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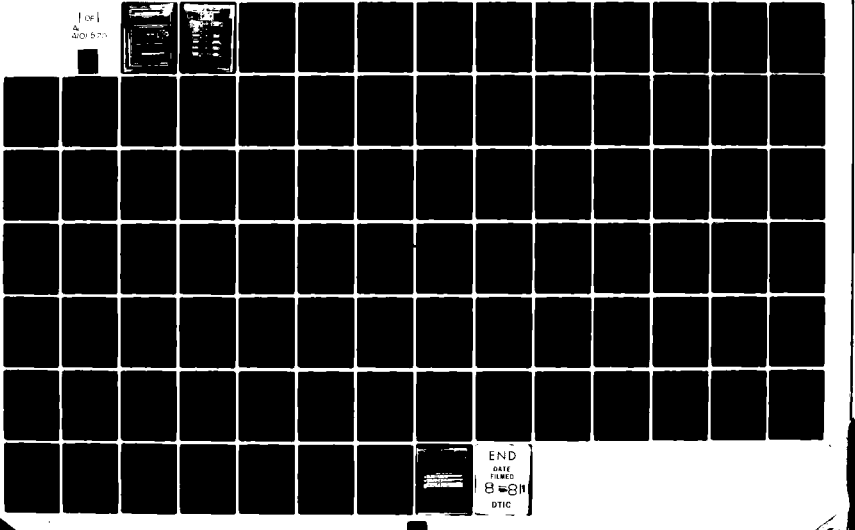

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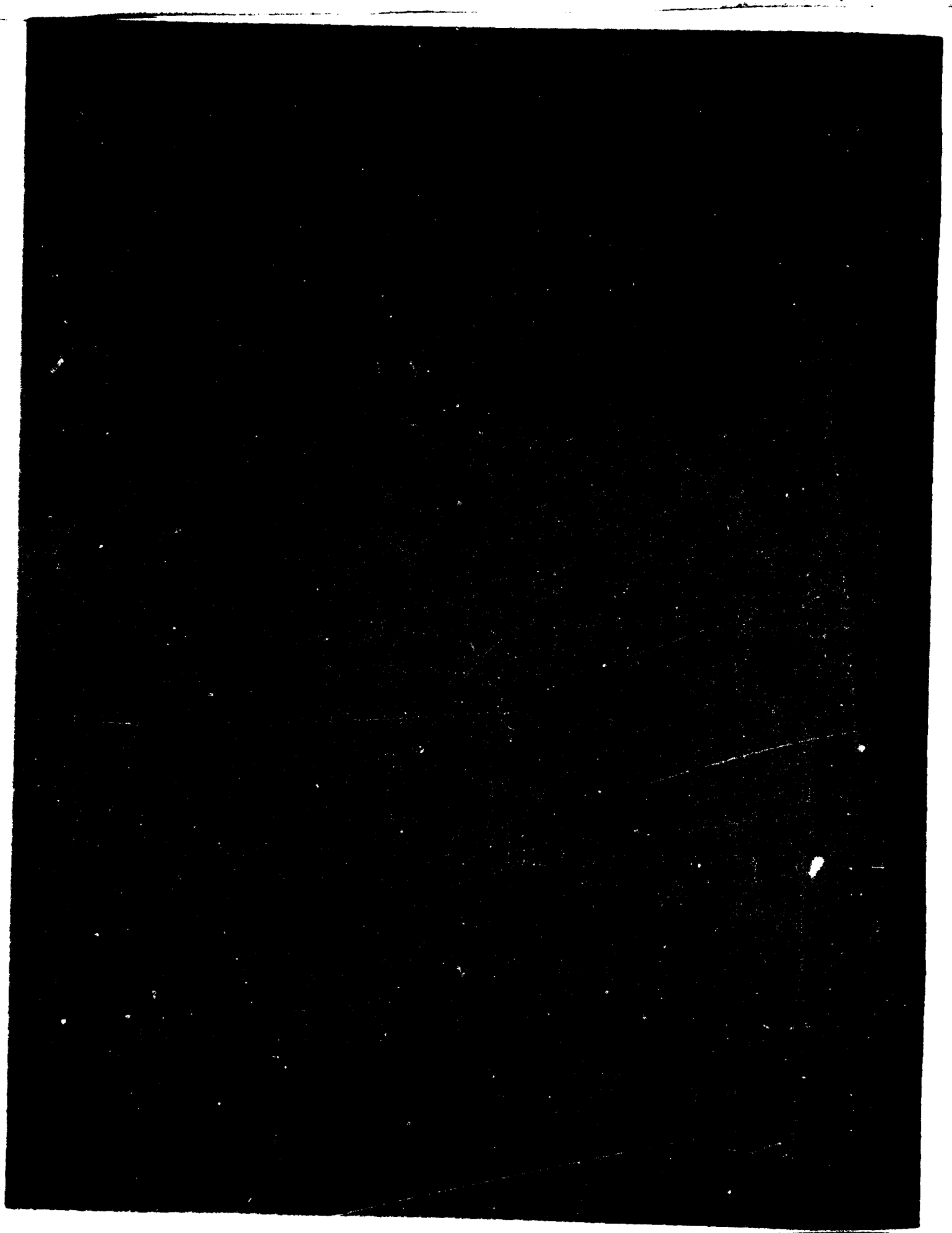

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The Battle Group Combat Suite Distribution routines are interactive computer programs written to support the Advanced Aircraft Carrier Development Program (AACDP). The weapons systems planners and analysts specify, as input to the programs, the Battle Group Combat Suite and the available platforms. The programs provide, as output to the user, an optimal Battle Group chosen from the available platforms which carries the specified Battle Group Combat Suite of weapons. A users manual is provided in addition to the description of the methods employed.

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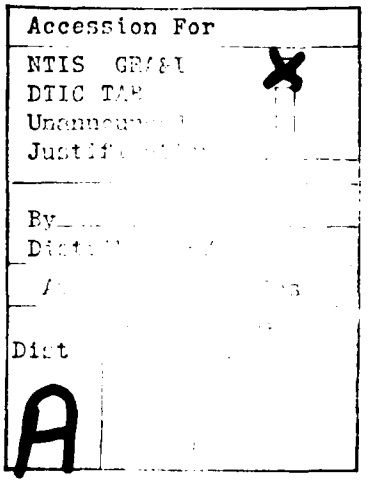
EXECUTIVE SUMMARY

Statement of the Problem

In order to achieve a specific naval military objective (e.g., Sea Control, Convoy) a Battle Group assigned to complete the mission may require a large number of weapons systems. This set of weapons is the Battle Group Combat Suite. Determining the platforms and weapons configurations which make up the Battle Group presents a formidable bookkeeping problem. The problem is further compounded when the Battle Group must be optimal from a platform composition point of view. The objective of this project was to develop an interactive computer program for use in allocating weapons systems to platforms under a set of preselected criteria.

Technical Approach

A mathematical algorithm was developed to distribute the equipment in the Battle Group Combat Suite. This algorithm was designed to minimize both the number of complex ships used and the extra equipment carried by the Battle Group but not specified in the Battle Group Combat Suite. The distribution algorithm was coded in the APL computer language and an interactive computer program system was built around the distribution algorithm. This system allows the user to change the weapons configurations of the available platforms easily, to change the numbers of the various types of available platforms, to outfit new platform types, and to see the effects on the resulting Battle Group.



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ABSTRACT

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ADMINISTRATIVE INFORMATION

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1.0 INTRODUCTION

The Advanced Aircraft Carrier Development Program (AACDP) was established several years ago to provide continuing concept development for future air capable platforms. The original plans for the AACDP called for 33 distinct tasks, as shown in the flow chart for the program on the next page, to be performed by various Navy organizations. The Systems Development Department of DTNSRDC was assigned the tasks in blocks 7, 12, and 28. Their objectives were to determine Battle Group Combat Suite/Platform compatibility and to provide a tool for determining Battle Group Candidates. The original idea was that carefully constructed Battle Group Combat Suites would be provided by the organization responsible for block 26 of the flowchart. The task of selecting candidate Battle Group platforms from all the possible platforms appeared to be a problem in optimization, and the Systems Development Department requested support from CMLD in this area. This report documents a computer program developed by CMLD for use in planning the distribution of weapons systems aboard platforms in the context of a Battle Group. Section 2 focuses on the mathematical aspects of the distribution process, Section 3 describes the computer techniques used in the implementation, and Section 4 is a users manual for the computer routines. A supporting input program was also written and is described in Section 4.3.

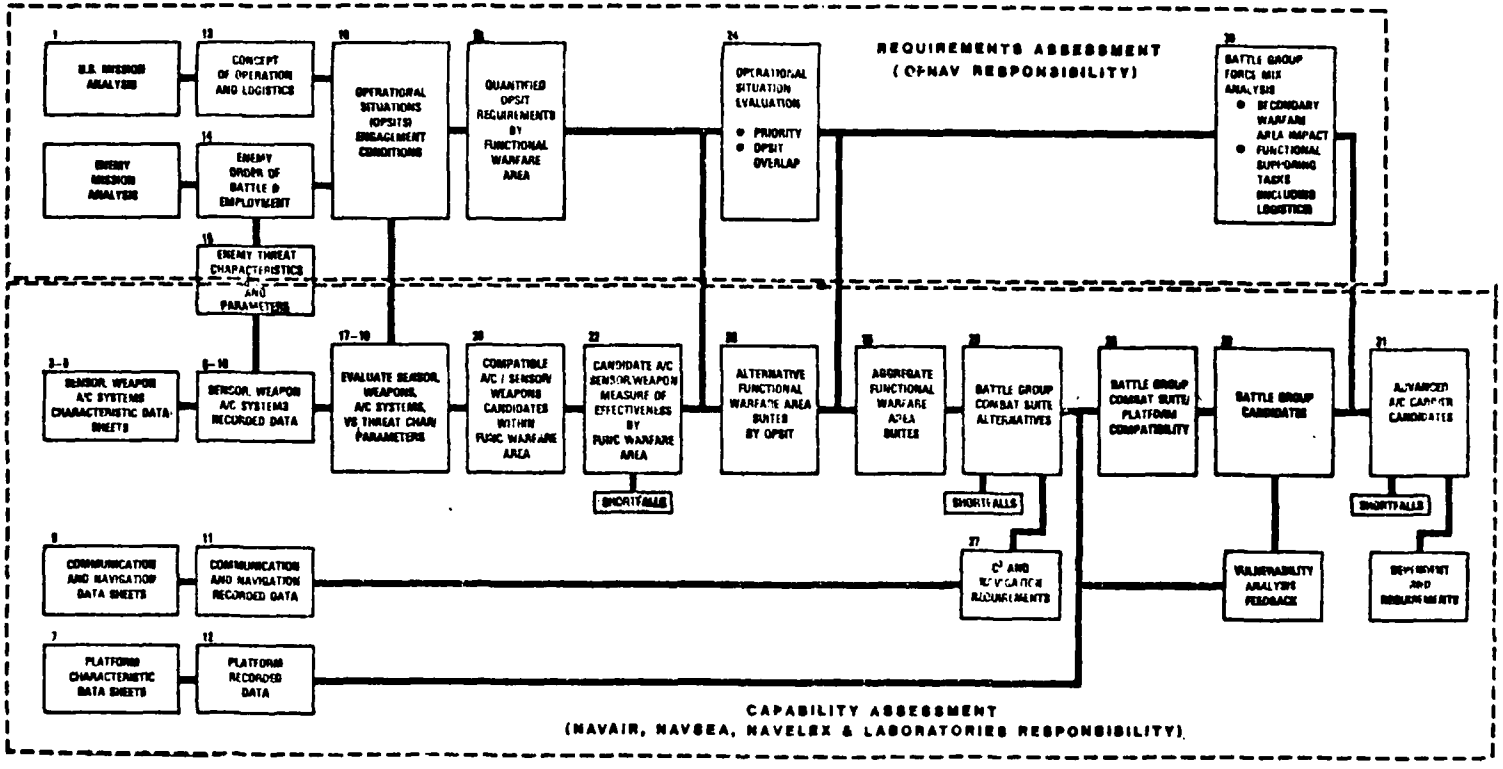


Figure - Advanced Aircraft Carrier Development Program

2.0 MATHEMATICAL TECHNIQUES

Modern naval weapons systems consist of three elements: weapons, sensors, and fire control systems. At least 50 separate items make up the weapons systems for modern surface combatant ships alone. Hence, a Battle Group Combat Suite can include on the order of 50 equipment types, with a numerical requirement for each type, and there are currently at least 20 types of major combatant ships. Therefore, to represent mathematically the weapons systems equipment configurations of current combatant vessles requires matrices on the order of 50x20. High speed computers are almost essential for computations involving matrices of this size.

2.1 SAMPLE PROBLEM

The allocation algorithm and the procedures used in the computer program will be described with the use of a sample problem:

> Analysis of a given mission indicates that it will require five A/A missiles, ten cruise missiles, twelve guns, eighteen mines, and seven torpedoes. The problem is to select, from an armada of available ships, a Battle Group that will contain the least number of expensive ships (the cost of a ship is defined by the total number of weapons it carries) and carry the smallest amount of uncalled for equipment. The available ships consist of cruisers, four submarines, and five frigates, outfitted as follows:

	Cruisers	Submarines	Frigates
A/A Missiles	1	1	0
Cruise Missiles	0	2	2
Guns	2	0	2
Mines	4	3	0
Torpedoes	0	2	1

Thus, submarines are most expensive with eight weapons, cruisers next with seven weapons, and frigates cheapest with only five weapons.

Let $\underline{a}$ (for "armada") be the 3-element row vector of the number of ships available, and let $\underline{w}$ (for "weapons suite") be the 5-element row vector of weapons necessary to complete the mission.

$$\underline{a} = (3,4,5)$$
$$\underline{w} = (5,10,12,18,7)$$

Let A (for "array") be the matrix consisting of the ships' configurations.

$$A = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 2 & 2 \\ 2 & 0 & 2 \\ 4 & 3 & 0 \\ 0 & 2 & 1 \end{bmatrix}$$

To determine whether the total armada can do the job, postmultiply A by $\underline{a}^T$ ($\underline{a}^T$ is the transpose of $\underline{a}$) to obtain the totals of the five weapons types.

$$A\,\underline{a}^T = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 2 & 2 \\ 2 & 0 & 2 \\ 4 & 3 & 2 \\ 0 & 2 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ 4 \\ 5 \end{bmatrix} = \begin{bmatrix} 7 \\ 18 \\ 16 \\ 24 \\ 13 \end{bmatrix}$$

Thus, the total armada has enough firepower to accomplish the mission but carries too much excess weaponry.

$$(A\,\underline{a}^T)^T - \underline{w} = (7,18,16,24,13)-(5,10,12,18,7) = (2,8,4,6,6)$$

The number of some type of vessel in the Battle Group, must be reduced. Submarines are the most expensive ships, so their number is reduced first. The submarine's weapons suite is divided type-by-type into the vector of excess weapons.

$$(2,8,4,6,6) \div (1,2,0,3,2) = (2,4,-,2,3)$$

Since the submarines carry no guns, they could all be eliminated without detriment to the gun requirement, but that would result in a shortage of A/A missiles and mines. (Note that division by zero is not defined.)

The vector (2,4,-,2,3) tells the number of excess submarines with respect to each type of equipment that is, two excess submarines for A/A missiles, four excess for cruise missiles, etc. Eliminating two submarines from the armada leaves a candidate Battle Group of three cruisers, two submarines, and five frigates. The new armada is then $\underline{a}^* = (3,2,5)$, where the superscript "*" indicates that this is the next iteration.

As before, $$A(\underline{a}^{*T}) = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 2 & 2 \\ 2 & 0 & 2 \\ 4 & 3 & 2 \\ 0 & 2 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ 2 \\ 5 \end{bmatrix} = \begin{bmatrix} 5 \\ 14 \\ 16 \\ 18 \\ 9 \end{bmatrix}$$

and $$(A(\underline{a}^*)^T)^T - \underline{w} = (5,14,16,18,9) - (5,10,12,18,7) = (0,4,4,0,2)$$

The candidate Battle Group now carries (0,4,4,0,2) excess pieces of equipment. The next most complex (expensive) ships after submarines are cruisers (with 7 weapons), so

$$(0,4,4,0,2) \div (1,0,2,4,0) = (0,-,2,0,-),$$

thus all the cruisers are needed.

Examining the frigates in like fashion gives

$$(0,4,4,0,2) \div (0,2,2,0,1) = (-,2,2,-,2)$$

Clearly, two of the frigates should be deleted, and the final Battle Group is then

$$\underline{a}^{**} = (3,2,3).$$

This Battle Group meets the criteria since

$$(A(\underline{a}^{**})^T)^T - \underline{w} = (5,10,12,18,7)-(5,10,12,18,7) = 0.$$

2.2 FORMAL STATEMENT OF THE PROBLEM

Let $c=(c_1,\ldots,c_n)$ and $d=(d_1,\ldots,d_n)$ be n-element row vectors of non-negative integers, and let A be an m by n matrix of non-negative integers. If c^T denotes the transpose of c (a column vector) and $x \cdot t^T$ denotes the inner product of n-element row vectors x and t, then the problem is to find an n-element row vector $x=(x_1,\ldots,x_n)$ that will

$$\text{minimize:} \quad f(x) = x \cdot t^T$$

$$\text{subject to:} \quad 1) \; Ax^T \geq c^T$$
$$2) \; 0 \leq x \leq d,$$

where $t=(t_1,\ldots,t_n)$ is the n-element vector of column sums of the matrix A.

2.3 FORMAL SOLUTION PROCEDURE

The m by n matrix, A, is the numerical array which carries the information on platform configurations. Each column of A represents the equipment configuration of a particular platform type, and each row of A represents the distribution of an equipment type over the various platforms. Thus, there are m equipment types and n platform types. The n element vector $(t_1,\ldots,t_n)$ is the vector of column sums of A. Each t_i (for i=1,...,n) gives the total number of pieces of equipment carried on the $i^{\underline{th}}$ platform type. The Battle Group Combat Suite is given by the m-vector $(c_1\ldots, c_m)$, and the n-vector $(d_1\ldots,d_n)$ contains the numbers available for each of the n platform types.

The problem of minimizing $(t_1,\ldots,t_n)\cdot(x_1,\ldots,x_n)^T$, where "·" denotes inner product, requires finding values for the x_i's (i=1,...,n) which are positive integers and which satisfy

$$A\,(x_1,\ldots,x_n)^T \geq (c_1,\ldots,c_m)^T$$

That is, the requirements of the Battle Group Combat Suite $(c_1,\ldots,c_m)$, must be met or exceeded by the proposed Battle Group $(x_1,\ldots,x_n)$.

The solution procedure starts with all the available platforms and then removes unnecessary platforms from each of the n platform types. Initially let $(x_1,\ldots,x_n) = (d_1,\ldots,d_n)$. The next step is to determine whether this element of the feasible set meets the requirements by computing to see if

$$A\,(x_1,\ldots,x_n)^T = A\,(d_1,\ldots,d_n)^T \geq (c_1,\ldots,c_m)^T$$

Set $$A\,(x_1,\ldots,x_n)^T - (c_1,\ldots,c_m)^T = (b_1,\ldots,b_m)^T$$

Without loss of generality, we may assume that the columns of A have been arranged so that the finite sequence of column sums $t_1,\ldots,t_n$, is non-increasing. For

$$a_{i1} \neq 0,\ (i=1,\ldots,n) \text{ set } r_i = b_i \div a_{i1}.$$

Let e_1 be the minimum of the r_i's which are greater than or equal to 1. Set $x_1 = d_1 - e_1$. This procedure is repeated for t_2 through t_n to give desired result $(x_1,\ldots,x_n)$.

3.0 COMPUTER TECHNIQUES

Since the availability of data for complete weapons systems and Combat Suites was uncertain, a flexible, interactive computer routine was developed incorporating an allocation technique that appeared to have potential utility. This routine requires neither formal training in computer programming languages nor familiarity with computer terminals (see Appendix A). To minimize response time, the computer routines were written in the APL computer language in such a way that data are often redundantly stored in both temporary (local) and permanent (global) files. To systematize and simplify the entry of equipment weights and volumes data, a supporting input program, TIDES (The Interactive Data Entry System), was written in BASIC for the Burroughs B7700 computer.

3.1 HARDWARE

The Battle Group Combat Suite distribution routines for the AACDP were implemented on the Burroughs B7700 computer located at the Carderock, Maryland installation of DTNSRDC. The B7700 is a third generation computer employing virtual memory and emphasizing interactive applications. It is a 48-bit per word machine with two independent Central Processing Units, one Input/Output module, and large disk memory capability. The time sharing user interface to the computer is via commercial phone lines with both 300 and 1200 baud rates supported. Although numerous terminals for the computer are located at the Carderock site, the user need not be on station to use the B7700. Most computer terminals can communicate with the B7700 through an acoustic coupler or MODEM (Modulator-Demodulator). The communication to the B7700 is half-duplex, without parity check. Information concerning the computer facilities at DTNSRDC may be obtained through User Services, Code 1892 (phone (202)227-1907).

3.2 SOFTWARE

3.2.1 APL

The Battle Group Combat Suite distribution routines are written in the computer language APL (A Programming Language). The language differs significantly from most other computer languages in that it is strictly an interactive language with no provision for "batch" programming. In fact, APL does not use

the word "program" to describe computer instructions. Instead one defines "functions" which are then evaluated in the mathematical sense of function evaluation. APL is, in general, mathematically oriented with particular strength in linear algebra. The language, in effect, uses its own alphabet, which includes all the standard English upper-case characters plus about 50 special symbols. Although it is best to have a terminal equipped with the APL character set, the AACDP Battle Group Combat Suite distribution routines are written to accommodate the regular ASCII characters.

3.2.2 Functions

The APL workspace AACDWS contains a number of the functions used in the distribution routines in addition to some service functions. One of the duties of the service functions is to call other APL functions from a file named AACDFNS. This use of service (or "cover") functions frees storage area in the workspace for calculations. The distribution functions themselves are fairly complicated and require considerable storage in the active workspace. Since several of the many functions making up the distribution routines are not in constant use, it is unnecessary to keep them in the active workspace. The strategy developed here stores most of the APL functions in the AACDFNS file and fixes them in the active workspace only when they are actually in use. A glossary is provided as Appendix B. Listings of the file functions are given in Appendix C. In addition to the functions which service the file functions, there are several "utility" functions which maintain the active workspace. These functions are helpful in such tasks as conversion of character data to numerical data. To assist in understanding the program flow, flow charts are provided in Appendix D.

3.2.3 Data Structures

Three types of data structures are used in the Battle Group Combat Suite distribution routines. Two of these hold numeric data, the other holds character data. The two numeric data structures are vectors and two dimensional arrays (matrices). The character data structure is the character matrix.

Nine data objects are used in the system:

1. Platform Configurations (Numeric Matrix)
2. Battle Group Combat Suite (Numeric Vector)

3. Platform List (Character Matrix)
4. Equipment List (Character Matrix)
5. Platform Numbers (Numeric Vector)
6. Equipment Characteristics (Numeric Matrix)
7. Advanced Platform Characteristics (Numeric Matrix)
8. Advanced Platform List (Character Matrix)
9. Advanced Platform Configurations (Numeric Matrix)

These data objects contain the input data that the distribution routines "edit" and "use". The Equipment Characteristics Matrix is the only matrix which has an input program to aid in data entry. This input program, called TIDES, is discussed in Section 4.3.

Particular care must be exercised in the modification of data structures. For example, the length of the Battle Group Combat Suite vector must be the same as the number of rows of the Platform Configurations Matrix. Refer to the compatibility table for more complete information.

COMPATIBILITY TABLE

Data Object	File Component	Data Type	Dimension	File Components Affected by Modification of Dimension
A, platform Configuration Matrix	1	Num	m	2,3,4,5,7,10
C, Battle Group Combat Suite	2	Num	m	1,4,7,10
Platform List	3	Char	n x w	1,5,
Equipment List	4	Char	m x v	1,2,7,10
Number of Platforms	5	Num	n	1,3,
Not Used	6	-	-	-
Equipment Characteristics Matrix	7	Num	m x 6	1,2,4,10
Adv. Platforms Char. Matrix	8	Num	k x 2	9
Adv. Platforms List	9	Char	k x u	8
Adv. Platforms Config. Matrix	10	Num	m x k	1,2,4,7,8,9

4.0 USER MANUAL

4.1 ACCESSING AND LEAVING THE SYSTEM

The following representative procedure is used for gaining access to the system. Although there may be slight differences from what is given here for other terminals, in the main following these instructions will get the user on line (and off again).

1. Turn the terminal on.
2. Set the baud rate (terminal and communication link dependent) and parity.
3. Set the communications link to half-duplex.
4. Dial up the Burroughs B7700 on the data set or phone being used for an acoustic coupler (the number is (202) 227-3300).
5. When the high pitched tone from the computer is heard, punch the data button on the phone or put the receiver in the accoustic coupler.
6. When either garbage or "TYPE <CR>" response is returned to the terminal, hit the carriage return or return button.
7. The computer will respond with a greeting and instruct: #ENTER USER CODE PLEASE:
8. In response, type the system command: ?MCS SYSTEM/APL. This will get you into APL.
9. The computer will respond with a greeting.
10. To sign on, type:)ON USERCODE(PASSWORD)CHARGECODE (Your personal USERCODE, PASSWORD, and CHARGECODE are assigned by the computer center.)
11. The comuter will return information on the status of your workspace.
12. To start the routines type:)LOAD (USERCODE)AACDWS, then type START.
13. Proceed with the instructions in Paragraph 4.2
14. Hanging up the phone or breaking the communication link will terminte the session.
15. Type o-u-t with the letters overstruck to suspend the sesssion without signing off.
16. To sign off, type:)OFF.
17. Turn off the terminal when finished.

4.2 USING THE SYSTEM

4.2.1 Starting the Distribution Routines

Once in the workspace AACDWS, the user can begin using the routines stored there. The interactive session is started by typing: START. The system responds by asking whether the user wants to go on. This question is asked because the user will return to this point at various times during the session and, at that time, may not want to go on. To proceed, type: GO. A "menu" of options will be returned.

4.2.2 Choosing the Desired Option

The five options are:

1. UPDATE OR VIEW FILE DATA,
2. UPDATE OR VIEW CURRENT LOCAL DATA,
3. ADJUST THE CURRENT PLATFORMS,
4. EXECUTE THE DISTRIBUTION ALGORITHM,
5. NONE OF THE ABOVE.

To pick one of these five options, type the number of with the option. The options are described as follows:

4.2.2.1 Option 1. UPDATE OR VIEW FILE DATA. This option allows the user to see what has been permanently stored on file. There is a distinction between file data and local data. File data refers to more or less permanent information which is the starting point for a session at the terminal. File data can be changed, but the process is intentionally made complicated so that data computed and entered over a period of time will not be inadvertently destroyed. The user is given a list of ten components from which to choose. (Think of a "file" as a drawer in a filing cabinet and a "component" as a folder within that drawer.) The user is asked which folder has the material of interest. After a component is chosen (by typing in the number of that component), the system displays the contents of that component. The information in that component is assigned to a temporary variable in the APL workspace AACDWS named DATA, and the system asks the user if he wants to change any information in DATA. If the answer is NO, the user is again shown the main menu of five options. If the answer is YES (or OUT), the user will exit from the AACD distribution procedure but will still be in the workspace AACDWS and the information

from the chosen component remains in the variable DATA ready to be changed. The variable DATA may be modified by the user using the APL language. The compatibility table (page 12) should be consulted when file changes are made. After the user has changed DATA to suit his needs, the file component remains unchanged. To change the file component the user must write DATA to that file component using the APL/700 command DATA⍎[n] 'AACDFILE', where n is the number of the file component.

4.2.2.2 Option 2. UPDATE OR VIEW CURRENT LOCAL DATA. This choice enables the user to manipulate local data. With this selection the user is immediately presented with another menu of six options.

1. PLATFORM CONFIGURATIONS
2. EQUIPMENT LIST
3. PLATFORM LIST
4. NUMBER OF PLATFORMS
5. BATTLE GROUP COMBAT SUITE
6. NONE OF THESE

Again, the user must choose the data object he wishes to look at, and the routine leads him through the modification procedure.

1. PLATFORM CONFIGURATIONS

   Each of the currently available platforms carries certain weapons systems, that is, so many radars of certain types, so many missiles, etc. Most of these configurations are stored in the file, but new platform types may have been added or changes made to the current weapons systems configurations. This option allows the user to look at and change these current weapons systems configurations. For example, the user may want to try a distribution in which all of the available FFG-7 class frigates carry LAMPS III helicopters. The platform configuration matrix is the place to make such a change.

2. EQUIPMENT LIST

   The list of equipment types to be distributed is not the same as the Battle Group Combat Suite, which is a list taken from the Equipment List with stated quantities

of each type of equipment. Changing the equipment list is a major step, for such changes affect the platform configuration matrix, the Battle Group Combat Suite and every variable that has anything to do with equipment. (Refer to the Compatibility Table.)

3. PLATFORM LIST

This option provides a list of the names and quantities of all the platform types which are currently distribution candidates. After viewing the platform list the user is asked if he wants to append a new platform type to the platform list.

4. NUMBER OF PLATFORMS

This option allows the user to change the number of platforms of each type available for distribution. The user will be asked to enter the platform number he wants to change and then will be given a chance to change the number of that type of platform available for distribution.

5. BATTLE GROUP COMBAT SUITE

This choice allows the user to make changes in the Battle Group Combat Suite. The current Battle Group Combat Suite is displayed and then changes can be made .

6. NONE OF THESE

This choice returns the user to the first menu.

4.2.2.3 Option 3. ADJUST THE CURRENT PLATFORMS. This choice allows the user to work with the list and the configurations of platforms currently available for distribution. First, the user is given yet another menu to choose from.

1. INCREASE THE NUMBER OF PLATFORMS
2. ADD AN ADVANCED PLATFORM
3. MODIFY AN EXISTING PLATFORM TYPE
4. OUTFIT A NEW PLATFORM TYPE
5. NONE OF THE ABOVE

The user makes his selection by typing the desired option from the list.

1. INCREASE THE NUMBER OF PLATFORMS

This choice is the same as updating the number of platforms.

2. ADD AN ADVANCED PLATFORM

This choice allows the user to pick a platform configuration from the list of advanced platforms and to insert such a conceptual vessel into the distribution mix with a minimum of effort. He is asked if he knows the advanced platform number if he does not, he is given the list of advanced platforms. After he has selected an advanced platform the file data for that advanced platform is added to the configuration matrix. The updated configuration matrix and updated list of platforms is then available for distribution. He is asked the quantity of these advanced platforms he wants available for distribution. When the user has answered all these questions, he goes back to the original menu.

3. MODIFY AN EXISTING PLATFORM TYPE

This choice is appropriate to retrofit an older platform or to try a different weapons suite on a new type. First, the user enters the platform number of interest; the system displays that platform's current configuration. Next, he enters the desired modifications, putting in the different weapons systems. The modify function updates the configuration matrix and returns the user to the original menu.

4. OUTFIT A NEW PLATFORM TYPE

Here the user can outfit a new platform from the hull up and obtain an estimate of the residual weight and volume. The first question the user must answer is whether the military payload weight and volume are on file. If they are, the system asks for the platform number and fetches the required data. If the payload weight and volume are not on file, the user is asked to name the ship. He then manually enters the payload weight

and volume. At this point (whether starting from scratch or not) the user enters the percentage of weight and volume he actually plans to use. The user decides whether he wants to consider the constraints on weapons systems himself or have the system help him with it. If he wants the constraints considered automatically, the system then asks what equipment type is desired and the number of them to be installed. The program indicates the constraints for the equipment type (i.e., other equipment which must be installed in conjunction with the given equipment) and allows the user to change those constraints. When the user is satisfied with the constraints, the system will compute the number of each associated equipment type which must be installed if the specified number of the desired equipment type is installed and how much payload the weapons systems will take up and subtracts this from the payload weight and volume remaining.

If the user selects the manual instead of the automatic mode for constraint consideration, the system displays the equipment currently on the platform being outfitted and asks the user whether he is finished with that platform. If he is not finished, the user is asked whether he wants to add or delete equipment. To add equipment the user types "A" and the system tells him to enter the equipment number. Next, the user enters the quantity to be added. To delete equipment, he types "D" when prompted and is then asked for the equipment type and the number to be deleted. In either case, the system computes the space and weight committed on the platform. The platform configuration is displayed and the user is again asked if he is finished. If the answer is YES, matrix A is updated and the user is asked how many of this new platform type he wants available for distribution. The user eventually is presented with the original menu.

5. NONE OF THE ABOVE

This option removes the user from the distribution scheme. At just about any point the user can type "OUT" to exit from the system.

4.2.2.4 Option 4. EXECUTE THE DISTRIBUTION ALGORITHM. This is the core of the entire system. The distribution algorithm distributes the equipment in the Battle Combat Group Suite over the available platforms, reducing the number of complex platforms used and keeping the excess equipment carried to a minimum.

When the user chooses this option, he will be asked whether he wants to see the Battle Group Combat Suite. If so, he is asked the same sequence of questions as in UPDATE THE BATTLE GROUP.

After the user has configured the Battle Group the way he desires, he will be asked if he wants to "DISTRIBUTE THE BATTLE GROUP COMBAT SUITE?". If he does he types "YES". (A "NO" answer returns him to the original menu). Now the distribution routine tries to use the platforms the user said were available, in the chosen configurations, to distribute the Battle Group Combat Suite. If enough platforms are availble, the final distribution appears and the user is returned to the original menu. (The user can actually see all the various iterations of the algorithm if he assigns the variable SHOW as "SHOWALL" in the AACDWS workspace). If enough platforms are not available, the system provides a summary of the items that were assigned to a platform in the distribution and the user is returned to the menu that allows him to "ADJUST THE CURRENT PLATFORMS". He can make changes in the available platforms and when he is finished, he is again asked if he wants to distribute. After completing his iterations the user can opt to exit, at which point he is returned to the original menu.

4.2.2.5 Option 5. NONE OF THE ABOVE. To end the session the user types "OUT". He is then out of the distribution system, but not off the APL system. To do this, he types "OFF."

4.3 TIDES USERS GUIDE

4.3.1 Introduction to TIDES

TIDES (The Interactive Data Entry System) was written as a data-gathering support program for AACDP (Advanced Aircraft Carrier Development Program) Battle Group Combat Suite Distribution Routines. Written in BASIC this program is a useful tool in the creation and editing of data files that contain weapon specifications. Among the specifications are total system weight, topside weight, below deck weight, total system volume, topside volume, and below deck volume. With its easy-to-use interactive approach, TIDES can be simply run at minimal cost. A sample interactive session is reproduced in Appendix E.

TIDES was developed in response to a need for a simple, quick method for entering weapon specification information into a data file with which the main program could interface and from which it could withdraw the needed information. Appendix F contains the program listing.

4.3.2. Use

After the opening greeting banner, options are availble for file editing or file creation.

4.3.2.1 Specification File Options. TIDES was designed specifically for editing purposes, but it also provides for creating a file to edit. This is the function of FILE OPTION "1", and once the file is created this option will not be needed. Be careful when entering FILE OPTION not to enter "1" by mistake. An entry in this first option returns a safety check to guard against deleting a previously created file named "TRY." Once the file is set up, there is full compatability between the file created in option one and the editing of this new file in option two. Because of system restrictions, the name must be internally specified in the program as "TRY."

FILE OPTION "2" is used to edit an already existing file named "TRY". Since data entry and editing are the main function of TIDES, FILE OPTION "2" will be used most often.

4.3.2.2 Equipment List Options. The need to interactively create, maintain, and edit an equipment file prompted the creation of equipment list file options. The program poses the question to the user, "Do you already have an equipment list file for the program?" A "YES" response places the user into a mode

from which he can enter his own equipment list (as opposed to using an already existing file) and then continue with the program. The equipment file, either way, must be and is named "EQUIP."

4.3.2.3 Data Entry Options. Once a file named "TRY" exists, it may be edited. TIDES offers eleven options:

Option (1). Print out all the options available to TIDES and their corresponding numbers.

Option (2). Print the list of equipment types and their corresponding numbers.

OPTION (3). Add or delete equipment types to or from "EQUIP". The corresponding characteristics of the equipment types are also added or deleted in the file "TRY" so both files are consistent. The name of an equipment type can also be modified with this option to correct misspellings, etc.

Option (4). Enter the weight (in pounds) and volume (in cubic feet) of a certain equipment type, specified by number.

Option (5). The design of option (5) allows a user who knows only the weight (or only the volume) of an item of equipment, to specify the density of that item. Using the specified density and holding either the weight or volume constant (specified by user), TIDES will compute the volume or weight of an item of equipment from the specified density and a known weight or volume.

Option (6). Using the weight and volume, this option calculates the (corresponding) topside and below deck weights and volumes. The user input is the percentage of the piece of equipment mounted above the main deck (0 level).

Option (7). The actual topside and below deck weights can be entered through option (7). If a total weight has already been specified, a check is made to see if the sum of these weights is consistent with the total weight.

Option (8). Option (8) is the same as option (7) but is calculated in terms of volume.

Option (9). In Option (9), a single line of data is printed out for the equipment number specified.

Option (10). To print out the entire array, option (10) is most useful. It is suggested that the user exercise option (10) prior to the terminate Option (11) to ensure that the updated array is in proper form.

Option (11). Stop the program and save all the results of the editing session into the respective files. This option provides the user exit from TIDES.

APPENDIX A - SAMPLE INTERACTIVE SESSION

)LOAD AACDWS
SAVED 80/08/06 12.52.32

PLATNUMS

4- 1. CGN 38-41
2- 2. CGN 36,37
5- 3. CG 26-34,CGN 35
10- 4. CG 16-24,CGN 25
17- 5. DDG 47-63
10- 6. DDG 37-45
4- 7. DDG 993-996
10- 8. DDG 15-24
12- 9. DDG 3-14
6-10. FFG 1-6
45-11. FFG 7-15,19-64
3-12. DDX
31-13. DD 963-992,997
46-14. FF 1052-1097
10-15. FF 1040CLASS
5-16. CVN
7-17. CV

EQUIPMENT

1. SPY-1
2. SPS-40
3. SPS-48C
4. SPS-49
5. SPS-55
6. SPS-67
7. MK-23 TAS
8. SQR-18
9. SQR-19
10. SLQ-25 NIXIE
11. SLQ-32(V)2
12. SLQ-32(V)3
13. SQS-53
14. SQS-56 SONAR
15. SSQ-72 OUTBOARD
16. SM-1(MR) MISSILE
17. SM-1(ER) MISSILE
18. SM-2(MR) MISSILE
19. SM-2(ER) MISSILE
20. NSSMS(W/ MK-91)
21. SLAT MISSILE
22. HARPOON (4-CELL CANNISTER)
23. HARPOON MISSILE
24. TOMAHAWK (4-CELL CANNISTER)
25. TOMAHAWK MISSILE
26. MK-10 GMLS
27. MK-13 GMLS
28. MK-11 GMLS
29. MK-16 GMLS
30. MK-36 DECOY LS
31. EX-41 VLS
32. MK-26 GMLS
33. MK-15 CIWS
34. MK-42 5 IN. GUN
35. MK-45 5 IN. GUN
36. MCLWG 8 IN. GUN
37. MK-75 76MM GUN
38. MK-32 TORP. TUBE
39. ASROC
40. MK-68 GFCS(W/ GIP MODS)
41. MK-74 GMFCS
42. MK-76 GMFCS
43. MK-86 GMFCS
44. MK-92 GMFCS
45. MK-99 GMFCS
46. SEAFIRE
47. A-6 INTRUDER
48. S-3 VIKING
49. E-2C HAWKEYE
50. F-14 TOMCAT
51. F-18. HORNET
52. AV-8B SEAHARRIER
53. SH-3 SEAKING
54. LAMPS I
55. LAMPS III

```
      START
THIS WORKSPACE CONTAINS ROUTINES WHICH DISTRIBUTE
WEAPONS SYSTEMS AND SENSORS OF A BATTLE GROUP COMBAT
SUITE OVER COMPATIBLE PLATFORMS.
IF YOU WISH TO CONTINUE ON, TYPE: GO.  OTHER-
WISE, TYPE: OUT.
GO
FROM THE FOLLOWING LIST CHOOSE THE
OPTION YOU WANT AND TYPE THAT NUMBER:
1. UPDATE OR VIEW FILE DATA
2. UPDATE OR VIEW CURRENT LOCAL DATA
3. ADJUST THE CURRENT PLATFORMS
4. EXECUTE THE DISTRIBUTION ALGORITHM
5. NONE OF THE ABOVE
4
WOULD YOU LIKE THE PRESENT BATTLE GROUP
COMBAT SUITE DISPLAYED?
YES
```


NOTE: OUTPUT IS ON NEXT PAGE

```
  3- 1. SPY-1
  0- 2. SPS-40
  2- 3. SPS-48C
  1- 4. SPS-49
  0- 5. SPS-55
  0- 6. SPS-67
  0- 7. MK-23 TAS
  1- 8. SQR-18
  3- 9. SQR-19
  0-10. SLQ-25 NIXIE
  3-11. SLQ-32(V)2
  2-12. SLQ-32(V)3
  2-13. SQS-53
  3-14. SQS-56 SONAR
  0-15. SSQ-72 OUTBOARD
 45-16. SM-1(MR) MISSILE
202-17. SM-1(ER) MISSILE
302-18. SM-2(MR) MISSILE
690-19. SM-2(ER) MISSILE
  4-20. NSSMS(W/ MK-91)
 20-21. SLAT MISSILE
  8-22. HARPOON (4-CELL CANNISTER)
 94-23. HARPOON MISSILE
  0-24. TOMAHAWK (4-CELL CANNISTER)
 16-25. TOMAHAWK MISSILE
  2-26. MK-10 GMLS
  0-27. MK-13 GMLS
  0-28. MK-11 GMLS
  1-29. MK-16 GMLS
  0-30. MK-36 DECOY LS
  4-31. EX-41 VLS
  5-32. MK-26 GMLS
 11-33. MK-15 CIWS
  4-34. MK-42 5 IN. GUN
  0-35. MK-45 5 IN. GUN
  0-36. MCLWG 8 IN. GUN
  1-37. MK-75 76MM GUN
  0-38. MK-32 TORP. TUBE
 40-39. ASROC
  0-40. MK-68 GFCS(W/ GIP MODS)
  4-41. MK-74 GMFCS
  1-42. MK-76 GMFCS
  2-43. MK-86 GMFCS
  0-44. MK-92 GMFCS
  4-45. MK-99 GMFCS
  0-46. SEAFIRE
 12-47. A-6 INTRUDER
 20-48. S-3 VIKING
  8-49. E-2C HAWKEYE
 48-50. F-14 TOMCAT
 96-51. F-18. HORNET
  0-52. AV-8B SEAHARRIER
 16-53. SH-3 SEAKING
  0-54. LAMPS I
  5-55. LAMPS III
DO YOU WISH TO MAKE ANY CHANGES?
NO
DO YOU WISH TO DISTRIBUTE THE PRESENT BAT
TLE GROUP
COMBAT SUITE?
YES
```

NOTE: OUTPUT IS ON NEXT PAGE

```
THERE ARE NOT ENOUGH PLATFORMS OF THE RIGHT
CONFIGURATIONS TO DISTRIBUTE ALL OF THE
REQUIRED EQUIPMENT.
THE FOLLOWING EQUIPMENT CANNOT BE ACCOMODATED.
 130 19. SM-2(ER) MISSILE


THIS IS THE DISTRIBUTION:
   4   1. CGN 38-41
   2   2. CGN 36,37
   5   3. CG 26-34,CGN 35
  10   4. CG 16-24,CGN 25
   1   5. DDG 47-63
  10   6. DDG 37-45
   0   7. DDG 993-996
   0   8. DDG 15-24
   0   9. DDG 3-14
   0  10. FFG 1-6
  13  11. FFG 7-15,19-64
   2  12. DDX
   4  13. DD 963-992,997
   1  14. FF 1052-1097
   0  15. FF 1040CLASS
   2  16. CVN
   1  17. CV
FROM THE FOLLOWING LIST, CHOOSE THE NUMBER
OF THE OPTION YOU WISH TO EXERCISE:
1. INCREASE QUANTITY OF A PLATFORM TYPE.
2. ADD AN ADV. PLATFORM TYPE FROM THE FILE.
3. MODIFY AN EXISTING PLATFORM TYPE.
4. OUTFIT NEW A PLATFORM.
5. NONE OF THE ABOVE.
4
ARE THE PAYLOAD WEIGHT AND VOLUME ON FILE FOR THE
PLATFORM YOU PROPOSE TO OUTFIT?
NO
```

```
ENTER THE NAME OF THE NEW PLATFORM YOU WANT OUTFITTED.
18. MISSILE FRIGATE
ENTER THE MILITARY PAYLOAD OF THE PLATFORM YOU WANT TO
OUTFIT.  FIRST GIVE THE WEIGHT IN POUNDS, THEN THE
VOLUME IN CUBIC FEET.
1000000 100000
ENTER, AS AN ORDERED PAIR, THE PERCENT OF THE PAYLOAD
WEIGHT AND THE PERCENT OF THE PAYLOAD VOLUME TO BE
UTILIZED IN OUTFITTING THIS PLATFORM.
90 80
ARE WEAPONS SYSTEMS CONSTRAINTS TO BE
CONSIDERED AUTOMATICALLY?
YES
WHICH EQUIPMENT NUMBER DO YOU WANT ABOARD?
19
HOW MANY OF THESE DO YOU WANT?
40
HERE ARE THE WEAPON SYSTEM CONSTRAINTS:
  1- 1. SPY-1
 52-19. SM-2(ER) MISSILE
  1-31. EX-41 VLS
  4-45. MK-99 GMFCS
DO YOU WISH TO MODIFY THESE CONSTRAINTS?
NO
HERE IS THE WEAPON SYSTEM IMPLIED:
  1- 1. SPY-1
 52-19. SM-2(ER) MISSILE
  1-31. EX-41 VLS
  4-45. MK-99 GMFCS
THERE ARE 469476 POUNDS OF PAYLOAD LEFT.
THERE ARE 74658 CUBIC FEET OF PAYLOAD LEFT.
18. MISSILE FRIGATE
  1- 1. SPY-1
 52-19. SM-2(ER) MISSILE
  1-31. EX-41 VLS
  4-45. MK-99 GMFCS
ARE YOU FINISHED WITH THIS PLATFORM?
```

YES

HOW MANY OF THESE NEWLY OUTFITTED PLATFORMS
DO YOU WANT AVAIVABLE FOR DISTRIBUTION?

2

WOULD YOU LIKE THE PRESENT BATTLE GROUP
COMBAT SUITE DISPLAYED?

NO

DO YOU WISH TO MAKE ANY CHANGES?

NO

DO YOU WISH TO DISTRIBUTE THE PRESENT BATTLE GROUP
COMBAT SUITE?

YES

NOTE: OUTPUT IS ON NEXT PAGE

```
THERE ARE NOT ENOUGH PLATFORMS OF THE RIGHT
CONFIGURATIONS TO DISTRIBUTE ALL OF THE
REQUIRED EQUIPMENT.
THE FOLLOWING EQUIPMENT CANNOT BE ACCOMODATED.
 26 19. SM-2(ER) MISSILE


THIS IS THE DISTRIBUTION:
  4  1. CGN 38-41
  2  2. CGN 36,37
  5  3. CG 26-34,CGN 35
 10  4. CG 16-24,CGN 25
  0  5. DDG 47-63
 10  6. DDG 37-45
  0  7. DDG 993-996
  0  8. DDG 15-24
  0  9. DDG 3-14
  0 10. FFG 1-6
 13 11. FFG 7-15,19-64
  2 12. DDX
  4 13. DD 963-992,997
  1 14. FF 1052-1097
  0 15. FF 1040CLASS
  2 16. CVN
  1 17. CV
  2 18. MISSILE FRIGATE
FROM THE FOLLOWING LIST, CHOOSE THE NUMBER
OF THE OPTION YOU WISH TO EXERCISE:
1. INCREASE QUANTITY OF A PLATFORM TYPE.
2. ADD AN ADV. PLATFORM TYPE FROM THE FILE.
3. MODIFY AN EXISTING PLATFORM TYPE.
4. OUTFIT NEW A PLATFORM.
5. NONE OF THE ABOVE.
```

```
4
ARE THE PAYLOAD WEIGHT AND VOLUME ON FILE FOR THE
PLATFORM YOU PROPOSE TO OUTFIT?
YES
DO YOU KNOW THE NUMBER OF THE PLATFORM YOU WANT?
NO
HERE IS THE LIST OF ADV. PLATFORMS:
101. SES FRIGATE
102. SWATH FRIGATE
103. CVV
104. SWATH FLATTOP
WHICH PLATFORM DO YOU WANT?
102
102. SWATH FRIGATE
ENTER, AS AN ORDERED PAIR, THE PERCENT OF THE PAYLOAD
WEIGHT AND THE PERCENT OF THE PAYLOAD VOLUME TO BE
UTILIZED IN OUTFITTING THIS PLATFORM.
90 90
ARE WEAPONS SYSTEMS CONSTRAINTS TO BE
CONSIDERED AUTOMATICALLY?
NO
102. SWATH FRIGATE
ARE YOU FINISHED WITH THIS PLATFORM?
NO
DO YOU WANT TO ADD OR TO DELETE
EQUIPMENT?(ANSWER:A OR D)
A
WHICH EQUIPMENT NUMBER DO YOU WANT ABOARD?
19
HOW MANY OF THESE DO YOU WANT?
10
THERE ARE 98130 POUNDS OF PAYLOAD LEFT.
THERE ARE 10130 CUBIC FEET OF PAYLOAD LEFT.
102. SWATH FRIGATE
 10-19. SM-2(ER) MISSILE
ARE YOU FINISHED WITH THIS PLATFORM?
YES
```

HOW MANY OF THESE NEWLY OUTFITTED PLATFORMS
DO YOU WANT AVAIVABLE FOR DISTRIBUTION?
3
WOULD YOU LIKE THE PRESENT BATTLE GROUP
COMBAT SUITE DISPLAYED?
NO
DO YOU WISH TO MAKE ANY CHANGES?
NO
DO YOU WISH TO DISTRIBUTE THE PRESENT BATTLE GROUP
COMBAT SUITE?
YES

NOTE: OUTPUT IS ON NEXT PAGE

```
THIS IS THE DISTRIBUTION:
   4   1. CGN 38-41
   2   2. CGN 36,37
   5   3. CG 26-34,CGN 35
  10   4. CG 16-24,CGN 25
   0   5. DDG 47-63
  10   6. DDG 37-45
   0   7. DDG 993-996
   0   8. DDG 15-24
   0   9. DDG 3-14
   0  10. FFG 1-6
  13  11. FFG 7-15,19-64
   2  12. DDX
   4  13. DD 963-992,997
   1  14. FF 1052-1097
   0  15. FF 1040CLASS
   2  16. CVN
   1  17. CV
   2  18. MISSILE FRIGATE
   3 102. SWATH FRIGATE
FROM THE FOLLOWING LIST CHOOSE THE
OPTION YOU WANT AND TYPE THAT NUMBER:
1. UPDATE OR VIEW FILE DATA
2. UPDATE OR VIEW CURRENT LOCAL DATA
3. ADJUST THE CURRENT PLATFORMS
4. EXECUTE THE DISTRIBUTION ALGORITHM
5. NONE OF THE ABOVE
5
```

)EXCESS
THERE ARE: 4053 EXTRA PIECES OF EQUIPMENT
WHICH ARE USED IN THIS DISTRIBUTION.
THEY ARE:

```
   1- 1. SPY-1
   5- 2. SPS-40
  33- 3. SPS-48C
  43- 4. SPS-49
  23- 5. SPS-55
  28- 6. SPS-67
   4- 7. MK-23 TAS
   0- 8. SQR-18
  14- 9. SQR-19
  49-10. SLQ-25 NIXIE
  17-11. SLQ-32(V)2
  29-12. SLQ-32(V)3
   8-13. SQS-53
  10-14. SQS-56 SONAR
  15-15. SSQ-72 OUTBOARD
1075-16. SM-1(MR) MISSILE
   6-17. SM-1(ER) MISSILE
 818-18. SM-2(MR) MISSILE
   4-19. SM-2(ER) MISSILE
   0-20. NSSMS(W/ MK-91)
   0-21. SLAT MISSILE
 260-22. HARPOON (4-CELL CANNISTER)
 174-23. HARPOON MISSILE
  96-24. TOMAHAWK (4-CELL CANNISTER)
  80-25. TOMAHAWK MISSILE
  33-26. MK-10 GMLS
  12-27. MK-13 GMLS
  13-28. MK-11 GMLS
 327-29. MK-16 GMLS
  14-30. MK-36 DECOY LS
  22-31. EX-41 VLS
   7-32. MK-26 GMLS
  58-33. MK-15 CIWS
  12-34. MK-42 5 IN. GUN
  16-35. MK-45 5 IN. GUN
   4-36. MCLWG 8 IN. GUN
  64-37. MK-75 76MM GUN
 102-38. MK-32 TORP. TUBE
 288-39. ASROC
  21-40. MK-68 GFCS(W/ GIP MODS)
   8-41. MK-74 GMFCS
  49-42. MK-76 GMFCS
  14-43. MK-86 GMFCS
  13-44. MK-92 GMFCS
  12-45. MK-99 GMFCS
   6-46. SEAFIRE
  15-47. A-6 INTRUDER
   8-48. S-3 VIKING
   1-49. E-2C HAWKEYE
  47-50. F-14 TOMCAT
  13-51. F-18. HORNET
  30-52. AV-8B SEAHARRIER
   1-53. SH-3 SEAKING
  14-54. LAMPS I
  37-55. LAMPS III
```

)OFF

THURSDAY	12 MARCH 1981	1:46 PM
TIMES:	SESSION	TO DATE
CONNECT	0.21.16	87.53.04
CPU	0.00.13	0.31.51
IO	0.00.02	0.09.58

NOTE: THIS SESSION WAS DONE ON
A TEKTRONIX 4015-1 TERMINAL.

APPENDIX B
GLOSSARY

FUNCTIONS (Resident in workspace)

APPEND - Appends a character matrix variable named LIST with more rows of character data. The resultant character matrix is called NEWLIST.

CALL - Calls a function from the file and fixes it in the active workspace

CLOSE - Closes a CANDE file which was previously opened by the function OPEN.

CONFIG - Shows the current weapon suite (i.e., configuration) of one of the platforms available for distribution.

CONVERT - Converts character data to numerical data for processing.

COPY - Copies a CANDE file.

FDISPLAY - Serially displays the contents of a specified APL file.

FIX - Fixes an APL function stored in a file into the active workspace.

OPEN - Opens a CANDE file from the APL workspace.

PACK - Removes the blank spaces from a character input.

PAD - Pads the end of a line of character data with blank spaces so the line can be appended to an exisiting character matrix.

PLATNUMS - Displays the current number of platforms of each class available for distribution.

READ - Reads the ntents of a CANDE file opened previously.

RESET - Resets the workspace when it is necessary to start over but to keep the changes made.

ROWNAMES - Produces a padded character matrix from a character vector input in which the rows are determined by user-selected delimiters.

START - Starts the distribution routine and makes the initial file function call.

STICK - Places the output of the function COPY into a numerical vector.

STRIP - Strips the leading blanks from a character vector input.

WRITE - Writes information onto a previously opened CANDE file.

FILE FUNCTIONS

ADD1 - Adds an advanced platform from the Advanced Platform List (Component 8, AACDFILE) to the list of platforms available for distribution.

ADJUST - Initiates the procedures for making adjustments to the platforms list and the configurations matrix.

AGGREGATE - Totals the weight and volume of a specified weapons system by referring to the Equipment Characteristics Matrix in Component 7 of the AACDFILE.

AGG1 - Pulls data from the Equipment Characteristics Matix (Component 7, AACDFILE).

BATTLEGROUP - Facilitates the user's desired modification of the Battle Group Combat Suite.

CHECK - Checks the weapons system constraints automatically and allows their modification.

COMMAND - Presents the main selection of user options.

COMPSYS - Computes and displays the weapons system implied in the automatic constraint consideration mode of ADJUST.

DISPLAY - Displays the weapons systems suite of the platform after the adjustments have been made.

DISTRIBUTE - This is the main distribution algorithm and is described in detail elsewhere in this report.

ENTER - Allows interactive choice for update of file components in the AACDFILE.

EXECUTE - Calls and executes various other funcitons in the file.

INCREASE1 - Increases the number of any platform available for distribution.

INSTALL - Carries out the arithmetic associated with installation of equipment on a platform; i.e., the weight and volume available on a platform type reduced by the equipment weight and volume stored in the characteristics matrix.

MODIFY - Modifies the weapons configuration of a platform type.

OUTFIT1 - This is the heart of the modification procedure, it allows the user to identify the bare hull and that hull's capacities.

SUBMIT1 - A short function which allows entry of an equipment type.

SUBMIT2 - Allows the user to specify unwanted equipment.

UP1 - Appends equipment to a list.

UPDATE - Updates the various file components.

VARIABLES

A - Configurations matrix.

AACDFILEMAP - List of the components of the file AACDFILE.

BGCS - Battle Group Combat Suite vector.

C - Temporary dimension vector.

EQUIPMENT - Equipment list.

FLAG - Flag test variable.

FLAG1 - Flag test variable.

FNMAP - File map for the file functions.

LIST - Temporary character matrix used in APPEND.

NEWLIST - Temporary character matrix output of APPENDD.

NUMBERPLATS - Vector of numbers of platforms available.

PAYLOAD - Temporary vector used in ADJUST.

PLAT - Temporary character matrix used in ADJUST.

PLATFORMS - Platforms available for distribution.

REGALIA - Temporary vector of weapons configurations used in ADJUST.

SHORT - Shortfalls (if any) after the distribution.

SHOW - Control variable for indicating whether intermediate steps in the distribution are to be shown.

SOLN - Solution vector for the distribution.

TEXT - Temporary variable of character data.

WEAPON - Temporary scalar used in ADJUST.

XS - Excess weaponry carried.

FILES

AACDFNS - Functions used or called in the workspace AACDWS.

AACDFILE - Permanent data used by the distribution routines.

OTHER

APL - Acronym for A Programming Language

AACDWS - Name of the APL workspace in which distribution routines are located.

CANDE - Acronym for the Burroughs "Command AND Edit" interactive system.

APPENDIX C - FUNCTION LISTINGS

RESIDENT FUNCTIONS

```
      ∇APPEND[□]∇
     ∇ APPEND LIST;DELIM;ENTRY
[1]    NEWLIST←LIST⍝     PUT LIST INTO NEWLIST.
[2]    'TO EXIT THIS FUNCTION: HIT RETURN.'
[3]   START:'ENTER NAME TO BE APPENDED.'
[4]    ENTRY←⍞⍝    USER INPUT PLACED IN ENTRY.
[5]    DIM←⍴NEWLIST⍝  PUT THE SHAPE OF NEWLIST INTO VARIABLE DIM.
[6]    →0×⍳0=⍴ENTRY⍝  EXIT IF THE ENTRY IS A RETURN.
[7]    DELIM←((1↑DIM),1)⍴'\'⍝     SHAPE A COLUMN OF THE DELIMITER \ FOR PREFIXING L
IST.
[8]    NEWLIST←,DELIM,[2]NEWLIST⍝    PLACE LEADING \ ON EVERY NAME IN LIST.
[9]    NEWLIST←NEWLIST,'\',ENTRY⍝    CATENATE THE NEW ENTRY ONTO THE LIST.
[10]   NEWLIST←NEWLIST←(⍳0)ROWNAMES NEWLIST⍝     RESHAPE THE LIST USING THE FUNCTIO
N ROWNAMES.
[11]   →START
     ∇
      ∇CALL[□]∇
     ∇ CALL FN;MAP
[1]    MAP←((1↑⍴FNMAP),⍴FN)↑FNMAP
[2]    →OUT×⍳∧/0=MAP←,MAP∧.=⍞FN
[3]    □FX⍞[MAP⍳1]'AACDFNS'
[4]    ⍎FN
[5]    □EX FN
[6]    →0
[7]   OUT:'THE FUNCTION ',FN,' COULD NOT BE FOUND.'
[8]    →0
     ∇
      ∇CLOSE[□]∇
     ∇ CLOSE
[1]    □SVR 2 2⍴'C1D1'
     ∇
```

```
      ▽CONFIG[□]▽
     ▽ CONFIG PLATNUM;IND
[1]    PLATFORMS[PLATNUM;]
[2]    IND←(A[;PLATNUM]≠0)/⍳1↑⍴A
[3]    (⍉⍕A[IND;PLATNUM]),' ',EQUIPMENT[IND;]
     ▽
      ▽CONVERT[□]▽
     ▽ NUMBER←CONVERT INPUT
[1]  START:→OUT×⍳∧/'OUT'=3↑INPUT
[2]    →BAD×⍳0=⍴INPUT
[3]    →BAD×⍳~∧/INPUT∈'0123456789 '
[4]    NUMBER←⊥INPUT
[5]    →0
[6]  BAD:'IMPROPER INPUT, ENTER NUMERICAL '
[7]    'DATA OR ''OUT''.'
[8]    INPUT←STRIP□
[9]    →START
[10] OUT:NUMBER←⍳0
[11]   FLAG←0
[12]   →0
     ▽
      ▽COPY[□]▽
     ▽ COPY;I;□;F;C1;D1;T
[1]    I←0
[2]    □←'INPUT FILE NAME? '
[3]    →(0=OPEN 17↓□)/OPENOK
[4]    □ER'ERROR IN FILE NAME.'
[5]  OPENOK:→(0≠T←READ I)/ERROR
[6]    OUTPUT←OUTPUT,D1
[7]    I+←1
[8]    →OPENOK
[9]  ERROR:→(10=T)/DONE
[10]   □ER'ERROR IN FILE READ.'
[11] DONE:CLOSE
     ▽
```

```
      ▽EXCESS[□]▽
     ▽ EXCESS
[1]    'THERE ARE: ';XS;' EXTRA PIECES OF EQUIPMENT'
[2]    'WHICH ARE USED IN THIS DISTRIBUTION.'
[3]    'THEY ARE: '
[4]    (⍕⍸(A+.×SOLN)-,C),'-',EQUIPMENT
     ▽
      ▽FDISPLAY[□]▽
     ▽ FDISPLAY F;N;J
[1]    ⍴F
[2]    F
[3]    N←⍳N←+/⍴F
[4]    J←0
[5]   GO:□←J←J+1
[6]    ⍴[J]F
[7]    □L
[8]    →GO×⍳J<⌈/N
[9]    ⍴F
[10]   →0
     ▽
      ▽FIX[□]▽
     ▽ FIX FN;MAP
[1]    MAP←((1↑⍴FNMAP),⍴FN)↑FNMAP
[2]    →OUT×⍳∧/0=MAP←,MAP∧.=⍴FN
[3]    □FX⍴[MAP⍳1]'AACDFNS'
[4]    →0
[5]   OUT:'THE FUNCTION ',FN,' COULD NOT BE FOUND.'
[6]    →0
     ▽
      ▽HELP[□]▽
     ▽ HELP
[1]    'YOU NEED HELP, PLEASE SEEK ASSISTANCE.'
     ▽
```

```
      ▽OPEN[□]▽
     ▽ ERR←OPEN FILENAME
[1]    'FILEUTIL'□SVO 2 2⍴'C1D1'
[2]    1 □SVC'C1'
[3]    C1←FILENAME
[4]    ERR←C1
     ▽
      ▽PACK[□]▽
     ▽ PACKED←PACK TEXT
[1]    PACKED←(TEXT≠' ')/TEXT
     ▽
      ▽PAD[□]▽
     ▽ R←LIST PAD LINE;NUM
[1]    NUM←(¯1↑⍴LIST)-⌊/(¯1↑⍴LIST),⍴LINE
[2]    R←LINE,NUM⍴' '
     ▽
      ▽PLATNUMS[□]▽
     ▽ PLATNUMS
[1]    □←(⍕⍴NUMBERPLATS),'-',PLATFORMS
     ▽
      ▽READ[□]▽
     ▽ ERR←READ RECORDNO
[1]    C1←0,RECORDNO
[2]    ERR←C1
     ▽
      ▽RESET[□]▽
     ▽ RESET
[1]    □EX FNMAP
     ▽
```

```
      ∇ROWNAMES[□]∇
     ∇ Z←S ROWNAMES T;A;B;R
[1]    B←T=1↑T←,T
[2]    A←(+/B)↑⍳⍴B
[3]    R←⌈/A←(1↓A,(?1)+⍴T)-1↓A
[4]    Z←((⍴A),R)⍴(,A∘.≤(~?1)+⍳R)\(~B)/T
[5]    R←⍴Z
[6]    →BY×R∨.≠S←2↑(2×3 2⊥(⍴,S),0=¯1↑S)↓((¯2↑0,S),R,-R)[2 3 2 3 2 1 2 5 0 1 0 5+?1
       ]
[7]   BY:Z←(S×1 ¯1⌈×S)↑Z
[8]    →OUT×0>¯1↑S
[9]   OUT:Z←(1-(Z=' ')⊥1)↓Z
     ∇
      ∇START[□]∇
     ∇ START;TEXT
[1]    'THIS WORKSPACE CONTAINS ROUTINES WHICH DISTRIBUTE'
[2]    'WEAPONS SYSTEMS AND SENSORS OF A BATTLE GROUP COMBAT'
[3]    'SUITE OVER COMPATIBLE PLATFORMS.'
[4]   INST:'IF YOU WISH TO CONTINUE ON, TYPE: GO.  OTHER-'
[5]    'WISE, TYPE: OUT.'
[6]    TEXT←STRIP TEXT←□⍝REMOVE LEADING BLANKS FROM USER INPUT
[7]    →0×⍳∧/(3↑TEXT)='OUT'⍝TEST FOR EXIT OF FUNCTION
[8]    →OK×⍳∧/(2↑TEXT)='GO'⍝TEST FOR GO AHEAD
[9]    'YOUR INPUT WAS NOT IN PROPER FORM.'
[10]   →INST
[11]  OK:CALL'COMMAND'
     ∇
      ∇STICK[□]∇
     ∇ STICK
[1]    ⍝THIS FN STICKS THE OUTPUT OF COPY INTO A NUMERICAL VECTOR NUMOUT.
[2]   LOOP:NUMOUT←NUMOUT,⊥⍨10↑OUTPUT
[3]    OUTPUT←⍨10↓OUTPUT
[4]    →(0=⍴OUTPUT)/0
[5]    →LOOP
     ∇
```

```
      ∇STRIP[0]∇
     ∇ R←STRIP A
[1]    R←(¯1+(' '≠A)⍳1)↓A
     ∇
      ∇WRITE[0]∇
     ∇ ERR←DATA WRITE RECORDNO
[1]    D1←DATA
[2]    C1←1,RECORDNO
[3]    ERR←C1
     ∇
```

FILE FUNCTIONS

```
     ⎕[1]'AACDFNS'
ADD1;NEWPLAT;ADVCON;REPLY
ADVCON←⎕[10]'AACDFILE'
'DO YOU KNOW THE NUMBER OF THE ADVANCED'
'PLATFORM DESIRED?'
→YES×⍳'Y'=1↑REPLY←STRIP⍞
→NO×⍳'N'=1↑REPLY
'INVALID RESPONSE'
→0
NO:'THIS IS THE LIST OF ADVANCED PLATFORMS:'
⎕[9]'AACDFILE'
YES:'WHAT IS THE NUMBER OF THE ADVANCED'
'PLATFORM YOU WANT ADDED?'
REPLY←¯100↑⍞
NEWPLAT←,ADVCON[;REPLY]
A←A,NEWPLAT
NEWPLAT←(⎕[9]'AACDFILE')[REPLY;]
PLATFORMS←PLATFORMS,[1]PLATFORMS PAD NEWPLAT
'HOW MANY OF THESE DO YOU WANT TO DISTRIBUTE?'
NUMBERPLATS←NUMBERPLATS,⍞
→0
```

```
     ⎕[2]'AACDFNS'
ADJUST:RESP:PAYLOAD
'FROM THE FOLLOWING LIST, CHOOSE THE N
     UMBER'
'OF THE OPTION YOU WISH TO EXERCISE:'
'1. INCREASE QUANTITY OF A PLATFORM TY
     PE.'
'2. ADD AN ADV. PLATFORM TYPE FROM THE
      FILE.'
'3. MODIFY AN EXISTING PLATFORM TYPE.'
'4. OUTFIT NEW A PLATFORM.'
'5. NONE OF THE ABOVE.'
TRYAGAIN:→OUT×⍳3=+/'OUT'=3↑RESP←⎕
→INCREASE×⍳'1'=1↑RESP
→ADD×⍳'2'=1↑RESP
→MODIFY×⍳'3'=1↑RESP
→OUTFIT×⍳'4'=1↑RESP
→OUT×⍳'5'=1↑RESP
'YOUR RESPONSE COULD NOT BE EVALUATED.
     '
'TYPE: 1, 2, 3, 4, 5, OR OUT.'
→TRYAGAIN
INCREASE:CALL'INCREASE1'
→0
ADD:CALL'ADD1'
→0
OUTFIT:CALL'OUTFIT1'
'ARE WEAPONS SYSTEMS CONSTRAINTS TO BE
     '
'CONSIDERED AUTOMATICALLY?'
FLAG1←0
REGALIA←(1↑⍴A)⍴0
→MANUAL×⍳'N'=1↑⎕
FLAG1←1
SUBMIT:CALL'SUBMIT1'
CALL'CHECK'
AGG:CALL'AGGREGATE'
CALL'INSTALL'
MANUAL:CALL'DISPLAY'
'ARE YOU FINISHED WITH THIS PLATFORM?'
→DONE×⍳'Y'=1↑⎕
→SUBMIT×⍳FLAG1=1
'DO YOU WANT TO ADD OR TO DELETE'
'EQUIPMENT?(ANSWER:A OR D)'
→DELETE×⍳'D'=1↑⎕
CALL'SUBMIT1'
R←WEAPON
→AGG
DELETE:CALL'SUBMIT2'
R←WEAPON
R←((⌈(1↑⍴R)÷2),2)⍴R
CALL'AGG1'
CALL'INSTALL'
→MANUAL
DONE:A←A,REGALIA
PLATFORMS←PLATFORMS,[1]PLATFORMS PAD P
     LAT
'HOW MANY OF THESE NEWLY OUTFITTED PLA
     TFORMS'
'DO YOU WANT AVAIVABLE FOR DISTRIBUTIO
     N?'
NUMBERPLATS←NUMBERPLATS,CONVERT⎕
→0
MODIFY:CALL'MODIFY1'
→0
OUT:FLAG←0
→0
```

```
      ⍝[3]'AACDFNS'
AGGREGATE;EQUOL;EQWT;EQCHAR
EQCHAR←⍝[7]'AACDFILE'
→TWO×⍳1=⍴⍴R
ONE:EQWT←+/R[;2]×EQCHAR[R[;1];1]
EQUOL←+/R[;2]×EQCHAR[R[;1];4]
WEAPONSYS←EQWT,EQUOL
→0
TWO:R←1 2⍴R
→ONE

      ⍝[4]'AACDFNS'
AGG1;EQCHAR
EQCHAR←⍝[7]'AACDFILE'
WEAPONSYS←WEAPON[2]×EQCHAR[WEAPON[1];1 4]

      ⍝[5]'AACDFNS'
BATTLEGROUP;REPLY;SHAPE
FIRST:'WOULD YOU LIKE THE PRESENT BATTLE GROUP'
'COMBAT SUITE DISPLAYED?'
REPLY←STRIP⍞
→OUT×⍳∧/'OUT'=3↑REPLY
→DISP×⍳∧/'Y'=1↑REPLY
→QUERY
CHANGE:'ENTER THE CHANGES DESIRED IN THE BATTLE'
'GROUP COMBAT SUITE AS A LIST OF ORDERED'
'PAIRS:  THE FIRST ENTRY IN EACH PAIR IS'
'THE EQUIPMENT TYPE NUMBER, THE SECOND'
'IS HOW MANY OF THE TYPE ARE NEEDED.'
REPLY←⍞
→OUT×⍳∧/'OUT'=3↑REPLY
→BAD×⍳~∧/REPLY∈'0123456789 '
REPLY←⊥REPLY
SHAPE←⍴,REPLY
REPLY←((SHAPE÷2),2)⍴REPLY
C[REPLY[;1]]←REPLY[;2]
→FIRST
OUT:→0
BAD:'YOUR RESPONSE WAS NOT IN THE '
'PROPER FORM.'
→FIRST
DISP:(T⍬,C),'-',EQUIPMENT
QUERY:'DO YOU WISH TO MAKE ANY CHANGES?'
REPLY←STRIP⍞
→OUT×⍳∧/'OUT'=3↑REPLY
→CHANGE×⍳∧/'Y'=1↑REPLY
→0
```

```
     ⎕[6]'AACDFNS'
CHECK
'HERE ARE THE WEAPON SYSTEM CONSTRAINTS:'
CONS←⎕[100+WEAPON[1]]'AACDFILE'
→NONE×⍳0=1↑,CONS
DISP:(⍕⍪CONS[;2]),'-',EQUIPMENT[CONS[;1];]
MODIFY:'DO YOU WISH TO MODIFY THESE CONSTRAINTS?'
→YES×⍳'Y'=1↑⍞
R←CONS
→NOCONS×⍳0=1↑,CONS
CALL'COMPSYS'
→0
YES:'ENTER THE NEW CONSTRAINTS AS A SEQUENCE'
'OF ORDERED PAIRS.  THE FIRST ELEMENT IN'
'EACH PAIR SHOULD BE THE EQUIPMENT NUMBER'
'AND THE SECOND ELEMENT SHOULD BE HOW MANY'
'OF THAT TYPE ARE IN THE WEAPON SYSTEM.'
CONS←CONVERT INPUT←⍞
→0×⍳0=FLAG
→NONE×⍳0=1↑,CONS
CONS←((⌈(⍴CONS)÷2),2)⍴CONS
'YOU HAVE SELECTED THE FOLLWING WEAPON SYSTEM.'
→DISP
BAD:'BE SURE TO ENTER DATA AS DIRECTED.'
→YES
NONE:'THERE ARE NO WEAPON SYSTEM CONSTRAINTS.'
→MOD
NOCONS:R←1 2⍴WEAPON
→0
```

```
     ⎕[7]'AACDFNS'
COMMAND:TEXT
FLAG←1
START:'FROM THE FOLLOWING LIST CHOOSE THE '
'OPTION YOU WANT AND TYPE THAT NUMBER:'
'1. UPDATE OR VIEW FILE DATA'
'2. UPDATE OR VIEW CURRENT LOCAL DATA'
'3. ADJUST THE CURRENT PLATFORMS '
'4. EXECUTE THE DISTRIBUTION ALGORITHM'
'5. NONE OF THE ABOVE'
TEXT←STRIP TEXT←⎕
→OUT×⍳∧/'OUT'=3↑TEXT
TEXT←1↓TEXT
→BAD×⍳0=+/TEXT='12345'
→ENT×⍳TEXT='1'
→UP×⍳TEXT='2'
→ADJ×⍳TEXT='3'
→EXE×⍳TEXT='4'
→OUT×⍳TEXT='5'
BAD:'INPUT NOT IN PROPER FORM'
→START
ENT:CALL'ENTER'
→0×⍳FLAG=0
→START
UP:CALL'UPDATE'
→0×⍳FLAG=0
→START
ADJ:CALL'ADJUST'
→0×⍳FLAG=0
→START
EXE:CALL'EXECUTE'
→0×⍳FLAG=0
→START
OUT:→0
```

```
      ∇[8]'AACDFNS'
COMPSYS;NUMBER
'HERE IS THE WEAPON SYSTEM IMPLIED:'
NUMBER←⌈WEAPON[2]÷(WEAPON[1]=R[;1])/R[;2]
R[;2]←NUMBER×R[;2]
(⍕R[;2]),'-',EQUIPMENT[R[;1];]

      ∇[9]'AACDFNS'
DISPLAY;IND
PLAT
IND←(REGALIA≠0)/⍳1↑⍴A
(⍕REGALIA[IND]),'-',EQUIPMENT[IND;]
```

```
→0
     ⎕IO←1 ⋄ 'AACDFNS'
DISTRIBUTE;EQUIPTOTS;IND;COEFFS;I;GRAD
     E;INDEX;DIFFERENCES;NONZERO;RATIO
     ;OBJEVAL
SOLN←NUMBERPLATS⍴⍨MAKE FIRST GUESS
SHORT←0
→START×⍳∧/C≤,EQUIPTOTS←A+.×⍉SOLN⍝CHECK
      TO SEE IF ALL OF THE EQUIPMENT I
     S ALLOCATED BY THE FIRST GUESS.
SHORT←C-EQUIPTOTS⍝   FIND THE SHORTFAL
     LS.
SHORT←SHORT×SHORT≥0⍝  PLACE ZEROS IN T
     HE NOTSHORT POSITIONS.
'THERE ARE NOT ENOUGH PLATFORMS OF THE
      RIGHT'
'CONFIGURATIONS TO DISTRIBUTE ALL OF T
     HE '
'REQUIRED EQUIPMENT.'
'THE FOLLOWING EQUIPMENT CANNOT BE ACC
     OMODATED.'
IND←(,SHORT≠0)/⍳⍴,SHORT⍝    FIND THE I
     NDICES OF THE SHORTFALLS.
(↑SHORT[IND;]),' ',EQUIPMENT[IND;]⍝
     DISPLAY THE LIST OF SHORTFALLS.,
C←,C-SHORT⍝  REDUCE THE REQUIRED EQUIP
     MENT VECTOR BY THE SHORTFALLS SO
     THE SORT WILL GO.
START:COEFFS←+/[1]A⍝SETS COEFFICIENTS
     OF THE OBJECTIVE FUNCTIONS.
I←1⍝INITIALIZES THE SENSITIVE VARIABLE
      INDEX.
GRADE←⍒COEFFS⍝RANKS THE COEFFS IN DECR
     EASING ORDER.
NEXT:INDEX←GRADE[I]⍝PICK THE NEXT LARG
     EST COEFFICIENT.
EQUIPTOTS←,A+.×⍉SOLN⍝RECOMPUTE THE EQU
     IPMENT TOTALS
DIFFERENCES←EQUIPTOTS-C⍝FIND THE DIFFE
     RENCES BETWEEN THE NUMBER OF EACH
      TYPE OF EQUIPMENT ALLOCATED AND
     THE NUMBER REQUIRED.
NONZERO←0≠A[;INDEX]⍝FIND NONZERO  ENTR
     IES OF SENSITIVE VARIABLE'S EQUIP
     MENT.
→INCR×⍳1↑RATIO←⌊/(NONZERO/,DIFFERENCES
     )÷NONZERO/A[;INDEX]⍝FIND THE RATI
     OS BETWEEN THE DIFFERENCES AND TH
     E NONZERO ENTRIES OF THE SENSITIV
     E VARIABLE.
SOLN[INDEX]←SOLN[INDEX]-⌊RATIO⍝REDUCE
     THE SENSITIVE VARIABLE BY TRUNCAT
     ED SMALLEST RATIO.
SOLN[INDEX]←0⌈SOLN[INDEX]⍝DON'T REDUCE
      THE NUMBER OF SHIPS LESS THAN ZE
     RO
OBJEVAL←+/COEFFS×SOLN⍝EVALUATES THE OB
     JECTIVE FUNCTION AT THE CURRENT S
     OLUTION.
→INCR×⍳∧/(7↑SHOW)≠'SHOWALL'⍝  PUT IN A
     N OVERRIDE SO THAT DISTRIBUTION P
     ROCESS MAY BE VIEWED.
'THE CURRENT DISTRIBUTION IS: ';SOLN⍝D
     ISPLAY THE CURRENT DISTRIBUTION.
'THERE ARE: ';OBJEVAL-+/,C;' EXTRA PIE
     CES OF EQUIPMENT WHICH ARE USED I
     N THIS DISTRIBUTION.'
INCR:I←I+1⍝INCREMENT THE COUNTER
→OUT×⍳I≥⍴NUMBERPLATS⍝CHECK TO SEE IF A
     LL VARIABLES HAVE BEEN REDUCED.
→NEXT⍝ITERATE SOME MORE
OUT:⎕L
'THIS IS THE DISTRIBUTION:'
(↑⍉SOLN),' ',PLATFORMS⍝DISPLAY THE FIN
     AL DISTRIBUTION
XS←OBJEVAL-+/,C
```

```
     ⎕[11]'AACDFNS'
ENTER:TEXT
GO:'CHOOSE THE NUMBER CORRESPONDING TO THE'
'FILE COMPONENT THAT YOU WANT TO VIEW'
'OR UPDATE:'
SHOW:AACDFILEMAP
→OUT×⍳∧/'OUT'=3↑TEXT←⍞
→BAD×⍳0=⍴TEXT
→BAD×⍳~∧/TEXT∈'0123456789 '
'HERE IS THE DATA IN THAT COMPONENT.'
⍞←DATA←⎕[⊥TEXT]'AACDFILE'
'DO YOU WISH TO CHANGE THIS DATA?'
→YES×⍳'Y'=1↑⍞
⍎EX'DATA'
→0
YES:'THIS DATA IS ASSIGNED TO THE VARIABLE'
'DATA.  YOU MAY MODIFY THE VARIABLE DATA'
'AND THEN STORE THIS BACK INTO THE CORRECT'
'FILE COMPONENT.'
→0
OUT:FLAG←0
→0
BAD:'PLEASE ENTER THE NUMBER OF A FILE'
'COMPONENT, OR TYPE ''OUT''.'
→SHOW
```

```
     ∇[12]'AACDFNS'
EXECUTE;REPLY;REMARK;SHAPE
FIRST:CALL'BATTLEGROUP'
START:'DO YOU WISH TO DISTRIBUTE THE PRESENT BATTLE GROUP'
'COMBAT SUITE?'
REPLY←STRIP⍞
→OUT×⍳∧/'OUT'=3↑REPLY
→DIST×⍳'Y'=1↑REPLY
→0×⍳'N'=1↑REPLY
'ANSWER YES, NO, OR OUT.'
→START
DIST:BGCS←C
CALL'DISTRIBUTE'
→FIT×⍳0≠+/,SHORT
→0
FIT:CALL'ADJUST'
C←BGCS
→FIRST
OUT:FLAG←0
→0

     ∇[13]'AACDFNS'
INCREASE1;RESP;ANS
'WHAT IS THE PLATFORM NUMBER?'
RESP←10⊥¯1+'0123456789'⍳STRIP⍞
→NUM×⍳(RESP>0)∧RESP<1↓⍴A
'YOU DID NOT ENTER THE  NUMBER OF A PLATFORM'
'TYPE WHICH IS ALREADY A DISTRIBUTION'
'CANDIDATE.'
→0
NUM:'THE PLATFORM IN QUESTION IS: ',PLATFORMS[RESP;]
'THERE ARE CURRENTLY ';NUMBERPLATS[RESP];' OF THESE PLATFORMS'
'AS DISTRIBUTION CANDIDATES.  HOW MANY'
'OF THESE DO YOU WANT?'
ANS←10⊥¯1+'0123456789'⍳STRIP⍞
NUMBERPLATS[RESP]←ANS
→0
```

```
     ⍝[14]'AACDFNS'
INSTALL;LEFT
LEFT←PAYLOAD-WEAPONSYS
→SHORT×⍳0>⌊/LEFT
PAYLOAD←LEFT
REGALIA[R[;1]]←R[;2]
'THERE ARE ';PAYLOAD[1];' POUNDS OF PA
     YLOAD LEFT.'
'THERE ARE ';PAYLOAD[2];' CUBIC FEET O
     F PAYLOAD LEFT.'
→0
SHORT:'THERE IS NOT ENOUGH PAYLOAD LEF
     T TO BRING'
'THIS SYSTEM ABOARD.  '
⎕EX'THREE'

     ⍝[15]'AACDFNS'
MODIFY1;REPLY;MODS
START:'FROM THE FOLLOWING LIST, CHOOSE
      THE NUMBER'
'OF THE PLATFORM YOU WISH TO MODIFY:'
PLATFORMS
REPLY←⍬
→OUT×⍳'O'=1↑REPLY
→BAD1×⍳0=⍴REPLY
→BAD1×⍳~∧/REPLY∈'0123456789 '
REPLY←⍎REPLY
→NUM×⍳REPLY≤(⍴A)[2]
'YOU FAILED TO ENTER THE NUMBER OF A P
     LATFORM'
'LISTED ABOVE.  TYPE ''OUT'' IF YOU WA
     NT TO EXIT.'
→0×⍳'O'=1↑⍬
→START
NUM:'YOU HAVE CHOSEN TO MODIFY:  ',PLA
     TFORMS[REPLY;]
'THE CURRENT CONFIGURATION IS:'
CONFIG REPLY
ENTER:'ENTER THE MODIFICATIONS TO THE
     PLATFORM'
'AS A LIST OF ORDERED PAIRS, WHERE THE
     '
'FIRST ENTRY IN EACH PAIR IS THE EQUIP
     MENT'
'NUMBER AND THE SECOND ENTRY IS HOW MA
     NY'
'OF THAT TYPE ARE DESIRED.'
MODS←⍬
→0×⍳'O'=1↑MODS
→BAD×⍳0=⍴MODS
→BAD×⍳~∧/MODS∈'0123456789 '
MODS←((⌊(⍴MODS)÷2),2)⍴MODS←⍎MODS
→MOD×⍳(1↑⍴A)≥⌈/MODS[;1]
'ONE OF THE EQUIPMENT NUMBERS YOU ENTE
     RED'
'IS NOT VALID.'
→ENTER
BAD:'YOUR RESPONSE SHOULD BE NUMERICAL
     .'
→ENTER
MOD:A[MODS[;1];REPLY]←MODS[;2]
→0
BAD1:'YOUR RESPONSE SHOULD BE NUMERICA
     L.'
→START
OUT:FLAG←0
→0
```

```
     ⎕[16]'AACDFNS'
OUTFIT1;ANS;R
START:'ARE THE PAYLOAD WEIGHT AND VOLU
     ME ON FILE FOR THE'
'PLATFORM YOU PROPOSE TO OUTFIT?'
ANS←1↑STRIP⍞
→YES×⍳'Y'=ANS
→NO2×⍳'N'=ANS
→OUT×⍳'O'=ANS
'PLEASE ANSWER YES, NO, OR OUT.'
→START
YES:'DO YOU KNOW THE NUMBER OF THE PLA
     TFORM YOU WANT?'
ANS←1↑STRIP⍞
→NOPE×⍳'N'=ANS
PICK:'WHICH PLATFORM DO YOU WANT?'
ANS←⍞
→BADIN×⍳~∧/ANS∈'0123456789 '
ANS←⍎ANS
→BADIN×⍳ANS≤100
ANS←100+ANS
⍞←PLAT←(⎕[9]'AACDFILE')[ANS;]
R←(⎕[8]'AACDFILE')[ANS;]
→NO1
NOPE:'HERE IS THE LIST OF ADV. PLATFOR
     MS:'
⎕[9]'AACDFILE'
→PICK
NO2:'ENTER THE NAME OF THE NEW PLATFOR
     M YOU WANT OUTFITTED.'
PLAT←⍞
NO:'ENTER THE MILITARY PAYLOAD OF THE
     PLATFORM YOU WANT TO'
'OUTFIT.  FIRST GIVE THE WEIGHT IN POU
     NDS, THEN THE'
'VOLUME IN CUBIC FEET.'
R←⎕
→OUT×⍳'O'=1↑R
→BADINPUT×⍳~∧/R∈'0123456789 '
R←⍎R
→BADINPUT×⍳∧/2≠⍴R
NO1:'ENTER, AS AN ORDERED PAIR, THE PE
     RCENT OF THE PAYLOAD'
'WEIGHT AND THE PERCENT OF THE PAYLOAD
      VOLUME TO BE'
'UTILIZED IN OUTFITTING THIS PLATFORM.
     '
ANS←⍞
→OUT×⍳'O'=1↑ANS
→BADINPUT2×⍳~∧/ANS∈'0123456789 '
ANS←⍎ANS
→BADINPUT2×⍳∧/2≠⍴ANS
PAYLOAD←R×0.01×ANS
→0
BADINPUT:'YOU FAILED TO ENTER THE REQU
     ESTED DATA PROPERLY.'
→NO
BADINPUT2:'YOU DID NOT ENTER THE DATA
     PROPERLY.'
→NO1
BADIN:'IMPROPER INPUT.'
→YES
OUT:FLAG←0
→0
```

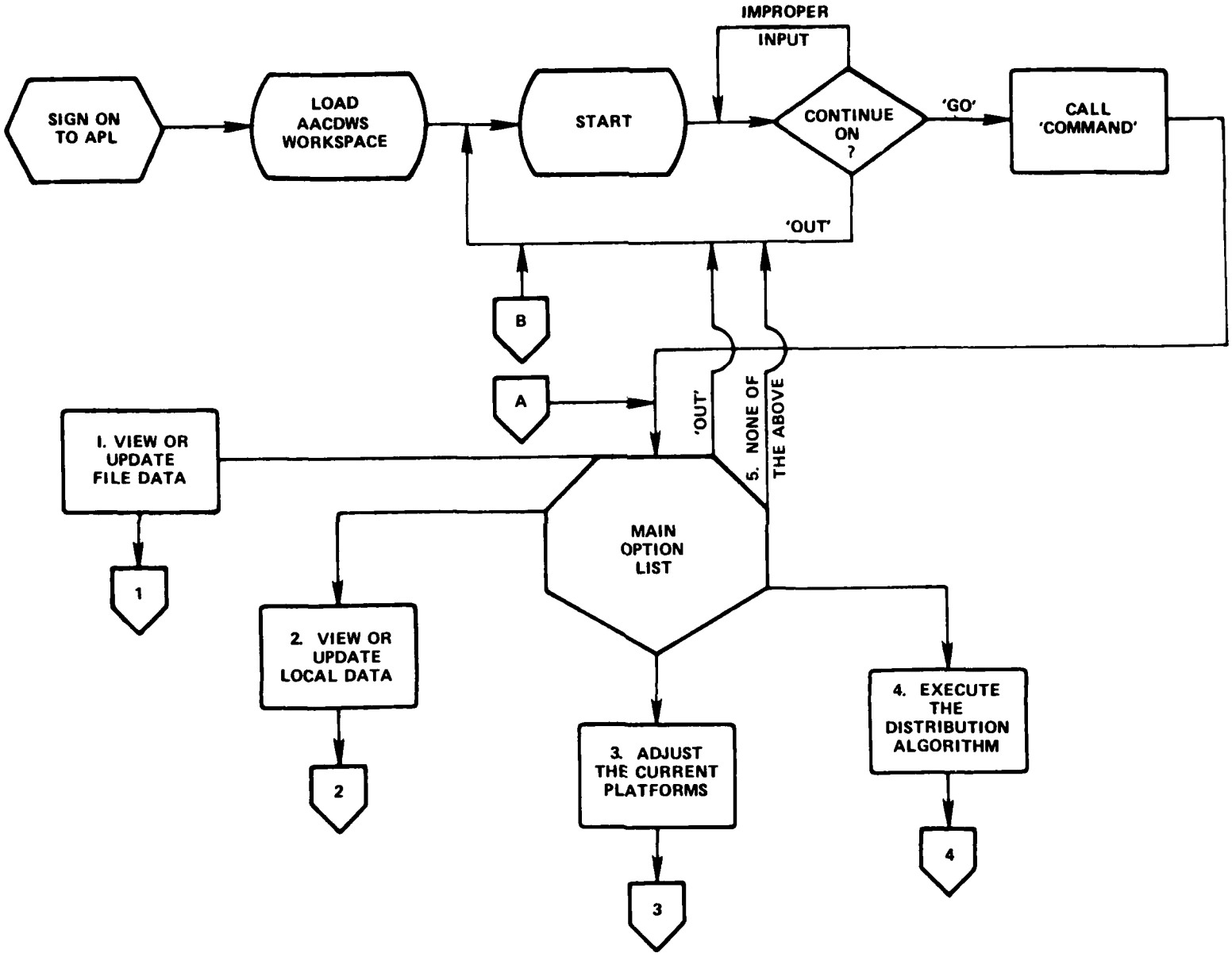
```
     ⎕[17]'AACDFNS'
SUBMIT1;WEAPON2
START:'WHICH EQUIPMENT NUMBER DO YOU WANT ABOARD?'
WEAPON←⍞
→BAD×⍳~∧/WEAPON∈'0123456789 '
WEAPON←⍎WEAPON
→BAD×⍳1≠+/WEAPON=⍳1↑⍴EQUIPMENT
'HOW MANY OF THESE DO YOU WANT?'
WEAPON2←⍞
→BAD×⍳~∧/WEAPON2∈'0123456789 '
WEAPON2←⍎WEAPON2
WEAPON←WEAPON,WEAPON2
→0
BAD:'YOU DID NOT ENTER A LEGITIMATE EQUIPMENT NUMBER.'
→START

     ⎕[18]'AACDFNS'
SUBMIT2;WEAPON2
START:'WHICH EQUIPMENT NUMBER DO YOU WANT THROWN'
'OVERBOARD?'
WEAPON←⍞
→BAD×⍳~∧/WEAPON∈'0123456789 '
WEAPON←⍎WEAPON
→BAD×⍳1≠+/WEAPON=⍳1↑⍴EQUIPMENT
MANY:'HOW MANY OF THESE DO YOU WANT PITCHED?'
WEAPON2←⍎
→BAD×⍳~∧/WEAPON2∈'0123456789 '
WEAPON←WEAPON,-⍎WEAPON2
→BAD2×⍳WEAPON[2]<-REGALIA[WEAPON[1]]
→0
BAD:'YOU DID NOT ENTER A LEGITIMATE '
'EQUIPMENT NUMBER.'
→START
BAD2:'YOU DON''T HAVE THAT MANY ABOARD.'
→START
```

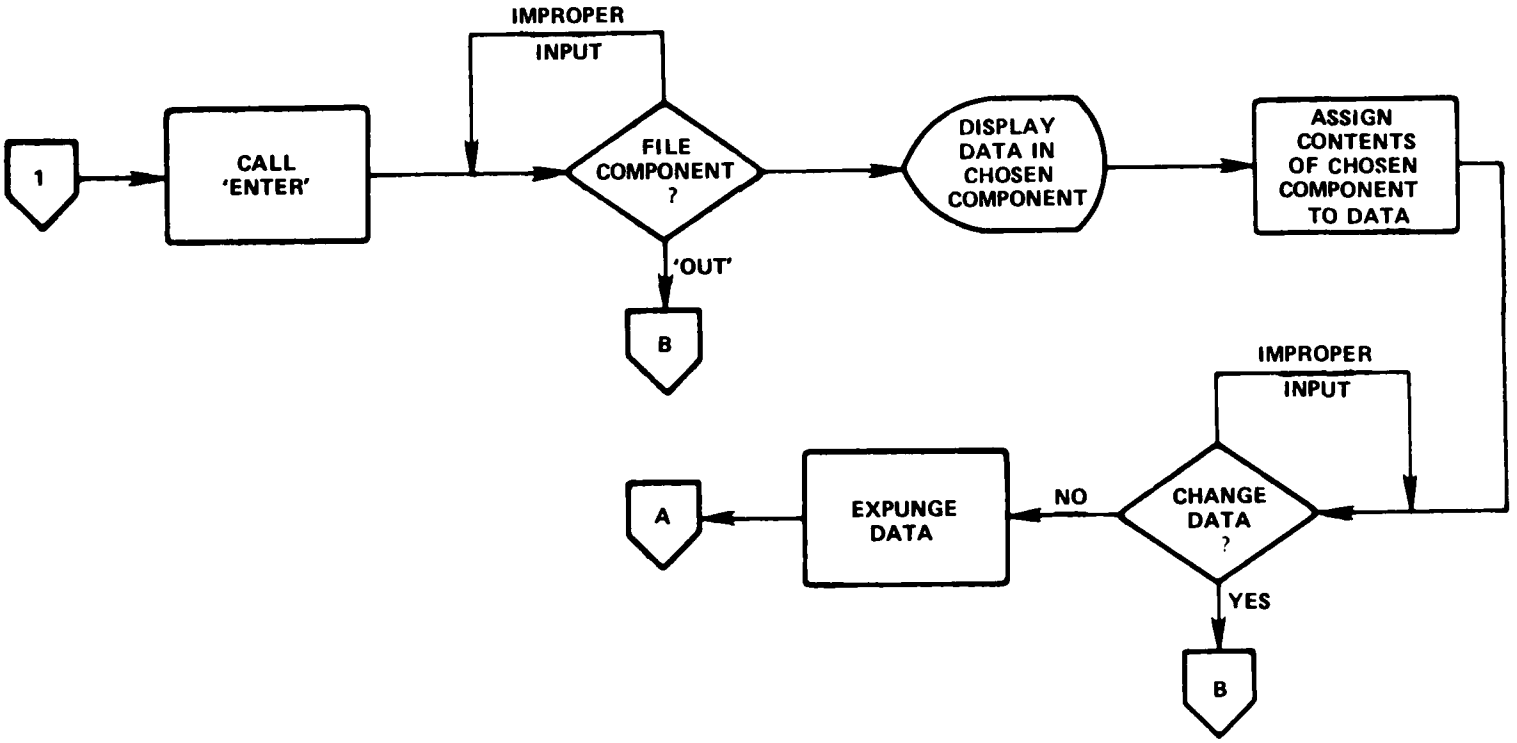
```
      ⍝[19]'AACDFNS'
UP1
LIST
'DO YOU WANT TO APPEND THIS LIST?'
→YES×1'Y'=1↑⍞
→0
YES:APPEND LIST
LIST←NEWLIST
→0

      ⍝[20]'AACDFNS'
UPDATE:REPLY
START:'FROM THE FOLLOWING LIST, CHOOSE THE OBJECT'
'THAT YOU WISH TO VIEW OR UPDATE:'
'1. PLATFORM CONFIGURATION'
'2. EQUIPMENT LIST'
'3. PLATFORM LIST'
'4. NUMBER OF PLATFORMS'
'5. BATTLE GROUP COMBAT SUITE'
'6. NONE OF THESE'
REPLY←STRIP REPLY←⍞
→OUT×1∧/'OUT'=3↑REPLY
REPLY←1↑REPLY
→BAD×1∊0=+/REPLY='123456'
→ONE×1REPLY='1'
→TWO×1REPLY='2'
→THREE×1REPLY='3'
→FOUR×1REPLY='4'
→FIVE×1REPLY='5'
→0×1REPLY='6'
OUT:FLAG←0
→0
BAD:'YOUR REPLY COULD NOT BE EVALUATED.'
→START
ONE:CALL'MODIFY1'
→START
TWO:LIST←EQUIPMENT
CALL'UP1'
→START
THREE:LIST←PLATFORMS
CALL'UP1'
→START
FOUR:CALL'INCREASE1'
→START
FIVE:CALL'BATTLEGROUP'
→START
```

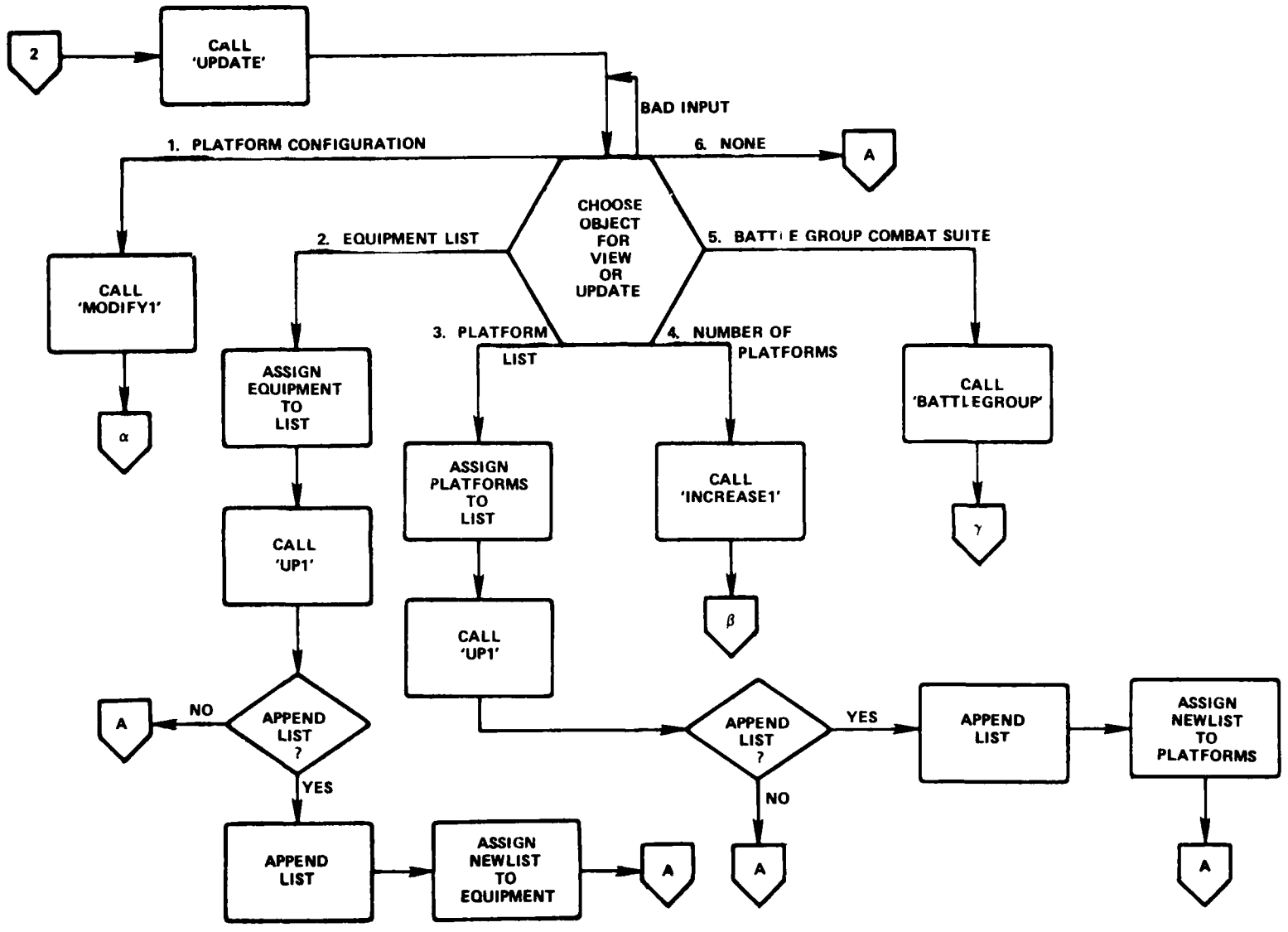
APPENDIX D - FLOW CHARTS


SIGN ON TO APL
LOAD AACDWS WORKSPACE
START
IMPROPER INPUT
CONTINUE ON ?
'GO'
CALL 'COMMAND'
'OUT'
B
A
'OUT'
5. NONE OF THE ABOVE
1. VIEW OR UPDATE FILE DATA
MAIN OPTION LIST
1
2. VIEW OR UPDATE LOCAL DATA
2
3. ADJUST THE CURRENT PLATFORMS
3
4. EXECUTE THE DISTRIBUTION ALGORITHM
4

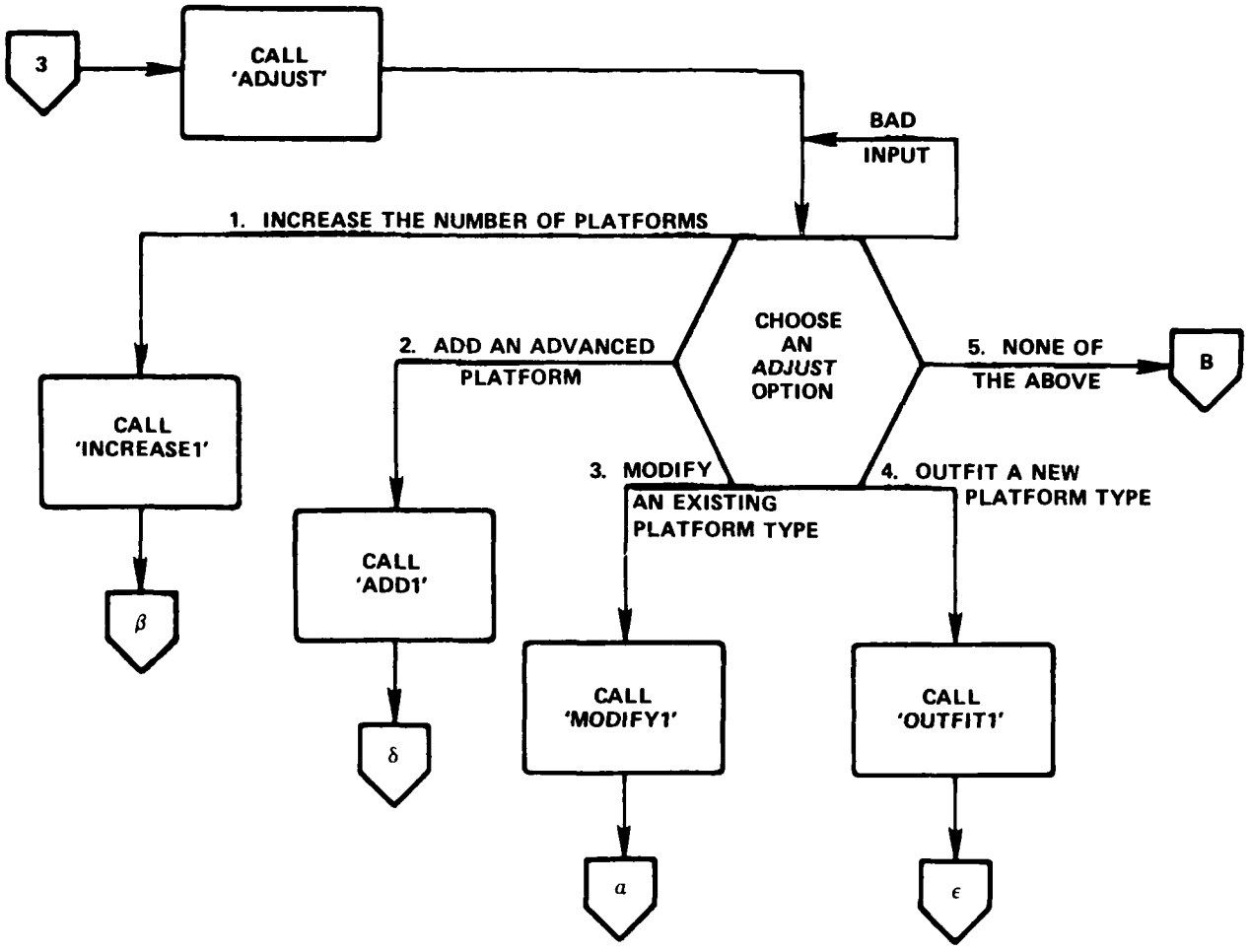
1. VIEW OR UPDATE FILE DATA



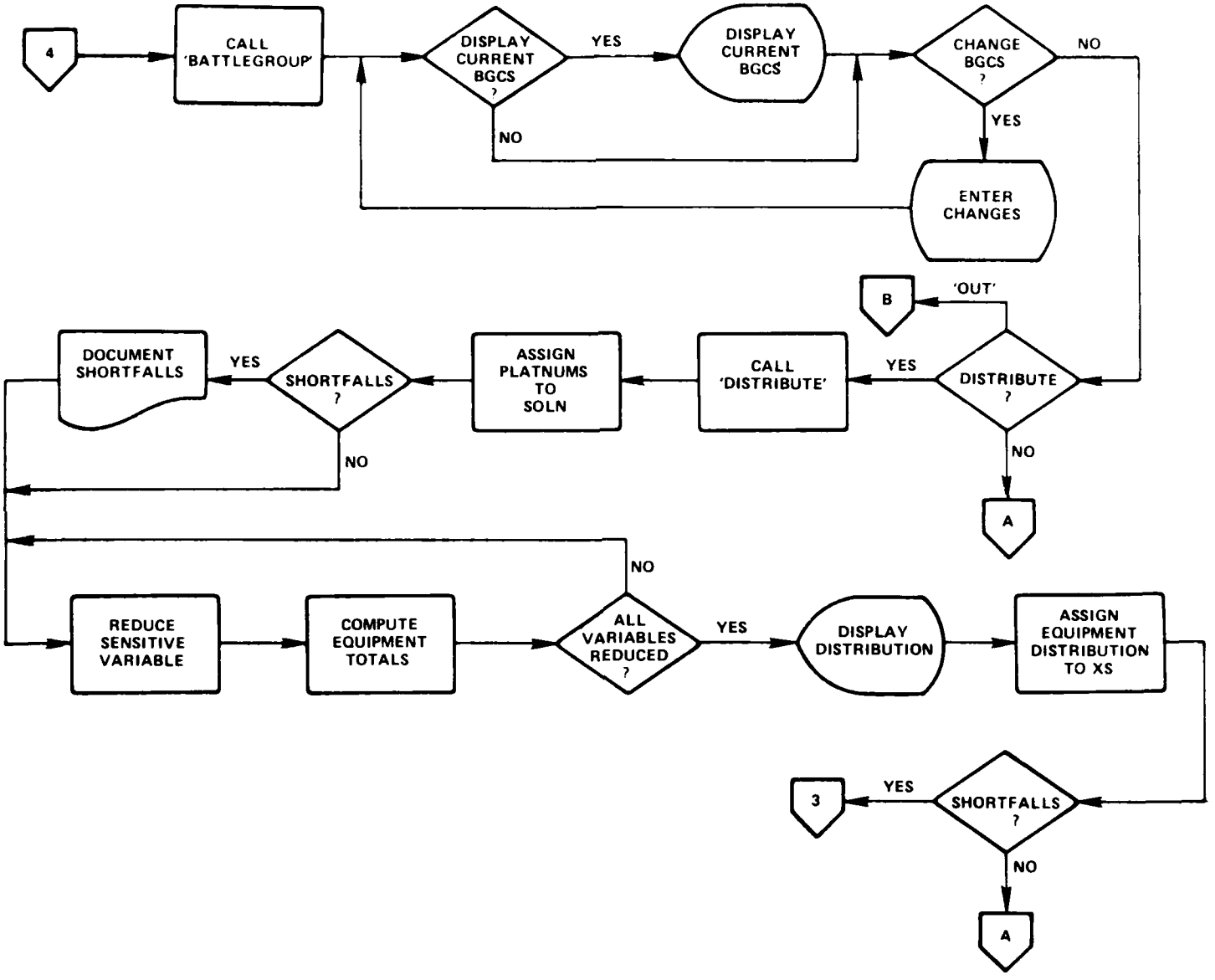
2. VIEW OR UPDATE CURRENT LOCAL DATA

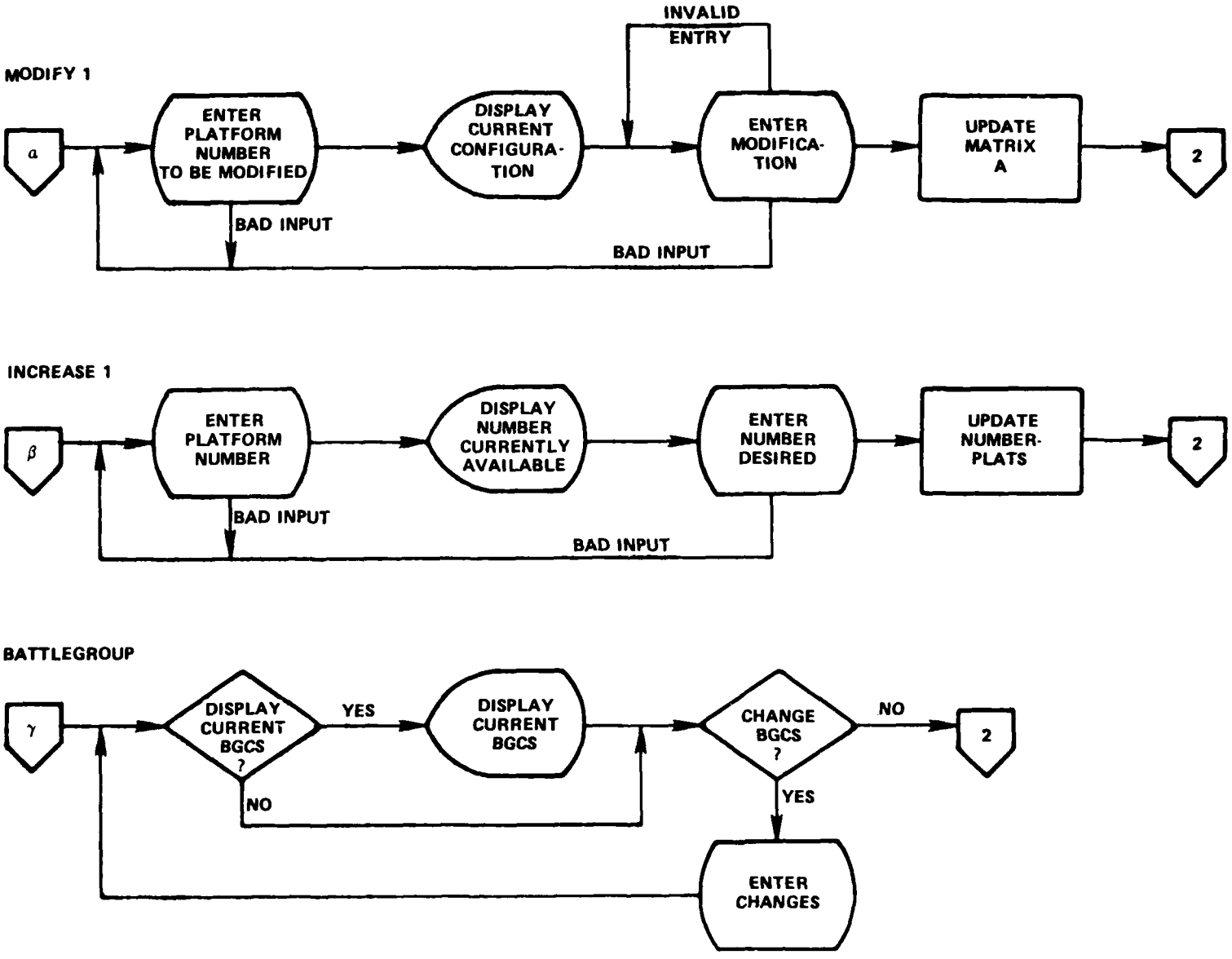


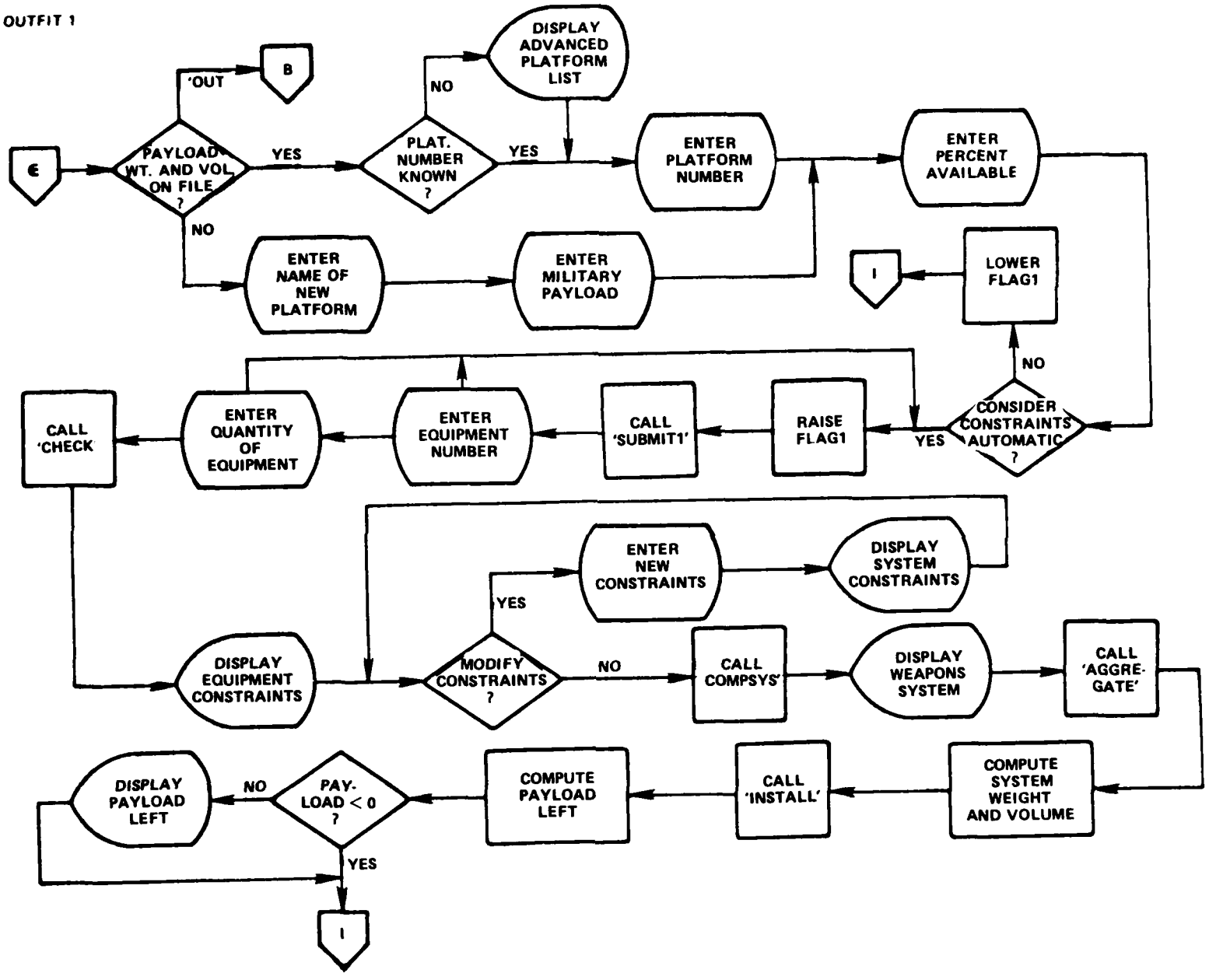
3. ADJUST THE CURRENT PLATFORMS



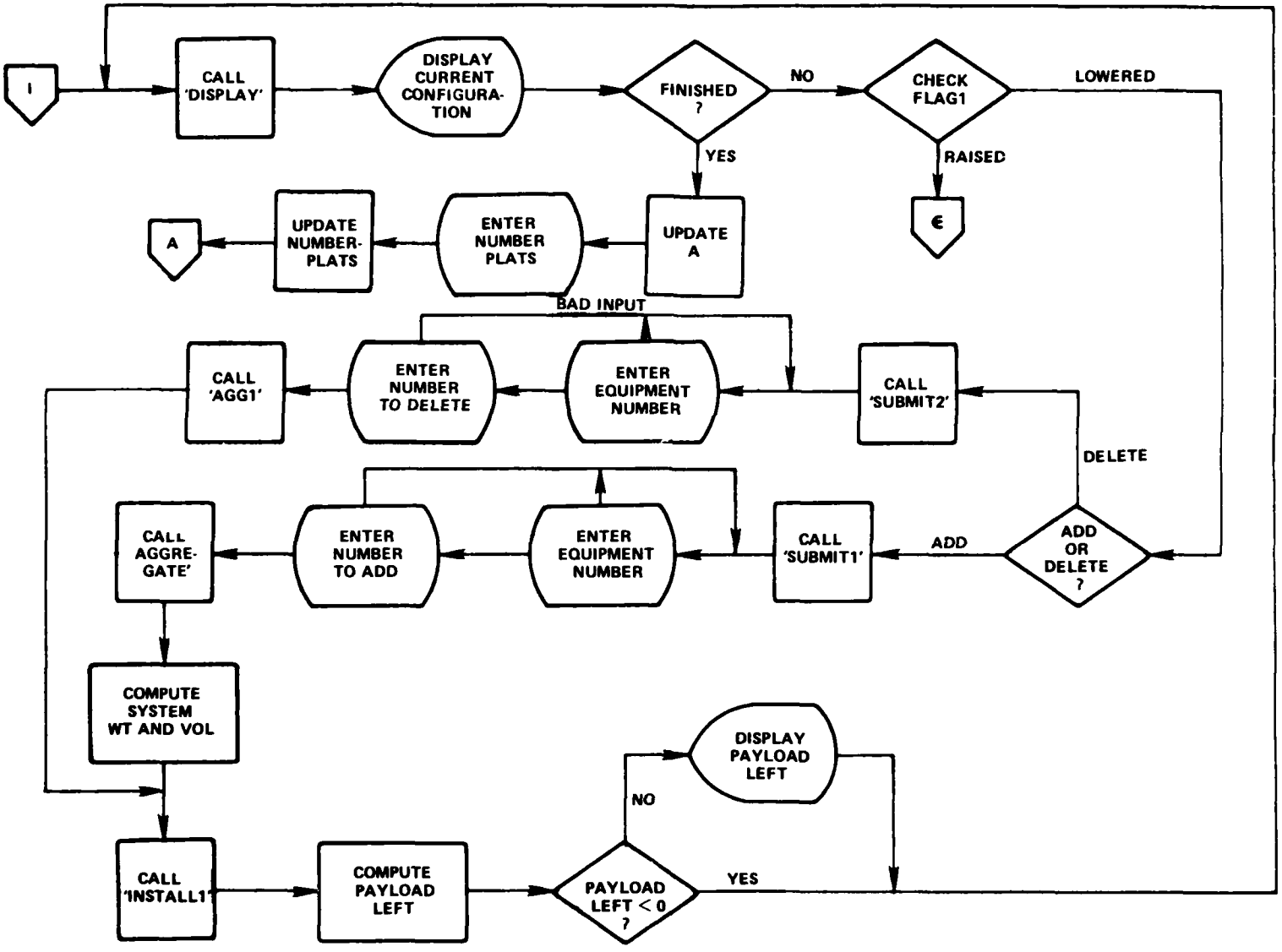
4 EXECUTE THE DISTRIBUTION ALGORITHM




MODIFY 1
α
ENTER PLATFORM NUMBER TO BE MODIFIED
DISPLAY CURRENT CONFIGURA-TION
INVALID ENTRY
ENTER MODIFICA-TION
UPDATE MATRIX A
2
BAD INPUT
BAD INPUT
INCREASE 1
β
ENTER PLATFORM NUMBER
DISPLAY NUMBER CURRENTLY AVAILABLE
ENTER NUMBER DESIRED
UPDATE NUMBER-PLATS
2
BAD INPUT
BAD INPUT
BATTLEGROUP
γ
DISPLAY CURRENT BGCS ?
YES
DISPLAY CURRENT BGCS
CHANGE BGCS ?
NO
2
NO
YES
ENTER CHANGES


OUTFIT 1
'OUT
B
DISPLAY ADVANCED PLATFORM LIST
NO
PAYLOAD WT. AND VOL ON FILE ?
YES
PLAT. NUMBER KNOWN ?
YES
ENTER PLATFORM NUMBER
ENTER PERCENT AVAILABLE
NO
ENTER NAME OF NEW PLATFORM
ENTER MILITARY PAYLOAD
I
LOWER FLAG1
NO
CONSIDER CONSTRAINTS AUTOMATIC ?
YES
RAISE FLAG1
CALL 'SUBMIT1'
ENTER EQUIPMENT NUMBER
ENTER QUANTITY OF EQUIPMENT
CALL 'CHECK'
ENTER NEW CONSTRAINTS
DISPLAY SYSTEM CONSTRAINTS
YES
DISPLAY EQUIPMENT CONSTRAINTS
MODIFY CONSTRAINTS ?
NO
CALL COMPSYS'
DISPLAY WEAPONS SYSTEM
CALL 'AGGRE-GATE'
COMPUTE SYSTEM WEIGHT AND VOLUME
CALL 'INSTALL'
COMPUTE PAYLOAD LEFT
PAY-LOAD < 0 ?
NO
DISPLAY PAYLOAD LEFT
YES
I

MANUAL CONSTRAINTS



APPENDIX E - TIDES INTERACTIVE SESSION

```
RUN TIDES
#RUNNING 3005
                    ****************************************
                    *         WELCOME TO TIDES             *
                    *  THE INTERACTIVE DATA ENTRY SYSTEM   *
                    *                                      *
                    *       TODAY'S DATE IS 01/28/81       *
                    *          THE TIME IS 15:09           *
                    *  MOST RECENT WORK SESSION-01/28/81   *
                    *              AT 14:56                *
                    ****************************************


THIS PROGRAM HAS THE CAPABILITY TO:
     (1)CREATE A NEW DATA FILE NAMED TRY
     (2)EDIT AN ALREADY EXISTING FILE NAMED TRY
#?
FILE OPTION?1
OPTION ONE, FILE CREATION MODE, REQUIRES A SAFETY CHECK
TO INSURE THAT AN ALREADY EXISTING FILE NAMED TRY IS NOT WIPED OUT
RE-ENTER FILE OPTION (BE SURE)?2
DO YOU ALREADY HAVE AN EQUIPMENT LIST FILE FOR PROGRAM(Y/N)?Y
FOR A LISTING OF OPTIONS, TYPE 1 AFTER OPTION?

OPTION?1

THIS PROGRAM HAS THE FOLLOWING OPTIONS FOR DATA ENTRIES:
       (1) OPTION LIST
       (2) EQUIPMENT TYPE NUMBER LIST
       (3) EDIT EXISTING EQUIP. FILE: ADD, DELETE, OR MODIFY NAME
       (4) WEIGHT/VOLUME IN LBS & CU. FT.
       (5) DENSITY IN LBS/CU.FT.
       (6) PERCENT TOPSIDE WEIGHT AND VOLUME
       (7) TOPSIDE AND BELOW WEIGHT
       (8) TOPSIDE AND BELOW VOLUME
       (9) PRINT OUT A SPECIFIC UPDATED LINE
       (10) PRINT OUT UPDATED ARRAY
       (11) END

OPTION?2

( 1 )
1)SPY-1


( 2 )
2)SPS-40


( 3 )
3)SPS-48C


( 4 )
4)SPS-49


( 5 )
5)SPS-55
```

(6)
6)SPS-67

(7)
7)MK-23TAS

(8)
8)SQR-18

(9)
9)SQR-19

(10)
10)SLQ-25

(11)
11)SLQ-32(V)2

(12)
12)SLQ-32(V)3

(13)
13)SQS-53 (W/ MK-116 FCS)

(14)
14)SQS-56

(15)
15)SSQ-72(OUTBOARD)

(16)
16)SM-1(MR)

(17)
17)SM-1(ER)

(18)
18)SM-2(MR)

(19)
19)SM-2(ER)

(20)
20)NSSMS(W/MK 91 GMFCS)

(21)
21)SLAT

(22)
22)HARPOON(4 CELL CANISTER)

(23)
23)HARPOON(ALONE)

(24)
24)TOMAHAWK(4 CELL CANISTER LAUNCHER)

(25)
25)TOMAHAWK(ALONE)

(26)
26)MK-10 GMLS

(27)
27)MK-11 GMLS

(28)
28)MK-13 GMLS

(29)
29)MK-16 RLS

(30)
30)MK-36 DECOY LS

(31)
31)EX-41 VLS

(32)
32)MK-26 GMLS

(33)
33)MK-15 CIWS

(34)
34)MK-42 5"/54 GUN

(35)
35)MK-45 5"/54 GUN

(36)
36)MCLWG 8"/55

(37)
37)MK-75 76mm GUN

(38)
38)MK-32 SVTT

(39)
39)ASROC

(40)
40)MK-68 GIP MODS

(41)
41)MK-74 GMFCS

(42)
42)MK-76 GMFCS

(43)
43)MK-86 GMFCS

(44)
44)MK-92 GMFCS

(45)
45)MK-99 GMFCS

(46)
46)SEAFIRE

(47)
47)A-6 INTRUDER

(48)
48)S-3 VIKING

(49)
49)E-2C HAWKEYE

(50)
50)F-14 TOMCAT

(51)
51)F-18 HORNET

(52)
52)AV-8B HARRIER

(53)
53)SH-3 SEAKING

(54)
54)LAMPS I

(55)
55)LAMPS III

```
OPTION?8

ENTER EQUIPMENT TYPE NUMBER?1
EQUIPMENT TYPE:
1)SPY-1

ENTER TOPSIDE VOL. AND BELOW VOL., SEPARATED BY COMMA?750,525
TOTAL VOL. DOES NOT EQUAL SUM OF TOP & BEL. VOLS. ENTERED
DO YOU WISH TO OVERWRITE CURRENT SUM OF-646 (Y/N)?N

OPTION?9

ENTER EQUIPMENT TYPE NUMBER?1
1)SPY-1
     47316  45934  1382 -646 -616 -30

OPTION?3

CHOOSE ADD, DELETE, OR MODIFY MODE (A/D/M)?M
ENTER EQUIP. NUMBER TO BE MODIFIED?1
ENTER NEW NAME-ONLY NAME CHANGES, NO CHANGE IN
SPECIFICATIONS?AN/SPY-1
1)SPY-1
     HAS BEEN CHANGED TO AN/SPY-1

OPTION?4

ENTER EQUIPMENT TYPE NUMBER?1
EQUIPMENT TYPE:AN/SPY-1
ENTER WEIGHT AND VOLUME, SEPARATED BY COMMA?48000,-650

OPTION?9

ENTER EQUIPMENT TYPE NUMBER?1
AN/SPY-1 48000  45934  1382 -650 -616 -30

OPTION?0

EQUIP.          TOT. WT.        TOP/BEL.        TOT. VOL.       TOP/BEL

( 1 )
AN/SPY-1          48000           45934 / 1382  -650            -616 /-30

( 2 )
2)SPS-40
                  277000          45600 / 231400 -4134          -1134 /-3000

( 3 )
3)SPS-48C
                  169822          56400 / 113422 -782           -531 /-251

( 4 )
4)SPS-49
                  134731          19868 / 114863 -609           -314 /-295

( 5 )
5)SPS-55
                  165018          48853 / 116165 -1332          -804 /-528

( 6 )
6)SPS-67
                  2300            2300 / 0       -201           -201 / 0
```

(7) 7)MK-23TAS	143450	110600 / 32850	-2055	-1810 /-245
(8) 8)SQR-18	54000	42000 / 12000	1814	1302 / 512
(9) 9)SQR-19	17299	16537 / 762	1435	517 / 918
(10) 10)SLQ-25	21629	0 / 21629	-31	0 /-31
(11) 11)SLQ-32(V)2	4868	4168 / 700	-107	-94 /-13
(12) 12)SLQ-32(V)3	20015	7100 / 12915	-94	-50 /-44
(13) 13)SQS-53 (W/ MK-116 FCS)	39045	13350 / 25695	-1014	-314 /-700
(14) 14)SQS-56	16157	6190 / 9967	-640	-240 /-400
(15) 15)SSQ-72(OUTBOARD)	7280	1905 / 5375	-107	-50 /-57
(16) 16)SM-1(MR)	0	0 / 0	0	0 / 0
(17) 17)SM-1(ER)	0	0 / 0	0	0 / 0
(18) 18)SM-2(MR)	0	0 / 0	0	0 / 0
(19) 19)SM-2(ER)	0	0 / 0	0	0 / 0
(20) 20)NSSMS(W/MK 91 GMFCS)	0	0 / 0	0	0 / 0
(21) 21)SLAT	0	0 / 0	0	0 / 0
(22) 22)HARPOON(4 CELL CANISTER)	0	0 / 0	0	0 / 0
(23) 23)HARPOON(ALONE)				

0	0 / 0	0	0 / 0

(24)
24)TOMAHAWK(4 CELL CANISTER LAUNCHER)

0	0 / 0	0	0 / 0

(25)
25)TOMAHAWK(ALONE)

0	0 / 0	0	0 / 0

(26)
26)MK-10 GMLS

0	0 / 0	0	0 / 0

(27)
27)MK-11 GMLS

0	0 / 0	0	0 / 0

(28)
28)MK-13 GMLS

0	0 / 0	0	0 / 0

(29)
29)MK-16 RLS

0	0 / 0	0	0 / 0

(30)
30)MK-36 DECOY LS

0	0 / 0	0	0 / 0

(31)
31)EX-41 VLS

0	0 / 0	0	0 / 0

(32)
32)MK-26 GMLS

0	0 / 0	0	0 / 0

(33)
33)MK-15 CIWS

0	0 / 0	0	0 / 0

(34)
34)MK-42 5"/54 GUN

0	0 / 0	0	0 / 0

(35)
35)MK-45 5"/54 GUN

0	0 / 0	0	0 / 0

(36)
36)MCLWG 8"/55

0	0 / 0	0	0 / 0

(37)
37)MK-75 76mm GUN

0	0 / 0	0	0 / 0

(38)
38)MK-32 SVTT

0	0 / 0	0	0 / 0

(39)
39)ASROC

0	0 / 0	0	0 / 0

(40)
40)MK-68 GIP MODS

0	0 / 0	0	0 / 0

(41)
41)MK-74 GMFCS

0	0 / 0	0	0 / 0

(42)
42)MK-76 GMFCS

0	0 / 0	0	0 / 0

(43)
43)MK-86 GMFCS

0	0 / 0	0	0 / 0

(44)
44)MK-92 GMFCS

0	0 / 0	0	0 / 0

(45)
45)MK-99 GMFCS

0	0 / 0	0	0 / 0

(46)
46)SEAFIRE

0	0 / 0	0	0 / 0

(47)
47)A-6 INTRUDER

0	0 / 0	0	0 / 0

(48)
48)S-3 VIKING

0	0 / 0	0	0 / 0

(49)
49)E-2C HAWKEYE

0	0 / 0	0	0 / 0

(50)
50)F-14 TOMCAT

0	0 / 0	0	0 / 0

(51)
51)F-18 HORNET

0	0 / 0	0	0 / 0

(52)
52)AV-8B HARRIER

0	0 / 0	0	0 / 0

(53)
53)SH-3 SEAKING

0	0 / 0	0	0 / 0

(54)
54)LAMPS I

0	0 / 0	0	0 / 0

(55)
55)LAMPS III

0	0 / 0	0	0 / 0

OPTION? 11

APPENDIX F - TIDES LISTINGS

```
#FILE (CACK)TIDES ON DTNSRDC
100     REM     TIDES:THE INTERACTIVE DATA ENTRY SYSTEM
125     REM           WAS WRITTEN BY BOB QUILLIN IN JUNE
150     REM           OF 1980 AT DTNSRDC.  TIDES IS A DATA
175     REM           GATHERING TOOL THAT SUPPORTS THE AACD
200     REM           (ADVANCED AIRCRAFT CARRIER DEVELOPMENT) PROGRAM.
225     REM           TIDES IS CAPABLE OF STORING WEIGHTS AND
250     REM           VOLUMES INTO AN ARRAY, UPDATING AND EDITING
275     REM           AN ALREADY EXISTING ARRAY, COMPUTING TOPSIDE
300     REM           AND BELOW WEIGHTS AND VOLUMES, EMPLOYING DENSITY
325     REM           IN CALCULAIONS, AND PRINTING OUT THIS ARRAY.
330     REM       NOTE! TIDES WAS UPDATED IN JANRUARY OF 1981 BY ITS
331     REM             ORIGINATOR, BOB QUILLIN.
340
350      REM   READ IN N=VERTICAL ARRAY LIMIT,B=HORIZONTAL ARRAY LIMIT
375     READ B
400         FILES HELP;EQUIP;TRY;INFO
425      INPUT #4,D$,I$
430
450      REM   A$ ARRAY=EQUIP. TYPES,D ARRAY-TEMP. MAIN DATA STORAGE
475     DIM A$(100),D(100,6)
480
500      REM   INTRODUCTION
525    PRINT TAB(20)"****************************************"
550    PRINT TAB(20)"*          WELCOME TO TIDES            *"
575    PRINT TAB(20)"*  THE INTERACTIVE DATA ENTRY SYSTEM   *"
600    PRINT TAB(20)"*"TAB(58)"*"
625     PRINT TAB(20)"*       TODAY'S DATE IS "DAT$TAB(58)"*"
650       PRINT TAB(20)"*           THE TIME IS ";CLK$TAB(58)"*"
675     PRINT TAB(20)"*  MOST RECENT WORK SESSION-"D$TAB(58)"*"
700     PRINT TAB(20)"*"TAB(35)"AT " I$TAB(58)"*"
725    PRINT TAB(20)"****************************************"
750    PRINT
775     PRINT
780
800    REM  FILE OPTION CHOICE
825      PRINT "THIS PROGRAM HAS THE CAPABILITY TO: "
850      PRINT "      (1)CREATE A NEW DATA FILE NAMED TRY"
875      PRINT "      (2)EDIT AN ALREADY EXISTING FILE NAMED TRY"
900     PRINT "FILE OPTION";
925     INPUT L
950      IF L=2 GOTO 1125
960
975        REM  SAFETY FEATURE TO GUARD AGAINST FILE ANNIHILATION
1000      PRINT"OPTION ONE, FILE CREATION MODE, REQUIRES A SAFETY CHECK";
1025      PRINT"TO INSURE THAT AN ALREADY EXISTING FILE NAMED TRY IS NOT";
1050      PRINT " WIPED OUT"
1075      PRINT"RE-ENTER FILE OPTION (BE SURE)";
1100      INPUT L
1105
1110       REM  OPTION TO USE OLD EQUIP. LIST OR CREATE NEW ONE
1125       PRINT "DO YOU ALREADY HAVE AN EQUIPMENT LIST FILE FOR PROGRAM";
1150        PRINT "(Y/N)";
1175         INPUT C$
1200         N=0
1225         IF C$="Y" GOTO 1550
1230
1240         REM  SAFETY CHECK GUARDING AGAINST FILE LOSS
1250         PRINT "BE CAREFUL. IF EQUIPMENT FILE ALREADY EXISTS, IT";
1275          PRINT "WILL BE OVERWRITTEN. TO BE SAFE, RE-ENTER ANSWER:"
1300          PRINT "DOES AN EQUIPMENT LIST EXIST (Y/N)?";
```

```
1325        INPUT C$
1350       IF C$="Y" GOTO 1550
1360
1370      REM  EQUIP. NAME ENTRY MODE
1375      PRINT "ENTER EQUIPMENT TYPES, ONE AT A TIME";
1400      PRINT "(TYPE STOP WHEN FINISHED),";
1425       INPUT E$
1450       IF E$="STOP" GOTO 1625
1475       N=N+1
1500       A$(N)=E$
1525       GOTO 1425
1550       N=N+1
1575        INPUT #2,A$(N)
1600       IF MORE #2 THEN 1550
1625       IF L=2 GOTO 2025
1640
1650       REM  **** FILE CREATION MODE ****
1675     REM   INITIALIZE D ARRAY WITH ALL ELEMENTS EQUAL TO ZERO
1700     FOR I=1 TO N
1725     FOR J=1 TO 8
1750    D(I,J)=0
1775    NEXT J
1800    NEXT I
1805
1825     REM  PRINT D ARRAY (ALL ZEROS) INTO TRY (CREATION MODE)
1850    SCRATCH #3
1875    FOR I=1 TO N
1900    PRINT #3,D(I,1),D(I,2),D(I,3),D(I,4),D(I,5),D(I,6)
1925    NEXT I
1950     REM  SKIP EDIT MODE STEPS AND MOVE ON
1975     GOTO 2150
1981
2000       REM  **** FILE EDIT MODE ****
2025   REM   COPY TRY INTO ARRAY D
2050    FOR I=1 TO N
2075    INPUT #3,D(I,1),D(I,2),D(I,3),D(I,4),D(I,5),D(I,6)
2100    NEXT I
2125     RESTORE #3
2140
2150    REM  OPTION CHOICE
2175    PRINT "FOR A LISTING OF OPTIONS, TYPE 1 AFTER OPTION?"
2200     PRINT
2225     PRINT "OPTION";
2250    INPUT P
2275    PRINT
2290
2300   REM   SENDS PROGRAM TO FOLLOWING LOCATIONS, ACCORD. TO OPTION
2325    ON P GOTO 2350,2675,2775,3525,3525,3525,3525,3525,3525,5225,5500
2340
2345    REM  OPTION LIST
2350    PRINT "THIS PROGRAM HAS THE FOLLOWING OPTIONS FOR DATA ENTRIES:"
2375    PRINT "        (1) OPTION LIST     "
2400    PRINT "        (2) EQUIPMENT TYPE NUMBER LIST"
2420    PRINT TAB(7)"(3) EDIT EXISTING EQUIP. FILE; ADD, DELETE, OR";
2422    PRINT " MODIFY NAME"
2425    PRINT "        (4) WEIGHT/VOLUME IN LBS & CU. FT."
2450    PRINT "        (5) DENSITY IN LBS/CU.FT."
2475    PRINT "        (6) PERCENT TOPSIDE WEIGHT AND VOLUME"
2500    PRINT "        (7) TOPSIDE AND BELOW WEIGHT"
2525    PRINT "        (8) TOPSIDE AND BELOW VOLUME"
2550    PRINT "        (9) PRINT OUT A SPECIFIC UPDATED LINE"
2575    PRINT "        (10) PRINT OUT UPDATED ARRAY"
2600    PRINT "        (11) END"
2625    GOTO 2200
2640
2650   REM   PRINT OUT EQUIP. TYPES
```

```
2675    FOR I=1 TO N
2700    PRINT "("I") ";A$(I)
2702    PRINT
2725    NEXT I
2750    GOTO 2200
2760
2770       REM  EQUIP. LIST EDIT MODE
2775       PRINT "CHOOSE ADD, DELETE, OR MODIFY MODE (A/D/M)";
2800       INPUT D$
2825       IF D$="D" GOTO 3225
2830       IF D$="M" GOTO 3480
2844
2845       REM  NAME INSERTION
2850       PRINT "ENTER EQUIPMENT TYPE NAME";
2875       INPUT N$
2900       PRINT "ENTER NUMBER WHERE EQUIP. TYPE IS TO BE INSERTED";
2925       INPUT N1
2950       FOR I=N TO N1 STEP -1
2975         A$(I+1)=A$(I)
3000         FOR J=1 TO 8
3025           D(I+1,J)=D(I,J)
3050         NEXT J
3075       NEXT I
3100       A$(N1)=N$
3125       FOR I=1 TO 8
3150         D(N1,I)=0
3175       NEXT I
3180       N=N+1
3200       GOTO 2200
3210
3215       REM  NAME DELETION
3225       PRINT "ENTER EQUIP. NUMBER YOU ARE DELETING";
3250       INPUT E1
3275       PRINT A$(E1)" DELETED"
3300       FOR I=E1 TO N
3325         A$(I)=A$(I+1)
3350         FOR J=1 TO 8
3375           D(I,J)=D(I+1,J)
3400         NEXT J
3425       NEXT I
3450       N=N-1
3475       GOTO 2200
3476
3477       REM  NAME MODIFICATION
3480       PRINT "ENTER EQUIP. NUMBER TO BE MODIFIED";
3482       INPUT N2
3484       PRINT "ENTER NEW NAME-ONLY NAME CHANGES, NO CHANGE IN "
3486       PRINT "SPECIFICATIONS";
3488       INPUT N$
3490       PRINT A$(N2)" HAS BEEN CHANGED TO "N$
3492       A$(N2)=N$
3494       GOTO 2200
3496
3500    REM   CHOOSE EQUIP. TYPE YOU ARE WORKING WITH
3525    PRINT "ENTER EQUIPMENT TYPE NUMBER";
3550      INPUT T
3575      IF P=9 GOTO 3625
3600      PRINT "EQUIPMENT TYPE:"A$(T)
3625      ON P GOTO 2350,2675,2775,3675,3825,4725,4100,4400,4950,5225,5500
3627
3650    REM   WEIGHT AND VOLUME
3675     PRINT "ENTER WEIGHT AND VOLUME, SEPARATED BY COMMA";
3700     INPUT W,V
3725        D(T,1)=INT(W+.5)
3750          D(T,4)=INT(V+.5)
3775     GOTO 2200
```

```
3780
3800   REM   DENSITY W/PRIORITIES '1'=WT. CONSTANT,'2'=VOL. CONSTANT
3825  PRINT'ENTER DENSITY FOLLOWED BY 1 FOR WT., 2 FOR VOL. PRIORITIES';
3850    INPUT Y,R
3875   IF R=2 GOTO 3975
3900    D(T,4)=INT((D(T,1)/Y)+.5)
3925      IF D(T,5)+D(T,6)<>D(T,4) GOTO 4050
3950    GOTO 2200
3975    D(T,1)=INT((D(T,4)*Y)+.5)
4000      IF D(T,2)+D(T,3)<>D(T,1) GOTO 4050
4025     GOTO 2200
4050 PRINT'WARNING-TOP & BEL. CALCULATIONS ARE NOW NOT ACCURATE W/ TOTAL'
4075      GOTO 2200
4080
4099      REM  TOPSIDE AND BELOW WEIGHT CALAULATIONS
4100      PRINT 'ENTER TOPSIDE WT. AND BELOW WT., SEPARATED BY COMMA';
4125      INPUT E,O
4150       IF D(T,1)=0 GOTO 4300
4175       IF D(T,1)=E+O GOTO 4300
4200     PRINT'TOTAL WT. DOES NOT EQUAL SUM OF TOP & BEL. WTS. ENTERED'
4225       PRINT'DO YOU WISH TO OVERWRITE CURRENT SUM OF';D(T,1);'(Y/N)';
4250       INPUT L$
4275       IF L$ = 'N' GOTO2200
4300      D(T,2)=E
4325      D(T,3)=O
4350      D(T,1)=E+O
4375      GOTO 2200
4380
4390      REM  TOPSIDE AND BELOW VOLUME ENTRY
4400      PRINT 'ENTER TOPSIDE VOL. AND BELOW VOL., SEPARATED BY COMMA';
4425      INPUT  M,X
4450       IF D(T,4)=0 GOTO 4600
4475       IF D(T,4)=M+X GOTO4600
4500  PRINT'TOTAL VOL. DOES NOT EQUAL SUM OF TOP & BEL. VOLS. ENTERED'
4525      PRINT'DO YOU WISH TO OVERWRITE CURRENT SUM OF';D(T,4);'(Y/N)';
4550      INPUT M$
4575      IF M$<>'N' GOTO 2200
4600      D(T,5)=M
4625      D(T,6)=X
4650      D(T,4)=M+X
4675      GOTO 2200
4680
4700    REM   PERCENTAGE WEIGHT AND VOLUME SPECIFICATIONS
4725     PRINT 'ENTER PERCENT TOPSIDE WEIGHT, IN DECIMAL FORM';
4750     INPUT P
4775           D(T,2)=INT((D(T,1)*P)+.5)
4800            D(T,3)=INT((D(T,1)*(1-P))+.5)
4825     PRINT 'ENTER PERCENT TOPSIDE VOLUME, IN DECIMAL FORM';
4850     INPUT Q
4875       D(T,5)=INT((D(T,4)*Q)+.5)
4900          D(T,6)=INT((D(T,4)*(1-Q))+.5)
4925     GOTO 2200
4930
4945     REM  PRINT OUT ONE SPECIFIC LINE 'T'
4950     PRINT A$(T);;;;D(T,1);D(T,2);D(T,3);D(T,4);D(T,5);D(T,6)
4975     GOTO 2200
4980
5225    REM   PRINT OUT ENTIRE ARRAY
5250     PRINT 'EQUIP.','TOT. WT.','TOP/BEL.','TOT. VOL.','TOP/BEL'
5252     PRINT
5275     FOR I=1 TO N
5300    PRINT '('I')'
5325   PRINT A$(I)TAB(16)D(I,1)TAB(31)D(I,2)"/"D(I,3)TAB(46)D(I,4)TAB(61);
5350   PRINT D(I,5)"/"D(I,6)
5352   PRINT
5375     NEXT I
```

```
5380        GOTO 2200
5400
5500      REM  TIME AND DATE WRITTEN INTO STORAGE
5525      SCRATCH #4
5530      SCRATCH #2
5534      SCRATCH #3
5550      D$=DAT$
5575      I$=CLK$
5600      PRINT #4,D$",";I$","
5601
5602    REM   PRINT ALL ARRAY D ELEMENTS INTO TRY
5604     FOR I=1 TO N
5606    PRINT #2,A$(I);","
5608   PRINT#3,D(I,1)",";D(I,2)",";D(I,3)",";D(I,4)",";D(I,5)","D(I,6)
5610     NEXT I
5615
5620    REM   DATA FOR VERTICAL AND HORIZONTAL BOUNDS
5624      DATA 6
5640
9999       END
#
```

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