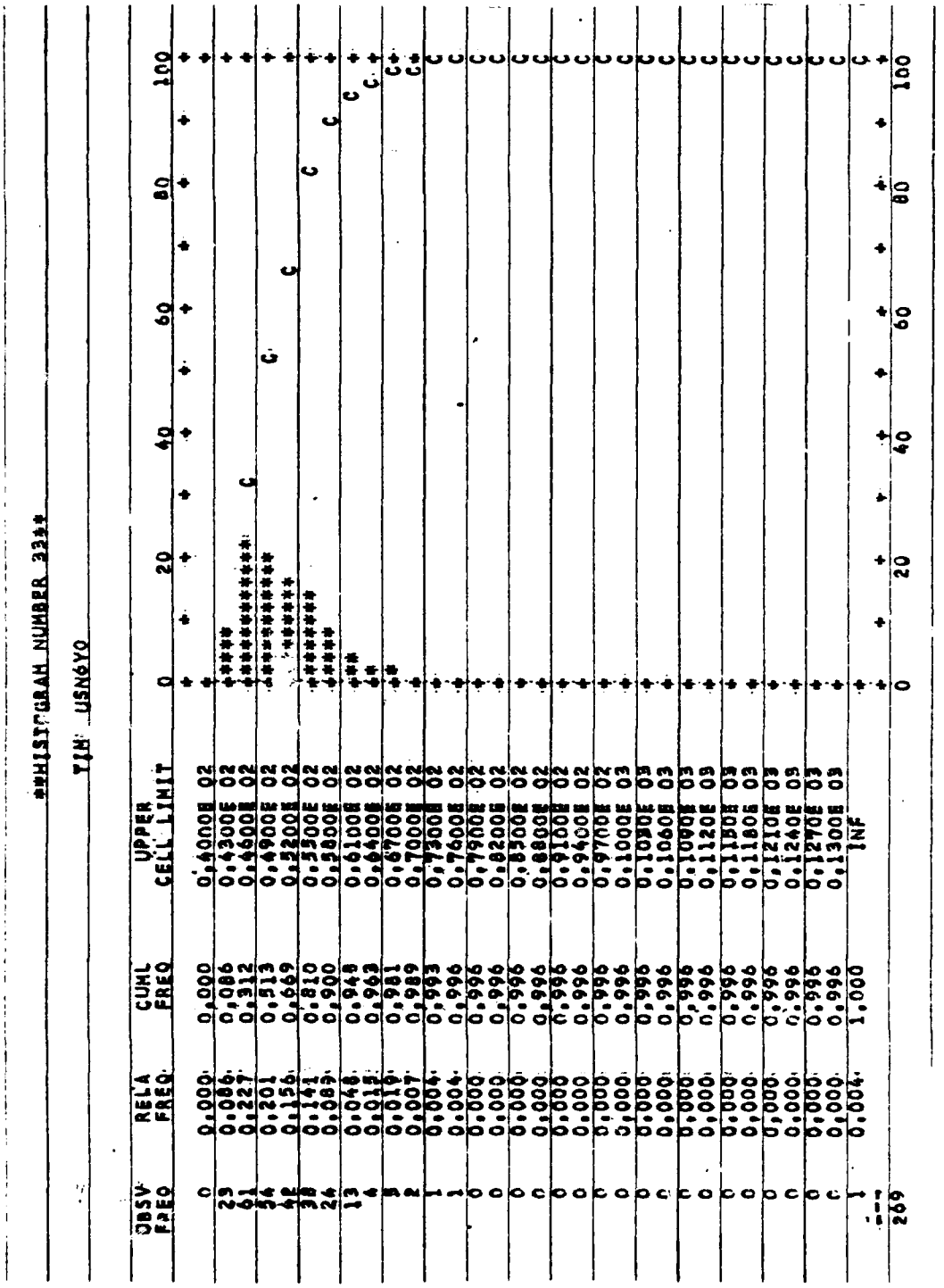


Figure 34A. SLAM Histogram

REGULAR ACTIVITY STATISTICS

ACTIVITY INDEX	AVERAGE UTILIZATION	STANDARD DEVIATION	MAXIMUM UTILIZATION	CURRENT UTILIZATION	ENTITY COUNT
50	0.0000	0.0000	0	0	0
51	0.0800	0.2713	1	0	2
52	0.0000	0.0000	0	0	0
53	0.0800	0.2713	1	0	2
54	0.2390	0.4265	1	1	5
55	0.0400	0.1960	1	0	1
56	0.7200	0.4490	1	0	12
57	0.7600	0.4271	1	1	12
58	0.0000	0.0000	0	0	0
59	0.6018	0.4895	1	0	16
60	0.0000	0.0000	0	0	0
61	0.6019	0.4895	1	0	4
62	0.7619	0.4839	1	0	5
63	0.7200	0.4490	1	1	18
64	0.3600	0.4800	1	1	4
65	0.0000	0.0000	0	0	0
66	0.1600	0.3666	1	0	2
67	0.0800	0.2713	1	0	1
68	0.5200	0.4996	1	1	3
69	0.6022	0.4894	1	0	4
70	0.7176	0.4802	1	1	4
71	1.0000	0.0000	1	1	25
72	1.0000	0.0000	1	1	50
73	1.0000	0.0000	1	1	25
74	1.0000	0.0000	1	1	12
45	1.0000	0.0000	1	1	12
33	33.1321	6.1145	50	25	769
30	9.9690	3.2226	22	11	212
28	15.1452	11.0107	49	2	2999
31	5.6469	3.6941	21	8	1107
34	48.8814	7.0623	62	45	763
32	12.7283	4.7547	29	13	195
36	14.0726	8.4465	43	18	2962
35	3.3751	4.4022	25	0	1097
29	24.4136	10.2810	54	34	1212
38	6.9472	4.5255	19	10	342
1	0.0000	0.0000	0	0	0
75	0.8819	2.4875	13	7	45
2	181.8797	9.6228	200	187	904
76	0.0000	0.0000	0	0	0
3	57.4020	16.1244	90	46	596
77	0.0000	0.0000	0	0	0
4	4.3460	2.8831	10	6	78

Figure 34B. SLAM Regular Activity Statistics

ACTIVITY INDEX: Activity number. Each one of these activities is associated with one of the CDP courses.

MAXIMUM UTILIZATION: The maximum number of students that were taking the CDP course at the same time.

CURRENT UTILIZATION: The number of students that were taking the CDP course when the SLAM SUMMARY REPORT was provided.

ENTITY COUNT: Represents the number of students who passed the CDP course. When the CDP course in consideration does not have an attrition and setback rate, that number also represents the number of students who pass the CDP course successfully. When the CDP course shows attrition and setback rates, the number of students passing successfully may be obtained by dividing the ENTITY COUNT value into 1.177 as long as 5% and 10% are the attrition and setback rates. (Entities are the number of times a particular statistic is called in simulation.)

Activity number 50 through activity number 74 inclusive and activity number 45 are used to specify the number of times a course was not offered because there were not enough students in the respective file waiting to take the course. The following statistics are provided in a SLAM SUMMARY REPORT:

ACTIVITY INDEX: Activity number, e.g., 50, 51, 52, 74, 45.

AVERAGE UTILIZATION: No practical meaning in this case.

STANDARD DEVIATION: No practical meaning in this case.

MAXIMUM UTILIZATION: It may take two values, zero or one.

CURRENT UTILIZATION: When its value is zero means course was in progress when the SUMMARY was provided. When its value is one means course was not offered at the moment the SUMMARY was provided.

ACTIVITY INDEX: Activity number. This activity is associated with a specific file.

MAXIMUM UTILIZATION: Maximum number of students that were denied access in a file before taking a course.

ENTITY COUNT: Total number of times an attempt to enter a file was denied.

b. NODES ASSOCIATED WITH FILES

There are 29 files in the EW student flow model. The first 26 files as shown in figure 35A, are associated with the GATES that control the Opening and Closing of the group courses. The last three are associated with LC and 1OH1 resources.

The following statistics are provided by the SLAM SUMMARY REPORT.

FILE NUMBER: Number of file.

AVERAGE LENGTH: The average number of students waiting in the file at one specific time.

STANDARD DEVIATION: Deviation from the mean.

MAXIMUM LENGTH: Maximum number of students in the file at one time. Note that this value will never be greater than the maximum number of students for a course.

CURRENT LENGTH: The number of students in the file when the SUMMARY was provided.

AVERAGE WAITING TIME: The average number of weeks the students were waiting in the file.

c. RESOURCE UTILIZATION

Statistics provided for the resources show the resource label name, current capacity, average utilization, standard deviation, maximum and current utilization. (see figure 35B).

FILE STATISTICS

FILE NUMBER	ASSOCIATED NODE TYPE	AVERAGE LENGTH	STANDARD DEVIATION	MAXIMUM LENGTH	CURRENT LENGTH	AVERAGE WAITING TIME
1	AWAIT	17.3987	11.1962	40	40	0.9186
2	AWAIT	2.0661	4.3904	35	0	0.1819
3	AWAIT	2.6842	2.5231	9	5	1.7014
4	AWAIT	12.4867	12.2972	46	25	0.9048
5	AWAIT	1.3099	2.0215	12	1	0.4678
6	AWAIT	1.4431	2.0006	24	4	0.1739
7	AWAIT	3.1607	2.2463	8	0	3.2924
8	AWAIT	2.5203	2.1119	8	2	4.2006
9	AWAIT	11.4800	11.4803	30	29	0.8931
10	AWAIT	3.6871	3.1316	12	8	1.8622
11	AWAIT	4.6824	4.2960	20	8	1.5864
12	AWAIT	3.9696	3.3108	10	2	4.9620
13	AWAIT	4.0639	2.8431	10	0	11.2886
14	AWAIT	4.9520	3.2012	12	0	3.2579
15	AWAIT	5.0761	5.0809	20	0	1.9524
16	AWAIT	5.3661	6.2277	28	0	1.0399
17	AWAIT	2.7403	5.0638	17	0	0.9449
18	AWAIT	2.2602	4.3663	17	0	0.9417
19	AWAIT	2.7718	1.9703	8	5	5.5437
20	AWAIT	1.6040	2.8869	8	0	4.0100
21	AWAIT	2.9150	2.6883	8	4	7.2876
22	AWAIT	0.0000	0.0000	0	0	0.0000
23	AWAIT	4.0000	0.0000	4	4	50.0000
24	AWAIT	1.0000	0.0000	1	1	50.0000
25	AWAIT	1.0000	0.0000	1	1	50.0000
26	AWAIT	5.0000	0.0000	5	5	50.0000
27	AWAIT	18.8224	18.1534	67	33	0.1348
28	AWAIT	0.0000	0.0000	0	0	0.0000
29	AWAIT	0.0000	0.0000	1	0	0.0000
30		670.9290	44.2493	767	657	0.2587

Figure 35A. SLAM File Statistics

RESOURCE STATISTICS

RESOURCE NUMBER	RESOURCE LABEL	CURRENT CAPACITY	AVERAGE UTILIZATION	STANDARD DEVIATION	MAXIMUM UTILIZATION	CURRENT UTILIZATION
1	LC	200	95.8928	13.2605	107	46
2	IOH1	120	113.5885	12.1517	120	120

Figure 35B. SLAM Resource Statistics

IV. SUBROUTINE EVENT (I)

This subroutine interfaces the EW student flow network by means of the EVENT node. Each time an entity arrives at one of the EVENT nodes in the model the EVENT (JEVNT) subroutine is called to perform a specialized logic. There are five different logic functions and each one is accessed by means of the value of integer variable I where I = 1,2,3,4, or 5.

When an entity in the network arrives at the EVENT node EVENT,1, the subroutine EVENT (I = 1) is accessed to perform logic No. 1, which consists of clearing statistics at this point in time, then provide a summary of the students in the network at the moment the call was made. This call is made only once at the end of the filling-out period.

When an entity in the network arrives at the EVENT node EVENT,2, the subroutine EVENT(I = 2) is accessed to perform logic No. 2, which consists of collecting the statistics of the system since the last time a CLEAR was done. A SUMMARY REPORT for these statistics is provided by the SLAM main process. Then the counter for the number of years collecting statistics is tested before the subroutine HOPE is called. Finally the system is CLEARED out. The subroutine EVENT(2) is called at the end of the first four years collecting statistics (first year w/s, second year w/s, third year w/s, and fourth year w/s).

When an entity in the network arrives at the EVENT node EVENT,3, the subroutine EVENT (I = 3) is accessed to perform logic No. 3. This logic provides the same function as logic No. 2. but the system is not CLEARED out at the end. The subroutine EVENT(3) is called at the end of the fifth year collecting statistics (end of simulation).

When a student in the network arrives at the EVENT node EVENT,4, the subroutine EVENT (I = 4) is accessed to perform logic No. 4. The main

function of this logic is to update the status of the students for using the Device 10H1. At the end of each year where statistics are collected, the conditions for using the device 10H1 are changed. These conditions may include the performance of more PHASEs using the Device 10H1 or may include more categories in the PHASEs already in operation.

- The number of years collecting statistics is tested.
- ATRIB(2) is tested to separate the students by their categories.
- The new status for using the 10H1 stations is updated by means of ATRIB(4).

Subroutine EVENT(4) is called any time a student is ready to take one of the following courses:

Phase I	Basic Operations
Phase II	Advanced Operations
Phase III	Watchstanding and Tactical Operation Exercises

When a student in the network arrives at the EVENT,5, the subroutine EVENT(I = 5) is accessed to perform logic No. 5. The main function of this logic is to provide to the students with the address number they will use in function USERF(I) where the time for the individualized module lesson is stored.

- The value of ATRIB(7) is tested to determine the PHASE where the student is located.
- The value of ATRIB(2) is tested in order to separate the student according to his category.
- When the student is located in PHASE II the value of ATRIB(9) is tested to determine in what module lesson the student will have to go.
- ATRIB(8) is assigned with the value of the address to be used in the function USERF(I).

Subroutine EVENT(5) is called every time a student requires the service of LC in PHASE I and PHASE II and when he requires the service of a 10H1 station in PHASE III-A.

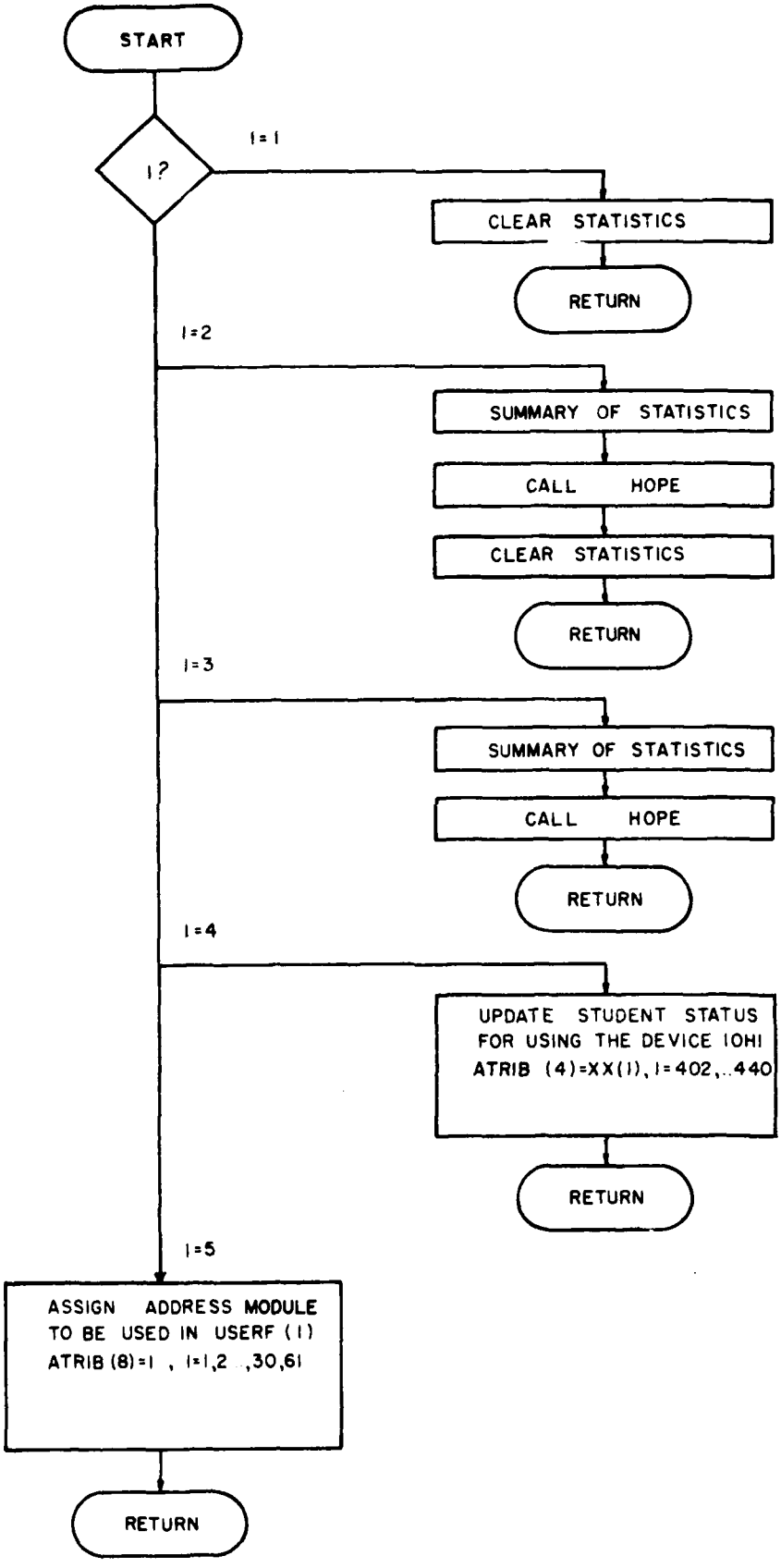


Figure 36. Subroutine EVENT (I)

V. FUNCTION USERF(I)

This function permits the analyst to make assignment of values for the activity duration representing the individualized module lessons when the LC and 10H1 resources are in operation.

The time a student spends in any module lesson is triangularly distributed with a deviation of plus or minus 10%. Once the main value is known (GVs XX(I), I = 393, ... 511) the optimistic time is obtained by multiplying the mean value by GV XX(391). The new value is 90% of the mean, i.e., MEAN VALUE XX(395) = XLO = XX(391)* XX(395) = 0.9* XX(395). The pessimistic time is obtained by multiplying the mean value by GV SS(392). The new value is 110% of the mean, i.e., MEAN VALUE = XX(395) XHI = XX(392) * XX(395) = 1.1 * XX(395). The function USERF(I) returns to the network a value which is triangularly distributed between these parameters and that value is the time the requesting student is delayed in the lesson module.

A student in the network passes his or her value of ATRIB(8) to the integer GV II which also passes the value to GV I in the function USERF(I). This value of I also represents the address label where the mean value is stored, i.e., ATRIB(8) = 10 Network

```
II = ATRIB(8) = 10

I = II = 10          Function USERF (I = 10)
10 XMOD = XX(467).
```

FUNCTION USERF(I) STEPS

- The value of GV I is tested in order to route the student to the respective address label I.
- The mean value is passed to the variable XMOD.
- The value of XMOD is tested. If this value is equal to zero the function returns value of zero time delay.

- If the value of XMOD is greater than zero, determine the lower parameter (optimistic time) and the upper parameter (pessimistic time).
- Function TRIAG (XLO, XMODE, XHI, IS) is accessed and its returning value is passed to the USERF variable.
- The value of USERF is the time the requesting student is delayed in the lesson module.

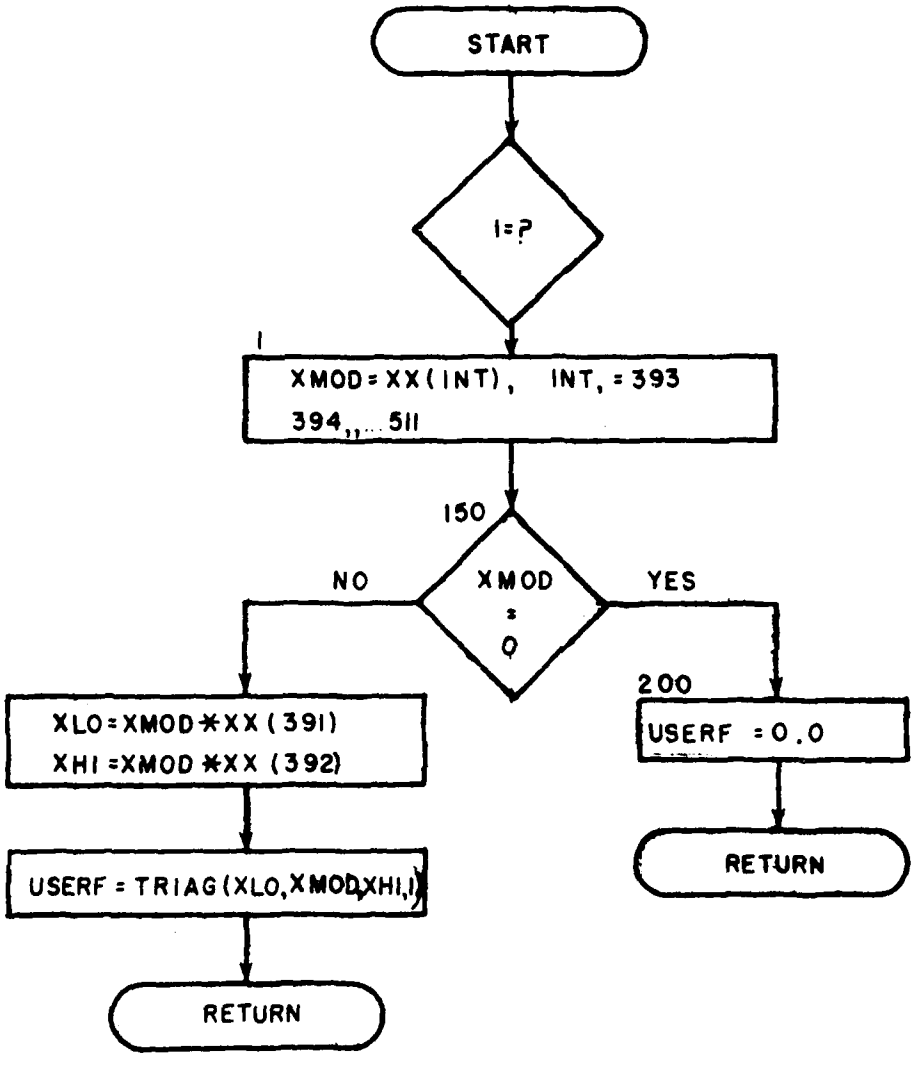


Figure 37. Function USERF (I)

VI. SUBROUTINE HOPE

This subroutine is accessed by means of subroutine EVENT (I), I = 2, or 3. Its main function is to keep record of the statistics summarized in the system at the end of each year w/s. When subroutine Hope is called by the EVENT (I = 2, or 3) processor, the statistics associated with the ending year are recorded in specific files.

These files are bi-dimensional arrays and by using the number of years w/s as a counter it is possible to store for some predetermined variables the data generated each year w/s during the last five years of simulation.

Th Steps of Subroutine HOPE are:

- The value of GV XX(199), which represents the ending year w/s, is passed to the variable NYEAR.
- The number of students who drop the system during the ending year w/s is recorded and stored in file NDROP.
- The number of graduate officers are recorded according to their category or track number and stored in file OFGRAD.
- The time in the system (average, maximum, minimum) spent by the graduate officers is recorded and stored in the respective file OFTIME.
- The number of graduate enlisted is recorded according to their category and stored in file ENGRAD.
- The time in system (average, maximum, minimum) spent by the graduate students is recorded and stored in file ENTIME.
- The number of LC resources in service and the statistics of their utilization (average, maximum utilization) is recorded and stored in file NLCS.
- The number of 10H1 resources and the statistics of their utilization are recorded and stored in file N10H1.

- The statistics of files 28 and 29 associated with the LC resources and the statistics of file 27 associated with the 1OH1 resources (maximum number of students in the files, average number of students and the average waiting time) are recorded and stored in file DEVWAT.
- The number of times (CDP frequency) group-paced CDP courses were offered during the year is recorded and stored in file CORCON.
- The average number of students by session for each group-paced CDP course is recorded and stored in file CORSIZ.
- The number of years w/s is tested. If NYEAR is not equal to J, return to subroutine EVENT(I = 2,3). If NYEAR equals J, create a tape file with all the data stored up to this point, and also print a hard copy.

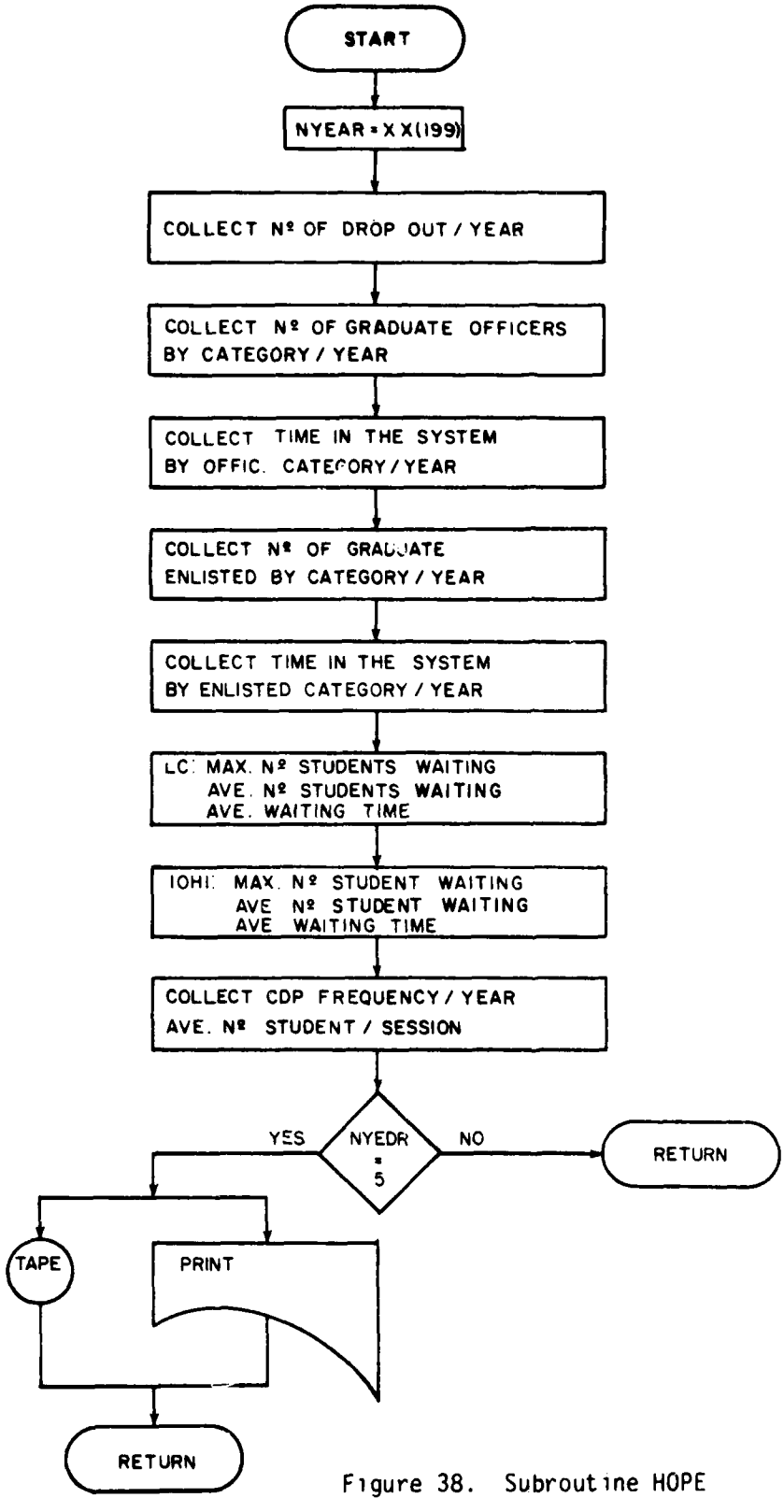


Figure 38. Subroutine HOPE

VII. PREPROCESSOR MODULE

It is necessary to test the input data prior to actual computer runs. The input data having small values may lead to an invalid or incomplete model; whereas the data having large values may result in no computer simulation because of insufficient computer memory capacity. To avoid lost time and additional cost, it is necessary to test the input data. At this point, the inputs that will be programmed are tested. These tests are basically taken from judgments and statistics. A preprocessor program (as in figure 38) is then developed, and it is described step by step as follows:

(1) Construct a table CDP matrix factor (See Table 4). Because of some CDP's permitting attrition and set-back, each CDP must be adjusted by a factor of these attrition and set-back values at Nth sequence of CDP through a particular student type track. The expression of this factor is:

$$\text{Factor} = \frac{(1 - \text{attrition rate})^{N-1}}{(1 - \text{set back rate})}$$

where N = Nth CDP sequence of a particular student type track.

(2) Read the annual arrival of each type of student for N years then find the average arrival of each type of student.

(3) Find the student arrival of each CDP.

(4) Read the maximum CDP size, time between CDP offering.

(5) Compute the ratio of each CDP by the equation.

$$\text{Ratio} = \frac{\text{Student arrival to each CDP}}{(\text{max. CDP size/time between CDP offering})}$$

This ratio determines whether the input data of a CDP is feasible or not to the model by assuming:

Ratio 1 : Feasible
Ratio 1 : Not feasible

(6) Read the annual officer arrival for N years.

(7) Read the number of 10H1 of each year of N years.

(8) Read the time spending at 10H1 of each phase of officer.

(9) Read the time spending at 10H1 of each phase of enlisted.

(10) Find the ratio of each scenario of each year for N years by the expression:

$$\text{Ratio} = \frac{\text{type phase (student arrival) (time spending at 10H1)}}{\text{(No. of 10H1) (Total school hours)}}$$

This ratio then determines whether the inputs related to each scenario are feasible or not for the simulation model by assuming also as follows:

Ratio 1 : Feasible
Ratio 1 : Not feasible

(11) All ratios are checked. If they are feasible, one can run the simulation program. If they are not, they must be modified and then will be tested again with the same procedure as above.

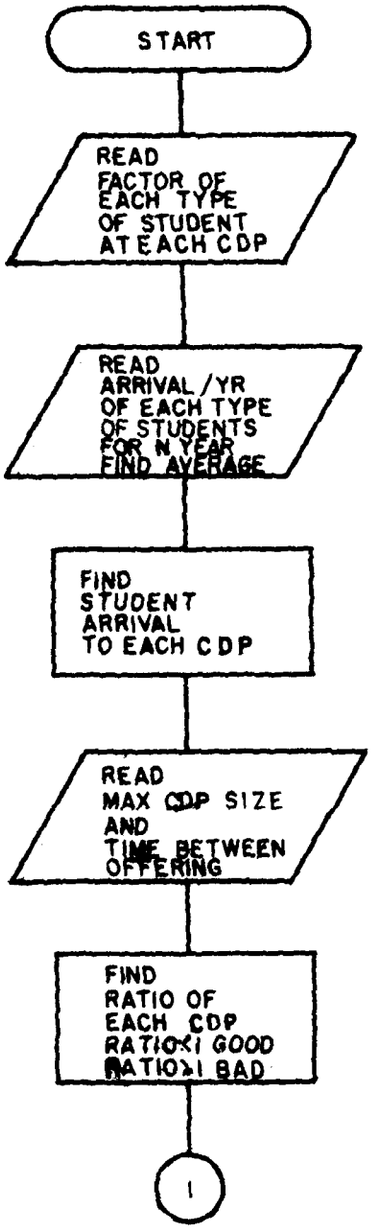


Figure 39. Preprocessor Flow Chart

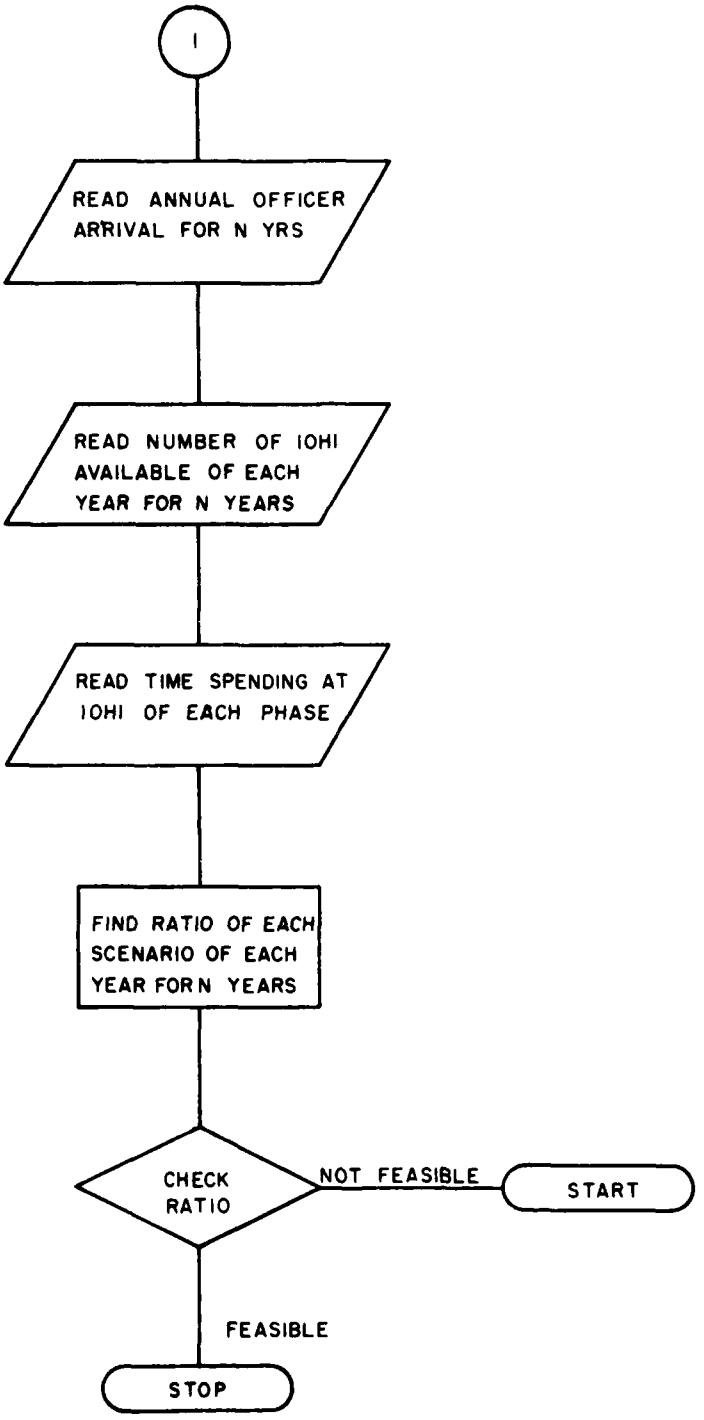


Figure 39. Preprocessor Flow Chart (continued)

Table 4. CDP Matrix Factor

	CDP / INPUT		60L4	C1	15A	16A	17A	18A	60L2C	15B	16B	17B	18B	C2	C3	15D	16D	17D	18D	4LM	16E	17E	16F	60L4C	60L2D	15C	16C	17C	18C
	STUDENT	NO.	LOWER SUITE	4w	10w	1w	1w	1w	1w	2w	2w	2w	2w	2w	5w	4w	11w	3w	4w	11w	4w	6w	6w	3w	3w	3w	2w	2w	2w	2w
1	USNAVO	1	WLR-1	1.111	1.055	1.0				0.859					1.004	0.852	0.946				1.0					1.0	1.0				
		2	WLR-8	1.111	1.055				1.0	0.859					1.004	0.852				1.0						1.0				1.0
		3	SLQ-17	1.111	1.055			1.0		0.859					1.004	0.852			1.0			1.0				1.0			1.0	
		4	SLQ-32	1.111	1.055		1.0			0.859					1.004	0.852		1.0			1.0		1.0		1.0		1.0			
2	USNAVO	1	WLR-1	1.111	1.055	1.0				0.852	0.925														1.0	1.0				
		2	WLR-8	1.111	1.055				1.0	0.852				1.0											1.0					1.0
		3	SLQ-17	1.111	1.055			1.0		0.852			1.0												1.0			1.0		
		4	SLQ-32	1.111	1.055		1.0			0.852		1.0													1.0		1.0			
3	USNAVSG	1	WLR-1	1.111	1.055	1.0				0.852	0.925														1.0	1.0				
		2	WLR-8	1.111	1.055				1.0	0.852				1.0											1.0					1.0
		3	SLQ-17	1.111	1.055			1.0		0.852			1.0												1.0			1.0		
		4	SLQ-32	1.111	1.055		1.0			0.852		1.0													1.0		1.0			
4	LAVE CONV	1	WLR-1	1.111	1.055	1.0				0.852	0.925														1.0	1.0				
		2	WLR-8	1.111	1.055				1.0	0.852				1.0											1.0					1.0
		3	SLQ-17	1.111	1.055			1.0		0.852			1.0												1.0			1.0		
		4	SLQ-32	1.111	1.055		1.0			0.852		1.0													1.0		1.0			
5	USNAVSTA	1	WLR-1	1.111	1.055	1.0				0.852					1.004	0.852									1.0	1.0				
6	FSTATN	2	WLR-8						1.0					1.0																1.0
		3	SLQ-17					1.0					1.0															1.0		
		4	SLQ-32				1.0					1.0															1.0			
7	FSTATNUS	2	WLR-8												1.111				1.0										1.0
		3	SLQ-17												1.111			1.0				1.0					1.0		
		4	SLQ-32												1.111		1.0				1.0		1.0				1.0		
		5	DIGITAL												1.111														
		6	ULQGC												1.111					1.0									
8	USCG	1	WLR-1													1.111													
9	USCG	3	UVK-20												1.111					1.0									
10	USCG	-	-		1.111										1.055	1.000								1.0					
11	USCG	-	-		1.111										1.055	0.951													

• CDP Permitting Attrition and Setback.

Table 5. CDP Matrix Sequence

	INPUT / CDP LNG		602-A	C1	15A	16A	17A	19A	80ACC	15D	16D	17B	18B	C2	C3	15D	16D	17D	18D	42M	16E	17E	16F	60AFC	60AD	15C	16C	17C	11C
	STUDENT	NO	EQUIPM. SUITE	4W	10W	1W	1W	1W	1W	2W	2W	2W	2W	2W	5W	4W	11W	3W	4W	11W	4W	6W	18W	3W	3W	3W	1W	4W	2W	2W
1	USNGYO	1	WLR-1	1	2	5				6					3	4	7				8					9	10			
		2	WLR-8	1	2				5	6					3	4				7						8				9
		3	SLQ-17	1	2			5		6					3	4			7				8			9			10	
		4	SLQ-32	1	2		3			6					3	4		7				8*		8*		9		10		
2	USN #YO	1	WL2-1	1	2	3				4	5															6	7			
		2	WLR-8	1	2				3	4				5												6				7
		3	SLQ-17	1	2			3		4			5													6			7	
		4	SLQ-32	1	2		3			4		5														6		7		
3	USNR 3YO	1	WLR-1	1	2	3				4	5															6	7			
		2	WLR-8	1	2				3	4				5												6				7
		3	SLQ-17	1	2			3		4			5													6			7	
		4	SLQ-32	1	2		3			4		5														6		7		
4	CATE CONV	1	WLR-1	1	2	3				4	5															6	7			
		2	WLR-8	1	2				3	4				5												6				7
		3	SLQ-17	1	2			3		4			5													6			7	
		4	SLQ-32	1	2		3			4		5														6		7		
5	USNR 3YO	1	WL2-1	1	2	4				5					3		6									7	8			
6	FLT ATN	2	WLR-8						1					2																3
		3	SLQ-17					1					2																3	
		4	SLQ-32				1					2																3		
7	FLT INPUTS	2	WLR-8													1				3										4
		3	SLQ-17													1			3				4						5	
		4	SLQ-32													1		3				4*		4*				5		
		5	DIGITAL													1														
		6	VLSGC													1				2										
8	USCG	1	WL2-1																											
9	CTM	3	UYK-20													1				2										
10	ETSM	-	-		1									2	3									4						
11	CRS SYO	-	-		1									2	3															

* Some portion of the students will be required to take

PREPROCESSOR PROGRAM REPORT

PART 1: COURSE

CDP#	RATIO	SIZE	FREQUENCY
1.	0.368	20.	1.
2.	0.553	40.	2.
3.	0.356	18.	2.
4.	0.670	12.	3.
5.	0.243	8.	3.
6.	0.249	8.	3.
7.	0.503	24.	2.
8.	0.304	12.	2.
9.	0.693	12.	8.
10.	0.397	10.	8.
11.	0.438	10.	8.
12.	0.348	40.	2.
13.	0.402	46.	2.
14.	0.254	12.	2.
15.	0.892	16.	8.
16.	0.400	8.	8.
17.	0.308	8.	8.
18.	0.713	16.	4.
19.	0.595	12.	8.
20.	0.400	8.	8.
21.	0.595	12.	8.
22.	0.688	10.	4.
23.	0.662	20.	2.
24.	0.160	20.	1.
25.	0.941	12.	4.
26.	0.299	12.	4.
27.	0.428	8.	4.

#BAD COP 0
INPUT DATA RELATED TO CDP ARE GOOD

FIGURE 40. OUTPUT FROM PREPROCESSOR- PART 1

```
PART 2  : 10H1

YEAR 2

SCENARIO 2 HAS A RATIO OF 0.632
SCENARIO 3 HAS A RATIO OF 0.278
SCENARIO 4 HAS A RATIO OF 0.409
SCENARIO 5 HAS A RATIO OF 0.911
SCENARIO 6 HAS A RATIO OF 1.042
SCENARIO 7 HAS A RATIO OF 0.688
SCENARIO 8 HAS A RATIO OF 1.320
#BAD SCE 2.
NEED TO MODIFY INPUT DATA

YEAR 3

SCENARIO 2 HAS A RATIO OF 0.474
SCENARIO 3 HAS A RATIO OF 0.209
SCENARIO 4 HAS A RATIO OF 0.307
SCENARIO 5 HAS A RATIO OF 0.683
SCENARIO 6 HAS A RATIO OF 0.781
SCENARIO 7 HAS A RATIO OF 0.516
SCENARIO 8 HAS A RATIO OF 0.990
#BAD SCE 0.
INPUT DATA RELATED TO 10H1 ARE GOOD

YEAR 4

SCENARIO 2 HAS A RATIO OF 0.316
SCENARIO 3 HAS A RATIO OF 0.139
SCENARIO 4 HAS A RATIO OF 0.205
SCENARIO 5 HAS A RATIO OF 0.455
SCENARIO 6 HAS A RATIO OF 0.521
SCENARIO 7 HAS A RATIO OF 0.344
SCENARIO 8 HAS A RATIO OF 0.660
#BAD SCE 0.
INPUT DATA RELATED TO 10H1 ARE GOOD

YEAR 5

SCENARIO 2 HAS A RATIO OF 0.316
SCENARIO 3 HAS A RATIO OF 0.139
SCENARIO 4 HAS A RATIO OF 0.205
SCENARIO 5 HAS A RATIO OF 0.455
SCENARIO 6 HAS A RATIO OF 0.521
SCENARIO 7 HAS A RATIO OF 0.344
SCENARIO 8 HAS A RATIO OF 0.660
# BAD SCE 0.
INPUT DATA RELATED TO 10H1 ARE GOOD
```

FIGURE 41. OUTPUT FROM PRERROCESSOR - PART 2

APPENDIX A

XX(I) GLOBAL VARIABLE REPRESENTATION

1. Minimum No. of students to Open CDP 1C.
2. Minimum No. of students required for double session 1C.
3. Maximum No. of students for CDP 1C.
4. Course length for CDP 1C.
5. Convening frequency for CDP 1C.
6. Minimum No. of students to Open CDP 2C.
7. Minimum No. of students required for double session 2C.
8. Maximum No. of students for CDP 2C.
9. Course length for CDP 2C.
10. Convening frequency for CDP 2C.
11. Minimum No. of students to open CDP 604C.
12. Minimum No. of students required for double session 604C.
13. Maximum No. of students for CDP 604C.
14. Course length for CDP 604C.
15. Convening frequency for CDP 604C.
16. Minimum No. of students to open CDP 3C.
17. Minimum No. of students required for double session 3C.
18. Maximum No. of students for CDP 3C.
19. Course length for CDP 3C.
20. Convening frequency for CDP 3C.
21. Minimum No. of students to open CDP 015A.
22. Minimum No. of students required for double session 015A.
23. Maximum No. of students for CDP 015A.
24. Course length for CDP 015A.
25. Convening frequency for CDP 015A.
26. Minimum No. of students to open CDP 016A.
27. Minimum No. of students required for double session 016A.
28. Maximum No. of students for CDP 016A.
29. Course length for CDP 016A.
30. Convening frequency for CDP 016A.
31. Minimum No. of students to open CDP 017A.
32. Minimum No. of students required for double session 017A.
33. Maximum No. of students for CDP 017A.
34. Course length for CDP 017A.
35. Convening frequency for CDP 017A.
36. Minimum No. of students to open CDP 018A.
37. Minimum No. of students required for double session 018A.
38. Maximum No. of students for CDP 018A.
39. Course length for CDP 018A.
40. Convening frequency for CDP 018A.
41. Minimum No. of students to open CDP 602C.
42. Minimum No. of students required for double session 602C.
43. Maximum No. of students for CDP 602C.
44. Course length for CDP 6C2C.
45. Convening frequency for CDP 602C.
46. Minimum No. of students to open CDP 015B.
47. Minimum No. of students required for double session 015B.
48. Maximum No. of students for CDP 015B.
49. Course length for CDP 015B.
50. Convening frequency for CDP 015B.

51. Minimum No. of students to open CDP 016B.
52. Minimun No. of students required for double session 016B.
53. Maximum No. of students for CDP 016B.
54. Course length for CDP 016B.
55. Convening frequency for CDP 016B.
56. Minimum No. of students to open CDP 017B.
57. Minimum No. of students required for double session 017B.
58. Maximum No. of students for CDP 017B.
59. Course length for CDP 017B.
60. Convening frequency for CDP 017B.
61. Minimum No. of students to open CDP 018B.
62. Minimum No. of students required for double session 018B.
63. Maximum No. of students for CDP 018B.
64. Course length for CDP 018B.
65. Convening frequency for CDP 018B.
66. Minimum No. of students to open CDP 015D.
67. Minimum No. of students required for double session 015D.
68. Maximum No. of students for CDP 015D.
69. Course length for CDP 015D.
70. Convening frequency for CDP 015D.
71. Minimum No. of students to open CDP 412M.
72. Minimum No. of students required for double session 412M.
73. Maximum No. of students for CDP 412M.
74. Course length for CDP 412M.
75. Convening frequency for CDP 412M.
76. Minimum No. of students to open CDP 016D.
77. Minimum No. of students required for double session 016D.
78. Maximum No. of students for CDP 016D.
79. Course length for CDP 016D.
80. Convening frequency for CDP 016D.
81. Minimum No. of students to open CDP 016E.
82. Minimum No. of students required for double session 016E.
83. Maximum No. of students for CDP 016E.
84. Course length for CDP 016E.
85. Convening frequency for CDP 016E.
86. Minimum No. of students to open CDP 016F.
87. Minimum No. of students required for double session 016F.
88. Maximum No. of students for CDP 016F.
89. Course length for CDP 016F.
90. Convening frequency for CDP 016F.
91. Minimum No. of students to open CDP 017E.
92. Minimum No. of students required for double session 017D.
93. Maximum No. of students for CDP 017D.
94. Course length for CDP 017D.
95. Convening frequency for CDP 017D.
96. Minimum No. of students to open 017E.
97. Minimum No. of students required for double session 017E.
98. Maximum No. of students for CDP 017E.
99. Course Length for CDP 017E.
100. Convening frequency for CDP 017E.

101. Minimum No. of students to open CDP 018D.
102 Minimum No. of students required for double session 018D.
103. Maximum No. of students for CDP 018D.
104. Course length for CDP 018D.
105. Convening frequency for CDP 018D.
106. Minimum No. of students to open 602D.
107. Minimum No. of students required for double session 602D.
108. Maximum No. of students for CDP 602D.
109. Course length for CDP 602D
110. Convening frequency for CDP 602D.
111. Minimum No. of students to open CDP 015C.
112. Minimum No. of students required for double session 015C.
113. Maximum No. of students for CDP 015C.
114. Course length for CDP 015C.
115. Convening frequency for CDP 015C.
116. Minimum No. of students to open 016C.
117. Minimum No. of students required for double session 016C.
118. Maximum No. of students for CDP 016C.
119. Course length for CDP 016C.
120. Convening frequency for CDP 016C.
121. Minimum No. of students to open CDP 017C.
122. Minimum No. of students required for double session 017C.
123. Maximum No. of students for CDP 017C.
124. Course length for CDP 017C.
125. Convening frequency for CDP 017C.
126. Minimum No. of students to open CDP 018C.
127. Minimum No. of students required for double session 018C.
128. Maximum No. of students required for CDP 018C.
129. Course length for CDP 018C.
130. Convening frequency for CDP 018C.
131. Available for a first extra CDP
132. " " " " " "
133. " " " " " "
134. " " " " " "
135. " " " " " "
136. Available for a second extra CDP.
137. " " " " " "
138. " " " " " "
139. " " " " " "
140. " " " " " "
141. Available for a third extra CDP.
142. " " " " " "
143. " " " " " "
144. " " " " " "
145. " " " " " "
146. Available for a fourth extra CDP.
147. " " " " " "
148. " " " " " "
149. " " " " " "
150. " " " " " "

151. Average No. of Students in double session CDP 1C.
152. " " " " " " " " CDP 2C.
153. " " " " " " " " CDP 604C.
154. " " " " " " " " CDP 3C.
155. " " " " " " " " CDP 015A.
156. " " " " " " " " CDP 016A.
157. " " " " " " " " CDP 017A.
158. " " " " " " " " CDP 018A.
159. " " " " " " " " CDP 602C.
160. " " " " " " " " CDP 015B.
161. Average No. of students in double session CDP 016B.
162. " " " " " " " " CDP 017B
163. " " " " " " " " CDP 018B.
164. " " " " " " " " CDP 015D.
165. " " " " " " " " CDP 412M
166. " " " " " " " " CDP 016D.
167. " " " " " " " " CDP 016E.
168. " " " " " " " " CDP 016F.
169. " " " " " " " " CDP 017D.
170. " " " " " " " " CDP 107E.
171. Average No. of students in double session CDP 108D.
172. " " " " " " " " CDP 602D.
173. " " " " " " " " CDP 015C.
174. " " " " " " " " CDP 016C.
175. " " " " " " " " CDP 017C.
176. " " " " " " " " CDP 018C.
177. Average No. of students in double session 1st extra CDP
178. " " " " " " " " 2nd " CDP
179. " " " " " " " " 3rd " CDP
180. " " " " " " " " 4th " CDP
181. Available for additional variables
182. " " " " " " "
183. " " " " " " "
184. " " " " " " "
185. " " " " " " "
186. " " " " " " "
187. " " " " " " "
188. " " " " " " "
189. " " " " " " "
190. " " " " " " "
191. " " " " " " "
192. " " " " " " "
193. " " " " " " "
194. " " " " " " "
195. " " " " " " "
196. " " " " " " "
197. " " " " " " "
198. " " " " " " "
199. " " " " " " "
200. First year of simulation w/s
201. USN 6YO/WLR-1 Input Rate for year 1.
202. " " " " " " " 2.
203. " " " " " " " 3.
204. " " " " " " " 4.
205. " " " " " " " 5.

206.	USN/SLQ-32	Input Rate for Year 1.
207.	" "	" " " " 2.
208.	" "	" " " " 3.
209.	" "	" " " " 4.
210.	" "	" " " " 5.
211.	USN 6YO/SLQ-17	Input Rate for Year 1.
212.	" " "	" " " " 2.
213.	" " "	" " " " 3.
214.	" " "	" " " " 4.
215.	" " "	" " " " 5.
216.	USN 6YO/WLR-8	Input Rate for Year 1.
217.	" " "	" " " " 2.
218.	" " "	" " " " 3.
219.	" " "	" " " " 4.
220.	" " "	" " " " 5.
221.	USN 4YO/WLR-1	Input Rate for Year 1.
222.	" " "	" " " " 2.
223.	" " "	" " " " 3.
224.	" " "	" " " " 4.
225.	" " "	" " " " 5.
226.	USN 4YO/SLQ-32	Input Rate for Year 1.
227.	" " "	" " " " 2.
228.	" " "	" " " " 3.
229.	" " "	" " " " 4.
230.	" " "	" " " " 5.
231.	USN 4YO/SLQ-17	Input Rate for Year 1.
232.	" " "	" " " " 2.
233.	" " "	" " " " 3.
234.	" " "	" " " " 4.
235.	" " "	" " " " 5.
236.	USN 4YO/WLR-8	Input Rate for Year 1.
237.	" " "	" " " " 2.
238.	" " "	" " " " 3.
239.	" " "	" " " " 4.
240.	" " "	" " " " 5.
241.	USN 3X6/WLR-1	Input Rate for Year 1.
242.	" " "	" " " " 2.
243.	" " "	" " " " 3.
244.	" " "	" " " " 4.
245.	" " "	" " " " 5.
246.	USN 3X6/SLQ-32	Input Rate for Year 1.
247.	" " "	" " " " 2.
248.	" " "	" " " " 3.
249.	" " "	" " " " 4.
250.	" " "	" " " " 5.
251.	USN 3X6/SLQ-17	Input Rate for Year 1.
252.	" " "	" " " " 2.
253.	" " "	" " " " 3.
254.	" " "	" " " " 4.
255.	" " "	" " " " 5.
256.	USN 3X6/WLR-8	Input Rate for Year 1.
257.	" " "	" " " " 2.
258.	" " "	" " " " 3.
259.	" " "	" " " " 4.
260.	" " "	" " " " 5.

261.	USN Late Conv/WLR-1	Input Rate for Year	1.
262.	" " " "	" " " "	2.
263.	" " " "	" " " "	3.
264.	" " " "	" " " "	4.
265.	" " " "	" " " "	5.
266.	USN Late Conv/SLQ-32	Input Rate for Year	1.
267.	" " " "	" " " "	2.
268.	" " " "	" " " "	3.
269.	" " " "	" " " "	4.
270.	" " " "	" " " "	5.
271.	USN Late Conv/SLQ-17	Input Rate for Year	1.
272.	" " " "	" " " "	2.
273.	" " " "	" " " "	3.
274.	" " " "	" " " "	4.
275.	" " " "	" " " "	5.
276.	USN Late Conv/WLR-8	Input Rate for Year	1.
277.	" " " "	" " " "	2.
278.	" " " "	" " " "	3.
279.	" " " "	" " " "	4.
280.	" " " "	" " " "	5.
281.	USNR 4X10/WLR-1	Input Rate for Year	1.
282.	" " " "	" " " "	2.
283.	" " " "	" " " "	3.
284.	" " " "	" " " "	4.
285.	" " " "	" " " "	5.
286.	Flt. RFN. ON/SLQ-32	Input Rate for Year	1.
287.	" " " "	" " " "	2.
288.	" " " "	" " " "	3.
289.	" " " "	" " " "	4.
290.	" " " "	" " " "	5.
291.	Flt. Rtn. ON/SLQ-17	Input Rate for Year	1.
292.	" " " "	" " " "	2.
293.	" " " "	" " " "	3.
294.	" " " "	" " " "	4.
295.	" " " "	" " " "	5.
296.	Flt. Rtn. ON/WLR-8	Input Rate for Year	1.
297.	" " " "	" " " "	2.
298.	" " " "	" " " "	3.
299.	" " " "	" " " "	4.
300.	" " " "	" " " "	5.
301.	Flt. Rtn /SLQ-32	Input Rate for Year	1.
302.	" " " "	" " " "	2.
303.	" " " "	" " " "	3.
304.	" " " "	" " " "	4.
305.	" " " "	" " " "	5.
306.	Flt. Rtn /SLQ-17 MAINT.	Input Rate for Year	1.
307.	" " " "	" " " "	2.
308.	" " " "	" " " "	3.
309.	" " " "	" " " "	4.
310.	" " " "	" " " "	5.
311.	Flt. Rtn. /WLR-8 MAINT.	Input Rate for Year	1.
312	" " " "	" " " "	2.
313.	" " " "	" " " "	3.
314.	" " " "	" " " "	4.
315.	" " " "	" " " "	5.

316.	FLT. ULQ6C Maint.	Input Rate for Year	1.
317.	" " "	" " " "	2.
318.	" " "	" " " "	3.
319.	" " "	" " " "	4.
320.	" " "	" " " "	5.
321.	Sys.Digital Maint.	Input Rate for Year	1.
322.	" " "	" " " "	2.
323.	" " "	" " " "	3.
324.	" " "	" " " "	4.
325.	" " "	" " " "	5.
326.	USCG/WLR-1	Input Rate for Year	1.
327.	" "	" " " "	2.
328.	" "	" " " "	3.
329.	" "	" " " "	4.
330.	" "	" " " "	5.
331.	ETSU	Input Rate for Year	1.
332.	"	" " " "	2.
333.	"	" " " "	3.
334.	"	" " " "	4.
335.	"	" " " "	5.
336.	CTM 6YO	Input Rate for Year	1.
337.	"	" " " "	2.
338.	"	" " " "	3.
339.	"	" " " "	4
340.	"	" " " "	5.
341.	VQ Pilot Navigator	Input Rate for Year	1.
242.	" " " "	" " " "	2.
343.	" " " "	" " " "	3.
344.	" " " "	" " " "	4.
345.	" " " "	" " " "	5.
346.	Aviation EW Off. ASW + DC	Input Rate for Year	1.
347.	" " " " "	" " " "	2.
348.	" " " " "	" " " "	3.
349.	" " " " "	" " " "	4.
350.	" " " " "	" " " "	5.
351.	Aviation EA6. Repl. Pilot	Input Rate for Year	1.
352.	" " " " "	" " " "	2.
353.	" " " " "	" " " "	3.
354.	" " " " "	" " " "	4.
355.	" " " " "	" " " "	5.
356.	Flt. Air.Recon. EW Eval.	Input Rate for Year	1.
357.	" " " " "	" " " "	2.
358.	" " " " "	" " " "	3.
359.	" " " " "	" " " "	4.
360.	" " " " "	" " " "	5.
361.	EA6 Repl. Pilot. NFO ECHO	Input Rate for Year	1.
362.	" " " " "	" " " "	2.
363.	" " " " "	" " " "	3.
364.	" " " " "	" " " "	4.
365.	" " " " "	" " " "	5.
366.	VAQ33 NFP Flt. EW	Input Rate for Year	1.
367.	" " " " "	" " " "	2.
368.	" " " " "	" " " "	3.
369.	" " " " "	" " " "	4.
370.	" " " " "	" " " "	5.

```
371.  EA6 USMC Aviation EW          Input Rate for Year 1.
372.    "    "    "    "             "     "    "    "  2.
373.    "    "    "    "             "     "    "    "  3.
374.    "    "    "    "             "     "    "    "  4.
375.    "    "    "    "             "     "    "    "  5.
376.  CTM-UYK20                      Input Rate for Year 1.
377.    "    "                        "     "    "    "  2.
378.    "    "                        "     "    "    "  3.
379.    "    "                        "     "    "    "  4.
380.    "    "                        "     "    "    "  5.
381.  Number of 10H1 stations available for Year 1.
382.    "    "    "    "    "    "    "    "     2.
383.    "    "    "    "    "    "    "    "     3.
384.    "    "    "    "    "    "    "    "     4.
385.    "    "    "    "    "    "    "    "     5.
386.  Total No. of 10H1 stations available at any time.
387.  Number of LC stations available at any time.
388.  Filling up period (first two years of simulation).
389.  Represents 100% in the calculation of deviation factors.
390.  Represents 10% deviation factor.
391.  Represents (100-10)% factor.
392.  Represents (100 + 10)% factor
393.  Time in LC Phase I Enlisted
394.  Time in 10H1 Phase I  "
395.  Time in LC Phase I Officers
396.  Time in LC Phase I    "
397.  Optimistic time in LC (CDP 602A) w/o 10H1
398.  Mean time in LC (CDP 602A) w/o 10H1
399.  Pessimistic time in LC (CDP 602A) w/o 10H1
400.  Counter of simulation time collecting statistics
401.  USN6Y0 status for Year 1.
402.    "    "    "    "     2.
403.    "    "    "    "     3.
404.    "    "    "    "     4.
405.    "    "    "    "     5.
406.  USN4Y0 status for year 1.
407.    "    "    "    "     2.
408.    "    "    "    "     3.
409.    "    "    "    "     4.
410.    "    "    "    "     5.
411.  USNR 3X6 status for Year 1.
412.    "    "    "    "    "  2.
413.    "    "    "    "    "  3.
414.    "    "    "    "    "  4.
415.    "    "    "    "    "  5.
416.  Late Conv. status for Year 1.
417.    "    "    "    "    "    2.
418.    "    "    "    "    "    3.
419.    "    "    "    "    "    4.
420.    "    "    "    "    "    5.
421.  USNR 4X10 status for Year 1.
422.    "    "    "    "    "   2.
423.    "    "    "    "    "   3.
424.    "    "    "    "    "   4.
425.    "    "    "    "    "   5.
```

426. Flt. Rtn. Ope. only status for Year 1.
427. " " " " " " " 2.
428. " " " " " " " 3.
429. " " " " " " " 4.
430. " " " " " " " 5.
431. Flt. Retn. Ope. Maint. status for Year 1.
432. " " " " " " " 2.
433. " " " " " " " 3.
434. " " " " " " " 4.
435. " " " " " " " 5.
436. Officers, status for Year 1.
437. " " " " 2.
438. " " " " 3.
439. " " " " 4.
440. " " " " 5.
441. Time in LC Phase II, Officer NFOs.
442. " " " " " "
443. " " " " " "
444. " " " " " "
445. " " " " " "
446. " " " " " "
447. Time in 1OH1 Phase II Officer NFOs.
448. " " " " " "
449. " " " " " "
450. " " " " " "
451. " " " " " "
452. " " " " " "
453. Time in LC Phase II, Officer TACAIR
454. " " " " " "
455. " " " " " "
456. " " " " " "
457. " " " " " "
458. " " " " " "
459. Time in 1OH1 Phase II Officer TACAIR
460. " " " " " "
461. " " " " " "
462. " " " " " "
463. " " " " " "
464. " " " " " "
465. Unassigned G.V.
466. Time in LC Phase II Officer, Other
467. " " " " " "
468. " " " " " "
469. " " " " " "
470. " " " " " "
471. " " " " " "
472. Time in 1OH1 Phase II Officer, Other
473. " " " " " "
474. " " " " " "
475. " " " " " "
476. " " " " " "
477. " " " " " "

478. Time in LC Phase II Enlisted
479. " " " " "
480. " " " " "
481. " " " " "
482. " " " " "
483. " " " " "
484. Time in 10H1 Phase II, Enlisted
485. " " " " "
486. " " " " "
487. " " " " "
488. " " " " "
489. " " " " "
490. Time in LC Phase II, Enlisted CTT
491. " " " " " "
492. " " " " " "
493. " " " " " "
494. " " " " " "
495. " " " " " "
496. Time in 10H1 Phase II, Enlisted CTT
497. " " " " " "
498. " " " " " "
499. " " " " " "
500. " " " " " "
501. " " " " " "
502. Time in 10H1 Phase III-A, Officers (6474,6475,9795)
503. " " " " " "
504. Time in 10H1 Phase III-A, Officers (9799)
505. Time in 10H1 Phase III-B " "
506. Time in 10H1 Phase III-A Officers (9797, 9798)
507. Time in 10H1 Phase III-B Officers (9797, 9798)
508. Time in 10H1 Phase III-A Enlisted (WLR-1)
509. " " " III-B " "
510. " " " III-A " (SLQ-32, SLQ-17,WLR-8)
511. " " " III-B " (SLQ-32, SLQ-17, WLR-8)
512. Unassigned Global Variables
thru " " "
600. " " "

APPENDIX B

GATES/FILES AND RESOURCES/FILES ASSOCIATED WITH CDP COURSES

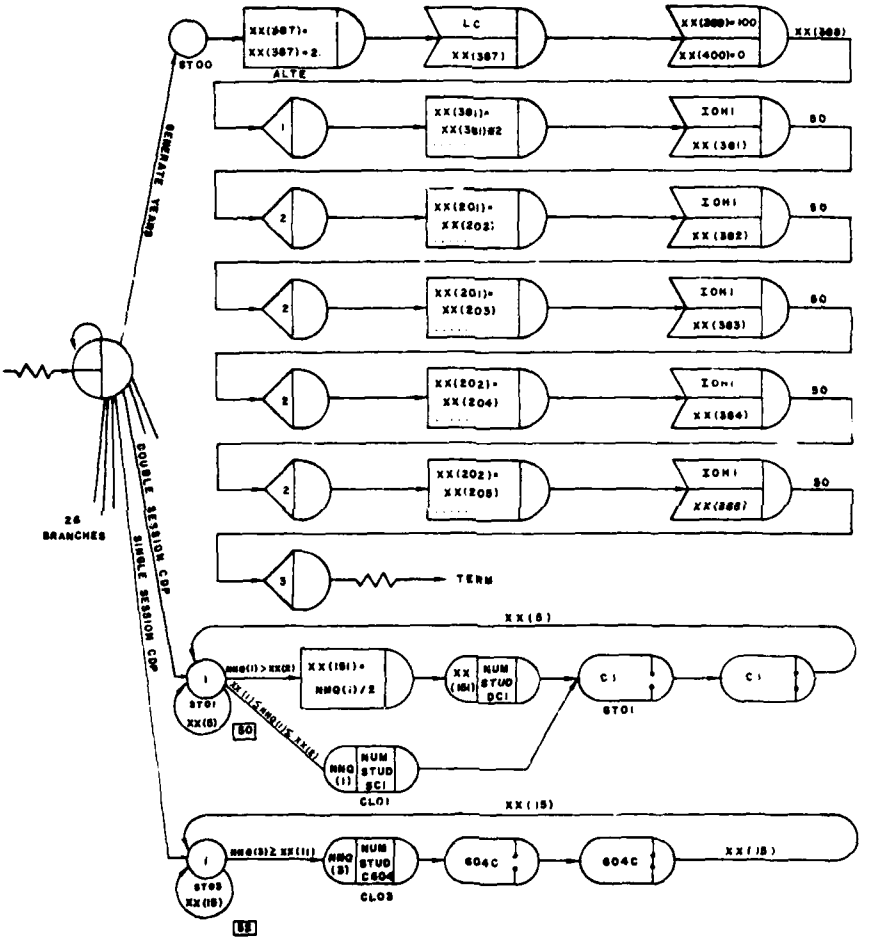
GATE	FILE	CDP
C1	1	C1 (602B, 604A, 605A)
	2	C2 (603A, 604B, 605B)
C3	4	C3 (603B, 604D, 605C)
A015	5	015A
A016	6	016A
A017	7	017A
A018	8	018A
C602	9	602C
B015	10	015B
B016	11	016B
B017	12	017B
B018	13	018B
D105	14	015D
M412	15	412M
D016	16	016D
E016	17	016E
F016	18	016F
D017	19	017D
E007	20	017E
D018	21	018D
D602	22	602D
C015	23	015C
C016	24	016C
C017	25	017C
C018	26	018C

RESOURCE	FILE	CDP
LC	28	602A
LC	29	LC (Phase I, II)
10H1	27	10H1 (Phase I, II, III)

APPENDIX C

INFORMATION FLOW FLOWCHART

INFORMATION FLOW FLOWCHART

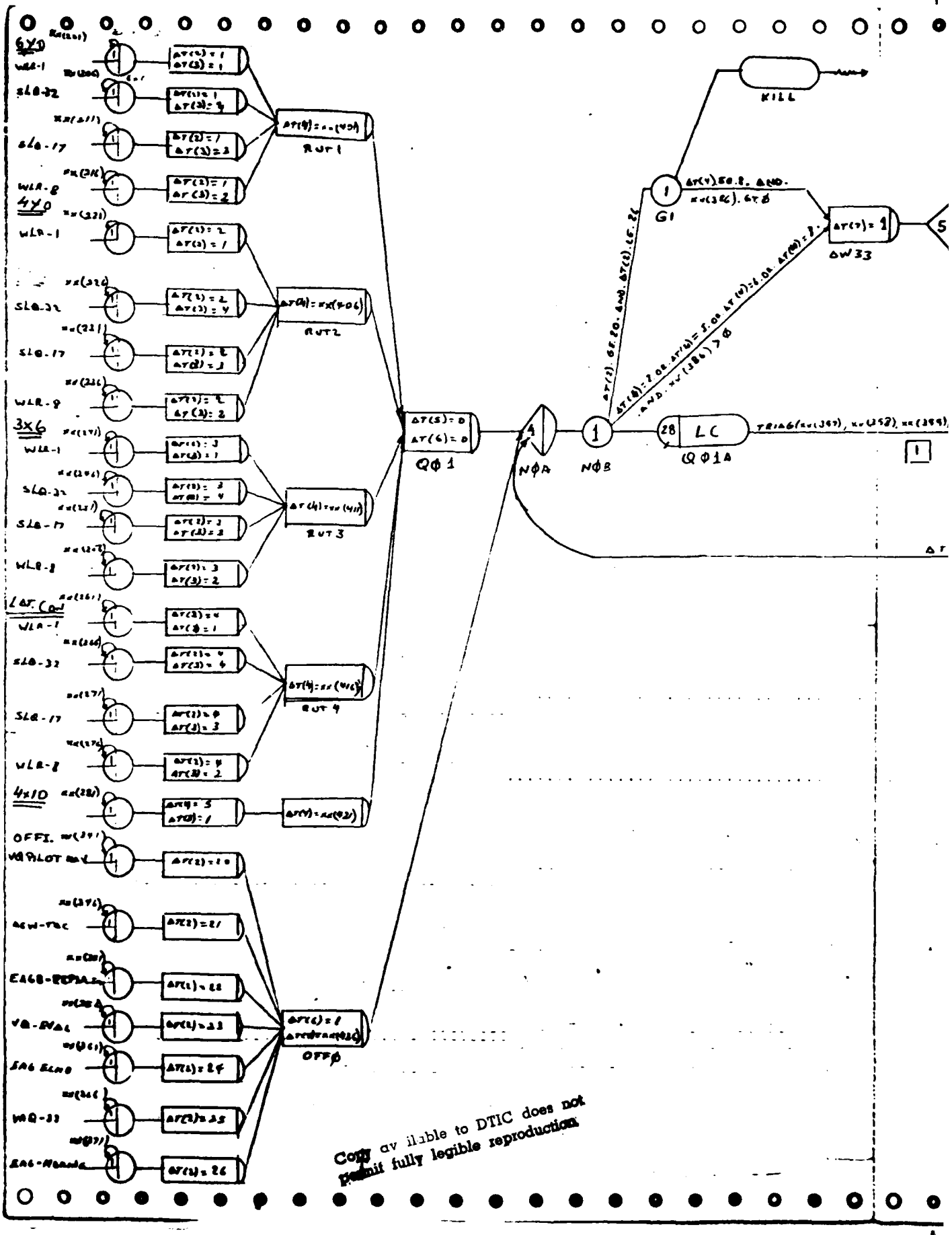


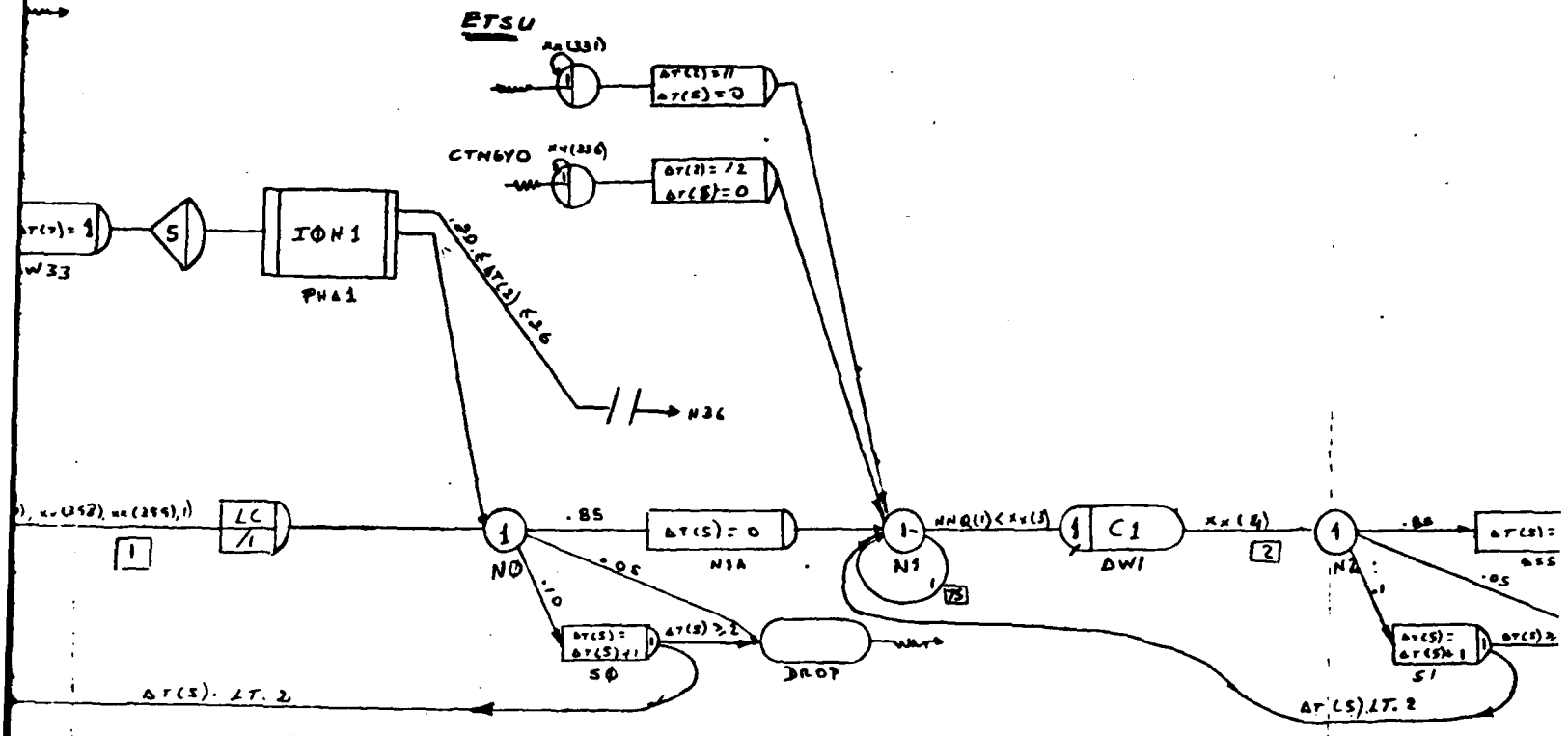
DOUBLE SESSION CDP: ST01 (C1), ST02 (C2), ST04 (C3), ST05 (018A), ST09 (602C), ST22 (602D)

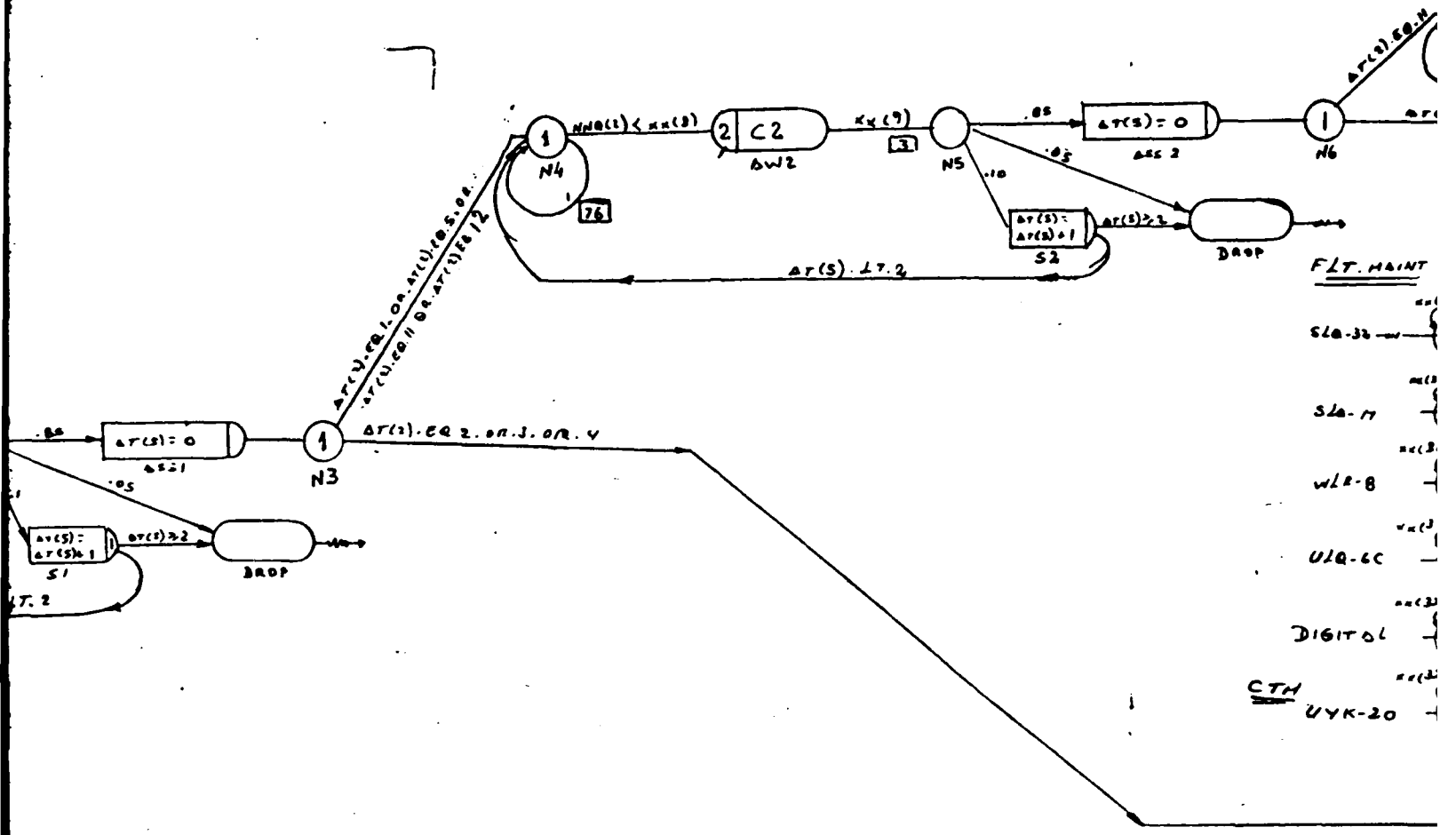
SINGLE SESSION CDP: ST03 (604C), ST06 (018A), ST07 (017A), ST08 (018A), ST10 (018B), ST11 (018B), ST12 (017B), ST13 (0188), ST14 (0190), ST15 (A18E), ST16 (018D), ST17 (018E), ST18 (018F), ST19 (017D), ST20 (017E), ST21 (018D), ST23 (018C), ST24 (018C), ST25 (017C), ST26 (018C)

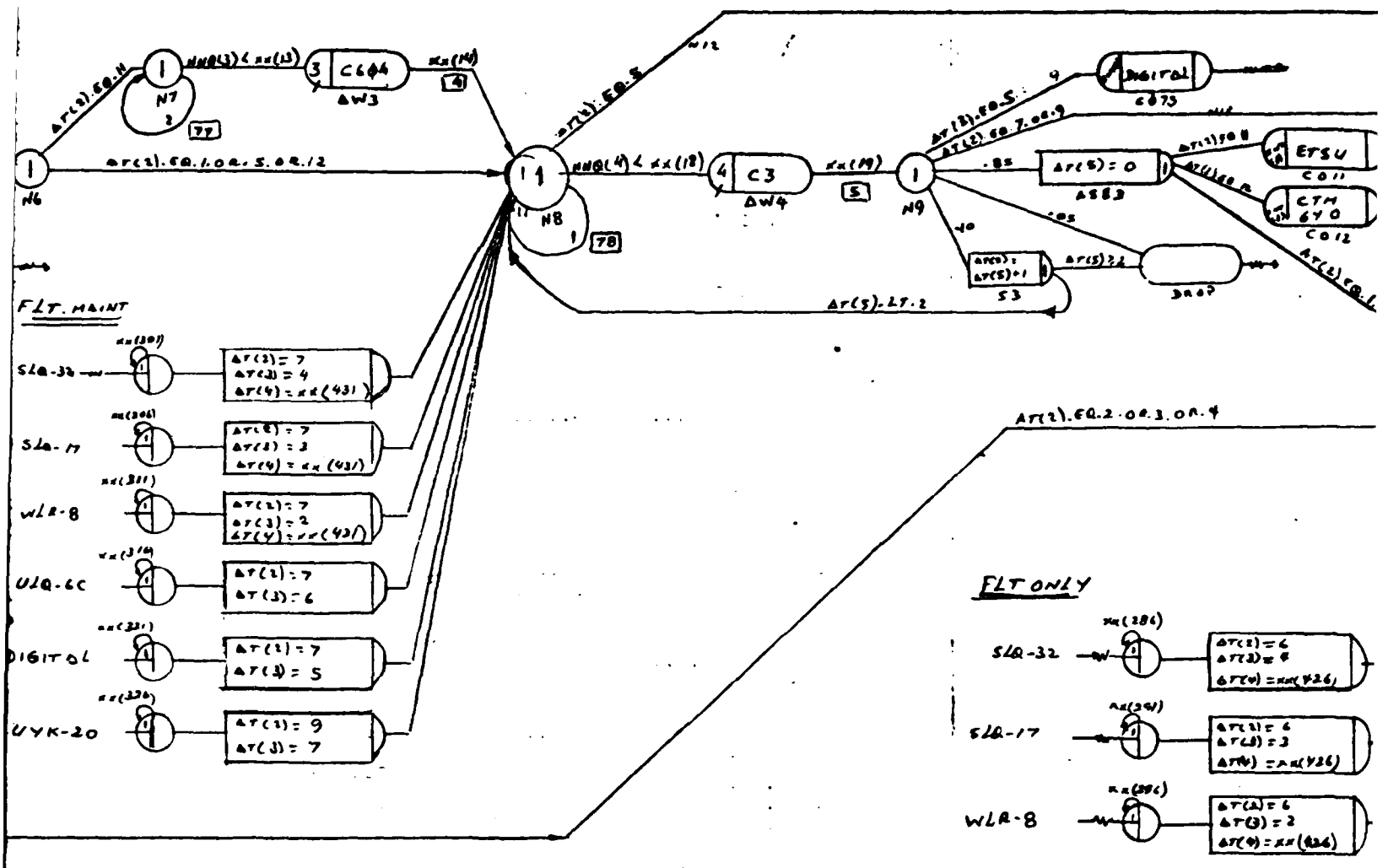
APPENDIX D

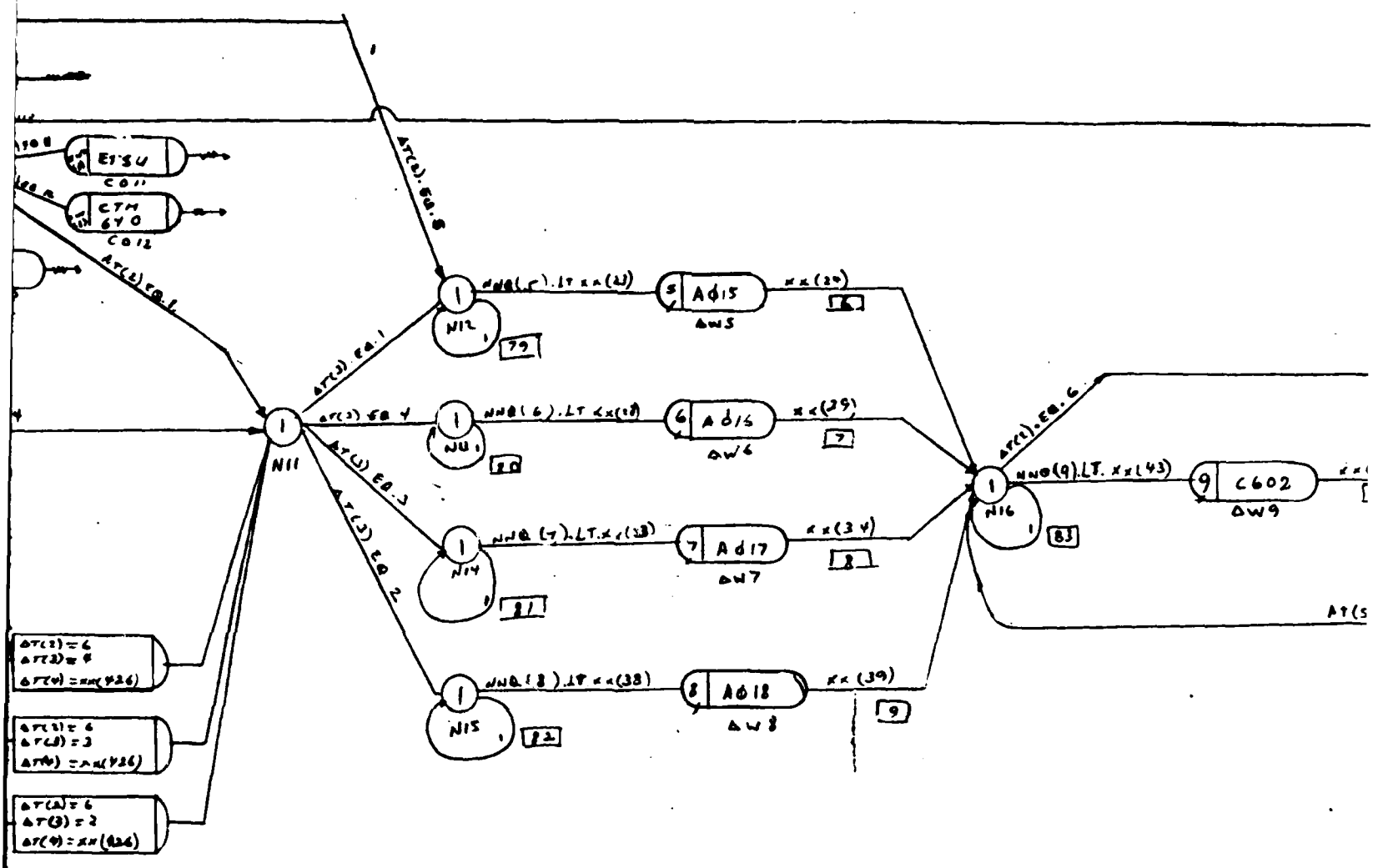
STUDENT FLOW FLOWCHART

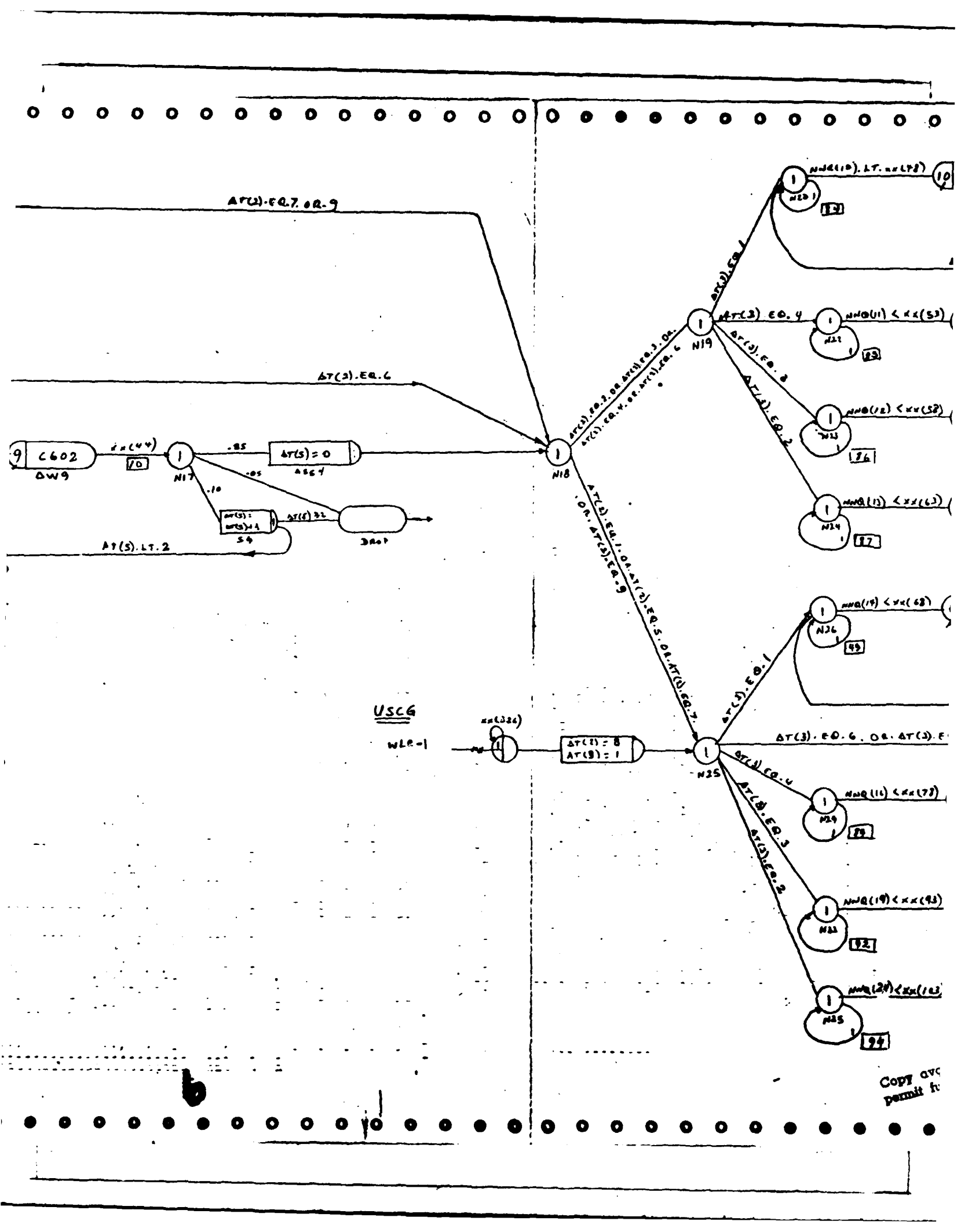


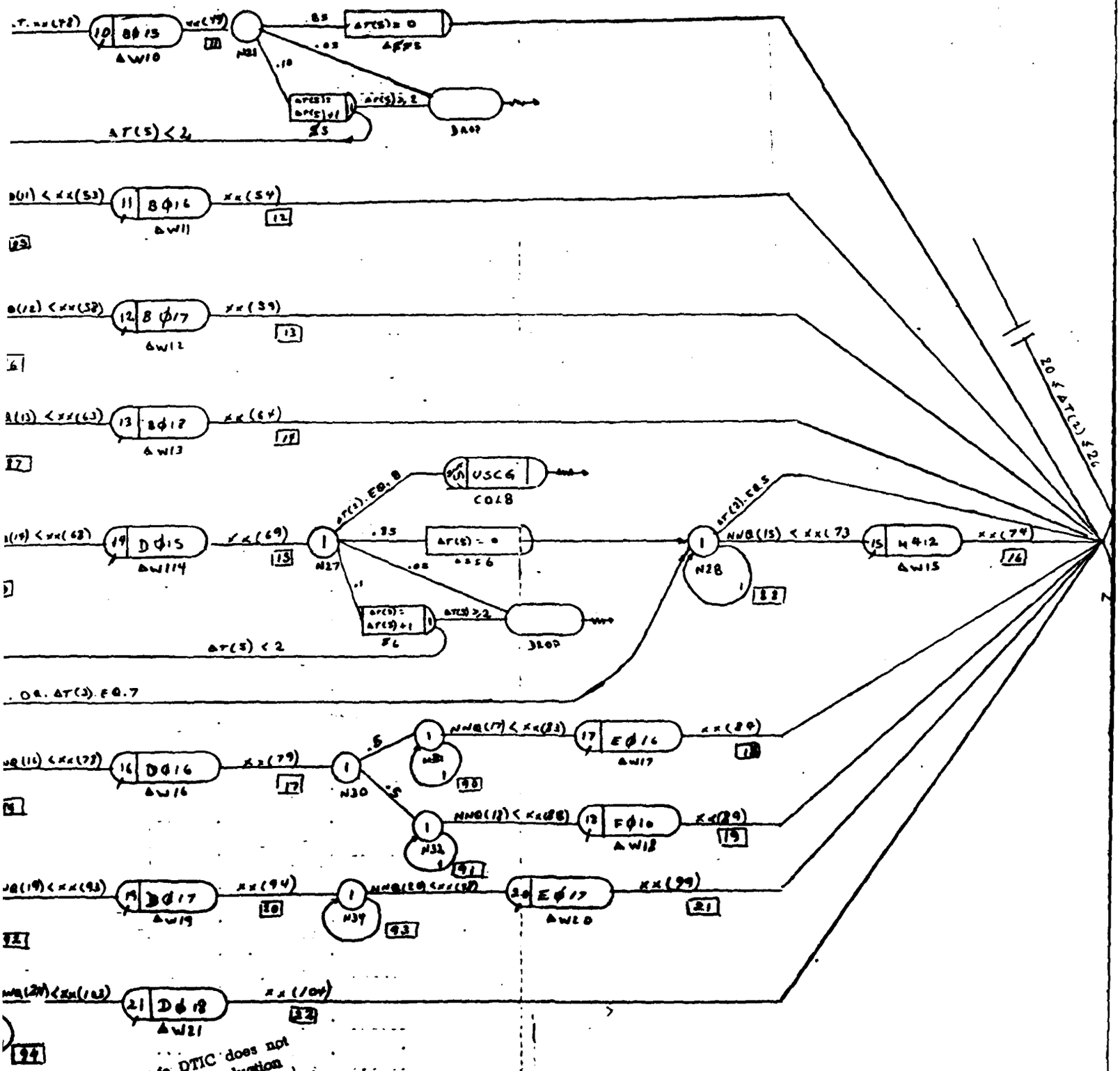


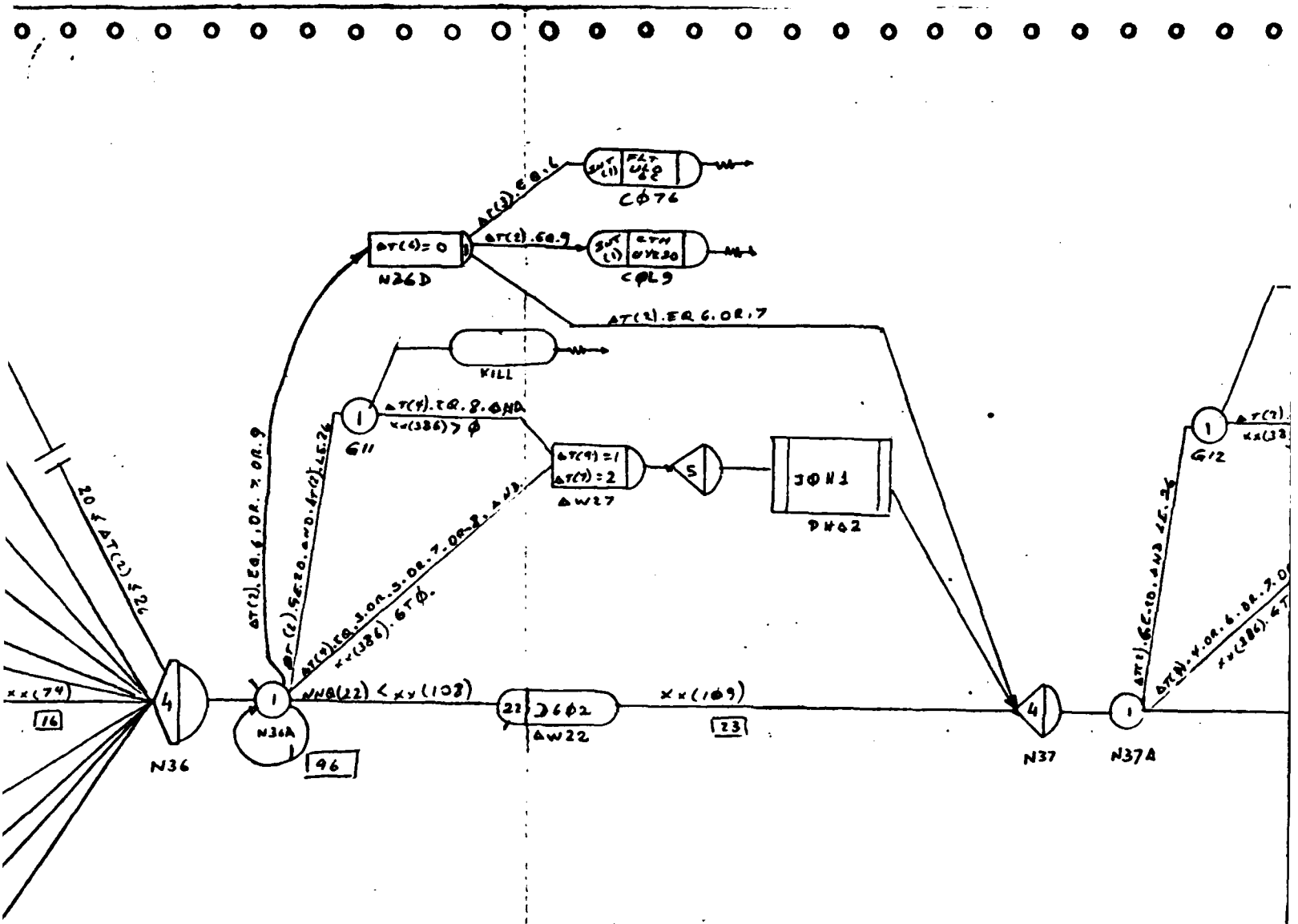

N4
76
NNB(1) < XX(3)
2 C2
DW2
XX(9)
3
N5
.85
.10
.05
ΔT(3) = 0
ΔSS 2
N6
ΔT(3) EQ N
ΔT(3) = ΔT(3) + 1
S2
ΔT(3) > 2
DROP
ΔT(5) . LT. 2
FLT. MAINT
SLQ-32
SLQ-17
WLR-8
ULQ-6C
DIGITAL
CTM
UYK-20
.80
ΔT(5) = 0
ΔSS 1
N3
ΔT(2) . EQ 2 . OR . 3 . OR . 4
.05
ΔT(5) = ΔT(5) + 1
S1
ΔT(2) > 2
DROP
LT. 2

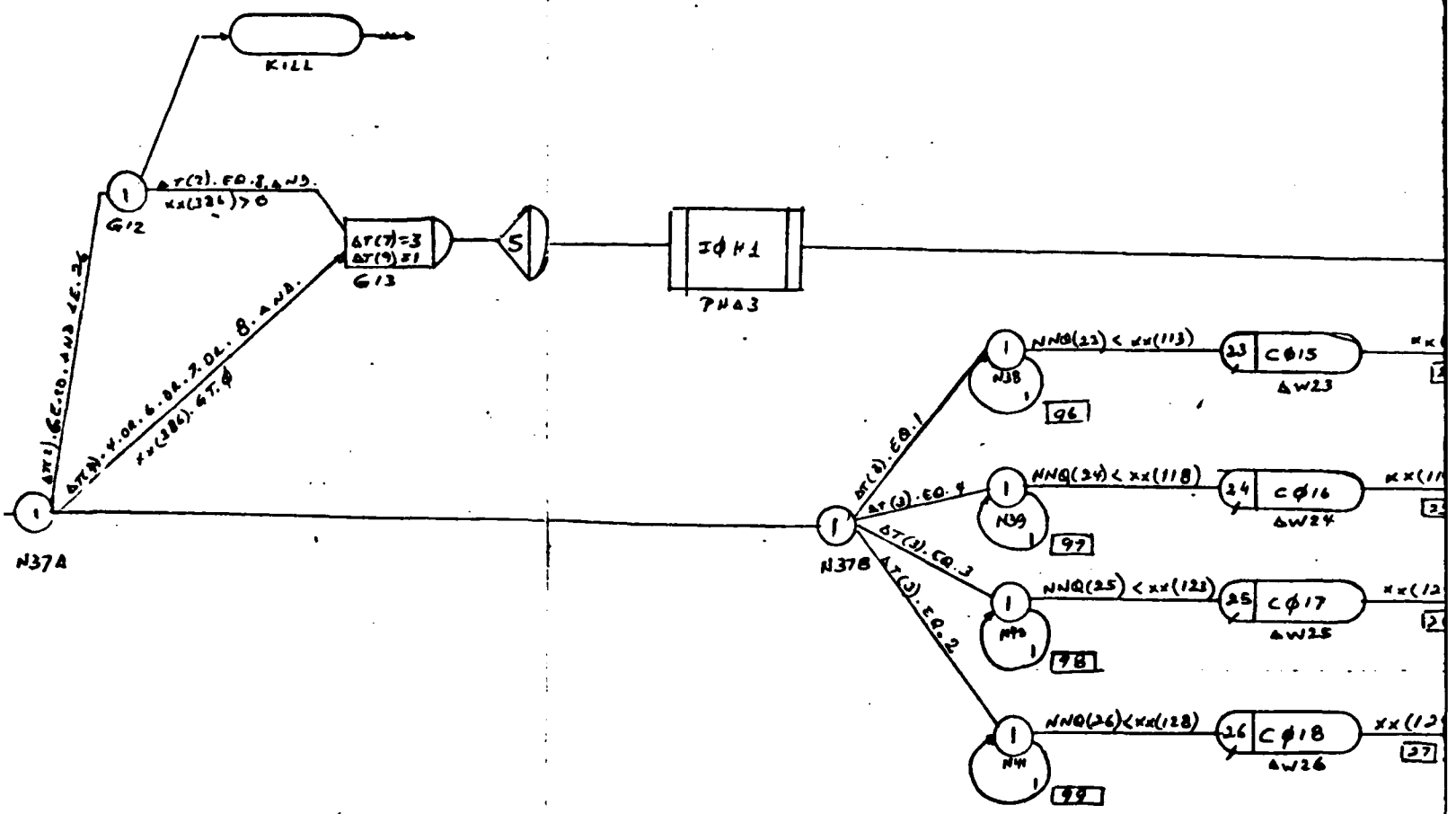

FLT. MAINT
SLQ-32
SLQ-17
WLR-8
UYQ-6C
DIGITOL
UYK-20
FLT ONLY
SLQ-32
SLQ-17
WLR-8
ETSU
CTM 6Y0
DIGITAL
C6Ø4
C3
ΔW3
ΔW4
ΔSB3
S3
N6
N7
N8
N9
78
77
5
4
Copy available to DTIC does not permit fully legible reproduction

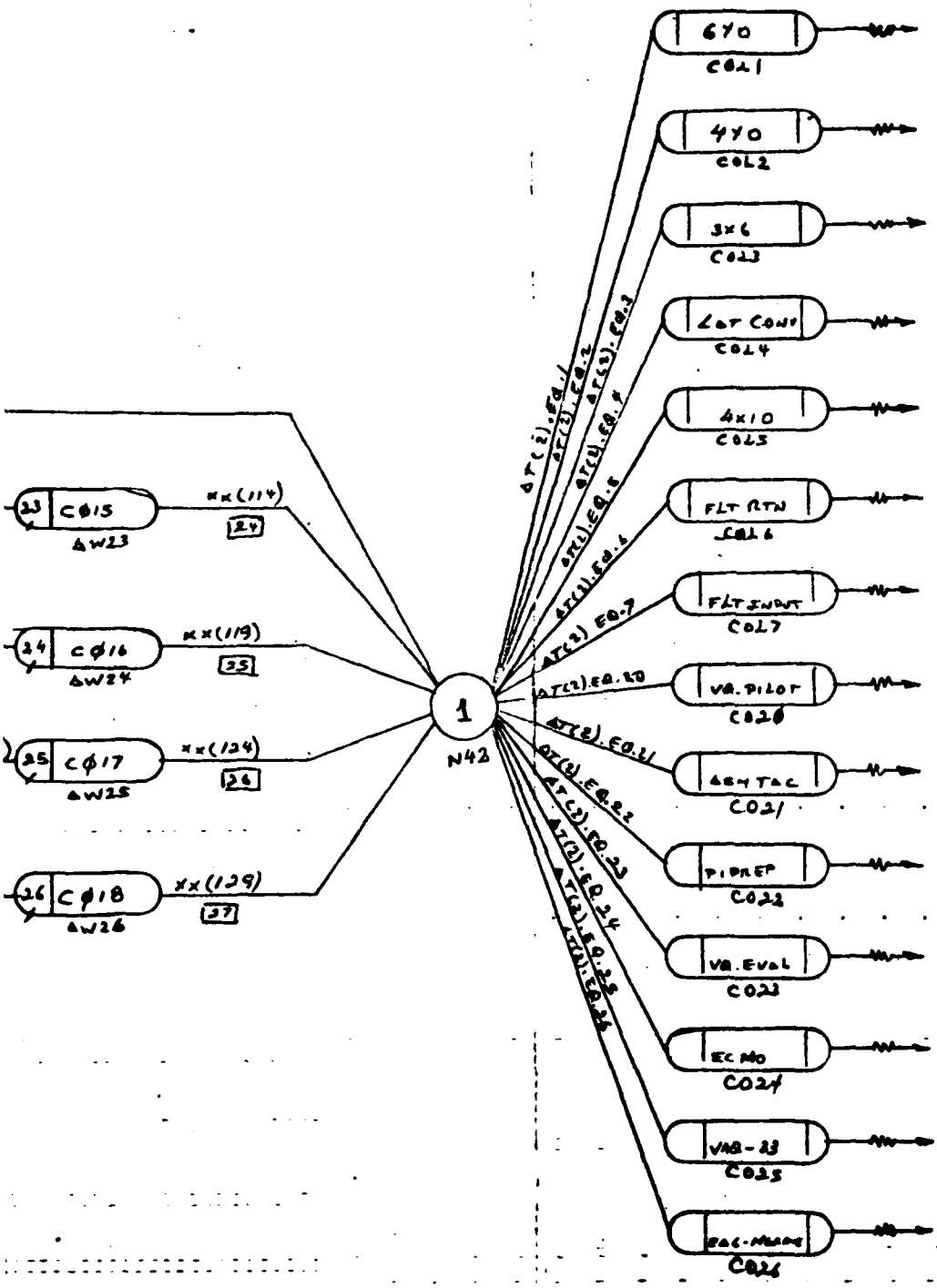






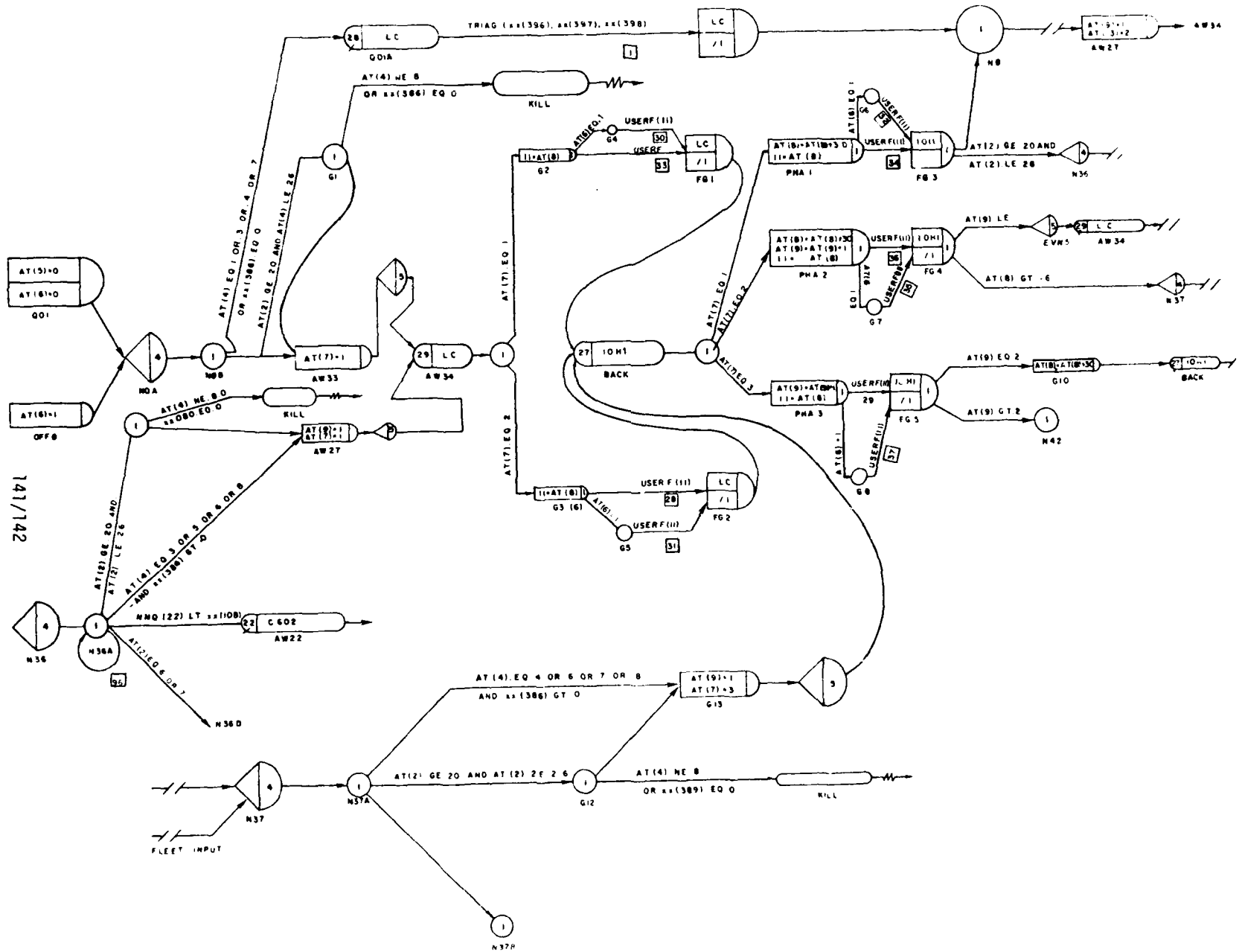



KILL
G12
G13
IΦH1
PHA3
N37A
N37B
N38
N39
N40
N41
C Φ15
C Φ16
C Φ17
C Φ18
ΔW23
ΔW24
ΔW25
ΔW26
96
97
98
99



APPENDIX E

LC/10H1 FLOWCHART


TRIAG (xx(396), xx(397), xx(398)
AT(4) NE 8
OR xx(386) EQ 0
KILL
AT(4) EQ 1 OR 3 OR 4 OR 7
OR xx(386) EQ 0
AT(2) GE 20 AND AT(4) LE 26
AT(7) EQ 1
AT(7) EQ 2
AT(7) EQ 3
USERF(11)
AT(8) GT -6
AT(9) EQ 2
AT(9) GT 2
AT(9) LE
AT(2) GE 20 AND
AT(2) LE 26
AT(5)+0
AT(6)+0
AT(6)+1
AT(4) NE 8 OR
xx(386) EQ 0
AT(8) GE 20 AND
AT(2) LE 26
AT(4) EQ 3 OR 5 OR 6 OR 8
AND xx(386) GT 0
NMQ (22) LT xx(108)
AT(2) EQ 6 OR 7
AT(4) EQ 4 OR 6 OR 7 OR 8
AND xx(386) GT 0
AT(2) GE 20 AND AT(2) LE 26
AT(4) NE 8
OR xx(389) EQ 0
FLEET INPUT
BACK
141/142

APPENDIX F

CHANGES INTO THE MODEL NOT AVAILABLE THROUGH THE INTERACTIVE MODE

1. If single session is desired for LC, GV XX(387) should be multiplied by one instead of two (see INITIAL CONDITION FOR EACH SIMULATION YEAR).

```
Old statement          ASSIGN, XX(387) = XX(387)*2;
New statement          ASSIGN, XX(387) = XX(387)*1;
```

2. If new parameters are desired for self-paced courses (different from ± 10%), a new value should be assigned to GV XX(390) in the initialization phase (see INITIALIZATION OF GLOBAL VARIABLES). Assuming the new condition for self-paced courses will be ACTIVITY TIME ± 5%, then the value of 5 should be assigned to XX(390).

```
Old statement          INTLC,...,XX(390) = 10;
New statement          INTLC,...,XX(390) = 05;
```

3. If single session is desired for 10H1, GVs XX(381) thru XX(385) are multiplied by one instead of two, at the beginning of each year w/s.

First year w/s:

```
Old statement          ASSIGN, XX(381) = XX(381)*2;
New statement          ASSIGN, XX(381) = XX(381)*1;
```

Second year w/s:

```
Old statement          ASSIGN, XX(382) = XX(382)*2;
New statement          ASSIGN, XX(382) = XX(382)*1;
```

Third year w/s:

```
Old statement          ASSIGN, XX(383) = XX(383)*2;
New statement          ASSIGN, XX(383) = XX(383)*1;
```

Fourth year w/s:

```
Old statement          ASSIGN, XX(384) = XX(384)*2;
New statement          ASSIGN, XX(384) = XX(384)*1;
```

Fifth year w/s:

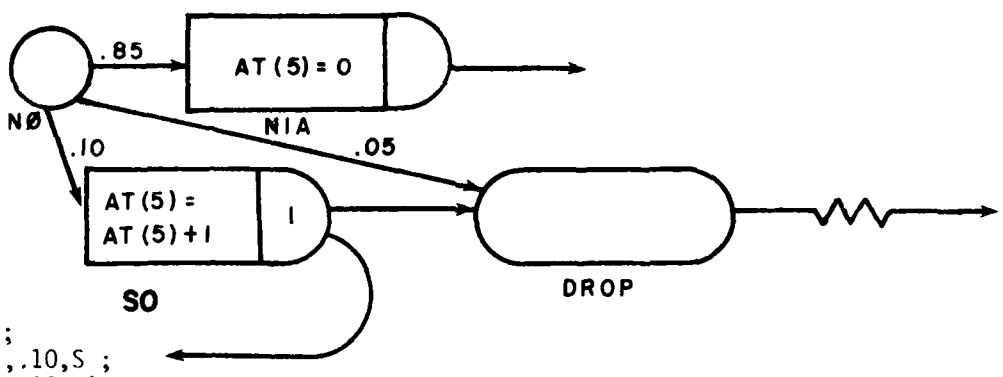
```
Old statement          ASSIGN, XX(385) = XX(385)*2;
New statement          ASSIGN, XX(385) = XX(385)*1;
```

4. There are seven CDP courses in the model that show attrition and

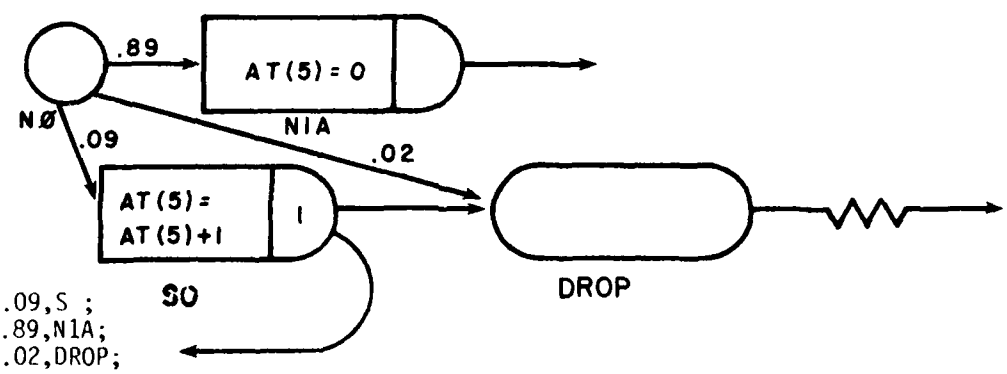
set-back rates. If new values are desired for these rates, find in the model the GOON nodes that follow the activities (see STUDENT FLOW FLOWCHART) which represent the seven courses in consideration and change the values of the three probabilistic activities for the new ones. Activities that present attrition rate and set-back rate: CDPs 602A, 1C, 2C, 3C, 602C, 015B and 015D.

CDP 602A will be selected to illustrate an example where the new values for the attrition rate will be 2% and for the set-back rate will be 9%:

OLD STATEMENTS:




```
N     GOON;
      ACT,,.10,S ;
      ACT,,.85,N1A;
      ACT,,105,DROP:
```




```
N     GOON;
      ACT,,.09,S ;
      ACT,,.89,N1A;
      ACT,,.02,DROP;
```

Figure 42. Attrition and Set-back Changes

5. If new filling-up period (XX(388)) is desired (see INITIAL CONDITION FOR EACH SIMULATION YEAR AND INITIALIZATION OF GV), assuming a new value of 150 weeks:

```
Old statement          INTLC,...,XX(388) = 100;
New statement          INTLC,...,XX(388) = 150;
```

6. If new value is desired for the self-paced CDP 602A course, just change the value of GV XX(398). (See INITIALIZATION OF GLOBAL VARIABLES.) Assuming a new value of 5 weeks is desired:

```
Old statement          INTLC,...,XX(398) = 4;
New statement          INTLC,...,XX(398) = 5;
```

APPENDIX G

FORTRAN SUBROUTINE EVENT(I)

```
FORTRAN IV (VER L46) SOURCE LISTING  EVENT   SUBROUTINE  09/26/30  10/16/29  PAGE 0001

      1       SUBROUTINE EVENT(I)                                                000100
      2       COMMON/SCOM1/ ATRIB(100),DD(600),DTL(600),DTNOW,II,MFA,MSTOP,NCLNR000200
      3      1,NCRDR,NPRNT,NRUN,NSET,NTAPE,SS(600),SSL(600),TNEXT,TNOW,XX(600)000300
      4       GO TO (1,2,3,4,5),I                                               000400
      5     1 CALL CLEAR                                                        000500
      6       CALL SUMRY                                                        000600
      7       RETURN                                                            000700
      8     2 CALL SUMRY                                                        000800
      9       ITIM=XX(400)                                                      000900
     10       IF(ITIM.EQ.0) XX(199)=1                                           001000
     11       IF(ITIM.EQ.50) XX(199)=2                                          001100
     12       IF(ITIM.EQ.100) XX(199)=3                                         001200
     13       IF(ITIM.EQ.150) XX(199)=4                                         001300
     14       IF(ITIM.EQ.200) XX(199)=5                                         001400
     15       CALL HOPE                                                         001500
     16       CALL CLEAR                                                        001600
     17       RETURN                                                            001700
     18     3 CALL SUMRY                                                        001800
     19       ITIM=XX(400)                                                      001900
     20       IF(ITIM.EQ.200) XX(199)=5                                         002000
     21       CALL HOPE                                                         002100
     22       RETURN                                                            002200
     23     4 ITIM=XX(400)                                                      002300
     24       NATB=ATRIB(2)                                                     002400
     25       IF(NTIM.EQ.0) RETURN                                              002500
     26       IF(NTIM.EQ.50) GO TO 10                                           002600
     27       IF(NTIM.EQ.100) GO TO 20                                          002700
     28       IF(NTIM.EQ.150) GO TO 30                                          002800
     29       IF(NTIM.EQ.200) GO TO 40                                          002900
     30       RETURN                                                            003000
     31    10 IF(NATB.EQ.0.OR.NATB.GT.26) RETURN                                003100
     32       IF(NATB.LE.20) GO TO 18                                           003200
     33       IF(NATB.GT.7.AND.NATB.LT.20) RETURN                               003300
     34       GO TO (11,12,13,14,15,16,17),NATB                                 003400
     35    11 ATRIB(4)=XX(402)                                                  003500
     36       RETURN                                                            003600
     37    12 ATRIB(4)=XX(407)                                                  003700
     38       RETURN                                                            003800
     39    13 ATRIB(4)=XX(412)                                                  003900
     40       RETURN                                                            004000
     41    14 ATRIB(4)=XX(417)                                                  004100
     42       RETURN                                                            004200
     43    15 ATRIB(4)=XX(422)                                                  004300
     44       RETURN                                                            004400
     45    16 ATRIB(4)=XX(427)                                                  004500
     46       RETURN                                                            004600
     47    17 ATRIB(4)=XX(432)                                                  004700
     48       RETURN                                                            004800
     49    18 ATRIB(4)=XX(437)                                                  004900
     50       RETURN                                                            005000
```

```
   51 20     IF(NATA.EQ.0.OR.NATA.GT.26) RETURN                          005100
   52        IF(NATA.GE.20) GO TO 28                                     005200
   53        IF(NATA.GT.7.AND.NATA.LT.20) RETURN                         005300
   54        GO TO (21,22,23,24,25,26,27),NATB                           005400
   55     21 ATRIB(4)=XX(403)                                            005500
   56        RETURN                                                      005600
   57     22 ATRIB(4)=XX(408)                                            005700
   58        RETURN                                                      005800
   59     23 ATRIB(4)=XX(413)                                            005900
   60        RETURN                                                      006000
   61     24 ATRIB(4)=XX(418)                                            006100
   62        RETURN                                                      006200
   63     25 ATRIB(4)=XX(423)                                            006300
   64        RETURN                                                      006400
   65     26 ATRIB(4)=XX(428)                                            006500
   66        RETURN                                                      006600
   67     27 ATRIB(4)=XX(433)                                            006700
   68        RETURN                                                      006800
   69     28 ATRIB(4)=XX(438)                                            006900
   70        RETURN                                                      007000
   71     30 IF(NATA.EQ.0.OR.NATB.GT.26) RETURN                          007100
   72        IF(NATA.GE.20) GO TO 38                                     007200
   73        IF(NATA.GT.7.AND.NATB.LT.20) RETURN                         007300
   74        GO TO (31,32,33,34,35,36,37),NATB                           007400
   75     31 ATRIB(4)=XX(404)                                            007500
   76        RETURN                                                      007600
   77     32 ATRIB(4)=XX(409)                                            007700
   78        RETURN                                                      007800
   79     33 ATRIB(4)=XX(414)                                            007900
   80        RETURN                                                      008000
   81     34 ATRIB(4)=XX(419)                                            008100
   82        RETURN                                                      008200
   83     35 ATRIB(4)=XX(424)                                            008300
   84        RETURN                                                      008400
   85     36 ATRIB(4)=XX(429)                                            008500
   86        RETURN                                                      008600
   87     37 ATRIB(4)=XX(434)                                            008700
   88        RETURN                                                      008800
   89     38 ATRIB(4)=XX(439)                                            008900
   90        RETURN                                                      009000
   91     40 IF(NATA.EQ.0.OR.NATB.GT.26) RETURN                          009100
   92        IF(NATA.GE.20) GO TO 48                                     009200
   93        IF(NATA.GT.7.AND.NATA.LT.20) RETURN                         009300
   94        GO TO (41,42,43,44,45,46,47),NATA                           009400
   95     41 ATRIB(4)=XX(405)                                            009500
   96        RETURN                                                      009600
   97     42 ATRIB(4)=XX(410)                                            009700
   98        RETURN                                                      009800
   99     43 ATRIB(4)=XX(415)                                            009900
  100        RETURN                                                      010000
```

```
FORTRAN IV (VER L4A) SOURCE LISTING?  EVENT   SUBROUTINE  09/26/80  10:16:54  PAGE 0003

  101      44 ATRIB(4)=XX(420)                                                  010100
  102         RETURN                                                            010200
  103      45 ATRIB(4)=XX(425)                                                  010300
  104         RETURN                                                            010400
  105      46 ATRIB(4)=XX(430)                                                  010500
  106         RETURN                                                            010600
  107      47 ATRIB(4)=XX(435)                                                  010700
  108         RETURN                                                            010800
  109      48 ATRIB(4)=XX(440)                                                  010900
  110         RETURN                                                            011000
  111       5 KKA=ATRIB(7)                                                      011100
  112         GO TO(51,52,53),KKA                                               011200
  113      51 IF(ATRIB(2).GE.20.AND.ATRIB(2).LE.26) ATRIB(8)=2                  011300
  114         IF(ATRIB(2).GE.1.AND.ATRIB(2).LE.5) ATRIB(8)=1                    011400
  115         RETURN                                                            011500
  116      52 KKB=ATRI(9)                                                       011600
  117         GO TO(521,522,523,524,525,526),KKB                                011700
  118     521 IF(ATRIB(2).GE.1.AND.ATRIB(2).LE.5)ATRIB(8)=3                     011800
  119         IF(ATRIB(2).EQ.21) ATRIB(8)=4                                     011900
  120         IF(ATRIB(2).GE.23.AND.ATRIB(2).LE.26) ATRIB(8)=5                  012000
  121         IF(ATRIB(2).EQ.20.OR.ATRIB(2).EQ.22) ATRIB(8)=6                   012100
  122         RETURN                                                            012200
  123     522 IF(ATRIB(2).GE.1.AND.ATRIB(2).LE.5)ATRIB(8)=7                     012300
  124         IF(ATRIB(2).EQ.21) ATRIB(8)=8                                     012400
  125         IF(ATRIB(2).GE.23.AND.ATRIB(2).LE.26) ATRIB(8)=9                  012500
  126         IF(ATRIB(2).EQ.20.OR.ATRIB(2).EQ.22) ATRIB(8)=10                  012600
  127         RETURN                                                            012700
  128     523 IF(ATRIB(2).GE.1.AND.ATRIB(2).LE.5)ATRIB(8)=11                    012800
  129         IF(ATRIB(2).EQ.21) ATRIB(8)=12                                    012900
  130         IF(ATRIB(2).GE.23.AND.ATRIB(2).LE.26) ATRIB(8)=13                 013000
  131         IF(ATRIB(2).EQ.20.OR.ATRIB(2).EQ.22) ATRIB(8)=14                  013100
  132         RETURN                                                            013200
  133     524 IF(ATRIB(2).GE.1.AND.ATRIB(2).LE.5)ATRIB(8)=15                    013300
  134         IF(ATRIB(2).EQ.21) ATRIB(8)=16                                    013400
  135         IF(ATRIB(2).GE.23.AND.ATRIB(2).LE.26) ATRIB(8)=17                 013500
  136         IF(ATRIB(2).EQ.20.OR.ATRIB(2).EQ.22) ATRIB(8)=18                  013600
  137         RETURN                                                            013700
  138     525 IF(ATRIB(2).GE.1.AND.ATRIB(2).LE.5)ATRIB(8)=19                    013800
  139         IF(ATRIB(2).EQ.21) ATRIB(8)=20                                    013900
  140         IF(ATRIB(2).GE.23.AND.ATRIB(2).LE.26) ATRIB(8)=21                 014000
  141         IF(ATRIB(2).EQ.20.OR.ATRIB(2).EQ.22) ATRIB(8)=22                  014100
  142         RETURN                                                            014200
  143     526 IF(ATRIB(2).GE.1.AND.ATRIB(2).LE.5)ATRIB(8)=23                    014300
  144         IF(ATRIB(2).EQ.21) ATRIB(8)=24                                    014400
  145         IF(ATRIB(2).GE.23.AND.ATRIB(2).LE.26) ATRIB(8)=25                 014500
  146         IF(ATRIB(2).EQ.20.OR.ATRIB(2).EQ.22) ATRIB(8)=26                  014600
  147         RETURN                                                            014700
  148      53 IF(ATRIB(2).GE.20.AND.ATRIB(2).LE.26) GO TO 530                   014800
  149         IF(ATRIB(3).EQ.1) ATRIB(8)=27                                     014900
  150         IF(ATRIB(3).EQ.2.OR.ATRIB(3).EQ.3.OR.ATRIB(3).EQ.4) ATRIB(8)=29   015000
```

```
FORTRAN IV (VEP L44) SOURCE LISTING: EVENT   SUBROUTINE  09/26/80  10116150  PAGE 0004

  151           RETURN                                                          015100
  152     330   IF(ATRIB(2).GE.20.AND.ATRIB(2).LE.22) ATRIB(8)=28               015200
  153           IF(ATRIB(2).EQ.25) ATRIB(6)=30                                  015300
  154           IF(ATRIB(2).EQ.23.OR.ATRIB(2).EQ.24.OR.ATRIB(2).EQ.29) ATRIB(8)=61015400
  155           RETURN                                                          015500
  156           END                                                             015600
```

APPENDIX H

FORTRAN FUNCTION USERF (I)

```
FORTRAN IV (VER L46) SOURCE LISTING: USERF   FUNCTION    08/28/80  10132112  PAGE 0001

      1         FUNCTION USERF(I)                                                 000100
      2         COMMON/SCR1/ ATRIB(100),DD(600),DDL(600),DTNOW,II,MFA,MSTOP,NCLNR000200
     3 1,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(600),SSL(600),TNEXT,TNOW,XX(600)000300
      4         IF(I.EQ.91) GO TO 91                                              000400
      5         GO TO(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,000500
     6 124,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,000600
     7 246,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61),I                      000700
      8       1 XMOD=XX(393)                                                    000800
      9         GO TO 150                                                       000900
     10      31 XMOD=XX(394)                                                    001000
     11         GO TO 150                                                       001100
     12       2 XMOD=XX(395)                                                    001200
     13         GO TO 150                                                       001300
     14      32 XMOD=XX(396)                                                    001400
     15         GO TO 150                                                       001500
     16       3 XMOD=XX(478)                                                    001600
     17         GO TO 150                                                       001700
     18      33 XMOD=XX(484)                                                    001800
     19         GO TO 150                                                       001900
     20       4 XMOD=XX(453)                                                    002000
     21         GO TO 150                                                       002100
     22      34 XMOD=XX(459)                                                    002200
     23         GO TO 150                                                       002300
     24       5 XMOD=XX(441)                                                    002400
     25         GO TO 150                                                       002500
     26      35 XMOD=XX(447)                                                    002600
     27         GO TO 150                                                       002700
     28       6 XMOD=XX(466)                                                    002800
     29         GO TO 150                                                       002900
     30      36 XMOD=XX(472)                                                    003000
     31         GO TO 150                                                       003100
     32       7 XMOD=XX(479)                                                    003200
     33         GO TO 150                                                       003300
     34      37 XMOD=XX(485)                                                    003400
     35         GO TO 150                                                       003500
     36       8 XMOD=XX(454)                                                    003600
     37         GO TO 150                                                       003700
     38      38 XMOD=XX(460)                                                    003800
     39         GO TO 150                                                       003900
     40       9 XMOD=XX(442)                                                    004000
     41         GO TO 150                                                       004100
     42      39 XMOD=XX(448)                                                    004200
     43         GO TO 150                                                       004300
     44      10 XMOD=XX(467)                                                    004400
     45         GO TO 150                                                       004500
     46      40 XMOD=XX(473)                                                    004600
     47         GO TO 150                                                       004700
     48      11 XMOD=XX(480)                                                    004800
     49         GO TO 150                                                       004900
     50      41 XMOD=XX(486)                                                    005000
```

```
      51        GO TO 150                                                   005100
      52     12 XMOD=XX(455)                                                005200
      53        GO TO 150                                                   005300
      54     42 XMOD=XX(461)                                                005400
      55        GO TO 150                                                   005500
      56     13 XMOD=XX(443)                                                005600
      57        GO TO 150                                                   005700
      58     43 XMOD=XX(449)                                                005800
      59        GO TO 150                                                   005900
      60     14 XMOD=XX(468)                                                006000
      61        GO TO 150                                                   006100
      62     44 XMOD=XX(474)                                                006200
      63        GO TO 150                                                   006300
      64     15 XMOD=XX(481)                                                006400
      65        GO TO 150                                                   006500
      66     45 XMOD=XX(437)                                                006600
      67        GO TO 150                                                   006700
      68     16 XMOD=XX(456)                                                006800
      69        GO TO 150                                                   006900
      70     46 XMOD=XX(462)                                                007000
      71        GO TO 150                                                   007100
      72     17 XMOD=XX(444)                                                007200
      73        GO TO 150                                                   007300
      74     47 XMOD=XX(450)                                                007400
      75        GO TO 150                                                   007500
      76     18 XMOD=XX(469)                                                007600
      77        GO TO 150                                                   007700
      78     48 XMOD=XX(475)                                                007800
      79        GO TO 150                                                   007900
      80     19 XMOD=XX(482)                                                008000
      81        GO TO 150                                                   008100
      82     49 XMOD=XX(438)                                                008200
      83        GO TO 150                                                   008300
      84     20 XMOD=XX(457)                                                008400
      85        GO TO 150                                                   008500
      86     50 XMOD=XX(463)                                                008600
      87        GO TO 150                                                   008700
      88     21 XMOD=XX(445)                                                008800
      89        GO TO 150                                                   008900
      90     51 XMOD=XX(451)                                                009000
      91        GO TO 150                                                   009100
      92     22 XMOD=XX(470)                                                009200
      93        GO TO 150                                                   009300
      94     52 XMOD=XX(476)                                                009400
      95        GO TO 150                                                   009500
      96     23 XMOD=XX(483)                                                009600
      97        GO TO 150                                                   009700
      98     53 XMOD=XX(439)                                                009800
      99        GO TO 150                                                   009900
     100     24 XMOD=XX(458)                                                010000
```

```
                GO TO 150                                                       010100
    54          XMOD=XX(454)                                                    010200
                GO TO 150                                                       010300
    25          XMOD=XX(446)                                                    010400
                GO TO 150                                                       010500
    52          XMOD=XX(452)                                                    010600
                GO TO 150                                                       010700
    26          XMOD=XX(471)                                                    010800
                GO TO 150                                                       010900
    56          XMOD=XX(477)                                                    011000
                GO TO 150                                                       011100
    27          XMOD=XX(508)                                                    011200
                GO TO 150                                                       011300
    57          XMOD=XX(509)                                                    011400
                GO TO 150                                                       011500
    28          XMOD=XX(502)                                                    011600
                GO TO 150                                                       011700
    58          XMOD=XX(503)                                                    011800
                GO TO 150                                                       011900
    29          XMOD=XX(510)                                                    012000
                GO TO 150                                                       012100
    59          XMOD=XX(511)                                                    012200
                GO TO 150                                                       012300
    30          XMOD=XX(504)                                                    012400
                GO TO 150                                                       012500
    60          XMOD=XX(505)                                                    012600
                GO TO 150                                                       012700
    61          XMOD=XX(506)                                                    012800
                GO TO 150                                                       012900
    31          XMOD=XX(507)                                                    013000
                GO TO 150                                                       013100
150             IF(X.EQ.0.) GO TO 200                                           013200
                XLO=XMOD*XX(391)                                                013300
                XHI=XMOD*XX(392)                                                013400
                USERF=TRIAG(XLO,XMOD,XHI,1)                                     013500
                RETURN                                                          013600
200             USERF=0.                                                        013700
                RETURN                                                          013800
                END                                                             013900
```

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