The Force Level Automated Planning System (FLAPS) is a computer software package developed by Systems Control Technology Inc (SCT) for the United States Air Forces in Europe (USAFE). FLAPS applies powerful mathematical optimization algorithms, detailed mathematical models, and large data base files to automatically perform critical force planning functions for tactical air assets. Program overall design is aimed towards assisting force planning personnel usually found at Allied Tactical Operations Centers (ATOC) and Allied Tactical Air Forces (ATAF) command headquarters. This report documents the proof-of-concept system that was initially delivered to USAFE and, as a demonstration system, shows how modern mathematical optimization techniques and off-the-shelf computer systems can assist force planners in quickly generating operating plans with totally effective use of limited assets.
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SYSTEM (FLAPS)

FLAPS USER'S MANUAL

FEBRUARY 1986

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FLAPS GLOSSARY

AAA------------------- Antiaircraft Artillery
ACCESSIBLE NODE------- A node which can be reached directly from another node.
ACCESSIBLE NODES BOX-- A rectangular area containing all of the nodes which can be reached from a given node. Used by the DPA when building arcs.
ACO--------------------- Airspace Coordination Order
AGL---------------------- Altitude Above Ground Level
ALTG--------------------- An array containing the optimal altitude of an aircraft above the ground.
ALTS--------------------- An array containing the optimal altitude of an aircraft above sea level.
ARC---------------------- Path between two nodes
ATAF--------------------- Allied Tactical Air Forces
ATM---------------------- Air Tasking Messages
ATO---------------------- Air Tasking Order
ATOC--------------------- Allied Tactical Operations Center
CL3D--------------------- The 3-dimensional Clobber array
COMPASS CALL------------ Airborne non-lethal electronic combat system
COOKIE-CUTTER TEMPLATE- A circular uniform threat lethality model.
CONTOUR MAP------------- Graphic displays of terrain heights, flight altitudes, roughness, slope, or danger. Lines are plotted to show regions of equal value at set increments.
CORRIDOR---------------- A high probability-of-survival region created by applying threat suppression assets through which sorties will be routed.
DANGER------------------ A quantitative representation of the threat to a penetrating aircraft at a location. Mathematically, the negative of the natural logarithm of the combined probability of survival per second.
DCL--------------------- DEC Command Language
DEC---------------------- Digital Equipment Corporation
DIALOG AREA-------------- The part of the terminal screen where the user's commands are entered and data and messages from FLAPS are displayed.
DMA---------------------- Defense Mapping Agency
DOO---------------------- Daily Operations Order
DPA---------------------- Dynamic Programming Algorithm
DTED--------------------- Digital Terrain Elevation Data
EC------------------------ Electronic Combat
ENTRY LLTR NODE——— The first LLTR node an aircraft will encounter upon leaving a staging base.

ENVELOPE--------------- A region defining the maximum extent of a threat. Because of terrain masking and other factors, some areas of the envelope can contain no danger from that threat.

EVENT------------------- The numeration of points along a route where "something happened," such as a turn point or a change in threat status.

EW---------------------- Electronic Warfare

EW/GCI------------------- Early Warning/Ground Control Intercept Radar

EXIT LLTR NODE--------- The last LLTR node an aircraft will pass before crossing the FEBA.

FEBA--------------------- Forward Edge of Battle Area

FLAPS------------------- Force Level Automated Planning System Computer Program

GCI---------------------- Ground Control Intercept Area

ID---------------------- Identification, in FLAPS, ID usually refers to the alphabetic name of some data object.

INACTIVE LLTR NODE----- An LLTR node which is not available for use during the current planning cycle. The ACO determines which LLTR nodes are on and which are off.

INTERMEDIATE LLTR NODE Any LLTR node which is available for use during the current planning cycle, but which cannot be reached directly from a staging base and cannot directly access the FEBA.

LEG---------------------- A segment of a route between consecutive turn points.

LLTR--------------------- Low Level Transit Route

NATO--------------------- North Atlantic Treaty Organization

NODE--------------------- Significant route points which are joined together by the DPA to form arcs and then routes. Specifically, they are staging bases, LLTR points, and targets.

NODE INDEX--------------- A unique number corresponding to every active staging base, LLTR point, or target. They can be retrieved by showing the NLIS or NPOS arrays.

OCA---------------------- Offensive Counter Air

PA----------------------- Probability of Arrival of Penetrating Aircraft

PD----------------------- Probability of Destruction of Target Aircraft

PK----------------------- Probability of Kill of Penetrating Aircraft

PS----------------------- Probability of Survival of Penetrating Aircraft

PRIMARY COMMAND-------- A FLAPS command designed to be used by a
mission planner.

RCS ------------------- Radar Cross Section
ROZ ------------------- Restricted Operating Zone
SAM ------------------- Surface-to-Air Missile System
SCALAR --------------- A data structure containing only a
                     single element.
SCENARIO SPACE ------- The entire geographical region under
                     consideration during a FLAPS session.
SCL ------------------- Standard Conventional Load
SCT ------------------- Systems Control Technology, Inc.
SECONDARY COMMAND---- A FLAPS command designed to be used by
                     program developers. These will not
                     normally be used by mission planners.
STALE DATA ----------- Data generated using input parameters
                     or data bases that have since been
                     modified. (For example, routes
                     generated using the statespace before it
                     was modified.)
STAT ------------------- The array containing the current
                      statespace.
STATESPACE ----------- Eight-directional grid collapsed from
                     two or 3-dimensional dangers. Used to
                     determine cost of travel from one cell
                     to another.
STATESPACE CELL ------ A geographic and altitudinal region in
                     which the probability of surviving
                     threats has been quantified.
STOCHASTIC THREAT---- A mobile threat whose location is only
                     approximately known with time.
SWITCH ---------------- A data construct which provides the
                      FLAPS program with information about how
                      it is currently configured.
TAF ------------------- Tactical Air Forces
TAC ------------------- Tactical Air Command
TEKTRONIX 4115-B ----- The color graphics display for FLAPS.
TERRAIN FOLLOWING --- Air vehicle having constant clearance
                     over terrain.
TERRAIN MASKING------ Using the terrain to minimize danger.
TF ------------------- Terrain Following
THREAT MODEL ------- A data structure which contains generic
                    information about a specific type of
                    threat.
TH2D------------------ An array containing the 2-dimensional
                      Threat environment data.
TH3D------------------ An array containing the 3-dimensional
                      Threat environment data.
TOT------------------- Time on Target
TREE------------------- Optimum sequence of LLTR nodes from each
                      LLTR entry point to all LLTR nodes
                      accessible from it.
USAFE----------------- United States Air Forces Europe
VAX------------------- A line of 32 bit DEC computers
VAX 11/750 ---------------- VAX (DEC) computer upon which FLAPS runs.
VECTOR--------------------- A data structure which contains many elements.
VMS------------------------ An operating system for VAX computers
WAYPOINT------------------- A point on a route where one or more of the flight parameters change (for example, heading or altitude).
WILD WEASEL---------------- Airborne Lethal Defense Suppression Weapons System
WFZ------------------------- Weapons Free Zone
CHAPTER I
INTRODUCTION

The purpose of this document is to describe the use of the Force Level Automated Planning System (FLAPS) developed by Systems Control Technology, Inc. Chapter I describes the purpose of FLAPS. The rest of the user's manual is a detailed description of the operation of the program. Chapter II contains an overview of the FLAPS commands and instructions on how to get started using the program. Chapter III provides detailed instructions on the FLAPS commands. The FLAPS data bases are very extensive because of the large amount of information that is needed to do force level planning. Chapter IV describes these data bases. Chapter V describes a number of examples that will help the user in building and running scenarios. Three appendices are included at the end of the manual. Appendix A explains how to set up and run the FLAPS software on a Digital Equipment Corporation VAX computer. Appendix B explains how to recompile code. Appendix C explains how to build up the FLAPS files from scratch and contains listings of command files that either initialize one of the data bases or initialize the program.
It is the intent of this user's manual to provide USAF personnel with all the information they need to use FLAPS effectively. The overview in Chapter II and the example in Chapter VII are very helpful in illustrating how the program should be used. Chapters III and IV should be used as references to answer specific questions about command options or items in the databases. A user reading this manual for the first time should probably read Chapters II and VII thoroughly and only glance over Chapters III and IV. The user should be able to answer any questions that come up while reading Chapter VII by referring to Chapters II, III, and IV. In addition, the FLAPS program contains an extensive internal and on-line HELP feature. The user can use this feature to answer specific questions about FLAPS commands anytime during the execution of the program.
1.1 THE PURPOSE OF FLAPS

FLAPS is a stand-alone, proof-of-concept computer software package which automatically performs various force planning functions. The system has been designed to meet the requirements of USAFE planners operating in the central European theater. However, the models and data bases are flexible enough to allow the user to build scenarios anywhere in the world. The program is "stand-alone" in the sense that there are no automated interfaces to other existing computer systems or data bases. The user is responsible for preparing the data required to run FLAPS and to ensure that the data is in the proper format. The program is a "proof-of-concept" because it is not intended to be used operationally. Instead, FLAPS is a demonstration system which shows how modern mathematical optimization techniques and computer systems can assist planners in quickly generating operating plans which use limited assets in the most effective way possible.

1.1.1 The Force Planning Problem

Force planners, like those at a NATO ATOC, face a very complicated problem. The planner's overall objectives are stated in the Daily Operations Order (DOO) generated by the NATO ATAF. In particular, the planner must assign the available assets to targets specified in the DOO. Ultimately, the planner generates Air Tasking Orders (ATO's) and Air Tasking Messages (ATM's) that assign specific NATO attack aircraft to specific targets. ATO's and ATM's are issued to NATO support aircraft, in particular EW support aircraft and tankers. These aircraft are assigned to locations where they can support the penetrating attack aircraft.
Generating these ATO's and ATM's is complicated by many factors. First, the aircraft assets available to meet the objectives of the DOO are spread out over many staging bases. Each staging base has its own inventory of aircraft and weapons. When assigning assets from a particular staging base to a specific target, the planner must make sure that aircraft are available, that weapons appropriate to the target are available at the staging base, that the available aircraft can deliver those weapons, and that the target is within range of the aircraft. These constraints must be considered within the context of the Airspace Coordination Order (ACO), which restricts the way the penetrating aircraft can fly through friendly airspace.

In addition, the enemy threat must be considered to ensure that the assigned missions are survivable. In the 1985-1995 timeframe, and beyond, the fixed and mobile threats will be extremely dense, rapidly changing, and lethal. These threats must be considered and planned for if the penetrating aircraft are to safely reach their targets and return.

Fortunately, support aircraft are available which can reduce the capability of the threats and significantly increase the probability that the attack aircraft will safely complete their missions. The availability of these aircraft will affect the way the attack aircraft are assigned. In other words, the attack and support aircraft must be considered simultaneously if the total force is to be as effective as possible.
Finally, the planner is under time pressure to output the ATO's and ATM's. While data regarding the available assets and the locations of enemy threats are available, the planner may not have time to quantitatively analyze it. Without automated tools, gross approximations must be used.

I.1.2 The FLAPS Solution

Many of the problems discussed above are basically numerical. For example, the status of the force, i.e., the number of aircraft and weapons available at each staging base, is just a table of numbers. Performance data for attack aircraft, fuel flow, fuel capacity, etc., are available. Using these two data bases together, it is a straightforward process to determine if a target is within range of a particular staging base, and if the right type of weapon is available. While this is difficult and time consuming to do by hand, it is very simple to do on a computer. This is the approach used in FLAPS; data bases from multiple sources are integrated and data is processed in a way that systematically and quickly solves the planning problem.

The solution approach can be broken down into six steps. These steps are:

STEP 1 UPDATE THE DATA BASE.
STEP 2 DETERMINE STAGING BASE AND TARGET ACCESSIBILITY.
STEP 3 COMPUTE OPTIMAL INGRESS AND EGRESS ROUTES TO TARGETS.
STEP 4 ALLOCATE WEAPONS TO TARGETS.
STEP 5 ALLOCATE SUPPORT AIRCRAFT TO OPEN HIGH PROBABILITY OF SURVIVAL FLIGHT CORRIDORS.

(steps 3, 4, and 5 may be iterated)
STEP 6 OUTPUT ATO's.

The initial step (STEP 1) is to update the force status data, the current target list, the ACO, and the current threat status. Force status, target, and ACO data are stored in the FLAPS database and are used continuously in the remaining five steps. The threat data is processed into a large file called the statespace array (STAT). This array is a summary of the entire enemy threat laydown. It is constructed using detailed models of threat system capability together with an efficient terrain masking algorithm. The next step (STEP 2) is to search the prioritized target list and determine which staging bases are in range of each target, and which of those staging bases have weapons effective against that target. Staging bases which are in range and have appropriate weapons are said to be "accessible." Force status data is included in the accessibility calculations. This includes the current inventories of aircraft and weapons at each staging base.

Once the data bases (including the statespace) have been calculated and accessibility has been determined, the "optimal" ingress and egress flight paths are computed. This is STEP 3. Optimal routes are generated for every target from every staging base accessible to that target, and back. Route performance data is calculated for each route. This data includes the probability of survival and the number of aircraft required to attack the target to reach the minimum damage threshold. This data is calculated for each route.
Using the accessibility and route performance data, FLAPS determines which staging bases should be tasked to each target. This is the weapons allocation step, or STEP 4. In general, several staging bases may be within range of a given target. FLAPS searches the route performance data for each of these staging bases and determines which staging base is most appropriate. This staging base is then allocated to the target. This is done for each target, in order of priority, until either the supply of weapons or of aircraft is exhausted.

Optimal routes are generated using the statespace together with a very fast and efficient dynamic programming algorithm (DPA). Routes are optimal in the sense that no other path between the staging base and the target will have a higher probability of survival. The ability to quickly generate these optimal flight plans, and to change the lethality of the enemy threat laydown (to change the statespace) is what gives FLAPS its power.

Up to this point, no electronic combat (EC) suppression has been applied, therefore, the routes for the penetrating fighters will encounter significant threat danger. The initial set of routes between the staging bases and the targets are available to assist the planner in deciding where to put the available EC suppression assets. The planner applies the EC suppression assets using a color graphics terminal. Graphic displays and reports are available to help the planner determine where EC suppression is required and where it will be most effective. After the planner has determined where the EC suppression should be applied, FLAPS updates the statespace to reflect the effectiveness of the EC suppression against the threat. Then the optimal flight paths are recalculated. Typically, the routes will change in order to take advantage of
the "high probability of survival corridors" through the forward edge of battle area (FEBA) that the EC suppression assets have opened up. Again reports and graphic displays are available to show the planner how effective this allocation will be in improving the probability of survival for the penetrating fighters. The planner may try several types of EC suppression allocations. The best allocation of weapons to targets, and locations for the EC suppression assets can then be output in ATO format.

The routes generated by FLAPS may not be exactly the same as the routes that are eventually flown. These routes are planned at the squadron. However, the planner knows that the information contained in the ATO that he has issued will provide safe corridors for the attacking fighters. The squadrons will know the locations of these corridors and should take advantage of them. The planner also knows that routes exist to the assigned targets that are within range, and which take maximum advantage of the available EC suppression assets. In this way, the planner (using FLAPS) can quantitatively analyze the threat and generate an ATO which assigns appropriate weapons to as many targets as possible and which maximizes the probability of survival of the penetrating fighters. FLAPS is very fast and efficient. The planner can solve the planning problem in a relatively short amount of time. This allows the planners to use more up-to-date data, to concentrate more on strategy, and to spend less time on bookkeeping tasks.
I.2 THE STRUCTURE OF FLAPS

FLAPS is designed to solve the force planning problem in the way described above. FLAPS is a command driven, interactive program. The commands are described in Chapters II and III. The major commands are shown below together with the appropriate steps in the planning process. This table helps the user relate the commands he issues in FLAPS to the planning problem to be solved.

<table>
<thead>
<tr>
<th>STEP</th>
<th>COMMAND</th>
<th>FLAPS DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP 1:</td>
<td>ADD</td>
<td>Add new records to data base</td>
</tr>
<tr>
<td></td>
<td>DELETE</td>
<td>Delete old records from data base</td>
</tr>
<tr>
<td></td>
<td>CHANGE</td>
<td>Change records in data base</td>
</tr>
<tr>
<td></td>
<td>COPY</td>
<td>Duplicate records in data base</td>
</tr>
<tr>
<td></td>
<td>PROC</td>
<td>Initialize the statespace arrays</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Terrain mask the fixed threats</td>
</tr>
<tr>
<td>(The PROC command automatically processes the updated data bases through target allocation)</td>
<td>Add a threat to the statespace</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delete a threat from the statespace</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Optimize AGL clearance altitude</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Preprocess staging bases, targets, and LLTR points</td>
</tr>
<tr>
<td>STEP 2:</td>
<td></td>
<td>Compute staging base and target</td>
</tr>
<tr>
<td></td>
<td>Determine Accessibility</td>
<td>accessibility</td>
</tr>
</tbody>
</table>

I-9
STEP 1: Calculate ingress and egress route
Compute segments
Routes
STEP 2: Link path segments to LLTR network
STEP 4: Allocate weapons to targets
Allocate Weapons
STEP 5: SELECT Format a route for display and
Allocate analysis
Suppression
ANALYZE Compute threat exposure
LOCATE Graphically input suppressor location
SUPPRESS Calculate suppressor effectiveness
REROUTE Recalculate routes
RESTORE Remove suppressors from the
data base
STEP 6: SHOW TGUS List the best target allocation
Output ATO's data
I-10
I.3 OTHER FLAPS FEATURES

FLAPS has many other features which can help the user to effectively solve the force planning problem. The program has been designed to be easy to operate. At the same time, the program is a powerful and flexible force planning tool. Much of this power and flexibility comes from the large FLAPS data bases. FLAPS provides the force planner with the capability to examine all critical elements of the data bases either graphically, in tabular form, or both.

Many parts of the FLAPS data bases can be examined in tabular form using the SHOW command. This command is described in Chapters II and III. The data bases that can be examined with SHOW are described in Chapter IV. The user can examine all critical input and final output data. Input data includes the threat data, prioritized targets, force status data, and airspace coordination data. Final outputs include an ATO-like output. The FLAPS data bases also contain many useful intermediate results that are generated during the force planning process. These intermediate results can be very helpful to the user and can also be examined with the SHOW command.

Besides the tabular data produced by the SHOW command, FLAPS provides the ability to view the data bases and solutions graphically. This feature is discussed in Chapters II and III under the DISPLAY command.

FLAPS is intended to be "user friendly." On-line help is available at any time during program execution. Normally, the user asks for help only when it is needed. In this mode, HELP refreshes the user's memory by explaining a command or a specific suboption. Novice users may invoke a full-time help feature by
issuing the "HELP ON" command. This feature puts the user in a menu-like environment. While this slows down the program, it helps the user learn how to use FLAPS.

I.4 CONVENTIONS USED IN THIS MANUAL

This manual contains many examples that were taken directly from actual FLAPS runs. Generally, FLAPS prompts and outputs are typed in uppercase text. Descriptive text is typed in mixed (upper and lower) case text. User inputs are enclosed in < > brackets. Optional inputs are enclosed in ( ) parenthesis. This makes it clear what text is being issued by FLAPS and what information is being entered by the user.

Most FLAPS commands and suboptions must be typed and entered using the carriage return (RETURN, or <cr>) key. This includes all primary and secondary commands, and most suboptions. The exceptions are certain suboptions for the FIND, LOCATE, and MANUAL commands. The carriage return key is not used for these suboptions. Instead, the thumbwheels and the space bar <sp> are used to position the graphics cursor and input graphic data. In the examples, carriage returns are noted with a <cr> symbol. Carriage returns are shown for all user inputs that require a carriage return.

In the descriptions of the commands, quotes are used to indicate which strings must be input as shown.
In the examples, user inputs are typed in uppercase letters enclosed in brackets < >. However, FLAPS accepts either uppercase or lowercase inputs.

When entering locational coordinates, remember that FLAPS inputs must be in decimal degrees, longitude first and latitude second. Some FLAPS reports do provide output in latitude/longitude, degrees, minutes, and seconds.

Most of the will become very clear when the user actually runs the program. If the user is unclear about how to do something, he or she should try it on the computer. By referring to this manual, using the HELP command, and following the prompts, the user should be able to solve most problems. Good luck.
FLAPS is a command driven program. In order to run the program successfully, the user must be familiar with a number of important commands and their suboptions. Fortunately, the number of commands that the user must learn is small. This chapter is an overview to the FLAPS commands and is intended to help the user get started using the program. Detailed information about the FLAPS commands is contained in Chapter III. The user may find it helpful to go over the example in Chapter V after reading this chapter in order to see how the program responds to the commands described below.

Subsection II.1 describes the VAX/VMS commands that must be issued to run the program. While this information does not refer directly to the FLAPS software, it should help the first-time user run the program.

II.1 GETTING STARTED: RUNNING AND INITIALIZING FLAPS ON A VAX COMPUTER

The FLAPS program runs on Digital Equipment Corporation VAX computers running under the VAX/VMS operating system. The user wishing to run FLAPS should contact the systems manager of the VAX that hosts the program and arrange
access to an account with access to a FLAPS executable and FLAPS data files.
Information on how to install the FLAPS software on a VAX computer is contained in Appendix A. Information on how to initialize the FLAPS data bases is in Chapter III and Appendix C. The instructions below assume that the program has already been installed and the data bases have been initialized. Also note that different computer systems may be set up in different ways. If the user has difficulty logging into the VAX or in finding or accessing the FLAPS executable or data files, contact the system manager.

First the user must "log-in" to the VAX. This is normally done by hitting the carriage return (RETURN) key and waiting for the "USERNAME:" prompt to appear on the user's terminal. The user then enters their username and password. If the username and password are accepted, a welcome message appears followed by a dollar sign ($) prompt. Suppose that the user's username is "MINE" and the corresponding password is "WALLOW". The user would login as follows:

<cr>
Username: < MINE > <cr>
Password: < WALLOW > <cr>

$  

If a login is unsuccessful, the user can try to login again.
The user must now link to the directory or subdirectory that contains the desired FLAPS data file. The default directory must contain the data files and the user must have read/write access to these files. Setting the default directory is done using the VAX "SET DEFAULT" command. Suppose the user has logged into the account "MINE" and that the FLAPS data files of interest are in the subdirectory [MINE.DATA]. The user would enter the following command:

S < SET DEFAULT [MINE.DATA] > <cr>

Now, suppose the FLAPS executable is in the subdirectory [MINE.SOURCE] and that the executable is named FLAPS.EXE. Note that the executable does not need to be in the same directory as the data files and it typically is not. The executable is often kept separate from the data files for convenience. To run FLAPS, the user enters the following command:

S < RUN/NODEBUG [MINE.SOURCE]FLAPS.EXE > <cr>

Note that the normal user should not run the program in the debug mode. This is the reason for using the "RUN/NODEBUG" command.

At this point, the FLAPS executable is executed by the VAX. FLAPS writes out the current date and prompts the user as follows:

FLAPS -- DATE = 17-DEC-85 TIME = 12:14:06

Read in previous flaps files "Y"es or "N"o?: 
The normal user always answers "Y" to this question. After a YES ("Y") response, FLAPS automatically opens all necessary data files. This assumes that the data bases have been properly installed and initialized. Information on how to install and initialize the data bases is contained in Chapter III and in Appendices A through C. The names of the files that are opened are listed in the command file ZCONTNU.DAT. A typical version of this command file is listed in Appendix C. If the user wishes to open different files with different names, the file names in the ZCONTNU.DAT file must be changed (edited). The VAX file editors will not be discussed in this manual.

FLAPS can now be run. The user will be given a colon (:) prompt and may begin issuing commands. The most often used commands are discussed in the next subsection. All of the commands are discussed in detail in Chapter III.

To summarize, this is how the user would start up a FLAPS session, assuming that the file names are as given above:
Username: < MINE > <cr>
Password: < ALLOW > <cr>

(login message from the VAX)

S < SET DEF [MINE.DATAM > <cr>
S < RUN/NODEBUG [MINE.SOURCE]FLAPS.EXE > <cr>

FLAPS -- DATE = 17-DEC-85 TIME = 12:14:06

Read in previous flaps files "Y"es or "N"o?:

< Y > <cr>

(FLAPS open the data files)

(FLAPS is ready)
II.2 COMMAND OVERVIEW

The primary FLAPS commands are listed below:

<table>
<thead>
<tr>
<th>Command</th>
<th>Two Character Abbreviation</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>HELP</td>
<td>HE</td>
<td>Obtain help concerning commands or suboptions.</td>
</tr>
<tr>
<td>READ</td>
<td>RE</td>
<td>Read a command file.</td>
</tr>
<tr>
<td>QUIT</td>
<td>QU</td>
<td>Quit: Stop FLAPS execution and save the current results in the data bases.</td>
</tr>
<tr>
<td>ADD</td>
<td>AD</td>
<td>Add a record to a data base table.</td>
</tr>
<tr>
<td>DELETE</td>
<td>DE</td>
<td>Delete a record from a data base table.</td>
</tr>
<tr>
<td>CHANGE</td>
<td>CH</td>
<td>Change a record in a data base table.</td>
</tr>
<tr>
<td>SHOW</td>
<td>SH</td>
<td>Show a record from a data base table or show the contents of a data base array.</td>
</tr>
<tr>
<td>PROCESS</td>
<td>PR</td>
<td>Process all algorithms through target allocation, using the latest data bases.</td>
</tr>
<tr>
<td>DISPLAY</td>
<td>DI</td>
<td>Display the contents of the data bases on the graphical display.</td>
</tr>
<tr>
<td>FIND</td>
<td>FI</td>
<td>Find an object displayed on the display screen and show information from the data bases that relates to it.</td>
</tr>
<tr>
<td>MANUAL</td>
<td>MA</td>
<td>Manually generate a route to a target.</td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>SELECT</td>
<td>SE</td>
<td></td>
</tr>
<tr>
<td>ANALYZE</td>
<td>AN</td>
<td></td>
</tr>
<tr>
<td>LOCATE</td>
<td>LO</td>
<td></td>
</tr>
<tr>
<td>SUPPRESS</td>
<td>SU</td>
<td></td>
</tr>
<tr>
<td>ReRoute</td>
<td>RR</td>
<td></td>
</tr>
<tr>
<td>ReStore</td>
<td>RS</td>
<td></td>
</tr>
</tbody>
</table>

Select a route and store it in the SPED data base table.

Analyze a route from the SPED table for threat exposure.

Locate an EC suppression asset at a specific location or orbit point.

Compute the effects of the EC suppression assets on the statespace.

Re-calculate the attack aircraft routes using the suppressed statespace.

Restore the statespace and restore the original attack aircraft routes.

The user should be able to use FLAPS very effectively using only these seventeen commands. There is another group of commands, called the secondary commands, which are discussed in Chapter III along with the primary commands. The normal user should never have to use these commands and the user need not even read over those sections of Chapter III. However, the user should note that the secondary commands SAVE (SA) and SPAWN (SP) are quite handy.

II.3 A TYPICAL FLAPS SESSION

Most FLAPS sessions involve the user modifying the existing data bases, processing those changes, and then examining the results. For example, a user may run FLAPS and open the data files for a scenario in central Europe. The user may then add some new targets to the target list, delete some of the old targets, and update the status of the aircraft at the various staging bases. The user would then "process" these changes and generate a new plan for the attack aircraft. Next, the user would look at this plan to see how effective it
is against the target set. EC suppression assets could be used to help the attack aircraft penetrate through the FEBA. The user would put these assets in, process their effect, and then look at the new results to see how effective the EC assets were in suppressing the threats. A brief summary of how the user would use the primary FLAPS commands to work through such an example is described below.

First the user would log-into the VAX, set the default directory to the directory or subdirectory containing the files for the central European scenario, and then start the program. The user would open the existing files as described in Subsection II.1, and then issue a series of commands. The commands that the user would use to work through this problem are listed below. Note that the suboptions are not discussed in detail. The user may refer to Chapter 7 to see examples of the specific suboptions. This list is intended to help the user get a feel for what the primary commands do.

Commands for the Sample Session Described Above

<table>
<thead>
<tr>
<th>TASK</th>
<th>COMMAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add new targets to the target table.</td>
<td><strong>ADD</strong>: This command will add new records to the target (TG) table. The user will be prompted for the specific data that must be input.</td>
</tr>
<tr>
<td>Delete old targets from the target table.</td>
<td><strong>DELETE</strong>: This command will delete old records from the target (TG) table. The user will be prompted for the records that will be deleted.</td>
</tr>
<tr>
<td>Update the status of the staging bases.</td>
<td><strong>CHANGE</strong>: This command will change specific items in existing records of the staging base (STGB) table. The user will be prompted for the table, records, items, and new data.</td>
</tr>
</tbody>
</table>
Process these changes and generate a new attack aircraft plan.

PROC: This command will update the appropriate arrays and run the necessary algorithms to generate the new attack aircraft plan.

Display the new scenario, including the new targets.

DISPLAY: This command will display the new scenario. The user will be prompted for the options that he or she may display. In this example, the "H" (MISSION) option.

Examine the results.

SHOW: This command will allow the user to look at the attack aircraft plan and effectiveness data. The user will be prompted for the tables and arrays that he or she may show. In this example, the TGUS array is the relevant array.

Put the attack aircraft routes into the SPED table so that they can be displayed.

SELECT: This command will format the routes and add them into the SPED file. The user will be prompted for which specific routes he or she wishes to select. In this example, the user would select "ALL" of the routes.

Display the attack aircraft routes.

DISPLAY: This command allows the user to add things to the existing display. In this example, the user would select the "R" (ROUTE) option.

Put EC aircraft into the scenario.

LOCATE: This command allows the user to put EC aircraft at specific locations within the scenario. The user graphically inputs the position and indicates the type of the EC aircraft.

Display the EC aircraft locations.

DISPLAY: Again the user would add the suppressor locations to the existing display. The user would use the "SU" (SUPPORTER) option.

Compute the effects of the EC aircraft on the statespace.

SUPPRESS: This command automatically updates the statespace to account for the effects of defense suppression.
Display the effects of the EC aircraft on the statespace.

DISPLAY: Again, this command will update the current display. In this case, the user would select the "D" (DANGER CONTOUR) option.

Recompute the attack aircraft plan, using the suppressed statespace.

REROUTE: This command automatically recomputes the attack aircraft plan.

Show the new plan, select and display the new routes.

SHOW, SELECT, and DISPLAY as above.

Again, the user is referred to Chapter V for a more complete example.

The primary commands are discussed in more detail in the following subsections.

The format descriptions below use the notation conventions described in Chapter I. Recall that user input options are enclosed in <> brackets. These are inputs that the user must enter. Some options are not required but may be input if the user desires. These optional items are enclosed in () parentheses. All commands may be input in lowercase, even though the examples are typed in uppercase.
II.4 THE CONTROL COMMANDS

The control commands are HELP (HE), READ (RE), and QUIT (QU). These commands provide high level control over the program. The commands and their suboptions are described briefly below. The exact formats for the commands and their suboptions are described in detail in Chapter III.
II.4.1 HELP (HE): The HELP Command

FORMAT: "HE" <cr> or "HE" <*>"ON" or "OF" <cr>

EXAMPLES: HELP
            HE PR
            HE ON
            HE OF

The HELP command provides help to the interactive user. HELP does two things, depending on how it is used. If the user enters "HELP"<cr>, "HE"<cr>, or "?"<cr>, FLAPS will come back with a list of commands about which the user can get help. These suboptions are:

<table>
<thead>
<tr>
<th>SUBOPTION</th>
<th>TWO CHARACTER ABBREVIATION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABORT</td>
<td>(AB)</td>
<td>Exit from the help command</td>
</tr>
<tr>
<td>GENERAL HELP</td>
<td>(GE)</td>
<td>General help about FLAPS</td>
</tr>
<tr>
<td>PRIMARY COMMANDS</td>
<td>(PR)</td>
<td>A list and description of the primary commands</td>
</tr>
<tr>
<td>SECONDARY COMMANDS</td>
<td>(SE)</td>
<td>A list and description of the secondary commands</td>
</tr>
<tr>
<td>CURRENT PROCESSING STATUS</td>
<td>(ST)</td>
<td>A description of the status of the data bases.</td>
</tr>
</tbody>
</table>

The user exits from HELP by entering the "AB" (ABORT) suboption.
HELP can also be used to control the way FLAPS prompts users for information. Whenever the user enters a command that requires additional inputs, FLAPS prompts for the input. Normally these prompts are very brief. If a beginning user wants more detailed prompts then he or she may turn on the "help always" feature. This is done by typing: "HE ON" <cr> or "HELP ON" <cr>. The user will not see the normal HELP menu described above. However, the user will get a detailed prompt every time he or she inputs a command that requires additional inputs. The user types "HE OF" (HELP OFF) to turn off the "help always" feature.
II.4.2 READ (RE): The READ Command

FORMAT: "RE" <command file name> <"Y" or "N"> <cr>

EXAMPLE: RE DEMO.DAT Y

The READ command is used to read FLAPS command files and execute them. A command file is a VAX/VMS file which contains a list of FLAPS commands. Command files are typically used to input large amounts of data into the program (see Appendix C, for example). If the user enters "READ" <cr> or "RE"<cr>, FLAPS will prompt the user for the command file name. The user responds to this by simply typing in the name of the command file followed by a <cr>. FLAPS will then ask the user if he wants to watch the file being read in (ECHO). The user responds with either "Y" (yes) or "N" (no).
11.4.3 QUIT (QU): The QUIT Command

FORMAT: "QU" <cr>

EXAMPLE: QU

The QUIT command is used to exit the program. It is the only way to exit the program, other than pulling the plug on the computer.
II.5 THE DATA BASE COMMANDS

The data base commands ADD, DELETE, and CHANGE manipulate the data base tables in the FLAPS data bases. The SHOW command is used to show the contents of both data base tables and arrays.
II.5.1 ADD (AD): The ADD Command

FORMAT: "AD" <table name> <first item, second item, etc.> <cr>

EXAMPLE: AD THRT TH01 SA-11 12.00 55.00 20 1.0

The ADD command is used to add records to a data base table. The user is prompted for the table (TABLE NAME) that he or she wishes to add to. Then the user is prompted for data to fill the new record.
II.5.2 DELETE (DE): The DELETE Command

FORMAT: "DE" <table name> <id, or first, or only record number>
( <last record number>) <cr>

EXAMPLE: DE THRT TH01

The DELETE command deletes records from a data base table. The user is prompted for the table (TABLE NAME) that he or she wishes to delete from. Then the user is prompted for the_record, or range of records, that he or she wishes to delete.
II.5.3 CHANGE (CH): The CHANGE Command

FORMAT: "CH" <table name> <record id or record number> <item name>
<new data value or values> (<next item name>
<new data value or values>, etc.)
"/" <cr>

EXAMPLE: CH THRT TH01 ITYP SA-8 /

The CHANGE command changes the contents of records in a data base table. The user is prompted for the name of the table that he or she wishes to change, and the record id or record number (either may be used, whichever is more convenient for the user). Then the name of the item that the user wishes to change, and the new data value for the item. If the item is a vector, then the user may enter values for all elements of the vector. The user may then continue entering item names and new values until he or she wishes to stop. CHANGE is exited by typing a "/" <cr>.
III.5.4  SHOW (SH): The SHOW Command

FORMAT:  (For Tables)

"SH" <table name> (item name> item name> ect. "/")
<record id or first record number>
(last record number>) <cr>

(For Arrays)

"SH" <array name> <additional data as necessary> <cr>

EXAMPLES:  (For Tables)

SHOW THT RT TH01
SHOW RT ID ITYP / TH01
SHOW THT ID ITYP / 2 10

(For Arrays)

SHOW TGUS
SHOW ARPE CASLAV

The SHOW command is used to show the content of database tables and arrays. The user is prompted for the name of the thing he or she wishes to show. This is either a database table or array name.

If the user is showing the contents of a database table, the name (or names) of the item (or items) that he or she wishes to show, followed by a slash to complete the list may be entered. Then the user must enter in the id or record number of the record he or she wishes to show. If record numbers are used, the user may show a range of records by entering the first and last record number. Alternatively, if the user wants to show the entire contents of the table, he or she may skip the list of items and only enter the record id or range of record numbers.
If the user is showing the contents of a data base array, then the prompts are issued on a case by case basis. Many arrays require no additional data at all.
II.6 THE ALGORITHM AND DISPLAY COMMANDS

These are the PROCESS (PR), DISPLAY (DI), FIND (FI), and MANUAL (MA) commands. FIND and MAKE should only be used when working on a Tektronix 4115 or 4125 terminal.
II.6.1 PROCESS (PR): The PROCESS Command

FORMAT: "PR" <attack aircraft penetration altitude level> <cr>
EXAMPLE: PR 1

The process command processes the data bases through initial (pre-suppression) attack aircraft weapons allocation. The user must input the altitude level that he or she wishes to use. The altitude level refers to the levels contained in the ALGP table. Appropriate values for the altitude level are 1, 2, 3, 4, or 5. Other suboptions may be input, however these should not be used by the normal user.
II.6.2 DISPLAY (DI): The DISPLAY Command

FORMAT: (For Graphic Displays)
"DI" <display option> (<display option> <display option> ect.)
"/" (<suboptions as necessary>) <cr>

(For Scaling the Display)
"DI SC" <"SC" or "ST" or min-long, max-long, min-lat, max-lat> <cr>

EXAMPLE: (For Graphic Displays)

DI M /
DI M L D / TH3D 0.005 0.05 0.1 0.25 / 6 2

(For Scaling the Display)

DI SC ST
DI SC 13.5 15.0 58.0 59.0

The DISPLAY command is used for creating graphic displays and for scaling the display area for future displays. All display options may be seen in a very convenient form by typing help after being prompted for options.

The user is first asked to enter his or her desired options. To create a display, the user lists the options to be displayed, followed by a slash to end the list. Suboptions may be necessary. If this is the case, the user is prompted for these on a case by case basis.

If the user wishes to rescale the display, an "SC" (for SCALE) is entered. Then the user may input an "SC" (to rescale to the scenario), an "ST" (to rescale to the statespace), or a longitude and latitude window. The display is updated automatically.
II.6.3 FIND (FI): The FIND Command

FORMAT: "FI" <type of thing the user wishes to find> <cr>
<move cursor using thumbwheels> <sp>

EXAMPLE: FI TG <move cursor> <sp>

The FIND command is used to identify objects on the color graphics display. The user is prompted as to what the options are. At this time, it is possible to find Targets, Staging Bases, Threats, LLTR points, and general long/lat locations. Once the user is in graphics mode, many inputs can be made using single keystrokes. It is not necessary to enter a carriage return.
II.6. MANUAL (MA): The MANUAL Command

FORMAT: "MA" <cr> <additional inputs as required>

EXAMPLE: MA

The MANUAL command is used to manually create attack aircraft routes. The user is prompted as to what the options are. At this time, it is possible to create ingress and egress routes using a variety of options. Once the user is in graphics mode, many inputs can be made using single keystrokes. It is not necessary to enter a carriage return.
II.7 THE SUPPRESSION COMMANDS

The suppression commands are used to determine where EC threat suppression is needed, to locate (position) it in the scenario, and to compute its effects.
II.7.1 SELECT (SE): The SELECT Command

FORMAT: "SE" "ALL" <cr>

or

"SE" "/" <target ID> <staging base ID> <cr>

EXAMPLES: SE ALL

SE / CASLAV RAMSTEIN

The SELECT command causes one or more routes to be written to the SPED table. From the SPED table, the routes may be displayed or analyzed. If the user wants all routes in the current attack aircraft allocation to be written to the SPED table, he or she should enter "ALL". If the user only wants one particular route written to the SPED table, he or she should enter a "/", then the target ID (or index), and the staging base ID (or index). The individual route is taken from the "ROUT" array. A route must exist in the ROUT array before it can be selected.
II.7.2 ANALYZE (AN): The ANALYZE Command

FORMAT: "AN" <SPED table record ID, or record number> <cr>

EXAMPLES:
AN BITB.CASL.01
AN 2

The ANALYZE command is used to analyze a route from the SPED table for threat exposure. The user inputs either the ID or the record number of the SPED table record of interest. A detailed report on the survivability on that route and threat exposure is generated.
II.7.3 LOCATE (LO): The LOCATE Command

FORMAT: "LO" <cr> <move the cursor to the desired position, using thumbwheels> <sp> <suppressor type> <cr>
<suppressor id> <cr>

EXAMPLE: LO <move cursor> EF-111 EF-111.1

The LOCATE command is used to position EC threat suppression assets in the scenario. The user is prompted from the terminal to make graphic inputs. LOCATE creates records in the SUPP (Suppressor Position) table.
11.7.4 SUPPRESS (SU): The SUPPRESS Command

**FORMAT:** "SU" <"YES" or "NO"> <cr>

**EXAMPLE:** SU YES

The SUPPRESS command is used to calculate the effects of the EC suppression assets on the statespace. FLAPS calculates how many threats each suppressor will affect, and reports this to the user. The user is then asked whether or not he or she wishes to continue. If the user answers "YES", then FLAPS calculates the effects of the suppressors and degrades the statespace accordingly. If the user answers "NO", FLAPS does not continue and the colon (:) prompt is displayed for the next command. If the user feels that the suppressors will not have the desired effect, or that they have been misplaced (i.e., LOCATEd incorrectly), then the user may move them someplace else. The suppression effectiveness is based on the SUPM (Suppression Model) and SUPP (Suppression Position) tables.
II.7.5 REROUTE (RR): The REROUTE Command

FORMAT: "RR" <cr>

EXAMPLE: RR

The REROUTE command recalculates the attack aircraft plan after the EC suppression assets have been applied to the statespace. No additional user inputs are necessary. The user should only use the REROUTE command after inputting suppressor positions (LOCATE) and suppressing the statespace (SUPPRESS).
II.7.6 RESTORE (RS): The RESTORE Command

FORMAT: "RS" <cr>
EXAMPLE: RS

The RESTORE command restores the statespace to its pre-suppression value and recalculates the attack aircraft plan. This effectively restores the data bases to the way they were before EC suppression was applied. No additional user inputs are necessary. The user may then make modifications to the data bases and generate a new plan.
CHAPTER III
COMMANDS

The available FLAPS commands are described in this section. They are subdivided into two categories: primary and secondary commands. Primary commands are those which are most likely to be used by planners; secondary commands are those with which most planners are not concerned -- they are normally used by program developers. These two types of commands are described in detail in Subsections III.2 and III.3, respectively.

The beginning user reading this manual for the first time may skip this chapter entirely. After reading Chapters I and II the beginning user should go directly to Chapter V and study the example. This chapter is meant to be a reference to answer specific questions about commands and suboptions. Similarly, Chapter IV is meant to be a reference for the FLAPS data bases.

Note that the commands in this chapter are often referred to as two character keywords. The FLAPS user interface has been designed so that all commands and many suboptions can be entered using only two characters. Usually the minimum input is the first two characters of the "command word". For
example, instead of typing "PROCESS", the user could type "PR". There are some exceptions to this rule. For example, the "READ", "REROUTE", and "RESTORE" commands begin with "RE". In order to make the two-character commands unique, the "REROUTE" and "RESTORE" commands are executed by typing "RR" and "RS" respectively. The other exception is "DEBUG" which is executed by typing "DB". The two-character rule only applies to FLAPS commands and subcommands. Other inputs must be typed out in full. This includes data file names and data base record item names.

This Chapter is organized into three parts. Subsection III.1 describes the general help feature. Subsection III.2 describes the primary commands. This material is very similar to that covered in Chapter II, but is slightly more detailed. Subsection III.3 describes the secondary commands. The normal user should never have to use these commands. However, the SAVE (SA) and SPAWN (SP) commands are very handy.

III.1 GENERAL HELP

FLAPS provides extensive on-line help to the interactive user. The on-line help feature is described in detail in Section III.1.1. The following excerpt, which gives general information about entering commands, was obtained from the program. Additional help excerpts appear in this section of the manual as capitalized text.

FLAPS GENERAL HELP

THE USER MAY OBTAIN HELP EVERY TIME HE TYPES A <CR> BY TYPING THE COMMAND "HE ON"; OR HE MAY TURN THIS FEATURE OFF BY TYPING "HE OFF". CURRENTLY, THE SETTING IS HELP ON.

FLAPS COMMANDS MAY BE ISSUED BY TYPING SEVERAL ITEMS
ON THE SAME LINE FOLLOWED BY A <CR> (TYPE-AHEAD MODE),
OR BY TYPING EACH ITEM FOLLOWED BY <CR>, AND LETTING
FLAPS PROMPT FOR THE NEXT ITEM. FLAPS COMMANDS MAY BE
TYPED IN UPPER OR LOWER CASE. MOST FLAPS KEYWORDS MAY
EITHER BE ABBREVIATED TO 2 LETTERS OR TYPED IN FULL--
E.G. "SHOW" OR "SH".

TO ABORT ANY FLAPS COMMAND, TYPE "AB" OR "ABORT".

TO EXIT FROM THE HELP COMMAND, TYPE "AB"
TO GET GENERAL HELP TYPE "GE"
TO GET A LIST OF PRIMARY COMMANDS TYPE "PR"
TO GET A LIST OF SECONDARY COMMANDS TYPE "SE"
TO SEE THE CURRENT PROCESSING STATUS TYPE "ST"

If the user asks for general help (GE), the information printed above
will repeat. If the user asks for a list of the primary commands (PR), the
following message will be written to the terminal:

FLAPS PRIMARY COMMANDS

CONTROL COMMANDS:
HE OBTAIN HELP
RE READ COMMANDS FROM A FILE
QU QUIT FLAPS EXECUTION

DATA BASE COMMANDS:
AD ADD A RECORD TO THE DATA BASE
DE DELETE A RECORD FROM THE DATA BASE
CH CHANGE A RECORD IN THE DATA BASE
SH SHOW CONTENTS OR STRUCTURE OF DATA BASE

ALGORITHMS AND DISPLAY:
PR PROCESS ALL ALGORITHMS
DI PRODUCE A GRAPHICAL DISPLAY
FI FIND OBJECT IN GRAPHICAL DISPLAY
MA MANUALLY GENERATE A ROUTE

SUPPRESSION Commands:
SE SELECT ROUTE(S)
AN ANALYZE ROUTE
LO LOCATE SUPPRESSOR
SU APPLY SUPPRESSION
PR RE-Calculate ROUTE WITH SUPPRESSION
RS RESTORE ENVIRONMENT W/O SUPPRESSORS
These commands are discussed in detail in Subsection III.2.

If the user asks for a list of the secondary commands (SE), the following message will be written out to the terminal:

**FLAPS SECONDARY COMMANDS**

- OP OPEN AN ARRAY OR TABLE
- CO COPY RECORD WITHIN A TABLE
- DB SET DEBUG SWITCH
- DR DRAW A ROZ OR PFZ POLYGON
- IN INITIALIZE DATA BASE
- SA SAVE ALL FILES AND CONTINUE EXECUTION
- SP SPAWN A BATCH JOB
- PA SHOW CURRENT VALUES OF PARAMETERS

*THE FOLLOWING ARE THE INDIVIDUAL ALGORITHMS:*  
- GE CALCULATE GEOMETRY
- ST GENERATE STATESPACE
- NO CALCULATE NODES
- AC CALCULATE ACCESSIBILITY
- AR GENERATE OPTIMAL ARCS BETWEEN NODES
- RO ROUTES BETWEEN STAGING BASES, TARGETS
- AL ALLOCATE TIME WINDOWS TO ROUTES

These commands are discussed in detail in Subsection III.3.

If the user asks to see the current processing status (ST), a message like the following will be written to the terminal.

A "PR" COMMAND WILL EXECUTE ALL ALGORITHMS WHOSE STATUS IS BAD

<table>
<thead>
<tr>
<th>ALGORITHM</th>
<th>STATUS</th>
<th>ESTIMATED TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATESPACE</td>
<td>GOOD</td>
<td>TBD</td>
</tr>
<tr>
<td>NODES</td>
<td>GOOD</td>
<td>TBD</td>
</tr>
<tr>
<td>ACCESS</td>
<td>GOOD</td>
<td>TBD</td>
</tr>
<tr>
<td>ARCS</td>
<td>GOOD</td>
<td>TBD</td>
</tr>
<tr>
<td>ROUTES</td>
<td>GOOD</td>
<td>TBD</td>
</tr>
<tr>
<td>ALLOCATE</td>
<td>GOOD</td>
<td>TBD</td>
</tr>
</tbody>
</table>

III-4
The user exits from the help menu by typing "AB" (ABORT).
III.2 PRIMARY COMMANDS

The FLAPS primary commands are used frequently by the majority of FLAPS users. These commands are discussed briefly in Chapter II and in detail below. The example in Chapter V illustrates how the primary commands are used.

Remember that brackets < > enclose a set of input options of which the user must choose one. Parentheses ( ) enclose optional command parameters. Optional parameters are not required to execute the command initially but are needed to execute specific command functions. Double quote marks " " enclose alpha-numeric which the user types on the terminal to execute a command or suboption.

The FLAPS primary commands are listed below.

FLAPS PRIMARY COMMANDS

CONTROL COMMANDS:
- HE OBTAIN HELP
- RE READ COMMANDS FROM A FILE
- QU QUIT FLAPS EXECUTION

DATA BASE COMMANDS:
- AD ADD A RECORD TO THE DATA BASE
- DE DELETE A RECORD FROM THE DATA BASE
- CH CHANGE A RECORD IN THE DATA BASE
- SH SHOW CONTENTS OR STRUCTURE OF DATA BASE

ALGORITHMS AND DISPLAY:
- PR PROCESS ALL ALGORITHMS
- DI PRODUCE A GRAPHICAL DISPLAY
- FT FIND AN OBJECT GRAPHICALLY
- MA MANUALLY GENERATE A ROUTE

SUPPRESSION COMMANDS:
- SE SELECT ROUTE
- AN ANALYZE ROUTE
- LO LOCATE SUPPRESSOR
- SU APPLY SUPPRESSION
- RR RE-CALCULATE ROUTE WITH SUPPRESSION
- RS RESTORE ENVIRONMENT W/O SUPPRESSORS
III.2.1 HELP Command

FORMAT: "HE" or "?" ("AB" or "GE" or "PR" or "SE" or "ST") <cr>

or

"HE" ("ON" or "OF") <cr>

EXAMPLES: HE (Get general help and the help menu)
? (Get general help and the help menu)
HE ON (Turn on the permanent help feature)
HE ST (Get general help and the current status)

The HELP command provides help to the interactive user of FLAPS. The user may type "HE" <cr>, "HELP" <cr>, or "?" <cr> to display the general help message. This message is shown in Section III.1 above.

The user must then specify if he or she wishes further help. An "AB" (ABORT) response returns to the FLAPS command level; "GE" (GENERAL) repeats the general help message; "PR" (PRIMARY) and "SE" (SECONDARY) give a list of the primary and secondary commands, respectively; and "ST" (STATUS) provides the processing status as explained under the PROCESS command (Section III.2.8).

The user may also type ahead to get a list of the primary ("HE PR") or secondary ("HE SE") commands or see the current processing status ("HE ST").

The HELP command is also used to set or clear the global help variable. The user sets the global help variable to ON by typing "HE ON" <cr> and clears it (turns it OFF) by typing "HE OF" <cr>. When this variable is set to ON, the user is able to receive help messages whenever a reminder of the command syntax is needed. A help message is given after every carriage return. The help message will give a description of the user's options and their meanings. If
the global help variable is off, the user still receives some help in the form of a terse one-line prompt. If the user is in the middle of typing a command, the global help variable is off, and the user would like to display a full description of the options, it may be obtained by typing "HE" <cr>, "HELP" <cr>, or "?" <cr>.
III.2.2 READ Command

FORMAT: "RE" <command file name> <"Y" or "N"> <cr>

EXAMPLE: RE ZDEMO Y (Read the command file ZDEMO.DAT and echo the command lines back to the terminal)

The READ command is used to read commands from a file, rather than typing them in interactively. After typing "RE" (READ), the user will be prompted to enter the name of the command file. The prompt looks like this:

CRREAD-FILE:
ENTER NAME OF COMMAND FILE TO BE READ
FILENAME:

The user then types the name of the command file. Next, the user must specify whether the commands read from the file are to be echoed on the terminal. This requires a yes or no answer. The prompt looks like this:

CRREAD-ECHO:
ENTER "YES" IF COMMANDS ARE TO BE ECHOED ON YOUR TERMINAL; OTHERWISE, ENTER "NO"
ECHO--"YES" or "NO":

Command files are normally used for data base initialization. These files are created using the VAX text editor. A naming convention has been established for FLAPS command files. Command files normally begin with a "Z" and end with the "DAT" suffix. The user may give a command file an name, but the "Z" and "DAT" convention helps to avoid confusion between the command files and the other FLAPS data base files. For example, "ZDEMO.DAT" is the standard
scenario initialization file. The ".DAT" suffix is a FLAPS default, therefore it is unnecessary to enter the filetype ".DAT".

Command files are usually the easiest way to enter large volumes of data into the program. The typical command file, like ZDEMO, is a large collection of ADD commands. The ADD commands for the threats, targets, staging bases, and LLTR nodes are all listed in the "ZDEMO.DAT" file. Changes to the database may also be made using command files and the DELE, ADD, and CHAN commands. A number of important command files are contained in the appendices of this manual.
III.2.3 QUIT Command

FORMAT: "QU" <cr>

EXAMPLE: QU (End the current FLAPS session)

The QUIT command is used to terminate the execution of FLAPS. All of the data base files are stored on disk when QUIT is executed. The next time a FLAPS session is begun using these files (i.e., from the same default directory or subdirectory), the user where he or she left off when the QUIT command was issued.
III.2.4 ADD Command

FORMAT: "AD" <table name> <table specific items> <cr>

EXAMPLE: AD THRT TB01 SA-11 13.0 55.0 20 1.0 (Add a record to the THRT table.)

The ADD command is used to add a record to the data base. First the user or command file must specify the table name. The prompt has the following form:

CRADD -TABL:
ENTER NAME OF TABLE TO BE MODIFIED:

<table>
<thead>
<tr>
<th>NAME</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALGP</td>
<td>ALGORITHM PARAMS</td>
</tr>
<tr>
<td>Curr</td>
<td>CURRENT STATUS</td>
</tr>
<tr>
<td>LLTR</td>
<td>LLTR NODE PARAMETERS</td>
</tr>
<tr>
<td>ROZ</td>
<td>RESTRICTED OPERATING ZONES</td>
</tr>
<tr>
<td>STCH</td>
<td>STOCHASTIC REGIONS</td>
</tr>
<tr>
<td>STGB</td>
<td>STAGING BASE PARAMS</td>
</tr>
<tr>
<td>SUMP</td>
<td>SUPPRESSION MODELS</td>
</tr>
<tr>
<td>SUPP</td>
<td>SUPPRESSOR TYPE</td>
</tr>
<tr>
<td>SWCH</td>
<td>VARIOUS SWITCHES</td>
</tr>
<tr>
<td>TG</td>
<td>TARGET PARAMS</td>
</tr>
<tr>
<td>THRT</td>
<td>THREAT LOCATIONS</td>
</tr>
<tr>
<td>TMDL</td>
<td>THREAT MODELS</td>
</tr>
<tr>
<td>VEHF</td>
<td>VEHICLE PARAMETERS</td>
</tr>
<tr>
<td>WPZ</td>
<td>WEAPON FREE ZONES</td>
</tr>
</tbody>
</table>

The user is then prompted to enter the information that goes into the new record. The information will go into scalar and vector items. A scalar item consists of a single entry, like the record ID. A vector item contains multiple entries. For each scalar item (size = 1) in the table, the value of the item in the new record must be specified:

III-12
CRADD -VALU:

ENTER VALUE FOR ITYP IN TABLE THRT
FORMAT =CH08
DESCRIPTION=THREAT TYPE
OR ENTER "/" TO FILL REST OF RECORD WITH 0
ITYP( 1) FMT=CH08, SIZE= 1

For each vector item (size > 1) in the table, the value for each element of the item in the new record must be specified:

CRADD -VALU:

ENTER VALUE FOR XTH ( 2) IN TABLE THRT
FORMAT =REAL, SIZE= 3
DESCRIPTION=GEOD LON, LAT, ELE OF DEF
OR ENTER "/" TO FILL REST OF XTH WITH 0
XTH ( 2) FMT=REAL, SIZE= 3

The effect of a slash ("/") is different if entered in response to a scalar or a vector item. If entered in response to a scalar item, a slash causes the rest of the record to be filled with zeroes, and the record to be entered into the data base. If entered in response to a vector item, a slash causes the remaining elements of the item to be filled with zeroes and proceeds to the next item in the table.
III.2.5 DELETE Command

FORMAT: "DE" <table name> <record ID or record number or first record number>
(last record number) <cr>

EXAMPLES: DE THRT TH01 (Delete the THRT record ID TH01)
DE THRT 2 (Delete the THRT record no. 2)
DE THRT 10 15 (Delete the THRT records numbers 10 through 15)

The DELETE command is used to delete one or more records from the data base. First the user or command file must specify the table. The prompt looks like this:

CRDELE-TABL:

ENTER NAME OF TABLE TO BE MODIFIED:

<table>
<thead>
<tr>
<th>NAME</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALGP</td>
<td>ALGORITHM PARAMS</td>
</tr>
<tr>
<td>CURR</td>
<td>CURRENT STATUS</td>
</tr>
<tr>
<td>LLTR</td>
<td>LLTR NODE PARAMETERS</td>
</tr>
<tr>
<td>ROZ</td>
<td>RESTRICTED OPERATING ZONES</td>
</tr>
<tr>
<td>STCH</td>
<td>STOCHASTIC REGIONS</td>
</tr>
<tr>
<td>STGB</td>
<td>STAGING BASE PARAMS</td>
</tr>
<tr>
<td>SUPM</td>
<td>SUPPRESSION MODELS</td>
</tr>
<tr>
<td>SUPP</td>
<td>SUPPRESSOR TYPE</td>
</tr>
<tr>
<td>SWCH</td>
<td>VARIOUS SWITCHES</td>
</tr>
<tr>
<td>TG</td>
<td>TARGET PARAMS</td>
</tr>
<tr>
<td>THRT</td>
<td>THREAT LOCATIONS</td>
</tr>
<tr>
<td>TMDL</td>
<td>THREAT MODELS</td>
</tr>
<tr>
<td>VEHF</td>
<td>VEHICLE PARAMETERS</td>
</tr>
<tr>
<td>VFZ</td>
<td>WEAPON FREE ZONES</td>
</tr>
</tbody>
</table>

TABLE NAME:
Then the record or range of records to be deleted must be specified:

**CRDELE-RCID:**

ENTER ID OR RECORD NUMBER FOR A SINGLE RECORD IN THRT
OR ENTER STARTING AND ENDING RECORD NUMBERS SEPARATED BY SPACE OR COMMA FOR A RANGE OF RECORDS
RECI "to" REC2 or IDWORD:
III.2.6 CHANGE Command

FORMAT: "CH" <table name> <record ID or record number> <item name> <new data value or values> (<next item name> <new data value or values>, etc.) "/" <cr>

EXAMPLE: CH THRT 5 XTH SU 25.0 / (Change THRT record 5 so that the threat antenna is located 25.0 meters above the terrain.)

The CHANGE command is used to change a record to the data base. First the user or command file must specify the table name. The prompt looks like this:

CRCHAN-TABL:

ENTER NAME OF TABLE TO BE MODIFIED:

<table>
<thead>
<tr>
<th>NAME</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALGP</td>
<td>ALGORITHM PARAMS</td>
</tr>
<tr>
<td>CURR</td>
<td>CURRENT STATUS</td>
</tr>
<tr>
<td>LLTR</td>
<td>LLTR NODE PARAMETERS</td>
</tr>
<tr>
<td>ROZ</td>
<td>RESTRICTED OPERATING ZONES</td>
</tr>
<tr>
<td>STCH</td>
<td>STOCHASTIC REGIONS</td>
</tr>
<tr>
<td>STGB</td>
<td>STAGING BASE PARAMS</td>
</tr>
<tr>
<td>SUPM</td>
<td>SUPPRESSION MODELS</td>
</tr>
<tr>
<td>SUPP</td>
<td>SUPPRESSOR TYPE</td>
</tr>
<tr>
<td>SWCH</td>
<td>VARIOUS SWITCHES</td>
</tr>
<tr>
<td>TG</td>
<td>TARGET PARAMS</td>
</tr>
<tr>
<td>THRT</td>
<td>THREAT LOCATIONS</td>
</tr>
<tr>
<td>TMDL</td>
<td>THREAT MODELS</td>
</tr>
<tr>
<td>VEBP</td>
<td>VEHICLE PARAMETERS</td>
</tr>
<tr>
<td>WPZ</td>
<td>WEAPON FREE ZONES</td>
</tr>
</tbody>
</table>

TABLE NAME:
Next the record to be changed must be specified:

CRCHAN-RCID:

ENTER EITHER ID OR RECORD NUMBER FOR RECORD IN THRT RECORD NUMBER or NAME:

Then the name of the next item to be changed must be specified:

CRCHAN-ITEM:

ENTER NEXT ITEM OR "/" IF ALL CHANGES HAVE BEEN MADE.

LUN NAME LREC MXRC NREC NITM IPTR TITLE
85 THRT 9 200 53 6 251 THREAT LOCATIONS

NAME TYPE SIZE LOC TITLE
ID CHO4 1 1 THREAT ID
ITYP CHO8 1 2 THREAT TYPE
XTH REAL 3 4 GEOD LON, LAT, ELE OF DEF
PEX REAL 1 7 PROBABILITY THREAT EXISTS

ITEM NAME or "/":

Depending on which item was specified, the information will go into scalar or a vector item. A scalar item consists of a single entry, like the record ID. A vector item contains multiple entries. If the item is a scalar (size=1) then its new value must be specified:

CRCHAN-VALU:

ENTER VALUE FOR ITYP IN TABLE THRT
FORMAT =CHO8
DESCRIPTION=THREAT TYPE
CURRENT VALUE=BIGGIE
ITYP(1) FMT=CHO8, SIZE=1

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If the item is a vector (size > 1), then the values for each element must be specified, starting with the first element. After entering values for the first element (or the first few elements), the user may type a "/" so that the remaining elements in the vector will be left unchanged. Alternatively, by typing "SU", the subscript for the first element to be changed may be selected:

CRCHAN-VALU:

ENTER VALUE FOR XTH ( 1) IN TABLE THRT
FORMAT =REAL, SIZE= 3
DESCRIPTION=GEOD LON, LAT, ELE OF DEF
CURRENT VALUE= 1.3000E-01
OR ENTER "/" TO LEAVE REST OF XTH UNCHANGED
OR SU TO RESET SUBSCRIPT
XTH ( 1) FMT=REAL, SIZE= 3

If "SU" was selected, then the subscript must be specified:

CRCHAN-SUBS:

ENTER NEW SUBSCRIPT--CURRENTLY= 1, MAX= 3
STARTING POSITION IN ARRAY:

Once all changes have been entered, the user must type "/" to write the modified record to the data base.
III.2.7 SHOW Command

FORMAT: (For Tables)

"SH" <table name> (<item name> <item name> etc. "/")
   <record id or record number or first record number>
   (<last record number>) <cr>

(For Arrays)

"SH" <array name> <additional data as necessary> <cr>

EXAMPLES: (For Tables)

SH TG LEGNICA
SH LLTR 2 4
SH ALGP DELE DELN / 2

(For Arrays)

SH NPOS
SH ARCS LEIPZIG S123

The SHOW command shows selected portions of the data base on the user's terminal. The user must first specify which table or array is desired.

CRSHOW-NAME:

ENTER "PLAN" TO SHOW FLIGHT PLAN
OR ENTER 4-CHARACTER TABLENAME,
OR TA TO SHOW STRUCTURES OF TABLES:

<table>
<thead>
<tr>
<th>NAME</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALGP</td>
<td>ALGORITHM PARAMS</td>
</tr>
<tr>
<td>CURR</td>
<td>CURRENT STATUS</td>
</tr>
<tr>
<td>LLTR</td>
<td>LLTR NODE PARAMETERS</td>
</tr>
<tr>
<td>ROZ</td>
<td>RESTRICTED OPERATING ZONES</td>
</tr>
<tr>
<td>STCH</td>
<td>STOCHASTIC REGIONS</td>
</tr>
<tr>
<td>STGB</td>
<td>STAGING BASE PARAMS</td>
</tr>
<tr>
<td>SUPM</td>
<td>SUPPRESSION MODELS</td>
</tr>
<tr>
<td>SUPP</td>
<td>SUPPRESSOR TYPE</td>
</tr>
<tr>
<td>SWCH</td>
<td>VARIOUS SWITCHES</td>
</tr>
<tr>
<td>TG</td>
<td>TARGET PARAMS</td>
</tr>
<tr>
<td>THRT</td>
<td>THREAT LOCATIONS</td>
</tr>
</tbody>
</table>

III-19
TABLE NAME:

OR ENTER 4-CHARACTER ARRATNAME,
OR AR TO SHOW STRUCTURE OF ARRAYS:

<table>
<thead>
<tr>
<th>NAME</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARCS</td>
<td>ARC WAYPOINT ARRAY</td>
</tr>
<tr>
<td>ARPE</td>
<td>TARG INGRESS/EGRESS PERF</td>
</tr>
<tr>
<td>ITGC</td>
<td>TARG ACCESSIBLE TO STGB</td>
</tr>
<tr>
<td>ITRC</td>
<td>TREX ACCESSIBLE TO TREN</td>
</tr>
<tr>
<td>NBOX</td>
<td>LIST OF TG BOX CORNERS</td>
</tr>
<tr>
<td>NLIS</td>
<td>LIST OF NODES</td>
</tr>
<tr>
<td>NPOS</td>
<td>NODE POSITIONS</td>
</tr>
<tr>
<td>ROUT</td>
<td>ROUT NODES DIST AND PERF</td>
</tr>
<tr>
<td>SXPE</td>
<td>STGB TO LLTR EXIT PERF</td>
</tr>
<tr>
<td>TGUS</td>
<td>TARGET STATUS ARRAY</td>
</tr>
<tr>
<td>TRPE</td>
<td>LLTR TREE PERFORMANCE</td>
</tr>
</tbody>
</table>

ARRATNAME or TABLENAME:

In the case of a table, the user may either specify individual items to be shown or request that all items in one or more records be shown:

CRSHOW-OPTN:

TO SHOW 1 OR MORE ENTIRE RECORDS:

ENTER ID OR RECORD NUMBER FOR A SINGLE RECORD IN THRT
OR ENTER STARTING AND ENDING RECORD NUMBERS SEPARATED BY SPACE OR COMMA FOR A RANGE OF RECORDS

OR TO SHOW SELECTED ITEMS, TYPE 1ST ITEMMNAME:

<table>
<thead>
<tr>
<th>LUN</th>
<th>NAME</th>
<th>LREC</th>
<th>MREC</th>
<th>NREC</th>
<th>NITM</th>
<th>IPTR</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>THRAT</td>
<td>9</td>
<td>200</td>
<td>52</td>
<td>6</td>
<td>251</td>
<td>THREAT LOCATIONS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CH04</td>
<td>1</td>
<td>1</td>
<td>THREAT ID</td>
</tr>
<tr>
<td>TYP</td>
<td>CH06</td>
<td>1</td>
<td>2</td>
<td>THREAT TYPE</td>
</tr>
<tr>
<td>XTH</td>
<td>REAL</td>
<td>3</td>
<td>4</td>
<td>GEOD LON, LAT, ELE OF DEF</td>
</tr>
<tr>
<td>PEX</td>
<td>REAL</td>
<td>1</td>
<td>7</td>
<td>PROBABILITY THREAT EXISTS</td>
</tr>
</tbody>
</table>

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If individual items are desired, then their names must be entered, terminated by a slash and then the record or range of records must be specified:

CRSHOW-ITEM:

ENTER NEXT ITEM OR "/" IF ALL ITEMS HAVE BEEN SELECTED

LUN NAME LREC MXRC NREC NITM IPTR TITLE

85 THRT 9 200 52 6 251 THREAT LOCATIONS

NAME TYPE SIZE LOC TITLE

ID CH04 1 1 THREAT ID
ITYP CH08 1 2 THREAT TYPE
XTH REAL 3 4 GEOD LON, LAT, ELE OF DEF
PEX REAL 1 7 PROBABILTY THREAT EXISTS
IDC INT 1 8 RECORD CREATION DATE
IDM INT 1 9 RECORD MODIFICATION DATE

ITEMNAME or "/":

CRSHOW-RCID:

ENTER ID OR RECORD NUMBER FOR A SINGLE RECORD IN THRT
OR ENTER STARTING AND ENDING RECORD NUMBERS SEP-ARATED BY SPACE OR COMMA FOR A RANGE OF RECORDS
RECI "to" REC2 or IDWORD:

If an array is chosen, then more information may have to be specified.

For the ARCS array, the target and LLTR must be specified:

PROMID-RCID:

ENTER ID OR INDEX OF TGT
OR "/" TO ABORT COMMAND--HEY WHY NOT JUST "AB"?
TGT ID, INDEX, or /

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PROMID-RCID:
ENTER ID OR INDEX OF LLTR
OR "/" TO ABORT COMMAND—HEY WHY NOT JUST "AB"?
LLTR ID, INDEX, or /

For the ARPE, ITGC, ROUT and SXPE arrays, the target(s) have to be specified:

PROMID-RCID:
ENTER ID OR IDX OF TGT
OR "/" TO ABORT COMMAND—HEY WHY NOT JUST "AB"?
OR "ALL" FOR ALL TGT TGT ID, INDEX, ALL, OR /

For the ITRC and TRPE arrays, the LLTR(s) have to be specified:

PROMID-RCID:
ENTER ID OR INDEX OF LLTR
OR "/" TO ABORT COMMAND—HEY WHY NOT JUST "AB"?
OR "ALL" FOR ALL LLTR LLTR ID, INDEX, ALL, OR /

For PLAN, the route(s) have to be specified:

PRINT -RCID:
ENTER EITHER ID OR RECORD NUMBER FOR RECORD IN SPED SPED FILE ID, OR RECORD :

For NBOX, NLIS, NPOS and TGUS, no additional parameters need to be specified.
III.2.8 PROCESS Command

FORMAT: "PR" <clearance altitude> <cr>

or

"PR" <"IN" or "GE" or "ST" or "NO" or "AC" or "AR" or "RO" or "AL" > <cr>

EXAMPLE: PR 3

The PROCESS command causes all of the following algorithms to be executed as required:

GEOMETRY
STATESPACE CLEAR, MASK, ADD AND AOPT
NODES
ACCESS
ARCS
ROUTES
ALLOCATE

The item, IPRO, in the CURR table keeps track of which of the above algorithms need to be executed. The value of this item is increased on a successful PROCESS command so that the algorithms will not have to be executed again. The value of this item is decreased when an ADD, COPY, CHANGE or DELETE command affects one or more of these algorithms. In order to see which algorithms need to be executed, type "HE ST":

A "PR" COMMAND WILL EXECUTE ALL ALGORITHMS WHOSE STATUS IS BAD

<table>
<thead>
<tr>
<th>ALGORITHM</th>
<th>STATUS</th>
<th>ESTIMATED TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATESPACE</td>
<td>BAD</td>
<td>TBD</td>
</tr>
<tr>
<td>NODES</td>
<td>BAD</td>
<td>TBD</td>
</tr>
<tr>
<td>ACCESS</td>
<td>BAD</td>
<td>TBD</td>
</tr>
<tr>
<td>ARCS</td>
<td>BAD</td>
<td>TBD</td>
</tr>
<tr>
<td>ROUTES</td>
<td>BAD</td>
<td>TBD</td>
</tr>
<tr>
<td>ALLOCATE</td>
<td>BAD</td>
<td>TBD</td>
</tr>
</tbody>
</table>

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Note that the estimated times in the above excerpt are all "to be determined" (TBD). The current version of the program does not have the necessary code to estimate the times. It is our intention to enhance the FLAPS program to include rough estimates of the CPU time involved.

If the PROCESS command causes the statespace algorithms to be executed, then the optimization altitude must be specified:

STATES-AOPT:

ENTER 1 TO FLY PENETRATORS AT 60. M.
ENTER 2 TO FLY PENETRATORS AT 120. M.
ENTER 3 TO FLY PENETRATORS AT 180. M.
ENTER 4 TO FLY PENETRATORS AT 240. M.
ENTER 5 TO FLY PENETRATORS AT 300. M.

ALTITUDE OPTIMIZATION LEVEL:

There is an alternate method for issuing the PROCESS command, with which planners need not be concerned. If for some reason, the user does not wish to process all the algorithms from statespace to allocate, the PROCESS command may be entered along with an algorithm name as the second parameter.

<table>
<thead>
<tr>
<th>COMMAND</th>
<th>EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PR IN</td>
<td>Process initialization</td>
</tr>
<tr>
<td>PR GE</td>
<td>Initialization + geometry (if required)</td>
</tr>
<tr>
<td>PR ST</td>
<td>Initialization + geometry + statespace (as required)</td>
</tr>
<tr>
<td>PR NO</td>
<td>Initialization + geometry + statespace + nodes (as required)</td>
</tr>
<tr>
<td>PR AC</td>
<td>Initialization + geometry + ... + access (as required)</td>
</tr>
<tr>
<td>PR AR</td>
<td>Initialization + geometry + ... + arcs (as required)</td>
</tr>
<tr>
<td>PR RO</td>
<td>Initialization + geometry + ... + routes (as required)</td>
</tr>
<tr>
<td>PR AL</td>
<td>Initialization + geometry + ... + allocate (as required)</td>
</tr>
</tbody>
</table>
### III.2.9 DISPLAY Command

**FORMAT:**

(For Displays)

"DI" <options as desired> "/"  
<suboptions as necessary> <cr>

(For Scaling)

"DI" "SC" <"SC" or "ST" or min-lon max-lon min-lat max-lat> <cr>

**EXAMPLES:**

DI M WF RO /
DI WF- RO- D C / ALL STAT D 5
DI SC ST
DI SC 13.5 15 58 59.0

The DISPLAY command scales and draws displays on a graphical device. The item, IDEV, in the CURR table determines which device — for planners this item will be set to "4115", so that displays will be drawn on the Tektronix 4115B. Other possible settings include: SEL (Selenar Board), PTX (Printronix), CRT (24 x 80 alphanumeric). To change the device, it is necessary to issue a CHANGE command (Section III.2.6) before the DISPLAY command.

The user must first either select a set of graphical options to be displayed, or type "SC" to indicate that the display is to be re-scaled. The prompt looks like this:
DISPLY-OPTN:

ENTER "SC" TO SCALE PLOTTING WINDOW
OR "/" TO DRAW GRAPH
OR NEXT SYMBOL TO TURN ON AN OPTION
OR SYMBOL FOLLOWED BY "/" TO TURN OFF OPTION
OR "?" TO TURN OFF ALL OPTIONS
SYMBOL STATUS DEFINITION

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>STATUS DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ALTITUDE CONTOURS</td>
</tr>
<tr>
<td>AB</td>
<td>ARCS</td>
</tr>
<tr>
<td>B</td>
<td>BOUNDARY OF GPWC WINDOW</td>
</tr>
<tr>
<td>C</td>
<td>ON THREAT CIRCLES</td>
</tr>
<tr>
<td>D</td>
<td>ON DANGER CONTOURS</td>
</tr>
<tr>
<td>E</td>
<td>ON ENVELOPES</td>
</tr>
<tr>
<td>G</td>
<td>ON GRID LINES</td>
</tr>
<tr>
<td>I</td>
<td>ON INDEXES</td>
</tr>
<tr>
<td>L</td>
<td>ON LONGITUDE/LATITUDE</td>
</tr>
<tr>
<td>LL</td>
<td>LLTRS</td>
</tr>
<tr>
<td>M</td>
<td>ON MISSION (BDRY + NODES)</td>
</tr>
<tr>
<td>MA</td>
<td>MASKING</td>
</tr>
<tr>
<td>RO</td>
<td>ON ROUTES</td>
</tr>
<tr>
<td>RZ</td>
<td>ON ROZS</td>
</tr>
<tr>
<td>ST</td>
<td>ON STAGING BASES</td>
</tr>
<tr>
<td>SU</td>
<td>ON SUPPRESSION CIRCLES</td>
</tr>
<tr>
<td>TG</td>
<td>ON TARGETS</td>
</tr>
<tr>
<td>V</td>
<td>ON CONTROL VECTORS</td>
</tr>
<tr>
<td>VF</td>
<td>ON VFZS</td>
</tr>
</tbody>
</table>

CHOOSE OPTIONS or SCALE:

If "SC" was selected, the user must specify whether the graphical display is to cover the entire scenario, the statespace or a specified longitude-latitude region. If the latter case is chosen, the value for the minimum longitude (in decimal degrees) is entered:

PLSCAL-LON1:

ENTER SC TO SET DISPLAY WINDOW TO ENTIRE SCENARIO
OR ST TO SET WINDOW TO ENTIRE STATESPACE
OR ENTER MINIMUM LONGITUDE IN DEGREES
"ST"ATESPACE,"SC"ENARIO or MIN-LONGITUDE:

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If a minimum longitude was selected, then the other 3 edges of the longitude-latitude region must be specified:

**PLSCAL-LON2:**
ENTER MAXIMUM LONGITUDE OF WINDOW IN DEGREES
MAX-LONGITUDE:

**PLSCAL-LAT1:**
ENTER MINIMUM LATITUDE OF WINDOW IN DEGREES
MIN-LATITUDE:

**PLSCAL-LAT2:**
ENTER MAXIMUM LATITUDE OF WINDOW IN DEGREES
MAX-LATITUDE:

The set of graphical options to be displayed are selected by typing the appropriate 1 or 2 letter code names and terminating the list of options with a slash. Once an option is selected, it will appear on all succeeding displays until it is turned off. An option may be turned off by typing its code name immediately (with no intervening spaces) followed by a minus. All options may be turned off by typing "P" for purge.

Certain display options require sub-options to be specified after the slash is entered. These sub-options, which are described below, remain in effect and do not have to be retyped until the particular graphical options are "re-selected."
The "re-select" feature allows the user to change sub-option settings. It has the effect of turning the option off and then turning it back on. Re-selecting is done by entering the option in the DISPLAY option list after it has already been selected. If any sub-options need to be specified, the user will be prompted for them again.

The Threat Circle option requires as a sub-option the list of threat models to be displayed:

THTYPE-TMDL:

ENTER ALL TO SELECT ALL MODELS
OR / TO USE CURRENT SELECTION
OR ENTER A NAME OF A MODEL TO BE ADDED TO LIST
NAME-STATUS NAME-STATUS NAME-STATUS NAME-STATUS
SA-1A - SA-1B - S-SA-1B - SA-4 - SA-6 -
SA-2 - S-SA-2 - AAA-1 - AAA-2 - SA-11 -
S-AAA-1 - S-AAA-2 - S-SA-11 - SA-7 - SA-13 -
SA-99 - EV - S-EV - SA-8 -

CHOOSE THREAT MODEL (ID), ALL or /:

The Envelope option requires as a sub-option the list of threat models to be displayed:

THTYPE-2MDL:

ENTER ALL TO SELECT ALL MODELS
OR / TO USE CURRENT SELECTION
OR ENTER A NAME OF A MODEL TO BE ADDED TO LIST
NAME-STATUS NAME-STATUS NAME-STATUS NAME-STATUS
SA-1A - SA-1B - S-SA-1B - SA-4 - SA-6 -
SA-2 - S-SA-2 - AAA-1 - AAA-2 - SA-11 -
S-AAA-1 - S-AAA-2 - S-SA-11 - SA-7 - SA-13 -
SA-99 - EV - S-EV - SA-8 -

CHOOSE ENVELOPE MODEL (ID), ALL or /:
The Suppressor Circle option requires as a sub-option the list of suppression models to be displayed:

```
HTYPE-SH-L:

ENTER ALL TO SELECT ALL MODELS
OR / TO USE CURRENT SELECTION
OR ENTER A NAME OF A MODEL TO BE ADDED TO LIST
NAME-STATUS NAME-STATUS NAME-STATUS NAME-STATUS NAME-STATUS

EF-111 - COMPCALL-
CHOOSE SUPPRESSOR MODEL (ID), ALL OR /;
```

The Arcs option requires as a sub-option the node around which arcs are to be drawn. Only staging base and target nodes are currently supported. Either the node name or the node index may be input. The node name is the eight character name contained in the STGB or TG table, and in the NLIS array. Node indexes are shown by the SH NLIS command, described in Section III.2.7:

```
PROMID-RCID:

ENTER ID OR INDEX OF NODE
OR "/" TO ABORT COMMAND
NODE ID, INDEX, or /;
```

The Routes option requires as a sub-option the particular routes which are to be drawn:

```
PROMPL-RCID:

ENTER ID OR RECORD NUMBER FOR A SINGLE RECORD IN SPED
OR ENTER STARTING AND ENDING RECORD NUMBERS SEPARATED BY SPACE OR COMMA FOR A RANGE OF RECORDS
REC1 "to" REC2 or IDWORD:
```
The Danger option requires several sub-options. First the array to be contoured must be specified:

**PROMPL-FILE:**

- ENTER ALTG TO PLOT OPTIMAL ALTITUDES ABOVE GROUND
- ALTS OPTIMAL ALTITUDES (MSL)
- CL3D DANGER FROM Clobber
- STAT TOTAL DANGER AT OPTIMAL ALT
- TH2D THREAT DANGER AT OPTIMAL ALT
- TH3D THREAT DANGER AT ANY ALTITUDE

FILE--ALTG,ALTS,CL3D,STAT,TH2D,TH3D:

Next the contour levels must be specified:

**PROMPL-LEVE:**

- ENTER VALUE OF FIRST CONTOUR LEVEL
- OR ENTER "D" TO USE DEFAULT LEVELS:
  - 0.3000 0.2000 0.1000 0.0500 0.0100
- NEXT CONTOUR LEVEL, DEFAULT(D), or /:

**PROMPL-LEVE:**

- ENTER VALUE OF NEXT CONTOUR LEVEL
- OR ENTER "/" TO USE CURRENT SET OF LEVELS:
  - 0.2800 0.2000 0.1500
- OR ENTER "D" TO USE DEFAULT LEVELS:
  - 0.3000 0.2000 0.1000 0.0500 0.0100
- NEXT CONTOUR LEVEL, DEFAULT(D), or /:

Next since these arrays are direction-dependent, the particular flight direction must be specified:

**PROMPL-DIRE:**

- ENTER 0 FOR DANGER AVERAGED OVER ALL 8 DIRECTIONS
- 1 FOR DANGER HEADING NORTHWEST
- 2 WEST
- 3 SOUTHWEST

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Finally if a three-dimensional array (CL3D or TH3D) was chosen, then the altitude must be specified:

PROMPL-ALTT:

ENTER 1 FOR ALTITUDE= 60. METERS
ENTER 2 FOR ALTITUDE= 120. METERS
ENTER 3 FOR ALTITUDE= 180. METERS
ENTER 4 FOR ALTITUDE= 240. METERS
ENTER 5 FOR ALTITUDE= 300. METERS

ALTITUDE LEVEL:

After all options and sub-options have been specified, the display is drawn on the selected graphics device.

Once an option is turned on, it is never redrawn unless it is "re-selected". Thus, if changes to the data base have made a graphics option stale, or if the user wishes to change the suboptions for a given option; it is necessary to re-select that option. For example:

DI C / SA-6 EW /
DI C / ALL

Here the user displayed the SA-6 and EW threats. Then the user decided to display all of the threats including the ones that are neither SA-6's or EW's. The second DI command overrides the first.
III.2.10 FIND Command

FORMAT: "FI" <"SB" or "TG" or "LL" or "TH" or "SU" or "CO"> <cr>
   <move cursor using thumbwheels> <sp>

EXAMPLE: FI SB <move cursor> <sp>

The FIND command is used to find the ID of an object in a graphical display, or to find the location of a point. It should only be entered on a graphics terminal with graphical input capabilities. As of today, this means a Tektronix 4115-B, or a 4125. It should be entered only after a DISPLAY command (Section III.2.9) has been executed, and all the desired graphics options selected. The user must specify what type of object he or she wishes to identify:

FIND -IDTY:

TO DETERMINE WHICH OBJECT ID YOU WHICH TO FIND
ENTER "SB" FOR A STAGING BASE ID
"TG" FOR A TARGET ID
"LL" FOR A LLTR ID
"TH" FOR A THREAT ID
"SU" FOR A SUPPRESSION ID
"CO" FOR A COORDINATE POINT OR
"AB" TO ABORT FIND
STGB(SB),TARGETS(TG),LLTRS(LL),THREATS(TH),SUPPRESSOR(SU),
COORDINATE(CO), OR ABORT(AB):

Then a cursor appears in the graphical window at the position it was left by the previous find or LOCATE command (if this is the first such command, at the lower left corner of the window). The user positions the cursor to the desired position using the thumbwheels and hits the space bar. The ID of the nearest object is displayed in the dialog area. The user may continue finding
ID's of the selected option by moving the cursor and hitting the space bar. If the user wishes to change the option (the object to be found), an "S" is entered to select a new option. No carriage return is required while in the graphics input mode. The menu shown above will then reappear. If the user wishes to exit from find, "AB" is entered. A carriage return is required when selecting options from the menu.
III.2.11 MANUAL Command

FORMAT: "MA" <"NEW" or SPED file record id or SPED file record number> <cr> <additional suboptions as required>

EXAMPLE: MA NEW

The MANUAL command is used to create or change a route manually using the graphics capability.

Before entering the MANUAL command, you must be in the graphics mode, i.e. there must be a graphic display on the screen (see the DISPLAY command).

After entering "MA", the user receives the following prompt:

MANUAL-ROUT:

DO YOU WISH TO START FROM SCRATCH CONSTRUCTING A ROUTE? IF SO TYPE IN "NEW". IF NOT, DO YOU WISH TO CHANGE AN EXISTING ROUTE THAT IS A RECORD IN THE SPED FILE? CHANGE MEANING ADD OR DELETE A WAYPOINT OR LLTR. TYPE IN THE RECORD NUMBER OF THAT SPED FILE OR THE CHARACTER ID OF THAT RECORD OF COURSE "A" WILL ABORT MANUAL.

TYPE IN "NEW", OR A SPED RECORD OR ID:

If "NEW" is entered, the user is prompted to enter the staging base ID or index and a target ID or index as shown below. (The staging base and target indexes are contained in the NLIS array.)

MANUAL-SBID:
INPUT A STAGING BASE ID OR THE INDEX ASSOCIATED WITH IT IN THE NLIS ARRAY. THIS STAGING BASE WILL BE THE STARTING AND ENDING POINT FOR YOUR MANUAL ROUTE.

then:

MANUAL-TGID

INPUT A TARGET ID OR THE INDEX ASSOCIATED WITH IT IN THE NLIS ARRAY. THIS TARGET WILL BE THE POINT YOU WILL BUILD A ROUTE TOWARDS FROM THE GIVEN STGB.

If a SPED record ID is entered, then this is the route that the user will be working with. The user does not need to specify a staging base or target.

Now the user is prompted to enter one of the following:

S - Select selects a waypoint. The waypoint nearest the cursor is selected. The selected waypoint is denoted by a yellow circle around the waypoint symbol.

E - Egress - chooses the Egress route. Any modifications made after this command are made to the Egress route.

I - Ingress - chooses the Ingress route. Any route modifications made after this command are made to the Ingress route.

W - Add Waypoint - add a waypoint. A waypoint is added at the cursor position after the selected waypoint. The new waypoint is connected to adjacent waypoints by a straight line. NOTE: A waypoint cannot be added after the target on an Ingress route or after the staging base on an Egress route.

D - Delete - delete a waypoint. The selected waypoint is deleted. The route is reconnected by a straight line.

O - Optimize - the optimal route between the staging base and the target, through the LLTR exit point closest to the cursor, is drawn.

H - Half Optimize - the optimal route between the staging base and exit LLTR nearest the cursor is drawn.

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F - Finish - a prompt appears asking if the user wishes to save the manually created or modified route. If the user wants to save the route, a SPED record id is asked for. The SPED record id may be up to 12 alphanumeric characters long and must begin with a letter. FLAPS will automatically select an id for the user if the user enters a "/". FLAPS then exits the MANUAL mode.

A - Abort - exits the Manual mode but does not save the route.

By using these options and the thumbwheel cursor controls, routes can be generated to and from a target or modifications can be made to an existing route. The new route may then be stored in the SPED table. From there it may be displayed using the DISPLAY command, analyzed for threat exposure using the ANALYZE command, or displayed as a flight plan, using the SHOW PLAN command.

The Ingress and Egress routes cannot be displayed simultaneously while the user is in the MANUAL command mode. To display the entire route, the user must finish the route (the F option), save the route in the SPED table, and then display it using the DISPLAY command.
III.2.12 SELECT Command

FORMAT: "SE" "ALL" <cr>

or

"SE" "/" <target id> <staging base id> <cr>

EXAMPLES: SE ALL
SE / LEGNICA 2
SE / CASLAV RAMSTEIN

The SELECT command causes one or more routes based on the most recent
attack aircraft plan to be generated and saved in the SPED table. The user must
first specify to select all routes from the current allocation (i.e., those
routes in the TGUS array) or a specific route. The following prompt appears:

SELECT-ALL/: 

ENTER ALL TO PUT ALL ROUTES
DETERMINED IN CURRENT ALLOCATION
IN SPED FILE OR "/" TO CHOOSE AN
INDIVIDUAL ROUTE TO BE PUT IN SPED FILE

ENTER "ALL" FOR CURRENT ALLOCATION OR "/" FOR INDIVIDUAL ROUTE:

If an individual route is desired, then the target and staging base must
be specified:

PROMID-RCID:

ENTER ID OR INDEX OF TGT
OR "/" TO ABORT COMMAND

TGT ID, INDEX, or "/"]

PROMID-RCID:

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ENTER ID OR INDEX OF SB
OR "/" TO ABORT COMMAND

SB ID, INDEX, or /

After the appropriate route or routes have been selected, they may be
displayed using the DISPLAY command, analyzed for threat exposure using the
ANALYZE command, or displayed as a flight plan on the user's terminal using the
SHOW PLAN command.
FORCE LEVEL AUTOMATED PLANNING SYSTEMS (FLAPS) USER'S MANUAL (U) SYSTEMS CONTROL TECHNOLOGY INC. PALO ALTO, CA
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III.2.13 ANALYZE Command

FORMAT: "AN" <SPED table record id or record number> <cr>

EXAMPLES: AN BITB.CASL.01
AN 33

The ANALYZE command is used to analyze a route for threat exposure. The route to be analyzed must be in the SPED table, having been put there by either the SELECT or MANUAL commands. The user must specify the route to be analyzed. The user receives the following prompt:

ANALIZ-RCID:

ENTER EITHER ID OR RECORD NUMBER FOR RECORD IN SPED
SPED FILE ID, OR RECORD :

A flight plan is issued for the selected route, with a leg by leg breakdown of the route's probability of survival. Then a listing of each threat encountered on the route, and the contribution of the threat to the route's exposure and danger is shown. This information is based on the array, STAT, so that if a SUPPRESS command has been issued, and has not been followed by a RESTORE command, the analysis will be based on the suppressed statespace. Refer to the examples in Chapter V for a fuller description of the information included in a route analysis.
III.2.14 LOCATE Command

FORMAT: "LO" <move cursor to desired location> <sp> <suppressor type> <suppressor id or "/"> <cr>

EXAMPLE: LO <move cursor to desired location> <sp> EF EF-111.1

The LOCATE command is used to locate or position an EC suppressor in the scenario. It should only be entered on a graphics terminal with graphical input capabilities. As of today, this means a Tektronix 4115-B, or a 4125. It should be entered only after a DISPLAY command has been executed, and all the graphics options which will aid the user in pinpointing the EC suppressor location are displayed.

After entering "LO", a cursor appears in the graphical window at the position it was left by the previous FIND, LOCATE, or MANUAL command (if this is the first such command, the cursor appears at the lower left corner of the window). The user uses the thumbwheels to move the cursor to the desired EC suppressor position and hits the space <sp> bar. The user must then specify the type of EC suppressor to put at this location. The following prompt appears:

LOCATE-SMDL:

ENTER THE FIRST TWO CHARACTERS OF ONE OF THE FOLLOWING SUPPRESSION MODELS TO DETERMINE THE TYPE OF SUPPRESSOR YOU WANT OR ENTER "AB" TO ABORT LOCATE

NAME NAME NAME NAME

EF-111 COMPCALL WILDWES

CHOOSE SUPPRESSION MODEL (ID) or "AB" TO ABORT:

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The ID for the particular EC suppressor must be specified. The following prompt appears:

LOCATE-SUID:

ENTER UP TO AN 8 CHARACTER SUPPRESSOR IDENTIFIER OR "/" FOR PROGRAM SELECTION OR "AB"ORT

ENTER 8 CHAR SUPP ID, "/" FOR PROGRAM SELECTION OR "AB"ORT:

If a slash is entered, the program constructs the ID by taking the first six characters of the Suppression Model ID followed by an underscore character followed by a unique integer (for example, COMPCA.3).

If an ID is entered which the same as that for an existing EC suppressor, the user must then choose either to move that suppressor to a new location or to try again to type a new ID. The following prompt appears:

ID IN USE--TYPE "I" TO INPUT NEW ID OR "R" TO RELOCATE ID

In any case, the effect of a LOCATE command is to add or change a record in the suppressor table (SUPP). EC suppressor positions may be displayed using the DISPLAY command and the SU option. EC suppressor effectiveness is computed using the SUPPRESS command.
III.2.15  SUPPRESS Command

FORMAT: "SU" <"YES" or "NO"> <cr>

EXAMPLE:  SU YES

The SUPPRESS command should be issued after a candidate set of EC suppressors have been located using the LOCATE command. It recalculates the danger for those threats which are in the vicinity of the EC suppression assets. After the user issues the SUPPRESS command, the program first shows a summary of the effectiveness of each suppressor. This summary looks like this:

SUPRES - SUPPRESSOR COMPCA.1 (COMPCALL) IN RANGE OF 9.0 FIXED THREATS AND 0.0 STOCHASTIC THREATS
CAPACITY IS 20 TOTAL THREATS.

SUPRES - SUPPRESSOR EF-111.1 (EF-111) IN RANGE OF 5.0 FIXED THREATS AND 0.0 STOCHASTIC THREATS
CAPACITY IS 12 TOTAL THREATS.

SUPRES - SUPPRESSOR COMPCA.2 (COMPCALL) IN RANGE OF 11.0 FIXED THREATS AND 0.0 STOCHASTIC THREATS
CAPACITY IS 20 TOTAL THREATS.

Then the user must specify whether or not to apply EC suppression based on this summary:

SUPRES-CONT:

SUPPRESSION IS FAIRLY TIME CONSUMING — REVIEW PREVIOUS LIST OF THREATS AFFECTED BY SUPPRESSORS AND DECIDE WHETHER TO APPLY SUPPRESSION

DO YOU WISH TO CONTINUE (YES OR NO) ?: 

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If the decision is to continue, the modified statespace is computed and stored in the array, STAT. The original unsuppressed statespace is still available in the array TH3D. The user may wish to analyze existing routes or graphically redraw danger contours before continuing with the RE-ROUTE command.
III.2.16 RE-ROUTE Command

FORMAT: "RR" <cr>
EXAMPLE: RR

The RE-ROUTE command calculates new routes based on the latest statespace, including EC suppression. It is relatively time consuming operation which involves recalculating all arcs, routes and the attack aircraft allocation. Therefore, it should only be performed once the user is confident that an interesting set of EC suppressors has been located. The RE-ROUTE command requires no additional inputs from the user.
III.2.17 RESTORE Command

FORMAT: "RS" <cr>
EXAMPLE: RS

The RESTORE command restores the statespace, arcs, routes and allocation back to the way they were before EC suppression was applied. In other words, the data base is restored to the way it was before the RR command was executed. It is a relatively time consuming operation which involves resetting the unsuppressed statespace and recalculating all arcs, routes and allocation. Therefore, it should only be performed once the user has obtained all the useful information out of the current set of EC suppressors. The RESTORE command requires no additional inputs from the user.
III.3 SECONDARY COMMANDS

The FLAPS secondary commands are described in this subsection. These are commands which will not be used by most users; they are used primarily by program developers. Most users reading this manual for the first time may skip this section.

While the secondary commands will be used infrequently by the normal user, they are useful. In particular, the SAVE and SPAWN commands are very handy. The COPY command is useful when the user is developing the data bases for a scenario. The following is a list of the secondary commands:

**FLAPS SECONDARY COMMANDS**

- **OP** (OPEN) OPEN AN ARRAY OR TABLE
- **CO** (COPY) COPY RECORD WITHIN A TABLE
- **DB** (DEBUG) SET DEBUG SWITCH
- **DR** (DRAW) DRAW A ROZ AND VIZ POLYGON
- **IN** (INIT) INITIALIZE DATA BASE
- **SA** (SAVE) SAVE ALL FILES AND CONTINUE EXECUTION
- **SP** (SPAWN) SPAWN A BATCH JOB
- **PA** (PARM) SHOW CURRENT VALUES OF PARAMETERS

**THE FOLLOWING ARE THE INDIVIDUAL ALGORITHMS:**

- **GE** (GEOM) CALCULATE GEOMETRY
- **ST** (STAT) GENERATE STATESPACE
- **NO** (NODES) CALCULATE NODES
- **AC** (ACCESS) CALCULATE ACCESSIBILITY
- **AR** (ARCS) GENERATE OPTIMAL ARCS BETWEEN NODES
- **RO** (ROUTES) ROUTES BETWEEN STAGING BASES, TARGETS
- **AL** (ALLOCATE) ALLOCATE TIME WINDOWS TO ROUTES
III.3.1 OPEN Command

FORMAT: "OP" <table name or array name> <"OLD" or "NEW"> <filename>
<"SR" or "R" or "SR/W" or "R/SW" or "R/W"> <cr>

EXAMPLE: OP ALGP OLD ALGP.FIL R/W

The OPEN command opens one of the tables or arrays needed by FLAPS. It is normally issued from within a command file, rather than interactively by a user. For example, most users will respond "Y" to the prompt to read in previous FLAPS files as described in Section II.1. This response causes the command file ZCONTNU.DAT to issue the open commands for all the files that the most users will need during a FLAPS session.

After an interactive user issues an OPEN command, the user must specify which table or array is to be opened. The prompt has the following form:

CROPEN-NAME:

ENTER "BYTE" TO OPEN BYTE-PACKED TERRAIN FILE
OR "CHRT" CHARACTERIZED TERRAIN FILE
OR 4-CHARACTER TABLENAME:

NAME TITLE
TSTR TABLE STRUCTURE
ASTR ARRAY STRUCTURE
ALGP ALGORITHM PARAMS
CMDL CLOBBER MODEL
CURR CURRENT STATUS
DISP DISPLAY PARAMS
GEOM COORD TRANSFMTN
LLTR LLTR NODE PARAMETERS
NODP NODE PARAMETERS
PBOR POLITICAL BORDERS
ROZ RESTRICTED OPERATING ZONES
SPED SORTIE RECORDS
STCH STOCHASTIC REGIONS
STGB STAGING BASE PARAMS
SUPM SUPPRESSION MODELS
SUPP SUPPRESSOR TYPE

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SVCH: VARIOUS SWITCHES
TG: TARGET PARAMS
THRT: THREAT LOCATIONS
TMDL: THREAT MODELS
VEHP: VEHICLE PARAMETERS
WEAP: WEAPON PARAMETERS
WFZ: WEAPON FREE ZONES

OR ENTER 4-CHARACTER ARRAYNAME:

NAME    TITLE
ACCL     LP ACCESSIBLE TO TCOM
ACCN     ACCESSIBLE NODES
ACCR     TCOM ACCESSIBLE TO TCOM
ALTG     ALTITUDE ARRAY
ALTS     ALTITUDE ARRAY
ARCS     ARC WAYPOINT ARRAY
ARPE     TARG INGRESS/EGRESS PERF
CL3D     Clobber model for 3-D
ITGC     TARG ACCESSIBLE TO STGB
ITRC     TREX ACCESSIBLE TO TREN
MASK     TERRAIN MASKING
NBOX     LIST OF TG BOX CORNERS
NLIS     LIST OF NODES
NPOS     NODE POSITIONS
ROUT     ROUT NODES DIST AND PERF
STAT     STATESPACE
SXPE     STGB TO LLTR EXIT PERF
TGUS     TARGET STATUS ARRAY
TH2D     TWO-D THREAT DANGER
TH3D     THREE-D THREAT DANGER
TOBS     THREAT OBSERVABILITY
TRPE     LLTR TREE PERFORMANCE

ARRAY or TABLE NAME:

The user is then prompted to specify whether this is an old, existing file or a new file to be created:

CROPEN-STUS:

OLD or NEW:
Then the filename must be specified:

CROPEN-FILE:

FILENAME:

And the user must specify the type of access required:

CROPEN-ACCS:

ACCESS-LEVEL FOR THIS FILE:
SR: SOFTWARE READ--CANNOT SHOW OR CHANGE
R: READ--CAN SHOW BUT CANNOT CHANGE
SR/\/W: SOFTWARE READ/WRITE--ONLY ALGORITHMS CAN CHANGE
R/SW: READ/SOFTWARE WRITE--CAN SHOW, BUT ONLY ALGS CAN CHANGE
R/W: READ/WRITE--CAN SHOW, ADD, DELETE, CHANGE, COPY
ACCESS--SR, R, SR/\/W, R/SW or R/W:

Most planners need not use the OPEN command.
III.1.2 COPY Command

FORMAT: "CO" <table name> <record id or record number>
          <new record id> <cr>

EXAMPLE: CO THRT 1 NEWID

The COPY command copies one record in a table to a new record in the same
table. All the information in the new record except for the ID is identical to
that in the old record. The user must first specify the table. The prompt
looks like this:

CRCOPY-TABL:

ENTER NAME OF TABLE TO BE MODIFIED:

NAME       TITLE
TSTR        TABLE STRUCTURE
ASTR        ARRAY STRUCTURE
ALGP        ALGORITHM PARAMS
CMDL        Clobber Model
CURR        Current Status
DISP        DISPLAY PARAMS
GEOM        COORD TRANSFORMATION
LLTR        LLTR NODE PARAMETERS
NODP        NODE PARAMETERS
PBOR        POLITICAL BORDERS
ROZ         RESTRICTED OPERATING ZONES
SPEED       SORTIE RECORDS
STCH        STOCHASTIC REGIONS
STGB        STAGING BASE PARAMS
SUPM        SUPPRESSION MODELS
SUPP        SUPPRESSOR TYPE
SWCH        VARIOUS SWITCHES
TG           TARGET PARAMS
THRT        THREAT LOCATIONS
TMDL        THREAT MODELS
VEHP        VEHICLE PARAMETERS
VEAP        WEAPON PARAMETERS
VFZ         WEAPON FREE ZONES

TABLE NAME:

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The user is then prompted to specify the record to be copied.

CRCOPY-RCID:

ENTER EITHER ID OR RECORD NUMBER FOR RECORD IN THRT
FROM RECORD NUM or IDWORD:

Next specify the ID of the new record:

CRCOPY-NWID:

ENTER NEW ID OF COPIED RECORD TO IDWORD:

Most planners need not use the COPY command.
III.3.3 DEBUG Command

FORMAT: "DB" <debug level> <cr>

EXAMPLE:  DB 5

The DEBUG command sets an internal program variable which determines how much debug output is produced by the program. The user must specify the level, by responding to the following prompt:

CRDBUG-LEVL:

ENTER DEBUG LEVEL (0 TO 9)--CURRENTLY= 5
DEBUG LEVEL -- 0 to 9:

A level of 0 implies no debug output; a level of 1 means only the elapsed CPU time and wall clock time associated with each command is produced. Higher levels produce a greater quantity of debug output. Planners need not use this command, since the ZCONTNU.DAT command file discussed in Section II.1 will set the debug level to a moderate value such as 5.
III.3.4 DRAW Command

FORMAT: "DR" <cr> "W" or "R" <move cursor to desired location><space bar> etc. "F" <record id>

EXAMPLE: DR <cr> W <space bar> <space bar> <space bar> F WFZAREA <cr>

The DRAW command is used to create polygonal avoidance areas. The avoidance area may be a WFZ area (denoted by red lines) or an ROZ area (denoted by purple lines). Currently these areas do not affect routes, however, in a future version of FLAPS, avoidance areas will affect routes.

The DRAW command should only be entered on a graphics terminal with graphical input capabilities. As of today, this means a Tektronix 4115-B or a 4125. It should be entered only after a DISPLAY command (Section III.2.9) has been executed, and all the desired graphics options selected. After entering "DR", the user receives the following prompt:

DRAWPO-POLY:
HELP IS NOT YET AVAILABLE
DO YOU WISH TO BUILD A WFZ(W) or ROZ(R) POLYGON?:

After responding to the above prompt, the user moves the cursor to the place on the display where he or she wishes to begin the polygon. The user is prompted to enter one of the following commands:

- space bar - Continue - sets the coordinates of the polygon. Adds a new vertex to the polygon at the location of the cursor. Up to 8 points may be entered. The coordinates are connected by straight lines, red for WFZ and purple for ROZ.
F - Finish - closes the polygon. At least 3 coordinates must be entered in order to complete the polygon. The user is prompted to enter a character ID (up to 3 alphanumeric characters, but must begin with a letter) or "AB" to abort.

D - Delete - deletes the last vertex of the polygon, and redraws the remaining vertices.

A - Abort - exits the DRAW command mode, but does not save the polygon.

By using these options and the thumbwheel cursor controls, the user can generate a new UFZ or ROZ and automatically store it in the FLAPS data base.

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III.3.5 INITIALIZE Command

FORMAT: "IN" <cr>

EXAMPLE: IN

The INITIALIZE command initializes the file management programs within FLAPS. The command is issued twice -- once for tables, once for arrays. Planners need not be concerned with this command since the ZCONTNU.DAT command file discussed in Section II.1 will also issue this command.
III.3.6 SAVE Command

FORMAT: "SA" <c-r>
EXAMPLE: SA

The SAVE command flushes all buffers, closes the experiment log file (FORO04.DAT), opens a new version of the experiment log and continues FLAPS execution. The SAVE command is useful for protecting the data base. It is suggested that Save be executed periodically after significant processing has been performed. This will protect the user's results from "system crashes" or "abnormal terminations" of the program. Because the statespace and arcs generation steps are time consuming, it is recommended that Save be run after those operations.
III.3.7 SPAWN Command

FORMAT: (For a single VAX system command)
"SP" <cr> <any VAX system command>

FORMAT: (For multiple VAX system commands)
"SP" <cr> "SP" <cr> <VAX system commands> "LOGOUT" <cr>

EXAMPLE: SP<cr> DIR FOR004.DAT

The SPAWN command allows the user to interrupt FLAPS execution to issue one VAX system command. For example, using the SPAWN command, the user may edit, type, print, or do a directory listing on the VAX. Upon completion of the VAX system command, FLAPS execution is resumed. If the VAX system command was itself a SPAWN command, then FLAPS execution is not resumed. In this case, VAX system commands may be issued until "LOGOUT" is typed. At that point, FLAPS execution is resumed. Planners need not be concerned with the SPAWN command.
III.3.3 PARAMETER Command

FORMAT: "PA" <cr>

EXAMPLE: PA

The PARAMETER command generates a listing of the descriptions and values of certain FLAPS parameters. These parameters are the dimensions used for various internal storage vectors. Planners need not be concerned with this command.
III.3.9 GEOMETRY Command

FORMAT: "GE" <cr>

EXAMPLE: GE

The GEOMETRY command calculates geometrical parameters. Specifically, it converts the user-friendly information in the ALGP table to the program-friendly information in the GEOM table. Planners should not issue this command, since the PROCESS command (Section III.2.8) automatically performs this function whenever it is required.
III.3.10 STATESPACE Commands

FORMAT: (For Clearing Statespace)

"ST" "CL" "CL3D" or "TH3D" or "T08S" <"?" or "/" <cr>

(For Masking Threats)

"ST" "MA" <record id or record number of first threat to mask>
(<record number of last threat to mask>) <cr>

(For Adding or Deleting Threats to the Statespace)

"ST" "AD" or "DE" <"THRT" or "STCH">
<record id or record number of first threat to add>
(<record number of last threat to add>) <cr>

(For Selecting Penetrator Altitude)

"ST" "AO" <clearance altitude>.<cr>

EXAMPLES: ST CL TH3D /
ST MA 2 99
ST AD THRT TH01
ST AD THRT 2 999
ST AO 3

The STATESPACE command maintains the statespace. Planners should not issue this command, since the PROCESS command (Section III.2.8) automatically performs this function whenever it is required.

If a STATESPACE command is issued, the user must specify which STATESPACE sub-command is to be performed. The prompt looks like this:

STATES-OPTN:

ENTER "CL" TO CLEAR A STATESPACE FILE
"AL" TO COMPUTE ALTERR ARRAY (NOT YET CODED)
"MA" TO COMPUTE MASKING FOR 1 OR MORE THREATS
"AD" TO ADD THE DANGER FROM 1 OR MORE THREATS
"DE" TO DELETE THE DANGER FROM THREATS
"GC" TO COMPUTE GROUND CLOBBER (NOT YET CODED)
"AO" TO PERFORM ALTITUDE OPTIMIZATION
CLEa,ADd,DEle,MAsk,GC"clob",AOp,ALT:
The CLEAR subcommand is used to clear one of the arrays created by the STATESPACE command to its initial value. The user must specify which array is to be cleared, by responding to the following prompt:

**STATES-ARRAY:**

ENTER "CL3D" TO CLEAR 3-D Clobber SPACE  
"TH3D" 3-D THREAT SPACE  
"TOBS" LIST OF MASKED THREATS

CL3D, TH3D, TOBS:

For TH3D and CL3D, the initial value for that array must be specified.

**STATES-VALU:**

ENTER VALUE TO CLEAR ARRAY TO  
OR "/" TO USE DEFAULT= 1.550E-04  
0 IS NORMAL FOR CL3D, TOBS; / FOR TH3D

STATESPACE VAL (/=FLAMAP):

A value of 0.0 is automatically used for the TOBS array. The CL3D array is not currently used by FLAPS and the user should not specify it as an option. The user may clear it to any value, but it will have no effect on the program.

The MASK subcommand performs terrain masking on one or more fixed threats. This subcommand uses the MASK array as temporary storage, and puts the results of masking into the TOBS array. The user must specify the fixed threat(s) to be masked. The prompt looks like this:

**PROMRC-RCID:**

ENTER ID OR RECORD NUMBER FOR A SINGLE RECORD IN THRT

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The ADD and DELETE subcommands add or delete the effects of one or more fixed or stochastic threats into the three-dimensional statespace TH3D. The user must first specify the type of threat desired. The following prompt appears:

```
STATES-TABL:

ENTER "THRT" IF FIXED THREATS ARE REQUIRED
"STCH" IF STOCHASTIC THREATS
THRT or STCH?:
```

The threats to be added or deleted must be specified. The prompt looks like this:

```
PROMRC-RCID:

ENTER ID OR RECORD NUMBER FOR A SINGLE RECORD IN THRT
OR ENTER STARTING AND ENDING RECORD NUMBERS SEPARATED BY SPACE OR COMMA FOR A RANGE OF RECORDS
REC1 "to" REC2 or IDWORD:
```

The ALTITUDE OPTIMIZATION command computes the optimal altitude at which penetrators are to fly. Currently this is done by having the user specify the altitude from the selection of altitudes included in the ALGP table. Future versions of the program may compute this altitude automatically by trading the probability of ground clobber at low altitudes against the probability of attrition at high altitudes. In any case, the danger at the optimal altitude is written to the STAT array.
The user currently selects the optimal altitude by responding to the following prompt:

**STATES-AOPT:**

- ENTER 1 TO FLY PENETRATORS AT 60. M.
- ENTER 2 TO FLY PENETRATORS AT 120. M.
- ENTER 3 TO FLY PENETRATORS AT 180. M.
- ENTER 4 TO FLY PENETRATORS AT 240. M.
- ENTER 5 TO FLY PENETRATORS AT 300. M.

**ALTITUDE OPTIMIZATION LEVEL:**
III.3.11 NODES Command

FORMAT: "NO" <cz>

EXAMPLE: NO

The NODES command prepares a list of nodes -- staging bases, low level transit routes and targets. It also calculates the LLTR trees -- that is the sequence of low level transit routes which connect each entry LLTR to each reachable exit LLTR. The list of nodes and their positions are written to the arrays NLIS and NPOS. The LLTR trees and their performance measures are written to the arrays ITRC and TRPE.

Planners should not issue this command, since the PROCESS command (Section III.2.8) automatically performs this function whenever it is required.
III.3.12 ACCESSIBILITY Command

FORMAT: "AC" <cr>

BLANK

EXAMPLE: AC

The ACCESSIBILITY command determines which target/staging base pairs are accessible to each other. This determination is based on distance of flight, the available LLTRs, the aircraft types, and applicability of weapons to targets. The accessibility lists are written to the ITGC array; the performances from the staging bases to the exit LLTRs are written to the SXPE array; and the boxes around each target to be used in the arcs generation function are written to the NBOX array.

Planners should not issue this command, since the PROCESS command (Section III.2.8) automatically performs this function whenever it is required.
III.3.13 ARCS Command

FORMAT: "AR" <cr>

EXAMPLE: AR

The ARCS command calculates the optimal Ingress arcs to each target from each accessible LLTR exit point and the optimal Egress arcs from each target to each accessible LLTR exit point. This calculation is very time consuming since it requires the dynamic programming algorithm to be executed to calculate the paths which minimize danger from threats. The waypoints on the arcs are written to the ARCS array. The performance of the arcs to the ARPE array.

Planners should not issue this command, since the PROCESS command (Section III.2.8) automatically performs this function whenever it is required.
III.3.14 ROUTES Command

FORMAT: "RO" <cr>

EXAMPLE: RO

The ROUTES command finds the optimal Ingress and Egress routes between each target and accessible staging base. The performance of each such route is written to the ROUT array. The actual waypoints on these routes are not generated until the SELECT command (Section III.2.12) is issued.

Planners should not issue this command, since the PROCESS command (Section III.2.8) automatically performs this function whenever it is required.
III.3.15 ALLOCATE Command

FORMAT: "AL" <cr>

EXAMPLE: AL

The ALLOCATE command allocates aircraft and weapons to the targets. It determines how many aircraft should be assigned to each target, the standard configuration loads for the aircraft, and the staging base from which the aircraft should be flown and recovered. This calculation is performed in the absence of suppression. The results are stored in the TGUS array.

Planners should not issue this command, since the PROCESS command (Section III.2.8) automatically performs this function whenever it is required.
There are two types of data structures in FLAPS: Tables and Arrays. Tables are record-oriented data structures which are under the direct control of the user. Tables may be accessed by the ADD, CHANGE, COPY, DELETE and SHOW commands discussed in Chapter III. Arrays are matrix-oriented data structures which are created and maintained by the FLAPS software. Some of the arrays may be accessed by the Show command. Typically arrays contain a much greater quantity of data than tables. Sections IV.1 and IV.2 describe the structure and contents of the FLAPS tables and arrays.

IV.1 TABLES

There are 22 tables defined in FLAPS. The names and descriptions of the tables are given below. Those tables which are of the greatest interest to planners are marked with an asterisk. The remaining tables, while important, will only occasionally be of interest to the planners. Many of these tables are
created when the data base is first initialized and then never change. For the
FLAPS prototype system, this will be done when the software is installed at
USAF Headquarters. These tables include TSTR, ASTR, and SWCH. Other tables
are created by the software. The user is not responsible for creating or
maintaining these tables. However, he may wish to show the contents of these
tables. Each four-character table name is associated with a random access disk
file (see the OPEN command in Section III). These disk files each consist of
two or more fixed length records.

**NAMES AND DESCRIPTIONS OF TABLES**

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSTR</td>
<td>TABLE STRUCTURE</td>
</tr>
<tr>
<td>ASTR</td>
<td>ARRAY STRUCTURE</td>
</tr>
<tr>
<td>ALGP</td>
<td>ALGORITHM PARAMETERS</td>
</tr>
<tr>
<td>Curr</td>
<td>CURRENT STATUS</td>
</tr>
<tr>
<td>Disp</td>
<td>DISPLAY PARAMETERS</td>
</tr>
<tr>
<td>Geom</td>
<td>COORDINATE TRANSFORMATIONS</td>
</tr>
<tr>
<td>LLTR</td>
<td>LLTR NODE PARAMETERS</td>
</tr>
<tr>
<td>Nodp</td>
<td>NODE PARAMETERS</td>
</tr>
<tr>
<td>PbOr</td>
<td>POLITICAL BORDERS</td>
</tr>
<tr>
<td>RoZ</td>
<td>RESTRICTED OPERATING ZONES</td>
</tr>
<tr>
<td>SpEd</td>
<td>SORTIE RECORDS</td>
</tr>
<tr>
<td>StCh</td>
<td>STOCHASTIC REGIONS</td>
</tr>
<tr>
<td>Stgb</td>
<td>STAGING BASE PARAMETERS</td>
</tr>
<tr>
<td>SupM</td>
<td>SUPPRESSION MODELS</td>
</tr>
<tr>
<td>SupP</td>
<td>SUPPRESSOR TYPE</td>
</tr>
<tr>
<td>SwCh</td>
<td>VARIOUS SWITCHES</td>
</tr>
<tr>
<td>Tg</td>
<td>TARGET PARAMETERS</td>
</tr>
<tr>
<td>Thtrt</td>
<td>FIXED THREAT LOCATIONS</td>
</tr>
<tr>
<td>Tmdl</td>
<td>THREAT MODELS</td>
</tr>
<tr>
<td>VehP</td>
<td>VEHICLE PARAMETERS</td>
</tr>
<tr>
<td>Weap</td>
<td>WEAPON PARAMETERS</td>
</tr>
<tr>
<td>WfZ</td>
<td>WEAPON FREE ZONES</td>
</tr>
</tbody>
</table>

* tables of greatest interest to planners

IV-2
The first record of each table is a header record. This record contains information used by the file management software, and is unimportant to the user. Data which is stored in a table begins in record 2. Some tables, such as the Algorithm Parameter (ALGP) Table have only two records. Other tables, such as the Threat Location (THRT) Table have as many as 200 records. Within a table, the structure of each record is the same; that is, the records are all of identical length and are organized into the same sequence of items. For example, the following excerpt shows the contents of the first two records (after the header record) and the last record in the THRT table. Each record (except the header record) corresponds to a single fixed threat. The same information, organized in the same fashion, exists for each threat.

CRSHOW -- RECORD #  2  IDWORD=S601
    ID = S601
    ITYP= SA-6
    XTH = 1.2082E+01 5.0615E+01 3.0500E+00
    PEX = 1.0000E+00
    IDC = 85/11/22 16:43
    IDM = 85/11/22 16:43

CRSHOW -- RECORD #  3  IDWORD=S602
    ID = S602
    ITYP= SA-6
    XTH = 1.2197E+01 5.0427E+01 3.0500E+00
    PEX = 1.0000E+00
    IDC = 85/11/22 16:43
    IDM = 85/11/22 16:43

CRSHOW -- RECORD #  98  IDWORD=S815
    ID = S815
    ITYP= SA-8
    XTH = 1.2129E+01 5.1260E+01 3.0500E+00
    PEX = 1.0000E+00
    IDC = 85/11/22 16:43
    IDM = 85/11/22 16:43
The TRHT table has six items. Each item has a one to four character name (ID, ITYP, etc.). Notice that some items, such as ID, correspond to one element of data (a scalar item); while other items, such as XTH, correspond to more than one element (a vector item). Each item is designated as character, integer or real. Mixed data types may not be associated with a single item.

The item structure of a record is very useful for manipulating the contents of the record. The first item in each record is the ID of the record. The ID is of character data type. A record may be accessed by its integer record number or by its character ID. The use of these two methods of accessing a record are discussed under the various data base commands in Chapter III.

The last two items of a record in each FLAPS table are the creation date (IDC) and modification data (IDM) of the record. These two items cannot be manipulated by the user. These items are changed internally by the FLAPS software. However, the user can display the IDC and IDM values using the Show command. The IDC and IDM values are displayed as integers so that dates may be easily compared to see which one is later. The format is 'YY/MM/DD HH:MM'. Thus, for example, the last record in the TRHT table above was created and modified at 16:43 on November 22, 1985 (IDC = IDM = 85/11/22 16:43).
IV.1.1 TSTR: Table Structure Table

The TSTR table contains the information defining the structure of all the other FLAPS tables. Each record in TSTR describes one of the other FLAPS tables. TSTR is created by the program during a special initialization run in which the file ZDEFINE.DAT is read. The current version of ZDEFINE.DAT is included in Appendix C. This run is "transparent" to the user in that the user sees only the result of the run and neither directly initiates nor sees the run itself. The user should never attempt to ADD, DELETE, CHANGE or COPY the TSTR table.

The structure of the TSTR Table is shown below. This excerpt may be recreated by typing "SHOW TSTR HELP".

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAMT</td>
<td>CH04</td>
<td>1</td>
<td>1</td>
<td>TABLE NAME</td>
</tr>
<tr>
<td>NXRC</td>
<td>INT</td>
<td>1</td>
<td>2</td>
<td>MAXIMUM RECORDS</td>
</tr>
<tr>
<td>IAFT</td>
<td>INT</td>
<td>1</td>
<td>3</td>
<td>EFFECT OF CHANGING TABLE</td>
</tr>
<tr>
<td>NIT</td>
<td>INT</td>
<td>1</td>
<td>4</td>
<td>NUMBER OF ITEMS</td>
</tr>
<tr>
<td>ITIT</td>
<td>CH24</td>
<td>1</td>
<td>5</td>
<td>TITLE OF TABLE</td>
</tr>
<tr>
<td>NAMI</td>
<td>CH04</td>
<td>80</td>
<td>11</td>
<td>ITEM NAMES</td>
</tr>
<tr>
<td>ITYP</td>
<td>CH04</td>
<td>80</td>
<td>91</td>
<td>ITEM TYPES</td>
</tr>
<tr>
<td>ISI2</td>
<td>INT</td>
<td>80</td>
<td>171</td>
<td>ITEM SIZES</td>
</tr>
<tr>
<td>ITTL</td>
<td>CH24</td>
<td>80</td>
<td>251</td>
<td>TITLE OF ITEMS</td>
</tr>
<tr>
<td>IDEF</td>
<td>INT</td>
<td>80</td>
<td>731</td>
<td>DEFAULTABLE ITEM FLAG</td>
</tr>
<tr>
<td>IACC</td>
<td>INT</td>
<td>80</td>
<td>811</td>
<td>ITEM ACCESS CLASS</td>
</tr>
<tr>
<td>IEDT</td>
<td>INT</td>
<td>80</td>
<td>891</td>
<td>ITEM EDIT TYPE</td>
</tr>
<tr>
<td>PAR1</td>
<td>REAL</td>
<td>80</td>
<td>971</td>
<td>ITEM LOWER LIMIT</td>
</tr>
<tr>
<td>PAR2</td>
<td>REAL</td>
<td>80</td>
<td>1051</td>
<td>ITEM UPPER LIMIT</td>
</tr>
<tr>
<td>IAFT</td>
<td>INT</td>
<td>80</td>
<td>1131</td>
<td>EFFECT OF CHANGING ITEM</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>1211</td>
<td>CREATION DATE</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>1212</td>
<td>MODIFICATION DATE</td>
</tr>
</tbody>
</table>

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The first item is the record ID (NAMT) -- it is the same as the name of the table which this record describes ('ASTR', 'ALGP', etc.). The next item (NXRC) is the maximum number of records allowed in the table, including the header record. The affect (IAFT) code is an integer whose meaning is described in the section on the CURR table (IV.1.4). Then comes the number of items in the table (NIT) and a 24 character title for the table (ITIT). The next ten items are each of size 80, and describe the individual items within the table. Thus the number of items in any table must not exceed 80. NAMI is the one to four character name of the items; ITYP is the data type ('REAL', 'INT', 'TIME' or 'CHAR', for a character item whose element length is nn characters). ITTL is a 24 character description of the item. IDEF is not currently implemented. IACC has the value of 0 for almost all items, but has the value of -5 for those few items which are not accessible to the user in ADD or CHANGE commands. IEDT, PAR1, PAR2 and IAFI are not currently implemented.
IV.1.2 ASTR: Array Structure Table

The ASTR table contains the information which defines the structure of every FLAPS array. Each record in ASTR describes one of the FLAPS arrays. ASTR is created by the program during a special initialization run, in which the file ZDEFAR.DAT is read. This run is "transparent" to the user in that the user sees only the result of the run and neither directly initiates nor sees the run itself. The current version of ZDEFAR.DAT is included in Appendix B. The user should never attempt to ADD, DELETE, CHANGE or COPY the ASTR table.

The structure of the ASTR table is shown below. This excerpt may be recreated by typing "SHOW ASTR HELP".

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAMA</td>
<td>CH04</td>
<td>1</td>
<td>1</td>
<td>ARRAY NAME</td>
</tr>
<tr>
<td>NXRC</td>
<td>INT</td>
<td>1</td>
<td>2</td>
<td>MAX NUMBER OF RECORDS</td>
</tr>
<tr>
<td>ITIT</td>
<td>CH24</td>
<td>1</td>
<td>3</td>
<td>TITLE OF ARRAY</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>9</td>
<td>RECORD CREATION DATE</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>10</td>
<td>RECORD MODIFICATION DATE</td>
</tr>
</tbody>
</table>

The first item is the record ID (NAMA) -- it is the same as the name of the array which this record describes ("ARCS", "ARPE", etc.). The next item (NXRC) is the maximum number of records allowed in the array, including the header record. ITIT is a 24 character title for the array.
IV.1.1 ALGP: Algorithm Parameters Table

The ALGP table defines the scenario and the statespace. This includes the geographic region over which the scenario is defined, and the statespace quantization level (cell size). Record 2 of this table must be properly defined before any processing starts.

IV.1.3.1 ALGP TABLE USAFE

The structure of the ALGP table is shown below. This table can be created by typing "SHOW ALGP HELP".

`ALGP TABLE STRUCTURE
NAME TYPE SIZE LOC TITLE
ID CHO4 1 1 ID = ALGP
DELE REAL 1 2 LONGITUDE GRID(NM)
DELN REAL 1 3 LATITUDE GRID(NM)
XMIN REAL 1 4 MIN LON OF STATESPACE
XMAX REAL 1 5 MAX LON OF STATESPACE
YMIN REAL 1 6 MIN LAT OF STATESPACE
YMAX REAL 1 7 MAX LAT OF STATESPACE
NALT INT 1 8 NUMBER OF ALTITUDES
NDIR INT 1 9 NUMBER OF DIRECTIONS
IDUM INT 1 10 # OF MASKING POINTS
IDVE CHO4 1 11 VEHICLE NAME FOR STATES
ARMX REAL 1 12 LAMDA - AIR DAMAGE
FLAM REAL 1 13 LAGRANGE MULTIPLIER
ALTS REAL 5 14 ALTITUDE GRID (M)
XSCL REAL 1 19 MIN LON OF SCENARIO
XSCL REAL 1 20 MAX LON OF SCENARIO
YSCL REAL 1 21 MIN LAT OF SCENARIO
YSCL REAL 1 22 MAX LAT OF SCENARIO
PCAP REAL 5 23 PROB OF Clobber GRID
IDC TIME 1 28 RECORD CREATION DATE
IDM TIME 1 29 RECORD MODIFICATION DATE`
The first item in the table is the ID which is always equal to ALGP. The next two items define the statespace cell size. DELE is the longitude increment and DELN is the latitude increment. Typically these two numbers are equal. Currently the values are both 2.4 nautical miles. The next four items define the statespace. XMIN and YMIN are the longitude and latitude of the southwest corner of the statespace. XMAX and YMAX define the northeast corner. As is standard for all the tables, the values are in decimal degrees; longitude is positive east and latitude is positive north. NALT is the number of altitude levels that will be used in constructing the three dimensional statespace (TH3D). NALT may be as low as 1 and should never exceed 5. It is currently set to 5. NDIR is the number of directions used in generating the statespace. It must be set to 8 for this version of FLAPS. This corresponds to a 45 degree angular separation of adjacent directions. IDUM is the number of masking points and should be set equal to 2. IDVE is the ID of the vehicle for which the statespace is to be built. IDVE must match an ID for one of the Vehicle Parameters table (VEHP) records. The statespace will be built assuming that all vehicles are flying at the nominal velocity (VNOM in VEHP) for the vehicle specified by IDVE. ARMX is the air danger per second. It is applied to all transition costs in the statespace. A vehicle flying through enemy airspace is at risk even if it is not within the coverage of any known threats. FLAPS models this risk with ARMX. It should always be a very small number. FLAM is the Lagrange multiplier which is used to ensure that the routes generated by the dynamic programming algorithm are direct and fuel efficient. It is also in the units of danger per second. ALTS is the list of above ground level clearance altitudes that are used in building the statespace. The altitudes are in meters. In building TH3D, threat exposure is calculated for each of these
altitudes, for every threat. The first NALT values should be greater than 0.
The variables XSCL, XSCU, ?SCL, and YSCU, define the scenario. XSC and YSCL
are the longitude and latitude of the southwest (lower) corner of the scenario.
XSCU and YSCU are the longitude and latitude of the northeast (upper) corner of
the scenario. The scenario must contain the statespace. ?CAP is the "constant
probability of clobber grid" and is not now being used.

IV.1.3.2 ALGP Table Usage

The ALGP table defines both the scenario space and the statespace. It is
critical that it be defined properly or else the threat modeling calculations,
which are very time consuming relative the the rest of FLAPS, will be incorrect.
The normal user should never have to change the values of ALGP. However, if
that becomes necessary, the following information will be useful.

Please note that the statespace must be completely contained within the
scenario space. The statespace must also be completely contained within the
boundaries of the byte packed terrain data (BYTE) file. Please see Sections
IV.2.13, IV.2.10, and IV.2.17 for descriptions of TH3D, STAT, and BYTE.

The statespace contains what are called "transition costs". A transition
cost is defined to be the negative log of the probability of survival going from
one cell to another. The negative log probability of survival is often referred
to as "danger." Because each cell is connected to eight other cells, there are
eight transition costs per statespace cell. Threat lethabilities are stored in
the threat model table (TMDL) in the form of negative log probability of
survival per second. To calculate a transition cost from a TMDL record

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requires, among other factors, that the danger per second be multiplied by the amount of time it takes to fly from one cell to another. At this time, the FLAPS statespace is built for only one vehicle. This is in spite of the fact that planning is being performed for several vehicle types. Currently it is assumed that the differences in speed and threat capability between the F-4, F-16, and F-111 are small. The item IDVE is the ID of the vehicle for which the statespace will be built.

Routes generated using the dynamic programming algorithm are sensitive to the values of ARMX and FLAM. The current values, 5.0 E-6 and 1.5 E-4 respectively, are appropriate for the force level planning application. SCT recommends that the user not change these parameters.
IV.1.4 CURR: Current Status Table

The CURR table consists of a single record of data. This record describes the current status of processing. CURR is updated by the program as a result of a PROC command, or an ADD, DELETE, CHANGE or COPY command to any other table. The user should never attempt to ADD, DELETE or COPY the CURR table. The user should CHANGE the table only to change the graphical plotting device.

The structure of the Current Status Table is shown below. This excerpt may be recreated by typing "SHOW CURR HELP".

CURR TABLE STRUCTURE

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CH04</td>
<td>1</td>
<td>1</td>
<td>ID = CURR</td>
</tr>
<tr>
<td>IADD</td>
<td>INT</td>
<td>1</td>
<td>2</td>
<td># OF THREATS ADDED</td>
</tr>
<tr>
<td>IALT</td>
<td>INT</td>
<td>1</td>
<td>3</td>
<td>TERRAIN ALT INDICATOR</td>
</tr>
<tr>
<td>IAO0</td>
<td>INT</td>
<td>1</td>
<td>4</td>
<td>ALTITUDE LEVEL</td>
</tr>
<tr>
<td>ICMP</td>
<td>INT</td>
<td>1</td>
<td>5</td>
<td>CLOBBER INDICATOR</td>
</tr>
<tr>
<td>IST0</td>
<td>INT</td>
<td>1</td>
<td>6</td>
<td># OF STCH THREATS ADDED</td>
</tr>
<tr>
<td>ILST</td>
<td>CH04</td>
<td>1</td>
<td>7</td>
<td>LAST COMMAND GIVEN</td>
</tr>
<tr>
<td>INDX</td>
<td>INT</td>
<td>1</td>
<td>8</td>
<td>INDEX OF LAST ARC DONE A</td>
</tr>
<tr>
<td>IPRO</td>
<td>INT</td>
<td>1</td>
<td>9</td>
<td>STATUS OF PROC COMMAND</td>
</tr>
<tr>
<td>IYP</td>
<td>INT</td>
<td>1</td>
<td>10</td>
<td>TYPE OF LAST ARC DONE A</td>
</tr>
<tr>
<td>IMSK</td>
<td>INT</td>
<td>1</td>
<td>11</td>
<td># OF THREATS MASKED</td>
</tr>
<tr>
<td>IDEV</td>
<td>CH04</td>
<td>1</td>
<td>12</td>
<td>INDEX OF LAST ARC DONE T</td>
</tr>
<tr>
<td>IDM1</td>
<td>INT</td>
<td>1</td>
<td>13</td>
<td>DEVICE CHARACTER</td>
</tr>
<tr>
<td>IDM2</td>
<td>INT</td>
<td>1</td>
<td>14</td>
<td>DUMMY NOT YET USED</td>
</tr>
<tr>
<td>IDM3</td>
<td>INT</td>
<td>1</td>
<td>15</td>
<td>DUMMY NOT YET USED</td>
</tr>
<tr>
<td>IDM4</td>
<td>INT</td>
<td>1</td>
<td>16</td>
<td>DUMMY NOT YET USED</td>
</tr>
<tr>
<td>IDM5</td>
<td>INT</td>
<td>1</td>
<td>17</td>
<td>DUMMY NOT YET USED</td>
</tr>
<tr>
<td>IDM6</td>
<td>INT</td>
<td>1</td>
<td>18</td>
<td>DUMMY NOT YET USED</td>
</tr>
<tr>
<td>IDM7</td>
<td>INT</td>
<td>1</td>
<td>19</td>
<td>DUMMY NOT YET USED</td>
</tr>
<tr>
<td>IDM8</td>
<td>INT</td>
<td>1</td>
<td>20</td>
<td>DUMMY NOT YET USED</td>
</tr>
<tr>
<td>IDM9</td>
<td>INT</td>
<td>1</td>
<td>21</td>
<td>DUMMY NOT YET USED</td>
</tr>
<tr>
<td>IDM0</td>
<td>INT</td>
<td>1</td>
<td>22</td>
<td>DUMMY NOT YET USED</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>23</td>
<td>RECORD CREATION DATE</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>24</td>
<td>RECORD MODIFICATION DATE</td>
</tr>
</tbody>
</table>

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The first item is the record ID and is always equal to CURR. Of the remaining items, only IAOP, IPRO and IDEV are currently used by the program.

IAOP is the altitude level used in the altitude optimization algorithm of statespace construction. The user specifies this level in response to a prompt issued by the STATES AOPT and PROC commands as described in Chapter III. IDEV is the plotting device currently in use, as described in the DISPLAY command of Chapter III. IPRO is the status of processing as defined below.

\[
\text{IPROCU} = "\text{STATUS OF PROCESSING}"
\]

\[
\begin{align*}
\text{"}0\text{"} & : \text{GEOMETRY TO BE DONE} \\
\text{"}100\text{"} & : \text{GEOMETRY OK; STATESPACE TO BE CLEARED} \\
\text{"}120\text{"} & : \text{STATESPACE CLEARED; MASKING TO BE DONE} \\
\text{"}140\text{"} & : \text{MASKING COMPLETE; THREATS TO BE ADDED} \\
\text{"}150\text{"} & : \text{THREATS ADDED; STCHS TO BE ADDED} \\
\text{"}160\text{"} & : \text{STCHS ADDED; Clobber to be Done} \\
\text{"}180\text{"} & : \text{Clobber OK; AOPT to be done} \\
\text{"}200\text{"} & : \text{STATESPACE OK; NODES TO BE DONE} \\
\text{"}250\text{"} & : \text{NODES OK; ACCESS to be done} \\
\text{"}300\text{"} & : \text{ACCESS OK; ARCS to be completed} \\
\text{"}400\text{"} & : \text{ARCS OK; ROUTES to be done} \\
\text{"}500\text{"} & : \text{ROUTES OK; ALLOCATE to be done} \\
\text{"}600\text{"} & : \text{ALLOCATE OK}
\end{align*}
\]

IV.1.4.1 CURR Table Usage

The CURR table is changed by the user using the standard table CHANGE command. Only the IDEV item should be selected for changing. Possible values for this item depend on the available hardware configuration. Because the data type of this item is character, values like 4014 and 4115 which are normally treated as integers must be enclosed in double quotation marks with no embedded blanks. IDEV may take one of the following values.
CRT 24 x 30 alphanumeric display (poor resolution)
HP Hewlett - Packard X - Y Plotter
PTX Printronix High - resolution line printer
SEL Selenar Board (V7-100 with special hardware)
"4014" Tektronix 4014 and 4014 emulators (4014 emulation software is available for the Macintosh)
"4115" Tektronix 4115

The standard display device is the Tektronix 4115B. Users on other systems must make sure that IDEV is set appropriately. The FIND and LOCATE commands are only supported on the 4115B.

The value of IPRO is set automatically by the program. It is increased on a PROCESS command, according to the last algorithm successfully completed. Thus, for example, if the PROCESS command successfully completed all the way through ALLOCATE, IPRO would be set to 600; while, if it exited after successfully completing ACCESS, IPRO would be set to 300. The value of IPRO may be decreased on an ADD, DELETE, CHANGE or COPY command. In this case, IPRO is either set to the smaller of its previous values or set to the value of the LAFT item in the Table Structure Table (TSTR) (See Section IV.1.1). Values for LAFT are as follows:

<table>
<thead>
<tr>
<th>CRSHOW -- RECORD #</th>
<th>IDWORD</th>
<th>LAFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>ASTR</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>ALGP</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>CMDL</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>CURR</td>
<td>600</td>
</tr>
</tbody>
</table>

IV-14
CRSHOW -- RECORD # 6  IDWORD=DISP
IAFT= 600

CRSHOW -- RECORD # 7  IDWORD=GEOM
IAFT= 0

CRSHOW -- RECORD # 8  IDWORD=LLTR
IAFT= 200

CRSHOW -- RECORD # 9  IDWORD=NODP
IAFT= 250

CRSHOW -- RECORD # 10 IDWORD=PBOR
IAFT= 600

CRSHOW -- RECORD # 11 IDWORD=ROZ
IAFT= 600

CRSHOW -- RECORD # 12 IDWORD=SPED
IAFT= 600

CRSHOW -- RECORD # 13 IDWORD=STCH
IAFT= 100

CRSHOW -- RECORD # 14 IDWORD=STGB
IAFT= 200

CRSHOW -- RECORD # 15 IDWORD=SUPM
IAFT= 100

CRSHOW -- RECORD # 16 IDWORD=SUPP
IAFT= 100

CRSHOW -- RECORD # 17 IDWORD=SWCH
IAFT= 100

CRSHOW -- RECORD # 18 IDWORD=TG
IAFT= 200

CRSHOW -- RECORD # 19 IDWORD=THRT
IAFT= 100

CRSHOW -- RECORD # 20 IDWORD=TMDL
IAFT= 100

CRSHOW -- RECORD # 21 IDWORD=VEHP
IAFT= 0

CRSHOW -- RECORD # 22 IDWORD=VEAP
IAFT= 400

CRSHOW -- RECORD # 23 IDWORD=VPZ

IV-15
Thus for example, if the value of IPRO is 600, and the user changes the LLIR file, then IPRO would be reduced to 200. A HELP STATUS command (Section III.1) would show that the STATESPACE is still good, but the NODES, ACCESS, ARCS, ROUTES, and ALLOCATE arrays are bad.

An example of the relevant items in the CURR table is shown below.

CRSHOW -- RECORD 4  2  IDWORD=Curr

ID   = CURR
LAOP  = 2
IPRO  = 600
IDEV  = 4115
IDC   = 85/11/22 16:43
IDM   = 85/12/18 15:23
IV.1.5 DISP: Display Table

The DISP table consists of three records of data which contain parameters necessary for writing to four different graphic display devices. The information in this table supports Lambert Conformal Projection plots. The information in this table is internal to the display algorithms. The user should never directly modify this table.

The structure of the DISP table is shown below. This table may be recreated by typing "SHOW DISP HELP".

```
DISPLAY TABLE STRUCTURE

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDEV</td>
<td>CH04</td>
<td>1</td>
<td>1</td>
<td>PLOTTING DEVICE</td>
</tr>
<tr>
<td>LMIN</td>
<td>INT</td>
<td>1</td>
<td>2</td>
<td>MIN HORIZONTAL RASTER</td>
</tr>
<tr>
<td>MMIN</td>
<td>INT</td>
<td>1</td>
<td>3</td>
<td>MIN VERTICAL RASTER</td>
</tr>
<tr>
<td>LMAX</td>
<td>INT</td>
<td>1</td>
<td>4</td>
<td>MAX HORIZONTAL RASTER</td>
</tr>
<tr>
<td>MMAX</td>
<td>INT</td>
<td>1</td>
<td>5</td>
<td>MAX VERTICAL RASTER</td>
</tr>
<tr>
<td>XSCL</td>
<td>REAL</td>
<td>1</td>
<td>6</td>
<td>HORIZ RASTER / DEG LONG.</td>
</tr>
<tr>
<td>YSCL</td>
<td>REAL</td>
<td>1</td>
<td>7</td>
<td>VERT RASTER / DEG LAT.</td>
</tr>
<tr>
<td>XSSUB</td>
<td>REAL</td>
<td>1</td>
<td>8</td>
<td>LAT AT HORIZ RASTER = 0</td>
</tr>
<tr>
<td>YSUB</td>
<td>REAL</td>
<td>1</td>
<td>9</td>
<td>LAT AT VERT RASTER = 0</td>
</tr>
<tr>
<td>XMIN</td>
<td>REAL</td>
<td>1</td>
<td>10</td>
<td>MIN LONG IN WINDOW (DEG)</td>
</tr>
<tr>
<td>YMIN</td>
<td>REAL</td>
<td>1</td>
<td>11</td>
<td>MIN LAT IN WINDOW (DEG)</td>
</tr>
<tr>
<td>XMAX</td>
<td>REAL</td>
<td>1</td>
<td>12</td>
<td>MAX LONG IN WINDOW (DEG)</td>
</tr>
<tr>
<td>YMAX</td>
<td>REAL</td>
<td>1</td>
<td>13</td>
<td>MAX LAT IN WINDOW (DEG)</td>
</tr>
<tr>
<td>IMIN</td>
<td>INT</td>
<td>1</td>
<td>14</td>
<td>MINIMUM I IN WINDOW</td>
</tr>
<tr>
<td>JMIN</td>
<td>INT</td>
<td>1</td>
<td>15</td>
<td>MINIMUM J IN WINDOW</td>
</tr>
<tr>
<td>IMAX</td>
<td>INT</td>
<td>1</td>
<td>16</td>
<td>MAXIMUM I IN WINDOW</td>
</tr>
<tr>
<td>JMAX</td>
<td>INT</td>
<td>1</td>
<td>17</td>
<td>MAXIMUM J IN WINDOW</td>
</tr>
<tr>
<td>XLB1</td>
<td>REAL</td>
<td>1</td>
<td>18</td>
<td>1ST LABELLED LONG. (DEG)</td>
</tr>
<tr>
<td>DXLB</td>
<td>REAL</td>
<td>1</td>
<td>19</td>
<td>DELTA LABELLED LONG (DEG)</td>
</tr>
<tr>
<td>NXLB</td>
<td>INT</td>
<td>1</td>
<td>20</td>
<td>NUMBER OF LABELLED LONGS</td>
</tr>
<tr>
<td>YLB1</td>
<td>REAL</td>
<td>1</td>
<td>21</td>
<td>1ST LABELLED LAT (DEG)</td>
</tr>
<tr>
<td>DYLB</td>
<td>REAL</td>
<td>1</td>
<td>22</td>
<td>DELTA LABELLED LAT (DEG)</td>
</tr>
<tr>
<td>NTLB</td>
<td>INT</td>
<td>1</td>
<td>23</td>
<td>NUMBER OF LABELLED LATS.</td>
</tr>
<tr>
<td>LAT1</td>
<td>REAL</td>
<td>1</td>
<td>24</td>
<td>1ST ZERO DISTORTION LAT</td>
</tr>
<tr>
<td>LAT2</td>
<td>REAL</td>
<td>1</td>
<td>25</td>
<td>2ND ZERO DISTORTION LAT</td>
</tr>
<tr>
<td>XCEN</td>
<td>REAL</td>
<td>1</td>
<td>26</td>
<td>CENTRAL LONGITUDE</td>
</tr>
<tr>
<td>RCON</td>
<td>REAL</td>
<td>1</td>
<td>27</td>
<td>DEG FR YMAX TO PROJ POLE</td>
</tr>
<tr>
<td>TSCL</td>
<td>REAL</td>
<td>1</td>
<td>28</td>
<td>ANGULAR SCALE (DEG/LONG)</td>
</tr>
<tr>
<td>LSCALE</td>
<td>REAL</td>
<td>1</td>
<td>29</td>
<td>LAMBERT LON SCALE FACTOR</td>
</tr>
<tr>
<td>MSCL</td>
<td>REAL</td>
<td>1</td>
<td>30</td>
<td>LAMBERT LAT SCALE FACTOR</td>
</tr>
</tbody>
</table>
```
<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCON</td>
<td>REAL</td>
<td>1</td>
<td>LAMBERT LON CONSTANT</td>
</tr>
<tr>
<td>MCON</td>
<td>REAL</td>
<td>2</td>
<td>LAMBERT LAT CONSTANT</td>
</tr>
<tr>
<td>DUM1</td>
<td>REAL</td>
<td>3</td>
<td>DUMMY NOT USED YET</td>
</tr>
<tr>
<td>DUM2</td>
<td>REAL</td>
<td>4</td>
<td>DUMMY NOT USED YET</td>
</tr>
<tr>
<td>DUM3</td>
<td>REAL</td>
<td>5</td>
<td>DUMMY NOT USED YET</td>
</tr>
<tr>
<td>DUM4</td>
<td>REAL</td>
<td>6</td>
<td>DUMMY NOT USED YET</td>
</tr>
<tr>
<td>DUM5</td>
<td>REAL</td>
<td>7</td>
<td>DUMMY NOT USED YET</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>8</td>
<td>RECORD CREATION DATE</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>9</td>
<td>RECORD MODIFICATION DATE</td>
</tr>
</tbody>
</table>
IV.1.6 GEOM: Geometry Table

The GEOM table consists of a single record of data. The GEOM table is created by the program when the GEOM command is issued. This is normally performed at program initialization and is "transparent" to the user, that is, the user sees only the product (the GEOM table) and neither directly initiates nor sees the process itself. The user should never attempt to ADD, DELETE, CHANGE, or COPY the GEOM table. Most of this data is based on the data in the ALGP table. The scenario geometry is modified by changing ALGP.

The structure of the Geometry Table is shown below. This table may be recreated by typing "SHOW GEOM HELP".

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CH04</td>
<td>1</td>
<td>1</td>
<td>ID = GEOM</td>
</tr>
<tr>
<td>NI</td>
<td>INT</td>
<td>1</td>
<td>2</td>
<td>NUMBER OF LONGITUDES</td>
</tr>
<tr>
<td>NJ</td>
<td>INT</td>
<td>1</td>
<td>3</td>
<td>NUMBER OF LATITUDES</td>
</tr>
<tr>
<td>NK</td>
<td>INT</td>
<td>1</td>
<td>4</td>
<td>NUMBER OF AGLS</td>
</tr>
<tr>
<td>NL</td>
<td>INT</td>
<td>1</td>
<td>5</td>
<td>NUMBER OF DIRECTIONS</td>
</tr>
<tr>
<td>XMAX</td>
<td>REAL</td>
<td>1</td>
<td>6</td>
<td>MAXIMUM LONGITUDE</td>
</tr>
<tr>
<td>XMIN</td>
<td>REAL</td>
<td>1</td>
<td>7</td>
<td>MINIMUM LONGITUDE</td>
</tr>
<tr>
<td>YMAX</td>
<td>REAL</td>
<td>1</td>
<td>8</td>
<td>MAXIMUM LATITUDE</td>
</tr>
<tr>
<td>YMIN</td>
<td>REAL</td>
<td>1</td>
<td>9</td>
<td>MINIMUM LATITUDE</td>
</tr>
<tr>
<td>AL</td>
<td>REAL</td>
<td>5</td>
<td>10</td>
<td>STATESPACE ALTITUDES (M)</td>
</tr>
<tr>
<td>DX</td>
<td>REAL</td>
<td>3</td>
<td>15</td>
<td>STATESPACE DELTS (DEG,M)</td>
</tr>
<tr>
<td>IDEL</td>
<td>INT</td>
<td>8</td>
<td>18</td>
<td>DELTA I (LTH DIRECTION)</td>
</tr>
<tr>
<td>JDEL</td>
<td>INT</td>
<td>8</td>
<td>26</td>
<td>DELTA J (LTH DIRECTION)</td>
</tr>
<tr>
<td>XO</td>
<td>REAL</td>
<td>3</td>
<td>34</td>
<td>STATESPACE ORIGIN(DEG,M)</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>37</td>
<td>RECORD CREATION DATE</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>38</td>
<td>RECORD MODIFICATION DATE</td>
</tr>
</tbody>
</table>
The first item is the record ID and is always equal to 320M. The next three items, NI, NJ, and NK give the number of statespace cells in the east, north and vertical direction. The number of cells is determined by the size of the statespace, the cell size, and the number of altitude levels specified in ALGP. XMIN, YMIN, XMAX, and YMAX are the southwest and northeast corners of the statespace respectively. AL contains the altitude levels. DX(1) and DX(2) contains the north and east statespace cell size in decimal degrees. DX(3) is not currently being used. IDEL and JDEL define the eight transition directions and are used by the dynamic programming algorithm. XO is again the southwest corner of the statespace.
IV.1.7 LLTR: Low Level Transit Route Table

The LLTR table defines the low level transit route (LLTR) network connecting the staging bases with the FEBA. This table must be constructed, or modified, by the user to model the transit route network in effect at the time the missions are to be flown. It contains one record for each LLTR node point. This record defines the ID, type and location of that node as well as its interconnections to other nodes. Records of this table may be referred to by their record number or the ID of the node as in the commands "SHOW LLTR 4" or "SHOW LLTR NO08". Illustrated below is the description of the LLTR table structure which is generated by the FLAPS command "SHOW LLTR HELP".

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CHO8</td>
<td>1</td>
<td>1</td>
<td>ID OF TRANSIT ROUTE NODE</td>
</tr>
<tr>
<td>X</td>
<td>REAL</td>
<td>2</td>
<td>3</td>
<td>LONG-LAT OF LLTR NODE</td>
</tr>
<tr>
<td>CLNG</td>
<td>REAL</td>
<td>1</td>
<td>5</td>
<td>TRANSIT ROUTE CEILING</td>
</tr>
<tr>
<td>ITYP</td>
<td>INT</td>
<td>1</td>
<td>6</td>
<td>TRANSIT ROUTE TYPE</td>
</tr>
<tr>
<td>ICON</td>
<td>CHO8</td>
<td>3</td>
<td>7</td>
<td>LLTR NODE CONNECTIONS</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>13</td>
<td>RECORD CREATION DATE</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>14</td>
<td>RECORD MODIFICATION DATE</td>
</tr>
</tbody>
</table>

The first item in each record is a unique ID for the LLTR node. This ID may be up to 8 alphanumeric characters long and the first character must be alpha. The second item (X) consists of the longitude and latitude (in that order) of the node, given in decimal degrees according to the convention: Longitude +East/-West; Latitude +North/-South. Item three (CLNG) is not presently used by the program. Item four (ITYP) is the node type: type 0 - inactive node, type 1 - active entry node, type 2 - active intermediate node, type 3 - active exit node. Item five (ICON) is a list of the other LLTR node IDs to which this node is connected; presently the length of this list may not
Connection is defined only for the direction from the staging base to the FEBA. Therefore, active exit points will have no connections and active entry points must have at least one connecting LLTR node. All LLTR nodes must be inside the scenario space, or else they will be ignored by the program. In addition, all LLTR exit points must be inside the statespace. This is because the dynamic programming algorithm (DPA) is used to generate routes from the LLTR exit points to the targets. The DPA can only be executed between two points if they are both inside the statespace.
IV.1.8 NODP: Node Parameter Table

The NODP table contains the number of nodes which are active in the specified scenario. NODP is an exception to the usual FLAPS convention that tables are defined by the user and arrays defined by the program - NODP consists of a single record ( #2 ) whose items are computed by the FLAPS command "NODES". The contents of this table may be examined with the command "SHOW NODP 2" but NODP records should never be added, copied, deleted or changed by the user. The description of the structure of NODP illustrated below is produced by the command "SHOW NODP HELP".

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CR04</td>
<td>1</td>
<td>1</td>
<td>ID = NODP</td>
</tr>
<tr>
<td>NSB</td>
<td>INT</td>
<td>1</td>
<td>2</td>
<td>NUMBER OF STAGING BASES</td>
</tr>
<tr>
<td>NTR</td>
<td>INT</td>
<td>1</td>
<td>3</td>
<td>NUMBER OF LLTR NODES</td>
</tr>
<tr>
<td>NTG</td>
<td>INT</td>
<td>1</td>
<td>4</td>
<td>NUMBER OF TARGETS</td>
</tr>
<tr>
<td>NTR1</td>
<td>INT</td>
<td>1</td>
<td>5</td>
<td>NBR OF LLTR ENTRY NODES</td>
</tr>
<tr>
<td>NTR2</td>
<td>INT</td>
<td>1</td>
<td>6</td>
<td># OF LLTR INTERMED NODES</td>
</tr>
<tr>
<td>NTR3</td>
<td>INT</td>
<td>1</td>
<td>7</td>
<td>NBR OF LLTR EXIT NODES</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>8</td>
<td>RECORD CREATION DATE</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>9</td>
<td>RECORD MODIFICATION DATE</td>
</tr>
</tbody>
</table>

Item one of the record is the table ID - NODP. Items NSB, NTR and NTG are the numbers of staging bases, LLTR nodes and targets, respectively, determined to be active and within the geographical region of interest. For example, inactive LLTR nodes (ITYP=0), targets outside the statespace boundaries, and staging bases and LLTR nodes outside the scenario boundaries are not counted and are excluded from consideration in the mission planning problem. Items NTR1, NTR2 and NTR3 allocate the total in item NTR among the 3 LLTR node types: entry, intermediate and exit.
IV.1.9 PBOR: Political Border Table

The PBOR table contains a list of long/lat points that outline the political borders between countries in a scenario. The PBOR table is used to display the country borders on the Tektronix 4115. Each record can contain one or more borders between countries.

IV.1.9.1 PBOR Table Structure

The structure of the PBOR table is shown below. This table may be reproduced by typing "SHOW PBOR HELP".

PBOR TABLE STRUCTURE

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CH08</td>
<td>1</td>
<td>1</td>
<td>ID OF POLITICAL BORDERS</td>
</tr>
<tr>
<td>NPTS</td>
<td>INT</td>
<td>1</td>
<td>3</td>
<td>NBR OF PBOR BOUNDARY PTS</td>
</tr>
<tr>
<td>XPB</td>
<td>REAL</td>
<td>200</td>
<td>4</td>
<td>LONG-LAT OF BNDRY POINTS</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>204</td>
<td>RECORD CREATION DATE</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>205</td>
<td>RECORD MODIFICATION DATE</td>
</tr>
</tbody>
</table>

The first item in the PBOR table is the political border ID. This ID may be up to eight characters long and must begin with an alpha character. This ID usually describes the countries around the borders being plotted. The second item (NPTS) is the number of longitude/latitude points in each record. One hundred points is the maximum, with each longitude/latitude coordinate counting as one point. The third item (XPB) is the political border points position expressed as decimal degrees (longitude and latitude). The data points must be contiguous (all entered in either clockwise or counterclockwise direction).
IV. 9.2 PBOR Table Usage

The current PBOR files contain all of the political borders for Western Europe within the current scenario space (July 85 delivery). The user will not need to add or change these files. If the scenario is increased or moved, the PBOR records will have to be updated. If new boundary points are desired, records may be added. The user could include roads, rivers or other cultural boundaries if data bases are available. The data may be displayed by using the BOUNDARY and MISSION options of the DISPLAY command.

An example of a PBOR record is shown below.

```
CRSHOW -- RECORD # 5 IDWORD=EASGER

ID = EASGER
NPTS = 76
XPB =
  1.2150E+01  5.0317E+01  1.2217E+01  5.0317E+01
  1.2333E+01  5.0167E+01  1.2333E+01  5.0233E+01
  1.2500E+01  5.0400E+01  1.2833E+01  5.0467E+01
  1.2950E+01  5.0400E+01  1.3000E+01  5.0433E+01
  1.3050E+01  5.0517E+01  1.3167E+01  5.0517E+01
  1.3217E+01  5.0517E+01  1.3250E+01  5.0583E+01
  1.3300E+01  5.0567E+01  1.3417E+01  5.0633E+01
  1.3450E+01  5.0583E+01  1.3467E+01  5.0600E+01
  1.3500E+01  5.0633E+01  1.3517E+01  5.0717E+01
  1.3783E+01  5.0733E+01  1.3850E+01  5.0733E+01
  1.3883E+01  5.0750E+01  1.3900E+01  5.0800E+01
  1.4000E+01  5.0817E+01  1.4050E+01  5.0800E+01
  1.4083E+01  5.0800E+01  1.4217E+01  5.0867E+01
  1.4217E+01  5.0900E+01  1.4383E+01  5.0900E+01
  1.4400E+01  5.0933E+01  1.4300E+01  5.0967E+01
  1.4333E+01  5.0967E+01  1.4283E+01  5.0983E+01
  1.4267E+01  5.1000E+01  1.4300E+01  5.1050E+01
  1.4417E+01  5.1017E+01  1.4500E+01  5.1050E+01
  1.4500E+01  5.1017E+01  1.4383E+01  5.1000E+01
  1.4617E+01  5.0967E+01  1.4583E+01  5.0917E+01
  1.4650E+01  5.0933E+01  1.4617E+01  5.0867E+01
  1.4800E+01  5.0817E+01  1.4817E+01  5.0867E+01
  1.4967E+01  5.1000E+01  1.5000E+01  5.1167E+01
  1.5033E+01  5.1283E+01  1.5000E+01  5.1317E+01
  1.4983E+01  5.1400E+01  1.4967E+01  5.1467E+01
  1.4717E+01  5.1517E+01  1.4700E+01  5.1550E+01
  1.4733E+01  5.1617E+01  1.4717E+01  5.1667E+01
```

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1.4667E-01  5.1733E-01  1.4667E-01  5.1300E-01
1.4633E-01  5.1800E-01  1.4382E-01  5.1335E-01
1.4700E-01  5.1917E-01  1.4717E-01  5.2000E-01
1.4733E-01  5.2067E-01  1.4833E-01  5.2100E-01
1.4683E-01  5.2133E-01  1.4700E-01  5.2167E-01
1.4700E-01  5.2233E-01  1.4600E-01  5.2267E-01
1.4333E-01  5.2383E-01  1.4550E-01  5.2433E-01
1.4617E-01  5.2500E-01  1.4600E-01  5.2533E-01
1.4633E-01  5.2583E-01  1.4217E-01  5.2817E-01
1.4133E-01  5.2833E-01  1.4167E-01  5.2867E-01
1.4133E-01  5.2967E-01  1.4250E-01  5.3000E-01
0.3000E-00  0.3000E-00  0.0000E-00  0.0000E-00
0.0000E-00  0.0000E-00  0.0000E-00  0.0000E-00
0.0000E-00  0.0000E-00  0.0000E-00  0.0000E-00
0.0000E-00  0.0000E-00  0.0000E-00  0.0000E-00
0.0000E-00  0.0000E-00  0.0000E-00  0.0000E-00
0.0000E-00  0.0000E-00  0.0000E-00  0.0000E-00
0.0000E-00  0.0000E-00  0.0000E-00  0.0000E-00
0.0000E-00  0.0000E-00  0.0000E-00  0.0000E-00
0.0000E-00  0.0000E-00  0.0000E-00  0.0000E-00
0.0000E-00  0.0000E-00  0.0000E-00  0.0000E-00
0.0000E-00  0.0000E-00  0.0000E-00  0.0000E-00
0.0000E-00  0.0000E-00  0.0000E-00  0.0000E-00
IDC = 85/11/22 16:43
IDM = 85/11/22 16:43
IV.1.10 ROZ: Restricted Operating Zone Table

The ROZ table is used to store the locations where the planner wishes to place restricted areas of flying. Each record contains one area of restricted operating zones.

IV.1.10.1 ROZ Table Structure

The structure of the ROZ table is shown below. This table may be reproduced by typing "SHOW ROZ HELP".

ROZ TABLE STRUCTURE

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CH08</td>
<td>1</td>
<td>1</td>
<td>ID OF ROZ</td>
</tr>
<tr>
<td>NPTS</td>
<td>INT</td>
<td>1</td>
<td>3</td>
<td>NBR OF ROZ BOUNDARY PTS</td>
</tr>
<tr>
<td>X</td>
<td>REAL</td>
<td>20</td>
<td>4</td>
<td>LONG-LAT OF BNDRY POINTS</td>
</tr>
<tr>
<td>TON</td>
<td>REAL</td>
<td>1</td>
<td>24</td>
<td>TIME ON OF ROZ</td>
</tr>
<tr>
<td>TOFF</td>
<td>REAL</td>
<td>1</td>
<td>25</td>
<td>TIME OFF OF ROZ</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>26</td>
<td>RECORD CREATION DATE</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>27</td>
<td>RECORD MODIFICATION DATE</td>
</tr>
</tbody>
</table>

The first item in the ROZ table is the restricted operating zone ID. This ID may be up to eight characters long and must begin with a letter. This ID can refer to the area involved or anything else the user wishes. The second item (NPTS) is the number of boundary points of the area. There is a minimum of three boundary points (triangle shaped area) and a maximum of ten points (ten-sided polygonal area). The third item (X) contains the vertices of the restricted operating zone as longitude and latitude. Longitude and latitude are in decimal degrees. The vertices must be contiguous (all entered in either clockwise or counterclockwise order). The fourth item (TON) is the time of day the ROZ is on and the fifth item (TOFF) is the time of day the ROZ is off. At
this time TON and TOFF are not being used. TON and TOFF are expressed in
decimal hours.

IV.1.10.2 ROZ Table Usage

The ROZ table is added by the user with the standard table ADD command.
Records can be changed, deleted, or copied. The data may be displayed by using
the RZ option in the DISPLAY command. At this time, ROZ's are only used for
display purposes and will have no effect on the routes. It is assumed that the
LLTR data is correct and no attempt is made to verify that ROZ's are in fact
avoided by the current set of available LLTR's.

An example of a ROZ record is shown below.

CRSHOW -- RECORD # 2 IDWORD=T1ROZ1

ID = T1ROZ1
NPTS= 8
X = 8.5807E+00 5.1252E+01 8.4132E+00 5.1652E+01
    8.6016E+00 5.1998E+01 9.3551E+00 5.2211E+01
    1.0171E+01 5.2024E+01 1.0255E+01 5.1732E+01
    9.8575E+00 5.1452E+01 9.4807E+00 5.1292E+01
    0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
TON = 0.0000E+00
TOFF = 0.0000E+00
IDC = 85/11/22 16:43
IDM = 85/11/22 16:43
IV.1.11 SPED: Sortie Record Table

The SPED table contains routes (sorties) stored as a series of waypoints and a header. Each record of the SPED table contains one route. Records in the SPED table are created using the SELECT command. Refer to the description of the SELECT command in Section III.2.12 to see how and when SPED records may be created. Each SPED record is quite large relative to the other tables in FLAPS. This makes SPED records rather difficult to manipulate. Several features have been built into FLAPS to make using the SPED table as easy as possible.

Routes are stored in the SPED table to support three commands. First, the DISPLAY command reads SPED records in order to graphically display routes. Refer to the ROUT option in the DISPLAY command in Section III.2.9. Routes are also read out of the SPED file for threat exposure analysis. Refer to the ANALIZE command in Section III.1.12. Finally, routes stored in the SPED table may be printed out in a flight plan format. Refer to the PLAN option for the SHOW command in Section III.2.7 and the flight plan description in Section IV.2.16.

IV.1.11.1 Table Structure

The structure of the SPED table is shown below. This table can be recreated by typing "SHOW SPED HELP".

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CH12</td>
<td>1</td>
<td>1</td>
<td>SORTIE ID (USER CHOOSEN)</td>
</tr>
<tr>
<td>ISB</td>
<td>INT</td>
<td>1</td>
<td>4</td>
<td>STAGING BASE INDEX</td>
</tr>
<tr>
<td>ITG</td>
<td>INT</td>
<td>1</td>
<td>5</td>
<td>TARGET INDEX</td>
</tr>
<tr>
<td>PS</td>
<td>REAL</td>
<td>1</td>
<td>6</td>
<td>PROB OF SURVIVAL</td>
</tr>
<tr>
<td>PTH</td>
<td>REAL</td>
<td>1</td>
<td>7</td>
<td>PROB KILL DUE TO THREATS</td>
</tr>
</tbody>
</table>

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Each SPED record is exactly 733 words long. The record represents a total route from the staging base to the target and back to the staging base. At this time, a maximum of 50 records may be stored in the SPED table. As with every FLAPS table, the first record contains header information, so that a maximum of 49 routes may be stored.

The first item in each record must be a unique ID. The ID may be up to 12 characters long, the first character must be a letter. The second and third items in each SPED record are the indices of the sortie staging base (ISB) and target (ITG), respectively. These index numbers correspond to the NLIS array. The fourth item is the total route probability of survival (PS). The fifth is the probability of kill due to threats (PTH). The total probability of survival is the product of one minus the probability of kill due to threats and one minus a small probability of kill due to "air danger." The sixth item is the total route distance (DFLT). The seventh is the take off time (TTOT) in minutes. The eighth is the time on target (TOT) in minutes. The ninth item is the number of waypoints in the route (NPT).

Next, the actual coordinates of the waypoints are stored (COOR). There are six components of a waypoint. The first is the time in minutes at which the waypoint occurs, the second and third are the longitude and latitude both in decimal degrees, the fourth is the altitude (above ground level) in meters, the...
fifth is heading from north in degrees, and the sixth is an integer index. The
integer index corresponds to the NLIS array and will be nonzero if the waypoint
is a staging base, target or LLTR node. Each SPED record may contain up to 120
waypoints. Routes with fewer waypoints will contain zeros after the last
waypoint.

IV.1.11.2 SPED Table Usage

Records in the SPED table may be shown, added, deleted, changed or copied
just like any other table. However, because of the length of each SPED table
record, care must be taken when working with the SPED table. SPED records
should only be added using the SELECT command. The user should feel free to
delete SPED records if some records are no longer needed or if more room is
needed. The user should never have to change items in a specific SPED record or
copy SPED records. The user may wish to show items in a SPED record header,
such as DFLT or PS. If this is the case, the user should specify the items he
or she wishes to see. Showing an entire SPED record is not recommended because
of the length of the COOR item. The SHOW PLAN command was created to print out
SPED records in an easily interpreted form. SHOW PLAN should be used if the
user wishes to see the actual route waypoints.

When creating a SPED record using SELECT, FLAPS will automatically
determine an ID if the user wishes. The ID is determined as follows: The first
four characters of the SPED ID are the first four characters of the name of the
staging base at which the route originated, the fifth character is an underscore
"_", the sixth through ninth characters are the first four characters of the
name of the target, the tenth character is an underscore, and the eleventh and
twelfth characters are a sequence number between 01 and 09. For example, the
first time a route from Ramstein AFB to target Caslav is put in the SPED table,
the ID will be RAMS.CASL.01. If a second version of this route is put into the
SPED table (say after suppression has been applied), then the ID will be
RAMS.CASL.02. Of course the user can override this convention by inputing his
own ID while executing SELECT.

Please note that the probability of survival and kill data is valid for
the route at the time it was created only. If suppression is later applied or
threats are added, the probability of survival data is not updated. The ANALIZE
command computes probability of survival on the current statespace and should be
used to check the impact of statespace changes on specific routes.

An example of a SPED record is shown below.

CRSHOW -- RECORD # 2  IDWORD=LAKEPANE01:
   ID =       LAKEPANE01
   ISB =      2
   ITG =      121
   PS = 4.0261E-01
   PTH = 5.9709E-01
   DFLT= 1.2088E+03
   TTOT= 0.0000E+00
   TOT = 7.5091E+01
   NPT = 35
   COOR= 0.0000E+00 5.8330E-01 5.2400E-01 6.0100E+01 1.2401E+02 0.0000E+00 4.0891E-01 7.6342E+00 4.9288E-01 6.0100E-01 1.0547E+02 0.0000E+00 4.3238E-01 8.1150E-00 4.9205E-01 6.0100E+01 9.7300E-01 0.0000E+00 4.7171E-01 8.9085E+00 9.7300E-01 0.0000E+00 4.7171E-01 8.9085E+00 4.9138E-01 6.0100E-01 8.5424E-01 0.0000E+00 4.9150E-01 9.3097E-00 4.9159E-01 6.0100E-01 9.2520E-01 0.0000E+00 5.2912E-01 1.0074E+01 4.9137E-01 6.0100E-01 5.2032E-01 0.0000E+00 5.5614E+01 1.0508E+01 4.9738E+01 6.0100E+01 8.4893E+01 0.0000E+00 5.9036E-01 1.1205E+01 4.9398E-01 6.0100E-01 5.3467E+01 0.0000E+00 6.3336E+01 1.1914E+01 4.9738E+01 6.0100E+01
4.7824E+01 0.0000E+00 6.6741E+01 1.2363E+01
5.0042E+01 6.0100E+01 8.4796E+01 0.0000E+00
7.0196E+01 1.3149E+01 5.0083E+01 6.0100E+01
6.0125E+01 0.0000E+00 7.2616E+01 1.3623E+01
5.0250E+01 6.0100E+01 4.4705E+01 0.0000E+00
7.3599E+01 1.3732E+01 5.0333E+01 6.0100E+01
5.0000E+00 0.0000E+00 7.3912E+01 1.3732E+01
5.0375E+01 6.0100E+01 9.0000E+01 0.0000E+00
7.4535E+01 1.3862E+01 5.0375E+01 6.0100E+01
1.1408E+02 0.0000E+00 7.5091E+01 1.3933E+01
6.0100E+01 1.2402E+02 0.0000E+00
7.5426E+01 1.3991E+01 5.0292E+01 6.0100E+01
4.4799E+01 0.0000E+00 7.5869E+01 1.4056E+01
5.0000E+00 0.0000E+00 7.5912E+01 1.3732E+01
5.0375E+01 6.0100E+01 1.8000E+02 0.0000E+00
7.8674E+01 1.3732E+01 5.0333E+01 6.0100E+01
2.2485E+02 0.0000E+00 7.8750E+01 1.3602E+01
5.0250E+01 6.0100E+01 2.4021E+02 0.0000E+00
8.1270E+01 1.3149E+01 5.0083E+01 6.0100E+01
2.6287E+02 0.0000E+00 8.3792E+01 1.2630E+01
5.0042E+01 6.0100E+01 2.2500E+02 0.0000E+00
8.4235E+01 1.2565E+01 5.0000E+01 6.0100E+01
2.7000E+02 0.0000E+00 8.5175E+01 1.2371E+01
5.0000E+00 6.0100E+01 2.2843E+02 0.0000E+00
8.8137E+01 1.1914E+01 4.9738E+01 6.0100E+01
2.3366E+02 0.0000E+00 9.2437E+01 1.1205E+01
4.9398E+01 6.0100E+01 2.6490E+02 0.0000E+00
9.5859E+01 1.0508E+01 4.9358E+01 6.0100E+01
2.3216E+02 0.0000E+00 9.3562E+01 1.0074E+01
4.9137E+01 6.0100E+01 2.7252E+02 0.0000E+00
1.0232E+02 9.3097E+00 4.9159E+01 6.0100E+01
2.6543E+02 0.0000E+00 1.0430E+02 8.9085E+00
4.9138E+01 6.0100E+01 2.7711E+02 0.0000E+00
1.0824E+02 8.1150E+00 4.9205E+01 6.0100E+01
2.8549E+02 0.0000E+00 1.1058E+02 7.6542E+00
4.9288E+01 6.0100E+01 3.0580E+02 0.0000E+00
1.5147E+02 5.8330E+01 5.2400E+01 6.0100E+01
3.0580E+01 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

IDC = 85/12/18 15:23
IDM = 85/12/18 15:23

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IV.1.12 STCH: Stochastic Threat Model Table

The STCH table is used for those threats that exhibit one or more of the following features. The exact location of the threat is not known. The threat is a mobile threat whose location varies with time. The threat is a group of threats that are spread out over an area (such as tanks along a road or an army division). This table contains the necessary information to describe the area that a stochastic threat can cover without terrain masking. The generic threat information for each threat is obtained from the threat model table (TMDL).

IV.1.12.1 STCH Table Structure

The structure of the STCH table is shown below. This table may be recreated by typing "SHOW STCH HELP".

STCH TABLE STRUCTURE

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CH04</td>
<td>1</td>
<td>1</td>
<td>THREAT ID</td>
</tr>
<tr>
<td>ITYP</td>
<td>CH08</td>
<td>1</td>
<td>2</td>
<td>THREAT TYPE NAME</td>
</tr>
<tr>
<td>XSC</td>
<td>REAL</td>
<td>3</td>
<td>4</td>
<td>THREAT LON, LAT, and ALT</td>
</tr>
<tr>
<td>EXNT</td>
<td>REAL</td>
<td>1</td>
<td>7</td>
<td>EXPECTED # OF THREATS</td>
</tr>
<tr>
<td>PEX</td>
<td>REAL</td>
<td>1</td>
<td>8</td>
<td>PROB THREAT EXISTS</td>
</tr>
<tr>
<td>RUNC</td>
<td>REAL</td>
<td>1</td>
<td>9</td>
<td>RADIUS OF UNCERTAINTY</td>
</tr>
<tr>
<td>NBPS</td>
<td>INT</td>
<td>1</td>
<td>10</td>
<td># OF PTS ON STCH BORDER</td>
</tr>
<tr>
<td>XPBS</td>
<td>REAL</td>
<td>100</td>
<td>11</td>
<td>LON &amp; LAT OF NTH POINT</td>
</tr>
<tr>
<td>FGRD</td>
<td>REAL</td>
<td>1</td>
<td>111</td>
<td>RATIO OF INT/GE0 GRID</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>112</td>
<td>RECORD CREATION DATE</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>113</td>
<td>RECORD MODIFICATION DATE</td>
</tr>
</tbody>
</table>
The first item in the table is the stochastic threat ID. This ID is four characters long, with the first character being an alpha. The second item (ITYP) is the generic threat type name. This name can be up to eight characters long with the first character being an alpha. The threat type provides a pointer into the threat model table. The third item (XSC) is an array with three elements that gives the threat longitude, latitude, and altitude. This item is used when the threat is contained at one location with a radius of uncertainty. In this case, the variables containing the number of boundary points and the boundary point locations are ignored when calculating the stochastic area. The fourth item (EXNT) gives the expected number of threats to be found in the stochastic area. The fifth item (PEX) gives the probability of existence for this number of threats in the stochastic area. The sixth item (RUNC) gives the radius of uncertainty for the location of this threat. The seventh item (NBPS) gives the number of points that describe the boundary of the stochastic area for this threat. A stochastic area can be described by up to 50 points. The eighth item (XPBS) is an array containing the longitude and latitude for each point that describes the boundary of the stochastic area. It is used when the number of boundary points is greater than one. Then the variables containing the threat location and radius of uncertainty are ignored. The boundary points must be the vertices of a convex polygon. They must also be entered contiguously (either all clockwise, or all counterclockwise). The ninth item (FGRD) is the ratio of the integration grid size to the statespace grid size. An appropriate value to use for this variable is 1.0.
17.1.12.2 STCH Table Usage

The STCH table is used when a threat is a mobile threat, an area threat, or there is poor information as to its exact location. In the cases where the threat is a mobile or area threat, a convex polygonal model is used to describe the threat boundaries. When the threat is a point with a radius of uncertainty, a circular model is used to describe the threat boundaries. Terrain masking is not used when modeling stochastic threats.

The current version of FLAPS does not support automatic threat suppression nor threat exposure analysis for stochastic threats. In other words, if the user has stochastic threats in his statespace and he applies suppression using the SUPRESS command, then the stochastic threat will not be suppressed. Similarly, if threat exposure is calculated for a route using the ANALYZE command, the time in and time out of the stochastic threats will not be reported. However, the leg-by-leg probability of survival report will be correct.
The STGB table defines the locations and resources of the staging bases from which missions are to be flown. It contains one record for each staging base and must be constructed by the user to define the collection of staging bases of interest to his mission planning problem. These records may be referred to by their record number or by the staging base ID as in the commands "DELE STGB 5" or "SHOW STGB RAMSTEIN". Illustrated below is a description of the structure of the STGB table produced by the command "SHOW STGB HELP".

**THE STAGING BASE (STGB) TABLE**

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CH08</td>
<td>1</td>
<td>1</td>
<td>ID OF STAGING BASE</td>
</tr>
<tr>
<td>X</td>
<td>REAL</td>
<td>2</td>
<td>3</td>
<td>LONG-LAT OF STAGING BASE</td>
</tr>
<tr>
<td>ITYP</td>
<td>CH04</td>
<td>1</td>
<td>5</td>
<td>TYPE OF AIRCRAFT AT BASE</td>
</tr>
<tr>
<td>NACR</td>
<td>INT</td>
<td>1</td>
<td>6</td>
<td>NUMBER OF AIRCRAFT</td>
</tr>
<tr>
<td>NWEP</td>
<td>INT</td>
<td>10</td>
<td>7</td>
<td>NUMBER OF WEAPONS</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>17</td>
<td>RECORD CREATION DATE</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>18</td>
<td>RECORD MODIFICATION DATE</td>
</tr>
</tbody>
</table>

The first item in each record is a unique alphanumeric ID for the staging base. This ID may be up to 8 characters long and the first character must be alpha. Item two (X) is the location of the staging base given as longitude, latitude (in that order) in decimal degrees according to the sign convention: Longitude +East/-West, Latitude +North/-South. Item three (ITYP) defines the type of aircraft assumed to be present at the staging base. This item may be up to 4 alphanumeric characters long and must agree with the aircraft ID of the record in the vehicle parameters table VEHP which describes this aircraft. Item four (NACR) is the number of aircraft available at the staging base. This
number is used by the allocation algorithm to ensure that the proposed
allocation of aircraft to targets is consistent with the aircraft resources.
Item five (NWEP) is a list of the number of weapons of each type available at
the staging base. The order of this list must be consistent with the order used
in the items ISCL (table VEHP), FCIN (table VEHP), PDWP (table WEAP) and NAME
(table WEAP). The present version of the FLAPS allocation algorithm does not
perform a detailed accounting of numbers of weapons allocated - it simply checks
that a non-zero number of the selected weapon type is available at the selected
staging base.
IV.1.14 SUPM: Suppressor Model Table

The SUPM table contains data about the generic capabilities of the three types of threat suppressors modeled in FLAPS. Each SUPM record corresponds to a type of suppressor: EF-III, Compass Call, or Wild Weasel. For each type of suppressor, the SUPM table describes how much of an effect individual suppressors will have on the nearby threats. The locations of the individual suppressors are contained in the suppressor position (SUPP) table.

IV.1.14.1 SUPM Table Structure

The structure of the SUPM table is shown below. This table may be recreated by typing "SHOW SUPM HELP".

SUPM TABLE STRUCTURE

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CHO8</td>
<td>1</td>
<td>1</td>
<td>SUPP MODEL IDENTIFIER</td>
</tr>
<tr>
<td>RAD</td>
<td>REAL</td>
<td>1</td>
<td>3</td>
<td>MAX RADIUS OF THE SUPPRESSOR</td>
</tr>
<tr>
<td>ICAP</td>
<td>INT</td>
<td>1</td>
<td>4</td>
<td>SUPP CAPACITY</td>
</tr>
<tr>
<td>TYPE</td>
<td>REAL</td>
<td>25</td>
<td>5</td>
<td>LIST THRT TYPE EFFECTIVE</td>
</tr>
<tr>
<td>DEGR</td>
<td>REAL</td>
<td>25</td>
<td>30</td>
<td>DEGRADE THRT CAPACITY</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>55</td>
<td>DATE SUPP MODEL CREATED</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>56</td>
<td>DATE SUPP MODEL MODIFIED</td>
</tr>
</tbody>
</table>
The first item in the table is the suppressor model ID. This ID may be up to eight characters long. The first character should be an alpha. The second item is the suppressor radius (RAD) in nautical miles. This is the radius over which the suppressor will be effective. The third item is the suppressor capacity (ICAP). This is the number of threats that this type of suppressor can be effective against, at one time. The fourth item is a list of the threat types (TYPE) that this type of suppressor is effective against. Each threat type in this list must correspond to a threat model ID in the TMDL table. A maximum of 25 threat models may be listed. The fifth item is a list containing the threat model degrade factors (DEGR). This list must correspond to the list of threat types in TYPE. Each degrade must be a real number between 0.0 and 1.0.

IV.1.14.2 SUPM Table Usage

The SUPM table is much like the threat model table TMDL. Each one contains generic information about a system. A threat system, a SAM for example, in the case of TMDL; and an EW or hard kill suppression system in the case of SUPM. Data about the deployments of actual threats and suppression aircraft is contained in the threat table (THRT) and the suppressor position table (SUPP) respectively.
The user should be aware of several things when creating records in the SUPM table. Currently, the above ground level altitude of the suppressor is not being used in determining the suppressor radius of coverage. For planning purposes, the model will use the radius $\text{RAD}$, no matter how high or low each individual suppressor actually flies.

It is unrealistic to expect a single Wild Weasel to clear out a large number of SAMS. The capacity of the Wild Weasel is ultimately limited by the number of missiles it can carry. For this reason, a capacity factor has been included in the SUPM table. If the number of threats within the radius of coverage of a suppressor exceeds its capacity, then the suppressor effectiveness is downgraded by a factor equal to the capacity of the suppressor divided by the number of threats within its coverage. For example, if $\text{ICAP}=6$ and $\text{DEGR}=0.5$, then as long as the number of threats within the radius of coverage is six or less, then each threat will be degraded by a factor of 0.5. However, if 10 threats were within the radius then each of them would be degraded by the factor $\frac{6}{10} \times 0.5 = 0.3$. Only threat types matching the SUPM TYPE list are included in the calculation. If the user does not want to downgrade suppressor effectiveness in this way, he can set the suppressor capacity to a large number (like 1000000).

Degrades are applied to the threats in the following way. If a threat site ($\text{XTH}$ in $\text{THRT}$) falls within the radius of coverage of a suppressor, and if the threat type is in the SUPM TYPE list, then a degrade is calculated. Nominally, the degrade will be the appropriate number in $\text{DEGR}$. The degrade number in $\text{DEGR}$ corresponds to the position of the threat type in the TYPE list. If the suppressor capacity is not exceeded, this will be the degrade
contribution from this suppressor. If other suppressors are present, their degrade contributions are calculated in the same way. Finally, all of the contributions are factored in together and the threat’s lethality will be degraded in the statespace (the SUPPRESS command). Each degrade is treated like an independent "probability of shutting the threat down." The effect of more than one suppressor on the same threat is multiplicative. If the capacity of one of the suppressors is exceeded, then the degrade contribution from that suppressor on each threat is downgraded as described above. FLAPS will warn the user of this during the SUPP command.

Finally, it is important that the degrades in DEGR be between 0.0 and 1.0. Negative degrades or degrades greater than 1.0 (100%) will produce errors in the statespace.
IV.1.15 SUPP: Suppressor Position Table

The SUPP table is used to store the locations where the planner wishes to place his available suppression assets. Each record in the suppressor position table will contain the position of one suppression asset.

IV.1.15.1 SUPP Table Structure

The structure of the SUPP table is shown below. This table may be reproduced by typing "SHOW SUPP HELP".

SUPP TABLE STRUCTURE

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CH08</td>
<td>1</td>
<td>1</td>
<td>SUPPRESSOR IDENTIFIER</td>
</tr>
<tr>
<td>TYPE</td>
<td>CH08</td>
<td>1</td>
<td>3</td>
<td>SUPPRESSOR TYPE</td>
</tr>
<tr>
<td>XSU</td>
<td>REAL</td>
<td>3</td>
<td>5</td>
<td>LONG, LAT, TERR CLEAR ALT</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>8</td>
<td>DATE SUPP REC CREATED</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>9</td>
<td>DATE MODIFICATION</td>
</tr>
</tbody>
</table>

The first item in the SUPP table is the suppressor ID. This ID may be up to eight characters long and must begin with an alpha character. This ID need not refer to the type of suppressor that is being used. The second item (TYPE) is the suppressor type. This is an ID up to eight characters long and must match a suppressor model ID in the SUPM table. The third item (XSU) is the suppressor position as longitude, latitude, and altitude above ground level. Longitude and latitude are in decimal degrees; altitude is in meters.
IV.1.15.2 SUPP Table Usage

The SUPP table may be added to or changed by the user with the standard table ADD and CHANGE commands, however the user will usually prefer to create SUPP records graphically. This can be done on a Tektronix 4115B graphics display terminal using the LOCATE command. These records must be deleted in the usual way if the data is no longer appropriate. The data may be displayed using the SUPPRESSOR option of the DISPLAY command. A suppressor will not be effective against any threats if it has been placed in a poor location. Only threats whose centers are within the radius of coverage of a suppressor are affected. If the user does not see any effect after applying suppression, he should check the suppressor positions and the suppressor model. If the degrades are very small or if the suppressor capacity is exceeded, little effect will be seen.
IV.1.16 SWCH: Software Switch Table

The SWCH table contains a number of "software switches" which control the way in which the program executes. Most of these switches are not being used in the current version of FLAPS and are only included to provide growth potential for the future. As the capability of the models in FLAPS expand, these switches will become useful. That is why the switch table has been maintained. It should never be necessary for the normal user to modify the SWCH table. The table will be write protected during normal execution. The normal user may skip this section.

There are only two records in the SWCH table. The first is a header record and the second is a record containing the actual data.

IV.1.16.1 SWCH Table Structure

The structure of the SWCH table is described below. This table can be recreated by typing "SHOW SWCH HELP".

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CH04</td>
<td>1</td>
<td>1</td>
<td>ID</td>
</tr>
<tr>
<td>IAOP</td>
<td>INT</td>
<td>1</td>
<td>2</td>
<td>ALTITUDE OPTIMIZATION</td>
</tr>
<tr>
<td>IARP</td>
<td>INT</td>
<td>1</td>
<td>3</td>
<td>ARRAY PROCESSOR:1ON,0OFF</td>
</tr>
<tr>
<td>IBYT</td>
<td>INT</td>
<td>1</td>
<td>4</td>
<td>BYTE PACKED TERRAIN</td>
</tr>
<tr>
<td>ICLB</td>
<td>INT</td>
<td>1</td>
<td>5</td>
<td>Clobber</td>
</tr>
<tr>
<td>ICSV</td>
<td>INT</td>
<td>1</td>
<td>6</td>
<td>CL MODEL:0=BERMAN,1=GD</td>
</tr>
<tr>
<td>IDCN</td>
<td>INT</td>
<td>1</td>
<td>7</td>
<td>DECONFLICTION</td>
</tr>
<tr>
<td>IDUL</td>
<td>INT</td>
<td>1</td>
<td>8</td>
<td>DUAL CONTROL:0=Y,1,2=NO</td>
</tr>
</tbody>
</table>

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The first item in the table is the ID which is always set to "SWCH". The IAOP, ICLB, ICVB, IFES, IGLD, IPCS, and IRUF switches all relate to three-dimensional route planning and probability of clobber modeling. This capability is not yet available in FLAPS and these switches are not currently used. The IARP switch refers to a special hardware configuration which is currently not available, so this switch is not being used. The IBYT switch refers to the level of terrain data subsampling that is desired when reading the terrain data from the byte packed terrain data file, BYTE. This switch must be set to 1 in this version of FLAPS (no subsampling). The IDCN switch is for automated deconfliction of routes and is not now being used. The IDUL (dual control) switch will have a small effect upon the route generation algorithm. A setting of 0 is appropriate; a setting of 1 is also permissible. The IEND switch controls the way the route data is stored. A setting of 1 is appropriate for this version of FLAPS. The IGDS switch refers to certain constraints on routes near the target area and is not now being used. The IMSK switch refers to the
level of detail desired in the terrain masking algorithm. A setting of 2 is appropriate for this version of FLAPS. The requantization and restart switches IREQ, IRST, and JRST are not being used at this time. The ISPD switch refers to the SPED file and is not being used. The ISRD controls the way the statespace is read into the computer’s core memory from disk. A setting of 0 is appropriate for this version of FLAPS. The target avoidance switch ITAV is not now being used. The shrink switch ISHK controls the way the "accessible nodes box" (NBOX) is constructed. A setting of 0 is appropriate for this version of FLAPS. The ICAV switch controls the labeling of the graphic displays and is not now being used. IDM1, IDM2, and IDM3 are dummy variables which are not now being used.

The following is a list of the current switch settings. This is what the user should see if he types "SHOW SWCH 2".

<table>
<thead>
<tr>
<th>Switch</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAOP</td>
<td>0</td>
</tr>
<tr>
<td>IARP</td>
<td>0</td>
</tr>
<tr>
<td>IBYT</td>
<td>1</td>
</tr>
<tr>
<td>ICLB</td>
<td>0</td>
</tr>
<tr>
<td>ICVB</td>
<td>0</td>
</tr>
<tr>
<td>IDCN</td>
<td>0</td>
</tr>
<tr>
<td>IDUL</td>
<td>0</td>
</tr>
<tr>
<td>IEND</td>
<td>1</td>
</tr>
<tr>
<td>IFES</td>
<td>0</td>
</tr>
<tr>
<td>IGDS</td>
<td>0</td>
</tr>
<tr>
<td>IGLD</td>
<td>0</td>
</tr>
<tr>
<td>IMSK</td>
<td>2</td>
</tr>
<tr>
<td>IPCS</td>
<td>0</td>
</tr>
<tr>
<td>IREQ</td>
<td>0</td>
</tr>
<tr>
<td>IRST</td>
<td>0</td>
</tr>
<tr>
<td>JRST</td>
<td>0</td>
</tr>
<tr>
<td>IRUF</td>
<td>0</td>
</tr>
<tr>
<td>ISPD</td>
<td>0</td>
</tr>
<tr>
<td>ISRD</td>
<td>0</td>
</tr>
<tr>
<td>ITAV</td>
<td>0</td>
</tr>
<tr>
<td>ISHK</td>
<td>0</td>
</tr>
</tbody>
</table>
ICAV = 0
IDM1 = 0
IDM2 = 0
IDM3 = 0
IDC = 85/11/22 16:43
IDM = 85/11/22 16:43

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IV.1.17 TG: Target Table

The TG table defines the IDs, locations, types, priorities, hardinesses, and desired damage levels of all targets of interest in the mission planning problem. This table must be constructed by the user and consists of one record for each target up to a maximum of 49. These records may be referenced by their record number or by the threat ID as in "SHOW TG 12" or "DELE TG MILVICE". The description of the target table shown below is produced by the command "SHOW TG HELP".

**TARGET TABLE STRUCTURE**

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CH08</td>
<td>1</td>
<td>1</td>
<td>TARGET ID</td>
</tr>
<tr>
<td>XTG</td>
<td>REAL</td>
<td>2</td>
<td>3</td>
<td>LONG-LAT OF TARGET</td>
</tr>
<tr>
<td>CLAS</td>
<td>CH04</td>
<td>1</td>
<td>5</td>
<td>CLASSIFICATION OF TARGET</td>
</tr>
<tr>
<td>IPRI</td>
<td>INT</td>
<td>1</td>
<td>6</td>
<td>TARGET PRIORITY</td>
</tr>
<tr>
<td>ITYP</td>
<td>INT</td>
<td>1</td>
<td>7</td>
<td>TYPE OF TARGET</td>
</tr>
<tr>
<td>PDMN</td>
<td>REAL</td>
<td>1</td>
<td>8</td>
<td>MIN PROB DAMAG THRES TAR</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>9</td>
<td>RECORD CREATION DATE</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>10</td>
<td>RECORD MODIFICATION DATE</td>
</tr>
</tbody>
</table>

The first item of each record is a unique alphanumeric ID for that target. It may be up to 8 characters long and the first character must be alpha. Item two (XTG) is the target location given as longitude, latitude (in that order) in decimal degrees according to the sign convention: Longitude +East/-West, Latitude +North/-South. Item three (CLAS) is a 4 character target class descriptor not presently used by the program. Item four (IPRI) is the integer valued priority assigned to the target. This item controls the order in which aircraft and weapons are allocated to targets. Thus a low value for this item indicates a high priority target. Item five (ITYP) is the target type.
which must be a positive integer between 1 and 25. This item is used as an index to determine the target's vulnerability to the different weapon types. Therefore the value of this item must be consistent with the order of the values in the item PDWP (in the weapons table WEAP) which defines weapons effectiveness. Item six (PDMN) is the minimum probability of damage desired for the target and so its value must be a real number between 0 and 1. The allocation algorithm examines the single shot weapon effectiveness in item PDWP (in the table WEAP) and the aircraft weapon carrying capacity in item ISCL (in the vehicle parameters table VEHP) to determine how many aircraft and weapons are required to achieve this desired probability of damage. Thus, more aircraft (up to 10) will be allocated to this target as the value of the PDMN item approaches 1.0. Conversely, fewer aircraft (down to 2) will be allocated as its value approaches 0.
IV.1.18 THRT: Threat Location Table

The THRT table contains the necessary information to describe the location of fixed threats. These threats will have terrain masking applied to them before being included in the statespace.

IV.1.18.1 THRT Table Structure

The structure of the THRT table is shown below. This table may be recreated by typing "SHOW THRT HELP".

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CH04</td>
<td>1</td>
<td>1</td>
<td>THREAT ID</td>
</tr>
<tr>
<td>ITYP</td>
<td>CH08</td>
<td>1</td>
<td>2</td>
<td>THREAT TYPE</td>
</tr>
<tr>
<td>XTH</td>
<td>REAL</td>
<td>3</td>
<td>4</td>
<td>GEOD LON, LAT, ELE OF DEF</td>
</tr>
<tr>
<td>PEX</td>
<td>REAL</td>
<td>1</td>
<td>7</td>
<td>PROBABILITY THREAT EXISTS</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>8</td>
<td>RECORD CREATION DATE</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>9</td>
<td>RECORD MODIFICATION DATE</td>
</tr>
</tbody>
</table>

The first item of this table is a threat ID. This ID can be up to four characters long with the first character being an alpha. The second item (ITYP) is a threat type name. This name can be up to eight characters long with the first character being an alpha. The threat type provides a pointer into the threat model table (TMDL) to get the generic information about this threat. The third item (XTH) is a three element array containing the threat location in longitude, latitude, and altitude. The fourth item (PEX) is a probability of
existence for this threat.

IV.1.18.2 THRT Table Usage

The THRT table is used by the modules that do terrain masking, adding and deleting threats from the statespace, threat suppression, and route analysis. The longitude and latitude is entered as decimal degrees with east longitude and north latitude being positive. Altitude is entered as decimal meters. The probability of existence is entered as a decimal from 0.0 to 1.0.
The TMDL table contains the generic information for each type of threat that is used in the statespace. The model contains a threat exposure template that is symmetric around the downrange axis. This model assumes that the threat template is a vertical cylinder, and contains only one set of danger (negative log probability of survival) values for all altitudes.

IV.1.19.1 TMDL Table Structure

The structure of the TMDL table is shown below. This table may be recreated by typing "SHOW TMDL HELP".
**TMDL Table Structure**

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CH05</td>
<td>1</td>
<td>1</td>
<td>SPECIFIC THREAT MODEL ID</td>
</tr>
<tr>
<td>RMAX</td>
<td>REAL</td>
<td>1</td>
<td>3</td>
<td>MAXIMUM RANGE OF THREAT</td>
</tr>
<tr>
<td>DMIN</td>
<td>REAL</td>
<td>1</td>
<td>4</td>
<td>MIN LOG-PROB INSIDE RMAX</td>
</tr>
<tr>
<td>NDRG</td>
<td>INT</td>
<td>1</td>
<td>5</td>
<td>NUMBER OF DOWNRANGE PTS</td>
</tr>
<tr>
<td>NCRG</td>
<td>INT</td>
<td>1</td>
<td>6</td>
<td>NUMBER OF CROSSRANGE PTS</td>
</tr>
<tr>
<td>DRG1</td>
<td>REAL</td>
<td>1</td>
<td>7</td>
<td>1ST DOWNRANGE PT (NM)</td>
</tr>
<tr>
<td>CRG1</td>
<td>REAL</td>
<td>1</td>
<td>8</td>
<td>1ST CROSSRANGE PT (NM)</td>
</tr>
<tr>
<td>DDRG</td>
<td>REAL</td>
<td>1</td>
<td>9</td>
<td>DELTA DOWNRANGE (NM)</td>
</tr>
<tr>
<td>DCRG</td>
<td>REAL</td>
<td>1</td>
<td>10</td>
<td>DELTA CROSSRANGE (NM)</td>
</tr>
<tr>
<td>PLOG</td>
<td>REAL</td>
<td>200</td>
<td>11</td>
<td>PLOG AT NTH CROSSRANGE</td>
</tr>
<tr>
<td>DUM1</td>
<td>REAL</td>
<td>1</td>
<td>211</td>
<td>DUMMY NOT USED YET</td>
</tr>
<tr>
<td>DUM2</td>
<td>REAL</td>
<td>1</td>
<td>212</td>
<td>DUMMY NOT USED YET</td>
</tr>
<tr>
<td>DUM3</td>
<td>REAL</td>
<td>1</td>
<td>213</td>
<td>DUMMY NOT USED YET</td>
</tr>
<tr>
<td>DUM4</td>
<td>REAL</td>
<td>1</td>
<td>214</td>
<td>DUMMY NOT USED YET</td>
</tr>
<tr>
<td>DUM5</td>
<td>REAL</td>
<td>1</td>
<td>215</td>
<td>DUMMY NOT USED YET</td>
</tr>
<tr>
<td>HIGH</td>
<td>REAL</td>
<td>1</td>
<td>216</td>
<td>MAX THREAT HEIGHT</td>
</tr>
<tr>
<td>FLOR</td>
<td>REAL</td>
<td>1</td>
<td>217</td>
<td>MIN THREAT DEPRES. HT</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>218</td>
<td>RECORD CREATION DATE</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>219</td>
<td>RECORD MODIFICATION DATE</td>
</tr>
</tbody>
</table>

The first item in the threat model table is a generic threat ID. This ID contains up to five characters and must begin with a letter. The second item (RMAX) is the maximum lethal range of the threat in decimal nautical miles. The third item (DMIN) is the minimum danger level that will be applied to the statespace within the threat's maximum radius. The user may set DMIN to a small danger level. This will tend to force the routes to fly around the threat's maximum radius, rather than to just avoid the threat's unmasked coverage. That is, even if a cell is terrain masked from a threat, a small amount of danger will be added to the statespace at that cell. DMIN is normally set to 0.0 in scenarios with dense threat coverage. A value of zero is appropriate in the European theatre. The fourth item (NDRG) is the integer number of downrange points up to a maximum of 20 points. If the number of downrange points is set to one, the statespace algorithm uses the first value in the log probability of

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danger array to create a cookie cutter type threat template at all unmasked points. The fifth item (NCRG) is the integer number of crossrange points up to a maximum of 10 points. The sixth item (DRGl) is the range to the first downrange point in nautical miles. The seventh item (CRGl) is the range to the first crossrange point in nautical miles. The eighth item (DDRG) is the range difference between downrange points in nautical miles. The ninth item (DCRG) is the range difference between crossrange points in nautical miles. The tenth item (PLOG) is an array that contains the danger template, which is defined as the negative log of probability of survival per second. The negative log of probability of survival per second is also referred to as the "danger rate" or the level of "danger." Each set of 20 elements in this array contains all the downrange values for one crossrange setting. The tenth through fourteenth items are dummy items that are not used at this time. The fifteenth item (HIGH) is the maximum lethal height of the threat in meters. The sixteenth item (FLOR) is the minimum lethal height of the threat in meters, to take into account the minimum depression angle on some threats.

An example of a record from the threat model table is shown below.

CRSHOW -- RECORD # 6  IDWORD=SA-6

<table>
<thead>
<tr>
<th>ID</th>
<th>RMAX</th>
<th>DMIN</th>
<th>NDRG</th>
<th>NCRG</th>
<th>DRGl</th>
<th>CRGl</th>
<th>DDRG</th>
<th>DCRG</th>
<th>PLOG</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA-6</td>
<td>1.8500E+01</td>
<td>0.0000E+00</td>
<td>11</td>
<td>6</td>
<td>1.8500E+01</td>
<td>0.0000E+00</td>
<td>3.7000E+00</td>
<td>3.7000E+00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0000E+00 1.0000E-03 2.0000E-03 3.0000E-03</td>
<td>3.5000E-03 2.0000E-03 1.0000E-03 0.0000E+00</td>
<td>0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00</td>
<td>0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IV-55
### IV.1.19.2 TMDL Table Usage

These threat templates are combined with the terrain masked templates for each threat to create a danger statespace.
Normally, threat templates will be delivered with the software. However, the user may create his or her own threat templates. The user has several options for creating threat templates. The user may create "non-symmetric" templates where the danger level varies as a function of cross-range and down-range distance. The template shown above is an example of a "non-symmetric" template. The user may also create two simpler types of templates. These are the "circularly-symmetric" and "cookie-cutter" templates.

For a non-symmetric threat, the number of cross-range points (NCRG) must be greater than 1, and the first cross-range value (CRG1) should be 0.0 nm. Then PLOG(j) (j < 21) is the danger at the j-th downrange and first cross-range point. PLOG(j) (20 < j < 41) is the danger at the (j-20)-th downrange point, and the second cross-range point. Refer to Figure IV-1.

For a circularly symmetric threat, the number of cross-range points (NCRG) must be set to 1, and the first radial (downrange) value (DRG1) to 0.0 nm. Then PLOG(1), PLOG(21), PLOG(41), ..., PLOG(j*20 + 1), ..., PLOG(181) gives the danger level at the first, second, ..., j-th, radial distance. Refer to Figure IV-1.

For a cookie-cutter threat, the danger level is the same for all points inside the threats lethal radius. This feature is accomplished by setting the item NDRG to 1, and setting PLOG(1) to the danger rate. No other PLOG values are looked at by the program.
Circularly Symmetric Threat

Figure IV-1
IV.1.20 VEHP: Vehicle Parameters Table

The VEHP table defines the ID, dynamics, fuel characteristics, weapon carrying capacity and radar profile for all the aircraft of interest in the mission planning problem. This table must be constructed by the user and consists of one record for each aircraft type. Records may be referenced by their record number or by the aircraft ID as in "DELE VEHP 3" or "SHOW VEHP F-16". The description of the VEHP table shown below is produced by the command "SHOW VEHP HELP".

**VEHICLE PARAMETERS TABLE STRUCTURE**

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CHO4</td>
<td>1</td>
<td>1</td>
<td>AIRCRAFT ID</td>
</tr>
<tr>
<td>VNOM</td>
<td>REAL</td>
<td>1</td>
<td>2</td>
<td>AIRCRAFT VELOCITY (NM/S)</td>
</tr>
<tr>
<td>CLM</td>
<td>REAL</td>
<td>1</td>
<td>3</td>
<td>MAX CLIMB RATE (M/S)</td>
</tr>
<tr>
<td>DIV</td>
<td>REAL</td>
<td>1</td>
<td>4</td>
<td>MAX DIVE RATE (M/S)</td>
</tr>
<tr>
<td>FCAP</td>
<td>REAL</td>
<td>2</td>
<td>5</td>
<td>FUEL CAPACITY (POUNDS)</td>
</tr>
<tr>
<td>FCEG</td>
<td>REAL</td>
<td>2</td>
<td>7</td>
<td>FUEL CONSUMP. (EGRESS)</td>
</tr>
<tr>
<td>FCIN</td>
<td>REAL</td>
<td>20</td>
<td>9</td>
<td>FUEL CONSUMP. (INGRESS)</td>
</tr>
<tr>
<td>NMFC</td>
<td>INT</td>
<td>1</td>
<td>29</td>
<td>NUMBER OF FUEL CONFIGS.</td>
</tr>
<tr>
<td>ISCL</td>
<td>INT</td>
<td>20</td>
<td>30</td>
<td>STD. CONFIGURATION LOAD</td>
</tr>
<tr>
<td>RCS</td>
<td>REAL</td>
<td>8</td>
<td>50</td>
<td>RADAR CROSS SECTIONS</td>
</tr>
<tr>
<td>TRAD</td>
<td>REAL</td>
<td>1</td>
<td>58</td>
<td>MAX TURN RADIUS (M)</td>
</tr>
<tr>
<td>TYP</td>
<td>CHO4</td>
<td>1</td>
<td>59</td>
<td>AIRCRAFT TYPE</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>60</td>
<td>RECORD CREATION DATE</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>61</td>
<td>RECORD MODIFICATION DATE</td>
</tr>
</tbody>
</table>

Item one of each record is a unique alphanumeric ID for the aircraft type. It may be up to 4 characters long and the first character must be a letter. Item two (VNOM) is the nominal aircraft velocity in units of nautical miles per second. This item is used in the computation of flying time and threat exposure along a route. Items three and four (CLM and DIV) are not...
presently used by the program. Item five (FCAP) is a list of real numbers defining the aircraft fuel capacity in-pounds as a function of the fuel configuration selected. Item six (FCEG) is a list of real numbers defining the aircraft fuel consumption rate during egress in pounds per second as a function of fuel configuration selected. Item seven (FCIN) is a list of real numbers defining the aircraft fuel consumption rates in pounds per second during ingress as a function of fuel configuration selected and weapon type being carried. This array is dimensioned (10,2). Item eight (NMFC) is the allowable number of fuel configurations - presently set at 2. Item nine (ISCL) is a list of integers defining the weapon carrying capacity of the aircraft as a function of fuel configuration selected and weapon type selected. The fuel configuration order in items five, six, seven and nine must be consistent. Likewise, the weapon type order in items seven and nine must be consistent. Items ten through twelve are not presently used by the program.
IV.1.21 WEAP: Weapons Effectiveness Table

The WEAP table defines the names and characteristics of the weapons of interest in the mission planning problem. This table consists of a single record (record 2) which must be created by the user. The contents of the table may be examined with the command "SHOW WEAP 2". The description of the WEAP table structure shown below is produced by the command "SHOW WEAP HELP".

WEAPONS EFFECTIVENESS TABLE STRUCTURE

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDWP</td>
<td>CH04</td>
<td>1</td>
<td>1</td>
<td>ID = WEAP</td>
</tr>
<tr>
<td>PDWP</td>
<td>REAL</td>
<td>50</td>
<td>2</td>
<td>PK WEAP BY TG TYPE</td>
</tr>
<tr>
<td>NMTY</td>
<td>INT</td>
<td>1</td>
<td>52</td>
<td>NUMBER OF WEAP TYPES</td>
</tr>
<tr>
<td>NAME</td>
<td>CH08</td>
<td>10</td>
<td>53</td>
<td>NAME OF WEAPON</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>73</td>
<td>RECORD CREATION DATE</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>74</td>
<td>RECORD MODIFICATION DATE</td>
</tr>
</tbody>
</table>

The first item is the table ID, which is always "WEAP". Item two (PDWP) serves as a simplified version of the "Bomber's Encyclopedia." It consists of a 2-dimensional array of floating point numbers between 0 and 1. This array defines single shot probability of kill as a function of weapon type and target type. The array is currently dimensioned (10,25). The routing and allocation algorithms use these probabilities to determine the number of weapons and aircraft required to obtain the level of damage specified for each target. Therefore the weapon type index used in this list must be consistent with the corresponding index used in the items NWEP (table STGB), FCIN (table VEHP) and ISCL (table VEHP). Similarly, the target type index used in the list must be consistent with the value of item ITYP (table TG). Item three (NMTY) is the
number of weapon types (up to 10) being considered. Item four (NAME) is a list of up to 10 alphanumeric weapon type names. These names may be up to 8 characters long and should be listed in the order consistent with the weapon type index used in item PDWP described above.
IV.1.22 WFZ: Weapons Free Zone Table

The WFZ table is used to store the locations where the planner wishes to place weapons free air space. Each record contains one weapons free zone.

IV.1.22.1 WFZ Table Structure

The structure of the WFZ table is shown below. This table may be reproduced by typing "SHOW WFZ HELP".

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>LOC</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>CH08</td>
<td>1</td>
<td>1</td>
<td>ID OF WEAPON FREE ZONE</td>
</tr>
<tr>
<td>NPTS</td>
<td>INT</td>
<td>1</td>
<td>3</td>
<td>NUMBER OF BOUNDARY POINT</td>
</tr>
<tr>
<td>X</td>
<td>REAL</td>
<td>20</td>
<td>4</td>
<td>LONG-LAT OF WFZ BNDRY PT</td>
</tr>
<tr>
<td>IDC</td>
<td>TIME</td>
<td>1</td>
<td>24</td>
<td>RECORD CREATION DATE</td>
</tr>
<tr>
<td>IDM</td>
<td>TIME</td>
<td>1</td>
<td>25</td>
<td>RECORD MODIFICATION DATE</td>
</tr>
</tbody>
</table>

The first item in the WFZ table is the weapon free zone ID. This ID may be up to eight characters long and must begin with a letter. This ID can refer to the area or anything the user wishes. The second item (NPTS) is the number of boundary points of the area. There is a minimum of three boundary points which would be plotted as a triangle and a maximum of ten which would be plotted as a polygon with ten sides. The third item (X) is the weapon free zone position as longitude and latitude. Longitude and latitude are in decimal degrees. These points must be entered in contiguous order (either clockwise, or counterclockwise).

IV.1.22.2 WFZ Table Usage

The WFZ table is added by the user with the standard table ADD command.
Records can be changed, deleted, or copied. The data may be displayed by using the VF option in the DISPLAY command. At this time, JWZ's are only used for display purposes and will have no effect on the routes. It is assumed that the LLTR data is correct and no attempt is made to verify that JWZ's are in fact avoided by the current set of available LLTR's.

An example of a JWZ record is shown below.

```
CRSHOW -- RECORD # 2 IDWORD=DUSLDORF
ID = DUSLDORF
NPTS = 4
X = 6.2500E-00 5.1450E-01 7.2500E-00 5.1767E-01 7.6667E-00 5.1500E-01
  7.0000E-00 5.1083E-01 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
  0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
IDC = 85/11/22 16:43
IDM = 85/11/22 16:43
```
IV.2 ARRAYS

This section describes the arrays used by FLAPS plus two special data structures: the flight plan output and the digital terrain elevation data (DTED). Arrays are matrix oriented data structures which are created and maintained by the FLAPS software. Each four character array name is associated with a random access disk file (see the OPEN command in Section III). These disk files each consist of 2 or more 2400 word records. The first record of each array is a header record. This record contains information used by the file management software; data which is stored in an array begins in record 2.

The actual record-oriented format of an array is uninteresting to the user; it only needs to be understood by the program developer. For some of the arrays, a SHOW command (Section III.1.7) is available. The "SHOW arrays commands" format the data in a manner which is of interest to the user. The names and descriptions of the FLAPS data base arrays are listed below. This list may be produced by typing "SHOW HELP".

NAMES AND DESCRIPTIONS OF ARRAYS

| ARCS       | ARC WAYPOINT ARRAY       |
| ARPE       | TARG INGRESS/EGRESS PERF |
| ITGC       | TARG ACCESSIBLE TO STGB  |
| ITRC       | TREX ACCESSIBLE TO TREN  |
| NBOX       | LIST OF TG BOX CORNERS  |
| NLIS       | LIST OF NODES           |
| NPOS       | NODE POSITIONS          |
| ROUT       | ROUT NODES DIST AND PERF|

IV-65
SXPE: STGB TO LLTR EXIT PERF
TGUS: TARGET STATUS ARRAY
TRPE: LLTR TREE PERFORMANCE
IV.2.1 ARCS: The Arcs Coordinate Array

The ARCS array contains the coordinates of the optimal path segments between the targets and their accessible LLTR exit points. Each target and LLTR exit point pair will have an associated ingress and egress arc. The arc performance data for the arcs is stored in the Arc Performance Array (ARPE).

The arcs are stored and displayed in the form of waypoints. Each arc is made up of at least two waypoints. Each waypoint has the following form: time (in hours), longitude (in decimal degrees), latitude (in decimal degrees), above ground level altitude (in meters), and a node index. Time is the elapsed time from the beginning of the arc. The first waypoint will always have time equal to 0.0. The node index refers to the node ID stored in the NLIS array. Only the first and last waypoints will have nonzero indices.

The ARCS array is created by the ARCS command. The user may show the ARCS array after this command has been executed. To show an arc, the user enters "SHOW ARCS". FLAPS then prompts the user for a target ID or index. Either may be entered, whichever is more convenient. Then, FLAPS prompts the user for an LLTR exit point ID or index. Again the user may enter either form. The user may show the NLIS array to determine the correspondence between the node ID's and indices. If the target and LLTR exit point pair are not accessible, FLAPS will give the user an error message. Accessible target and LLTR exit point pairs may be seen by showing the ITGC or ARPE arrays. The result of the SHOW ARCS command will be a listing of the ingress and egress arcs, in that order, as a sequence of waypoints. The form of the waypoints is described above.
The following table is the result of a "SHOW ARCS" command. The table could have been generated by entering:

SHOW ARCS CASLAV 5133

or

SHOW ARCS 124 S133, or SHOW ARCS CASLAV 51

or

SHOW ARCS 124 51

**VRARCS - ARRAY ARCS - 22 POINT INGRESS ARC FROM CASLAV (124) TO S133 (51)**

<table>
<thead>
<tr>
<th>TIME</th>
<th>LONGITUDE</th>
<th>LATITUDE</th>
<th>ALTITUDE</th>
<th>NODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000</td>
<td>12.870</td>
<td>49.184</td>
<td>60.100</td>
<td>S133</td>
</tr>
<tr>
<td>0.023</td>
<td>12.824</td>
<td>49.000</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.038</td>
<td>12.695</td>
<td>49.083</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.049</td>
<td>12.565</td>
<td>49.083</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.056</td>
<td>12.500</td>
<td>49.125</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.062</td>
<td>12.500</td>
<td>49.167</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.069</td>
<td>12.436</td>
<td>49.208</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.081</td>
<td>12.371</td>
<td>49.292</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.092</td>
<td>12.306</td>
<td>49.375</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.119</td>
<td>12.241</td>
<td>49.583</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.161</td>
<td>12.241</td>
<td>49.917</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.183</td>
<td>12.436</td>
<td>50.042</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.251</td>
<td>13.278</td>
<td>50.042</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.335</td>
<td>14.315</td>
<td>49.958</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.342</td>
<td>14.380</td>
<td>49.917</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.353</td>
<td>14.510</td>
<td>49.917</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.360</td>
<td>14.575</td>
<td>49.875</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.366</td>
<td>14.639</td>
<td>49.875</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.377</td>
<td>14.769</td>
<td>49.917</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.392</td>
<td>14.899</td>
<td>50.000</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.418</td>
<td>15.223</td>
<td>50.000</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.433</td>
<td>15.383</td>
<td>49.950</td>
<td>60.100</td>
<td></td>
</tr>
</tbody>
</table>

**VRARCS - ARRAY ARCS - 28 POINT EGRESS ARC FROM CASLAV (124) TO S133 (51)**

<table>
<thead>
<tr>
<th>TIME</th>
<th>LONGITUDE</th>
<th>LATITUDE</th>
<th>ALTITUDE</th>
<th>NODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000</td>
<td>15.383</td>
<td>49.950</td>
<td>60.100</td>
<td>CASLAV</td>
</tr>
<tr>
<td>0.003</td>
<td>15.417</td>
<td>49.958</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.010</td>
<td>15.482</td>
<td>50.000</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.026</td>
<td>15.482</td>
<td>50.125</td>
<td>60.100</td>
<td></td>
</tr>
</tbody>
</table>

IV-68
<table>
<thead>
<tr>
<th>Value</th>
<th>X Value</th>
<th>Y Value</th>
<th>Z Value</th>
<th>W Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.041</td>
<td>15.353</td>
<td>50.208</td>
<td>60.100</td>
<td>S133</td>
</tr>
<tr>
<td>0.056</td>
<td>15.158</td>
<td>50.208</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.064</td>
<td>15.093</td>
<td>50.167</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.069</td>
<td>15.028</td>
<td>50.167</td>
<td>60.100</td>
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</tr>
<tr>
<td>0.076</td>
<td>14.964</td>
<td>50.125</td>
<td>60.100</td>
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</tr>
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<td>0.092</td>
<td>14.769</td>
<td>50.125</td>
<td>60.100</td>
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</tr>
<tr>
<td>0.114</td>
<td>14.575</td>
<td>50.000</td>
<td>60.100</td>
<td></td>
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<td>0.140</td>
<td>14.251</td>
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<td>60.100</td>
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<td>0.274</td>
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<td>0.281</td>
<td>12.565</td>
<td>50.000</td>
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<td></td>
</tr>
<tr>
<td>0.297</td>
<td>12.371</td>
<td>50.000</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.311</td>
<td>12.241</td>
<td>49.917</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.353</td>
<td>12.241</td>
<td>49.583</td>
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<tr>
<td>0.380</td>
<td>12.306</td>
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<tr>
<td>0.391</td>
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<tr>
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<td>12.565</td>
<td>49.083</td>
<td>60.100</td>
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<tr>
<td>0.434</td>
<td>12.695</td>
<td>49.083</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.449</td>
<td>12.824</td>
<td>49.000</td>
<td>60.100</td>
<td></td>
</tr>
<tr>
<td>0.472</td>
<td>12.870</td>
<td>49.184</td>
<td>60.100</td>
<td></td>
</tr>
</tbody>
</table>
The ARPE array contains the distance and probability of survival for each arc generated by the ARCS command. For each target and each accessible LLTR exit point there is an ingress and egress arc. The accessible LLTR exit points for a given target can be seen by showing the ITGC array. The ARPE array contains the probability of survival and distance for each of these ingress and egress arcs.

The ARPE array is closely related to the Arc Coordinate Array (ARCS). The data is stored separately because only the performance data is needed to do the route construction (ROUT) and target allocation (ALLOCATE).

The Arc Performance Array is generated by the ARCS command. The user may show this array after the ARCS command has been run. To show this array the user types "SHOW ARPE". FLAPS will then prompt the user to enter a target index, a target ID, "ALL", or "/". If the user wishes to see the performance of the arcs for a specific target, the target index or target ID may be entered, whichever is more convenient. If all of the arc performances are required, the user may enter "ALL". A "/" will cause the SHOW command to abort, and control will return to the main program. The output will be in the following form: "ID #" refers to the target ID name, "INDEX" refers to the NLIS indices. The ingress and egress route distances and probabilities of survival are then shown. The following table was generated by FLAPS. It shows the arc performances for target "CASLAV". The user could have entered either:

SHOW ARPE CASLAV
or

SHOW ARPE 124

to generate this table.

WRPERF -- ARRAY ARPE -- ARC PERFORMANCES FROM CASLAV (124)

INGRESS

<table>
<thead>
<tr>
<th>IC #</th>
<th>INDEX</th>
<th>DIST (NM)</th>
<th>PS</th>
<th>DIST (NM)</th>
<th>PS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NO05</td>
<td>48</td>
<td>299.89</td>
<td>0.6495</td>
<td>317.05</td>
</tr>
<tr>
<td>2</td>
<td>NO28</td>
<td>49</td>
<td>265.22</td>
<td>0.6378</td>
<td>282.38</td>
</tr>
<tr>
<td>3</td>
<td>S092</td>
<td>50</td>
<td>146.60</td>
<td>0.6588</td>
<td>165.64</td>
</tr>
<tr>
<td>4</td>
<td>S133</td>
<td>51</td>
<td>207.08</td>
<td>0.4612</td>
<td>226.11</td>
</tr>
</tbody>
</table>

IV-71
IV.2.3 ITGC: Target Accessibility Array

The ITGC array is a list of all of the paths that one can take to a given target provided he returns to his staging base on the shortest distance path. This array is used to determine which LLTR exit points should have arcs built from them to the target when the ARCS command is given. Building arcs is a time consuming process. By carefully applying accessibility rules, the number of arcs which need to be built can be kept to a minimum. For example, there is no need to build arcs to a target from a staging base (via a LLTR exit) if that staging base does not have weapons which will be effective against that target.

There is one ITGC record for every target which has at least one staging base accessible to it. Each line in the record corresponds to a potential path from a staging base to the target. The path is uniquely specified by giving the staging base, LLTR entry point and the LLTR exit point which would be used to reach the target. With this information, the actual LLTR node sequence can be retrieved from array ITRC.

The ITGC array has a one-to-one correspondence with the Staging Base to LLTR Exit Performance (SXPE) Array. That is, one would use the ITGC array to find the Staging Base to LLTR entry to LLTR exit paths that are feasible for a given target and then use the SXPE array to find the distance and probability of survival along the path from the Staging Base to the LLTR exit.

The Target Accessibility Array is generated by issuing the ACCESS command. Changes to the STGB, LLTR, TG, WEAP and VEHP tables may make the ITGC array have stale data. The following ITGC record could have been generated by FLAPS by issuing the command "SHOW ITGC CASLAV" or the command "SHOW ITGC 124".
If all ITGC records are desired, the command would be "SHOW ITGC ALL".

**VRACC -- THERE ARE 24 PATHS TO TARGET CASLAV (124) IN ARRAY ITGC**

<table>
<thead>
<tr>
<th>STAGING BASE</th>
<th>LLTR ENTRY</th>
<th>LLTR EXIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 FAIRFORD (1) NO01 (21) NO05 (48)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 FAIRFORD (1) NO31 (22) NO28 (49)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 FAIRFORD (1) S079 (23) S092 (50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 FAIRFORD (1) S113 (24) S133 (51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 LAKENHT (2) NO01 (21) NO05 (48)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 LAKENHT (2) NO31 (22) NO28 (49)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 LAKENHT (2) S079 (23) S092 (50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 LAKENHT (2) S113 (24) S133 (51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 MILDENHA (3) NO01 (21) NO05 (48)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 MILDENHA (3) NO31 (22) NO28 (49)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 MILDENHA (3) S079 (23) S092 (50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 MILDENHA (3) S113 (24) S133 (51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 RAMSTEIN (8) NO31 (22) NO05 (48)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 RAMSTEIN (8) NO31 (22) NO28 (49)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 RAMSTEIN (8) S079 (23) S092 (50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 RAMSTEIN (8) S113 (24) S133 (51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 SEMBACH (9) NO01 (21) NO05 (48)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 SEMBACH (9) NO31 (22) NO28 (49)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 SEMBACH (9) S079 (23) S092 (50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 SEMBACH (9) S113 (24) S133 (51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 LAHR (10) NO31 (22) NO05 (48)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 LAHR (10) NO31 (22) NO28 (49)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 LAHR (10) S079 (23) S092 (50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 LAHR (10) S113 (24) S133 (51)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IV-73
IV.2.4 ITRC: Low Level Transit Route Access Array

The ITRC array contains the optimal LLTR node sequences from a given LLTR entry point to every LLTR exit point which can be reached from that entry point. It also shows the distance through the network in nautical miles and the probability of arriving at the LLTR exit given one left from the LLTR entry. Even though the route from the LLTR entry point to the LLTR exit point is not contained in the statespace, and therefore is not exposed to any threat danger, the probability of survival will be slightly less than 1.0. This is due to the small "air danger" penalty. The same is also true for the TRPE and SXPE arrays. The distance and probability of arrival does not change on ingress or egress. The LLTR node sequence on egress is simply the reverse of the sequence on ingress. Therefore, one can read down the list to find the optimal path from the entry point to the exit (for ingress) and up the list to find the optimal path from the exit back to the entry point (for egress).

The Low Level Transit Route Access Array has a direct correspondence to the Transit Route Performance (TRPE) Array. That is, one would use the ITRC array to find the optimal node sequence through the LLTR network and the TRPE array to find the distance and probability of arrival along this path.

The ITRC array is created by issuing the NODES command. There are as many ITRC records as there are LLTR entry points which are accessible to at least one exit point. An individual ITRC record can be shown by specifying the alphanumeric LLTR entry point name or its unique NLIS index. All ITRC records can be displayed by giving the "SHOW ITRC ALL" command. The following sample ITRC table could have been generated by FLAPS by either issuing the "SHOW ITRC NO31" or "SHOW ITRC 22" commands.
VRTREE -- THERE ARE 2 EXITS ACCESSIBLE TO LLTR ENTRY POINT NO31 (22)

<table>
<thead>
<tr>
<th>Branch for LLTR Exit</th>
<th>N005 (48)</th>
<th>Dist = 144.44 PA = 0.9946</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NO31 (22)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>NO30 (33)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>NO23 (28)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>NO02 (25)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>NO03 (26)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>NO04 (27)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>NO05 (48)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Branch for LLTR Exit</th>
<th>N028 (49)</th>
<th>Dist = 134.20 PA = 0.9950</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NO31 (22)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>NO30 (33)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>NO23 (28)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>NO24 (29)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>NO25 (30)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>NO26 (31)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>NO27 (32)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>NO28 (49)</td>
<td></td>
</tr>
</tbody>
</table>
IV.2.3 MASK: Mask Array File

The MASK array is an internal file to the software and is not accessible to the user. The mask array is a temporary array file that is used during the masking function. It is stored in a polar coordinate system centered around the location of the threat. It consists of a set of rays emanating from the threat that are spaced equal angles apart in degrees. Along each ray is a set of points that are spaced equal distances apart. The minimum observable altitude is calculated for each point along the ray, and the ray is then written out to the mask file. Then, the mask file is read and transformed into X,Y coordinates. The new array is then stored in the file "TOBS" for later use in creating and modifying the statespace, implementing threat suppression, and analyzing routes. The parameters for creating the mask array are stored in file "MSKEXT". See SCT Technical Memo 5398-300 titled "TERRAIN MASKING ALGORITHM" for a detailed description of how the mask array file is created. This file is not available for showing by the user. The default dimensions for this array are shown below. Where the number of rays = 120 and the number of points along a ray = 125.

```
MASK = 1 1 120 125
```
IV.2.6 NBOX: Node Box Array

The NBOX array consists of the coordinates of a box around each target. The box is stored in the form: minimum longitude, maximum longitude, minimum latitude, and maximum latitude. All coordinates are in decimal degrees. The box defines the region over which the dynamic programming algorithm (DPA) will be run. Besides the target, the box contains all of the accessible LLTR exit points. These accessible LLTR exit points can be seen by showing the ITGC array. The optimal ingress and egress routes, from each LLTR exit point to the target will be contained within the box.

The Node Box Array is generated by the ACCESS command. The user may show this array after this command has been run. To show this array the user simply types "SHOW NBOX". No other inputs are required. The output will be in the following form: "ID #" refers to the target ID name, "INDEX" refers to the NLIS indices. The box coordinates are in decimal degrees. The following table was generated by FLAPS after a "SHOW NBOX" was entered.

<table>
<thead>
<tr>
<th>ID #</th>
<th>INDEX</th>
<th>MIN LONG</th>
<th>MAX LONG</th>
<th>MIN LAT</th>
<th>MAX LAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PANENSKY</td>
<td>121</td>
<td>9.2</td>
<td>14.1</td>
<td>49.0</td>
<td>51.3</td>
</tr>
<tr>
<td>ZOLLSCHN</td>
<td>122</td>
<td>9.2</td>
<td>13.0</td>
<td>49.0</td>
<td>51.4</td>
</tr>
<tr>
<td>PRESCHEN</td>
<td>123</td>
<td>9.2</td>
<td>14.8</td>
<td>49.0</td>
<td>51.8</td>
</tr>
<tr>
<td>CASLAV</td>
<td>124</td>
<td>9.2</td>
<td>15.5</td>
<td>49.0</td>
<td>51.3</td>
</tr>
<tr>
<td>LEIPZIG</td>
<td>125</td>
<td>9.2</td>
<td>13.0</td>
<td>49.0</td>
<td>51.6</td>
</tr>
<tr>
<td>PRAGUE</td>
<td>126</td>
<td>9.2</td>
<td>14.4</td>
<td>49.0</td>
<td>51.3</td>
</tr>
</tbody>
</table>

IV-77
IV.2.7 NLIS: Node List Array

The NLIS array is an ordered list of all active nodes in the current scenario. The nodes are ordered in the sense that they are grouped by type. That is, the first entries in the list are the staging bases. Next comes the LLTR entry points, followed by the LLTR intermediate points and then the LLTR exit points. At the end of the list is the targets.

The NLIS array only contains active nodes. Therefore, it does not include any staging bases or LLTR points that are not contained within in the scenario boundaries. Similarly, it does not include any targets that do not lie within the statespace boundaries. It also excludes LLTR nodes which are turned off. Keeping this list as small as possible by excluding nodes that will not be usable increases processing speed and minimizes computer memory usage.

The structure of NLIS is very simple since it only has two elements: the eight character alphanumeric node name and its unique integer index. These indices can be used in commands to specify a node instead of typing in the alphanumeric node ID. Care must be taken that a current version of NLIS is used since the indices can change as nodes become active or inactive (i.e. when the NODES command is given after changing STGB, LLTR or TG data bases or changing the statespace or scenario boundaries).

There is only one NLIS array record. Usually, it is suggested that the Node Position Array (NPOS) be used since it contains all of the information in NLIS and the node position information.
The NLIS array is generated by the NODES command. To show this array the user simply types "SHOW NLIS". The following table was generated by FLAPS by issuing the "SHOW NLIS" command.

WRLIS -- ARRAY NLIS LIST OF ID NAMES

<table>
<thead>
<tr>
<th>INDEX</th>
<th>ID Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FAIRFORD</td>
</tr>
<tr>
<td>2</td>
<td>LAKENHTH</td>
</tr>
<tr>
<td>3</td>
<td>MILDENHA</td>
</tr>
<tr>
<td>4</td>
<td>BENTVATE</td>
</tr>
<tr>
<td>5</td>
<td>BITBURG</td>
</tr>
<tr>
<td>6</td>
<td>SPANGDAH</td>
</tr>
<tr>
<td>7</td>
<td>HAHN</td>
</tr>
<tr>
<td>8</td>
<td>RAMSTEIN</td>
</tr>
<tr>
<td>9</td>
<td>SEMBACH</td>
</tr>
<tr>
<td>10</td>
<td>LAHR</td>
</tr>
<tr>
<td>11</td>
<td>SOLLING</td>
</tr>
<tr>
<td>12</td>
<td>VIESBADN</td>
</tr>
<tr>
<td>21</td>
<td>N001</td>
</tr>
<tr>
<td>22</td>
<td>N031</td>
</tr>
<tr>
<td>23</td>
<td>S079</td>
</tr>
<tr>
<td>24</td>
<td>S113</td>
</tr>
<tr>
<td>25</td>
<td>N002</td>
</tr>
<tr>
<td>26</td>
<td>N003</td>
</tr>
<tr>
<td>27</td>
<td>N004</td>
</tr>
<tr>
<td>28</td>
<td>N023</td>
</tr>
<tr>
<td>29</td>
<td>N024</td>
</tr>
<tr>
<td>30</td>
<td>N025</td>
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<td>31</td>
<td>N026</td>
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<tr>
<td>32</td>
<td>N027</td>
</tr>
<tr>
<td>33</td>
<td>N030</td>
</tr>
<tr>
<td>34</td>
<td>S080</td>
</tr>
<tr>
<td>35</td>
<td>S081</td>
</tr>
<tr>
<td>36</td>
<td>S082</td>
</tr>
<tr>
<td>37</td>
<td>S085</td>
</tr>
<tr>
<td>38</td>
<td>S086</td>
</tr>
<tr>
<td>39</td>
<td>S091</td>
</tr>
<tr>
<td>40</td>
<td>S112</td>
</tr>
<tr>
<td>41</td>
<td>S126</td>
</tr>
<tr>
<td>42</td>
<td>S127</td>
</tr>
<tr>
<td>43</td>
<td>S128</td>
</tr>
<tr>
<td>44</td>
<td>S129</td>
</tr>
<tr>
<td>45</td>
<td>S130</td>
</tr>
<tr>
<td>46</td>
<td>S131</td>
</tr>
<tr>
<td>47</td>
<td>S132</td>
</tr>
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<td>48</td>
<td>N005</td>
</tr>
<tr>
<td>49</td>
<td>N028</td>
</tr>
<tr>
<td>50</td>
<td>S092</td>
</tr>
</tbody>
</table>

IV-79
<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td>S133</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>121</td>
<td>PANENSKY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>122</td>
<td>ZOLLSCHN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>123</td>
<td>PRESCHEN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>124</td>
<td>CASLAV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>125</td>
<td>LEIPZIG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>126</td>
<td>PRAGUE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IV-80
IV.2.8 NPOS: Node Position Array

The NPOS array is very similar to the Node List Array (NLIS). It contains all of the NLIS information and all of the comments about NLIS apply to NPOS (see Section IV.2.7). The major difference between the two arrays is that NPOS also includes the longitude and latitude positions of the nodes (in decimal degrees with the convention that east is positive for longitude and north is positive for latitude).

It is suggested that the NPOS list be used instead of the NLIS since it contains more information and is therefore more useful. The NPOS array is generated by the NODES command and will change when this command is given if there have been changes made to the STGB, LLTR or TG data bases or to the boundaries of the statespace or scenario. The following is an example of a Node Position Array generated by FLAPS by issuing the "SHOW NPOS" command.

<table>
<thead>
<tr>
<th>ID</th>
<th>NAME</th>
<th>INDEX</th>
<th>LONG</th>
<th>LAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FAIRFORD</td>
<td>75</td>
<td>51.58</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>LAKENHTE</td>
<td>58</td>
<td>52.40</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>MILDENHEA</td>
<td>50</td>
<td>52.37</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BENTWATER</td>
<td>42</td>
<td>52.13</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BITBURG</td>
<td>53</td>
<td>49.97</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>SPANGDAHAH</td>
<td>67</td>
<td>49.93</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>HAHN</td>
<td>25</td>
<td>49.93</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>RAMSTEIN</td>
<td>57</td>
<td>49.43</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>SEMBACH</td>
<td>88</td>
<td>49.50</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>LAHR</td>
<td>93</td>
<td>48.37</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>SOLING</td>
<td>08</td>
<td>48.78</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>WIESBADN</td>
<td>33</td>
<td>50.05</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>N001</td>
<td>94</td>
<td>50.45</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>N031</td>
<td>70</td>
<td>49.59</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>S079</td>
<td>65</td>
<td>49.29</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>S113</td>
<td>34</td>
<td>48.66</td>
<td></td>
</tr>
<tr>
<td>25</td>
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<tr>
<td>26</td>
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<td>27</td>
<td>N004</td>
<td>59</td>
<td>51.03</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Value 1</td>
<td>Value 2</td>
<td>Value 3</td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>---------</td>
<td>---------</td>
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<tr>
<td>No23</td>
<td>28</td>
<td>7.21</td>
<td>50.09</td>
<td></td>
</tr>
<tr>
<td>No24</td>
<td>29</td>
<td>7.55</td>
<td>50.18</td>
<td></td>
</tr>
<tr>
<td>No25</td>
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<td>8.46</td>
<td>50.24</td>
<td></td>
</tr>
<tr>
<td>No26</td>
<td>31</td>
<td>9.12</td>
<td>50.31</td>
<td></td>
</tr>
<tr>
<td>No27</td>
<td>32</td>
<td>9.35</td>
<td>49.89</td>
<td></td>
</tr>
<tr>
<td>No28</td>
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<td>8.91</td>
<td>49.14</td>
<td></td>
</tr>
<tr>
<td>No30</td>
<td>35</td>
<td>9.31</td>
<td>49.16</td>
<td></td>
</tr>
<tr>
<td>No31</td>
<td>36</td>
<td>10.07</td>
<td>49.14</td>
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</tr>
<tr>
<td>No32</td>
<td>37</td>
<td>10.51</td>
<td>49.36</td>
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</tr>
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<td></td>
</tr>
<tr>
<td>No36</td>
<td>41</td>
<td>12.22</td>
<td>48.93</td>
<td></td>
</tr>
<tr>
<td>No37</td>
<td>42</td>
<td>12.38</td>
<td>49.19</td>
<td></td>
</tr>
<tr>
<td>No38</td>
<td>43</td>
<td>12.56</td>
<td>50.60</td>
<td></td>
</tr>
<tr>
<td>No39</td>
<td>44</td>
<td>12.87</td>
<td>49.18</td>
<td></td>
</tr>
<tr>
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<td>13.93</td>
<td>50.32</td>
<td></td>
</tr>
<tr>
<td>No41</td>
<td>46</td>
<td>14.12</td>
<td>51.27</td>
<td></td>
</tr>
<tr>
<td>No42</td>
<td>47</td>
<td>14.65</td>
<td>51.65</td>
<td></td>
</tr>
<tr>
<td>No43</td>
<td>48</td>
<td>15.38</td>
<td>49.65</td>
<td></td>
</tr>
<tr>
<td>No44</td>
<td>49</td>
<td>12.43</td>
<td>51.43</td>
<td></td>
</tr>
<tr>
<td>No45</td>
<td>50</td>
<td>14.27</td>
<td>50.12</td>
<td></td>
</tr>
</tbody>
</table>

IV-82
IV.2.9 ROUT: Route Array

The ROUT array contains a summary of the hypothetical sorties generated by the command "RO". Each sortie consists of a round trip route-aircraft-weapon combination which is optimal for its target and staging base. The criterion for optimality is to minimize the expected number of lost aircraft among all feasible route-aircraft-weapon combinations. Feasible here means that the proposed combination is consistent with the aircraft fuel and weapon characteristics defined in table VEHP, and achieves the probability of damage specified for the target in table TG.

The hypothetical sorties assigned to a particular target may be examined using the "SHOW" command by specifying either the target index or the target ID as in "SHOW ROUT 124" or "SHOW ROUT CASLAV". In addition all hypothetical sorties may be examined with the command "SHOW ROUT ALL". Illustrated below is the summary of a sortie assigned to target Caslav.

<table>
<thead>
<tr>
<th>TARGET: CASLAV</th>
<th>PD ACHIEVED: 0.9612</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAGING BASE</td>
<td>LLTR ENTRY LLTR EXIT</td>
</tr>
<tr>
<td>FAIRFORD</td>
<td>S079 S092 710.3</td>
</tr>
<tr>
<td>EG FAIRFORD</td>
<td>S079 S092 729.3</td>
</tr>
<tr>
<td>TOTAL TOTAL</td>
<td>1439.5 0.366 1.268</td>
</tr>
</tbody>
</table>

The probability of target damage (PD) shown in this summary represents only the effect of the proposed weapons package on the target - it does not reflect the probability of survival (PS) of the proposed route. Thus, the value of PD must be regarded as a probability of damage assuming the successful arrival of the aircraft at the target.
The detailed routes for the sorties in the ROUT array may be displayed graphically by using the DISPLAY ROUTE command and analyzed for threat exposure using the ANALIZ command. However, it is first necessary that the routes be selected with the SELECT command.
IV.2.10 STAT: Statespace Array

The STAT array is an internal file that is used by the software and is not available for showing to the user. It is stored in an X,Y coordinate system. The statespace array file covers the operational area of interest for one operational altitude. The parameters for the statespace array are stored in the parameter files ALGP and GEOM. STAT contains the danger values for a given altitude. Prior to applying suppression, this data is derived from the three dimensional statespace array TH3D. The PROCESS and STATESPACE ALTOPT commands, described in Section III, prompt the user to indicate which altitude level he wants loaded into STAT. The SUPPRESS command, described in Section III.1.4, re-calculates STAT to take into account the lower levels of danger produced by the suppression assets. The STAT array is used to display danger contours, create minimum lethality routes from the staging base to the targets and back, and to analyze routes. The current default dimensions for this array are as shown below, where the number of flight directions = 8, the number of altitudes = 1, the number of longitude increments = 101, the number of latitude increments = 114. These file dimensions are printed out when STAT is opened by the initialization file ZCONTINU.DAT.

\[ \text{STAT} = 8 \ 1 \ 101 \ 114 \]
IV.2.11 SXPE: Staging Base To LLTR Exit Performance Array

The SXPE array gives the distance in nautical miles and probability of arrival performance data for the optimal path from a staging base to a LLTR exit. This array corresponds record-by-record and row-by-row with the Target Accessibility Array (ITGC). Therefore, there is one record for every target which has at least one staging base accessible to it; and, each row of a record contains the performance data for the optimal path from the staging base to a LLTR exit on a path to the target.

The following sample SXPE table could have been generated by FLAPS either by entering the command "SHOW SXPE LEGNICA" or by entering the command "SHOW SXPE 135". If all of the SXPE records are desired, the command "SHOW SXPE ALL" can be entered.

WRSXPE -- THERE ARE 24 PATHS TO TARGET CASLAV (124)

PATHS FOR STAGING BASE FAIRFORD (1)

<table>
<thead>
<tr>
<th>LLTR EXIT</th>
<th>DISTANCE TO EXIT</th>
<th>PROB OF ARRIVAL AT EXIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 NO05 (48)</td>
<td>441.12</td>
<td>0.9836</td>
</tr>
<tr>
<td>2 NO28 (49)</td>
<td>490.58</td>
<td>0.9817</td>
</tr>
<tr>
<td>3 S092 (50)</td>
<td>563.65</td>
<td>0.9790</td>
</tr>
<tr>
<td>4 S133 (51)</td>
<td>634.06</td>
<td>0.9764</td>
</tr>
</tbody>
</table>

PATHS FOR STAGING BASE LAKENHHT (2)

<table>
<thead>
<tr>
<th>LLTR EXIT</th>
<th>DISTANCE TO EXIT</th>
<th>PROB OF ARRIVAL AT EXIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 NO05 (48)</td>
<td>371.29</td>
<td>0.9861</td>
</tr>
<tr>
<td>6 NO28 (49)</td>
<td>431.36</td>
<td>0.9839</td>
</tr>
<tr>
<td>7 S092 (50)</td>
<td>505.42</td>
<td>0.9812</td>
</tr>
<tr>
<td>8 S133 (51)</td>
<td>579.59</td>
<td>0.9784</td>
</tr>
</tbody>
</table>

PATHS FOR STAGING BASE MILDENHA (3)

<table>
<thead>
<tr>
<th>LLTR EXIT</th>
<th>DISTANCE TO EXIT</th>
<th>PROB OF ARRIVAL AT EXIT</th>
</tr>
</thead>
</table>

IV-86
The TGUS array is derived from the ROUT array by the weapons allocation command "AL". The weapons allocation procedure is to examine the targets in order of decreasing priority and to select for each the feasible sortie from the ROUT array with minimum expected aircraft losses. Feasible here means that the total number of aircraft allocated from any given staging base does not exceed the aircraft inventory for that base as defined in the staging base table STGB, that the aircraft have weapons available that can destroy the target, and that the aircraft can carry enough fuel to reach the target and return. The array TGUS consists of a one line summary of each of these selected sorties listed in order of decreasing target priority.

The contents of TGUS, which resembles an air tasking order (ATO), is examined using the command "SHOW TGUS". One sample is illustrated below.

<table>
<thead>
<tr>
<th>TARGET</th>
<th>STAGING BASE</th>
<th>AIRCRAFT ALLOCATED</th>
<th>WEAPON TYPE</th>
<th>PD ACHIEVED</th>
<th>ROUTE PS</th>
<th>ROUTE DIST (NM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PANENSKY</td>
<td>LAKENHHT</td>
<td>2 F111</td>
<td>CBU-38</td>
<td>0.878</td>
<td>0.40</td>
<td>1208.8</td>
</tr>
<tr>
<td>ZOLLSCHN</td>
<td>FAIRFORD</td>
<td>4 F111</td>
<td>MARK-84</td>
<td>0.990</td>
<td>0.22</td>
<td>1398.8</td>
</tr>
<tr>
<td>PRESCHEN</td>
<td>RAMSTEIN</td>
<td>2 F-16</td>
<td>MARK-20</td>
<td>0.900</td>
<td>0.33</td>
<td>709.8</td>
</tr>
<tr>
<td>CASLAV</td>
<td>MILDENHA</td>
<td>2 F111</td>
<td>MARK-20</td>
<td>0.961</td>
<td>0.37</td>
<td>1326.2</td>
</tr>
<tr>
<td>LEIPZIG</td>
<td>RAMSTEIN</td>
<td>4 F-16</td>
<td>AGM-65</td>
<td>0.999</td>
<td>0.37</td>
<td>695.7</td>
</tr>
<tr>
<td>PRAGUE</td>
<td>BAHN</td>
<td>4 F-16</td>
<td>AGM-65</td>
<td>0.999</td>
<td>0.39</td>
<td>661.3</td>
</tr>
</tbody>
</table>

As in the array ROUT, the probability of damage (PD) appearing in TGUS reflects only the effects of the selected weapon package on the target - not the probability of survival of the route (PS).
IV.2.12 TGUS: Target Status Array

The TGUS array is derived from the ROUT array by the weapons allocation command 'AL'. The weapons allocation procedure is to examine the targets in order of decreasing priority and to select for each the feasible sortie from the ROUT array with minimum expected aircraft losses. Feasible here means that the total number of aircraft allocated from any given staging base does not exceed the aircraft inventory for that base as defined in the staging base table STGB, that the aircraft have weapons available that can destroy the target, and that the aircraft can carry enough fuel to reach the target and return. The array TGUS consists of a one line summary of each of these selected sorties listed in order of decreasing target priority.

The contents of TGUS, which resembles an air tasking order (ATO), is examined using the command "SHOW TGUS". One sample is illustrated below.

<table>
<thead>
<tr>
<th>TARGET STAGING BASE</th>
<th>AIRCRAFT ALLOCATED</th>
<th>AIRCRAFT TYPE</th>
<th>WEAPON TYPE</th>
<th>PD ACHIEVED</th>
<th>ROUTE PS</th>
<th>ROUTE DIST (NM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PANENSKY LAKENHTH</td>
<td>2 F111</td>
<td></td>
<td>CBU-38</td>
<td>0.878</td>
<td>0.40</td>
<td>1208.8</td>
</tr>
<tr>
<td>ZOLLSCHN FAIRFORD</td>
<td>4 F111</td>
<td></td>
<td>MARK-84</td>
<td>0.990</td>
<td>0.22</td>
<td>1398.8</td>
</tr>
<tr>
<td>PRESCHEN RAMSTEIN</td>
<td>2 F-16</td>
<td></td>
<td>MARK-20</td>
<td>0.900</td>
<td>0.33</td>
<td>709.8</td>
</tr>
<tr>
<td>CASLAV MILDENHA</td>
<td>2 F111</td>
<td></td>
<td>MARK-20</td>
<td>0.961</td>
<td>0.37</td>
<td>1326.2</td>
</tr>
<tr>
<td>LEIPZIG RAMSTEIN</td>
<td>4 F-16</td>
<td></td>
<td>AGM-65</td>
<td>0.999</td>
<td>0.37</td>
<td>695.7</td>
</tr>
<tr>
<td>PRAGUE HAHN</td>
<td>4 F-16</td>
<td></td>
<td>AGM-65</td>
<td>0.999</td>
<td>0.39</td>
<td>661.3</td>
</tr>
</tbody>
</table>

As in the array ROUT, the probability of damage (PD) appearing in TGUS reflects only the effects of the selected weapon package on the target - not the probability of survival of the route (PS).

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As the above illustration shows, there may be targets for which no suitable sortie can be found. Since weapons and aircraft are allocated to targets in order of decreasing target priority, this is particularly likely for the lower priority targets appearing at the bottom of the list.
IV.2.11 TH3D: Three Dimensional Statespace Array File

The TH3D array is an internal file that is used by the software and is not available for showing to the user. It is stored in an X,Y coordinate system. The array "TH3D" covers the operational area of interest for all the operational altitudes. The parameters for "TH3D" are stored in the parameter files "ALGF" and "GEOM". To load data into array "TH3D" you type the commands "ST AD" with the appropriate parameters as prompted. This causes the software to read the threat observability file and calculate the danger values which are then stored in array "TH3D". The array "TH3D" is used to load data into the array "STAT" for doing minimum lethality route calculations and threat suppression. The danger values in "TH3D" can be displayed by using the display commands described elsewhere in this document. The current default dimensions for this array are as shown below, where the number of flight directions = 8, the number of operational altitudes = 5, the number of longitude increments = 101, and the number of latitude increments = 114. These file dimensions are printed out when TH3D is opened by the initialization file ZCONTNU.DAT.

TH3D = 8 5 101 114
IV.2.14 TOBS: Threat Observability Array File

The TOBS array is an internal file that is used by the software, and is not available for showing by the user. The "TOBS" array contains the minimum observable altitude for each threat that has been masked by the FLAPS program. The data for each threat is stored in a subarray in the "TOBS" file using an X,Y coordinate system centered around the threat location. The data is stored in sixteen bit integers in units of meters. The subarray is initialized to 32764 meters before terrain masking. The "TOBS" file has as a header an information word, and two arrays. The information word gives the number of threats that have been masked and stored in the "TOBS" file. The first array consists of 8 character words that identify the threats that have been masked. And the second array consist of integer words that are pointers to the threat subarrays in the "TOBS" file. The "TOBS" file is dimensioned as shown below where 256000 is the available size of the "TOBS" file. The "TOBS" file is used in adding or deleting threats from the statespace, doing threat suppression, and doing route analysis. The following file dimensions are printed out when TOBS is opened by the initialization file ZCONTNU.DAT.

TOBS = 256000 1 1 1
IV.2.15 TRPE: Low Level Transit Route Performance Array

The TRPE array gives the performance data for the optimal node sequences through the LLTR network. Performance, in this case, is the distance in nautical miles from an LLTR entry point to an LLTR exit point and the probability of arrival at the LLTR exit given one left from the LLTR entry point.

This array corresponds record-by-record and row-by-row with the Low Level Transit Route Accessibility (ITRC) Array. Therefore, there is one record for every LLTR entry point which has at least one LLTR exit point accessible to it; and, every row in a record contains the performances from the entry point to an accessible exit point. Because LLTR exits lie on the friendly side of the FEBA, there is no directionality included in the probability of arrival calculations. This means that the probability of arrival at the LLTR exit given one left from the LLTR entry is the same as the probability of arrival at the LLTR entry given that one left from the LLTR exit.

The following TRPE example could have been generated by FLAPS either by issuing the command "SHOW TRPE N031" or by issuing the command "SHOW TRPE 22". If all of the TRPE records had been desired to be shown, the proper command would have been "SHOW TRPE ALL".

WTRFRPE -- THERE ARE 2 EXITS ACCESSIBLE TO LLTR ENTRY POINT NO31 ( 22)
IV.2.16 THE FLIGHT PLAN (SPED)

A flight plan may be generated from routes stored in the SPED table and displayed on the users terminal. This flight plan is in an easily interpreted form. It is recommended that users use this feature instead of the "SHOW SPED" command.

The form of the flight plan is as follows. A header is printed which gives the name of the sortie (the SPED table record ID), the ID and index of the staging base and target, the total probability of survival, the probability of kill due to threats, the flight distance (in nautical miles), the take off time (in decimal minutes), the time on target (in decimal minutes), and the number of waypoints. These are all labeled. Refer to Section IV.1.11 for a description of the SPED table. The actual flight plan is shown as a list of waypoints. Each waypoint consists of time (in decimal minutes), latitude and longitude (in degrees, minutes and seconds), altitude (in feet), heading (in decimal degrees from north), and the node ID. A node ID will appear at the first and last waypoint (the staging base), at the target, and at all of the LLTR points. Simple turn points do not have a node ID listed.

To show a flight plan, the user should type "SHOW PLAN". FLAPS will then prompt the user for a SPED record ID or a record number. The user may enter either, whichever is more convenient. The following table was generated by FLAPS using the SHOW PLAN command for a SPED record with ID BITB.CASL.01, and record number 6. The plan could have been generated by entering either:

SHOW PLAN BITB.CASL.01
SHOW PLAN 6

WRPLAN - FLIGHT PLAN FOR SORTIE: LAKENHTH , 01

STAGING BASE LAKENHTH (0) TO TARGET PANENSKY (121)

PROB OF SURVIVAL: 0.4026

THREAT FK: 0.5971

FLIGHT DISTANCE: 1208.75 NM

TAKE OFF TIME: 0.0000

TIME ON TARGET: 75.0913

# OF WAYPOINTS: 35

<table>
<thead>
<tr>
<th>TIME (MIN)</th>
<th>LATITUDE (DMS)</th>
<th>LONGITUDE (DMS)</th>
<th>ALTITUDE (FEET)</th>
<th>HEADING (DEG)</th>
<th>NODE ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000</td>
<td>52 24 00</td>
<td>0 34 60</td>
<td>197.18</td>
<td>124.01</td>
<td>LAKENHTH</td>
</tr>
<tr>
<td>40.391</td>
<td>49 17 17</td>
<td>7 39 15</td>
<td>197.18</td>
<td>105.47</td>
<td>S079</td>
</tr>
<tr>
<td>43.238</td>
<td>49 12 17</td>
<td>8 06 54</td>
<td>197.18</td>
<td>97.30</td>
<td>S080</td>
</tr>
<tr>
<td>47.171</td>
<td>49 08 18</td>
<td>8 54 31</td>
<td>197.18</td>
<td>85.42</td>
<td>S081</td>
</tr>
<tr>
<td>49.150</td>
<td>49 09 33</td>
<td>9 18 35</td>
<td>197.18</td>
<td>92.52</td>
<td>S082</td>
</tr>
<tr>
<td>52.912</td>
<td>49 08 14</td>
<td>10 04 26</td>
<td>197.18</td>
<td>52.03</td>
<td>S085</td>
</tr>
<tr>
<td>55.614</td>
<td>49 21 29</td>
<td>10 30 30</td>
<td>197.18</td>
<td>84.89</td>
<td>S086</td>
</tr>
<tr>
<td>59.036</td>
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<td>11 12 16</td>
<td>197.18</td>
<td>53.47</td>
<td>S091</td>
</tr>
<tr>
<td>63.336</td>
<td>49 44 18</td>
<td>11 54 50</td>
<td>197.18</td>
<td>47.82</td>
<td>S092</td>
</tr>
<tr>
<td>66.741</td>
<td>50 02 30</td>
<td>12 26 08</td>
<td>197.18</td>
<td>84.80</td>
<td></td>
</tr>
<tr>
<td>70.196</td>
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<td>197.18</td>
<td>60.13</td>
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</tr>
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<td>13 36 08</td>
<td>197.18</td>
<td>44.80</td>
<td></td>
</tr>
<tr>
<td>73.599</td>
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<td>13 43 55</td>
<td>197.18</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>73.312</td>
<td>50 22 30</td>
<td>13 43 55</td>
<td>197.18</td>
<td>90.00</td>
<td></td>
</tr>
<tr>
<td>74.534</td>
<td>50 22 30</td>
<td>13 51 42</td>
<td>197.18</td>
<td>141.89</td>
<td></td>
</tr>
<tr>
<td>75.391</td>
<td>50 19 00</td>
<td>13 55 60</td>
<td>197.18</td>
<td>124.02</td>
<td>PANENSKY</td>
</tr>
<tr>
<td>75.427</td>
<td>50 17 30</td>
<td>13 59 29</td>
<td>197.18</td>
<td>44.80</td>
<td></td>
</tr>
<tr>
<td>75.869</td>
<td>50 19 60</td>
<td>14 03 22</td>
<td>197.18</td>
<td>315.23</td>
<td></td>
</tr>
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<td>76.310</td>
<td>50 22 30</td>
<td>13 59 29</td>
<td>197.18</td>
<td>270.00</td>
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</tr>
<tr>
<td>77.554</td>
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<td>13 43 55</td>
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<td>0 34 60</td>
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<td>305.80</td>
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</table>

IV-94
IV.2.17 THE BYTE (BYTE) ARRAY FILE

The byte array file is an internal file that is used by the software and is not available for showing to the user. It contains byte packed DTED data that is in an SCT format. To change the area of operation requires formatting a new data file. This file is used during the terrain masking process. This file has a header shown below that is described for the current scenario as, minimum longitude = 11 degrees east, minimum latitude = 48 degrees north, maximum longitude = 20 degrees east, maximum latitude = 54 degrees north. The following file dimensions are printed out when BYTE is opened by the initialization file ZCONTNU.DAT.

LUNTER, MXRCTR = 0 0

IHDR = 11. 48. 20. 54. 200 240 8 16
CHAPTER V
SAMPLE FLAPS SESSION

The following is a sample FLAPS interactive session. It was taken directly from a FLAPS log file (FORO04.DAT) which was generated during an actual FLAPS session. Some explanation has been added, but the output below is typical of what the user sees when he running FLAPS.

There are a number of standard features of which the user should be aware. These are:

(1) The Colon (:) Prompt. FLAPS presents the user with a colon when it is ready for a command. The user inputs follow the colon. To make the listing below easier to read, user inputs are enclosed in brackets, like this < ... >. Explanations appear in mixed case and are inside parentheses.
(2) The Type-Ahead Feature. In the sample session, the user inputs are typed as a single line of data consisting of several commands. For example, <SHOW ALGP 2 >. The user could also issue this command one word at a time, by typing <SHOW> <cr> <ALGP> <cr> <2> <cr>, where <cr> represents the carriage return key. If the command is issued one word at a time, then the program provides a helpful prompt each time the carriage return key is hit. This reminds the user what information is required next.

(3) The Timing Data. After a FLAPS command has been executed, a line is written to the screen and to the log file which tells the user how much time it took to process that command. The timing data includes the computer CPU time, the wall clock time, and the "Page Faults". Page Faults refers to the virtual operating system.

SAMPLE SESSION

FLAPS -- DATE = 1-JAN-86 TIME = 10:43:59

Read in previous flaps files "Y"es or "N"o?:

< Y >

; NORMAL RUN
; OPEN TSTR OLD TSTR.FIL R
  TSTR NREC,LREC= 23 1212
  INIT
; OPEN ASTR OLD ASTR.FIL R
  ASTR NREC,LREC= 20 10
  INIT
; OPEN TABLES
; OPEN ALGP OLD ALGP.FIL R/W
OPEN CURR OLD CURR.FIL R/V
CURR NREC,LREC = 2 24
OPEN CMDL OLD CMDL.FIL SR
CMDL NREC,LREC = 1 130
OPEN DISP OLD DISP.FIL R/SW
DISP NREC,LREC = 4 39
OPEN GEOM OLD GEOM.FIL R/SW
GEOM NREC,LREC = 2 38
OPEN LLTR OLD LLTR.FIL R/SW
LLTR NREC,LREC = 88 14
OPEN NODP OLD NODP.FIL R/SW
NODP NREC,LREC = 2 9
OPEN PBOR OLD PBOR.FIL R
PBOR NREC,LREC = 15 205
OPEN ROZR OLD ROZR.FIL R/V
ROZR NREC,LREC = 6 27
OPEN SPED OLD SPED.FIL R/SW
SPED NREC,LREC = 17 733
OPEN STCH OLD STCH.FIL R/SW
STCH NREC,LREC = 12 113
OPEN STGB OLD STGB.FIL R/SW
STGB NREC,LREC = 13 18
OPEN SUPM OLD SUPM.FIL R/V
SUPM NREC,LREC = 4 81
OPEN SUPP OLD SUPP.FIL R/V
SUPP NREC,LREC = 7 9
OPEN SWCH OLD SWCH.FIL R/SW
SWCH NREC,LREC = 2 28
OPEN TG OLD TG.FIL R/W
TG NREC,LREC = 7 10
OPEN THRT OLD THRT.FIL R/W
THRT NREC,LREC = 98 9
OPEN TMDL OLD TMDL.FIL R/W
TMDL NREC,LREC = 22 219
OPEN VEHP OLD VEHP.FIL R/W
VEHP NREC,LREC = 4 61
OPEN WEAFL OLD WEAFL.FIL R/W
WEAFL NREC,LREC = 2 274
OPEN WFZ OLD WFZ.FIL R/W
WFZ NREC,LREC = 4 25
OPEN ARRAYS
OPEN ALTG OLD ALTG.FIL SR/V
ALTG = 8 1 97 109
OPEN ALTS OLD ALTS.FIL SR/V
ALTS = 8 1 97 109
OPEN ARCS OLD ARCS.FIL R/SW
ARCS = 432660 1 1 1
OPEN ARPE OLD ARPE.FIL R/SW
ARPE = 2460 1 1 1
(The above is an example of how the user begins a FLAPS session.
ZCONTNU.DAT (z-continue) is a command file which opens all of the arrays and tables. These arrays and tables contain all of the work done in previous sessions. See Chapter IV for a description of the arrays and tables. ZCONTNU issues the "PROC GEOM" and "DEBUG 5" commands. These commands initialize the
critical data bases and set the debug level to 5. This is a moderately high debug level.) The current version of ZCONTNU.DAT is contained in Appendix C.

(The user can now begin issuing interactive commands. In this session, the data base tables have been set up in a previous session. In particular, the command file ZDEMO.DAT (Appendix C) was used to initialize the data base. The user issues the "PROC" command. Entering "PR" would produce the same result. This command will automatically perform all of the necessary commands through ALLOCATE. This includes the STATESPACE commands, NODES, ACCESS, ARCS and ALLOCATE. The secondary commands are listed in parentheses to the right of the page at the time they are executed by "PROC". The debug output has been included so that the user can see the actual FLAPS outputs.)

: < PROC >

******************************************************************************
STATES "CL" EXECUTING

CLEARING TH3D TO 1.550E-04
(STAT CL3D 1.550E-04)
******************************************************************************
STATES "CL" EXECUTING

CLEARING TOBS TO 0.0000E+00
(STAT TOBS 0.0000E+00)

******************************************************************************
(STAT MASK 2 999)

(This is the output produced by the terrain masking algorithm at debug level 5. Each threat in the THRT table will be masked.)

******************************************************************************
STATES "MA" EXECUTING

RMAX, IDTH, ILXT, IUKT, JLXT, JUXT= 18.50 5601 41 57 56 72
WRTMSK -- XOT, YOT, NXT, NYT = 0.79950E+01 0.47998E+02 1600 2400
DXAMT, DYAMT = 0.50000E-02 0.25000E-02
WRTMSK -- NXAMT, NYAMT, KSUB, XOA, YOA = 196 249 1 0.11590E+02 0.50303E+02
DXAMT, DYAMT, XATHMT, YATHMT = 0.50000E-02 0.25000E-02 0.08400E-02 0.12500E-03
WRTMSK -- NRGMT, NTHMT, DRGMT, DTHMT = 123 94 0.15041E+00 0.66842E-01
WRTMSK -- NEARBY ALTS, HTHMT = 4.530E+02 4.590E+02 4.460E+02 4.530E+02
4.533E+02


RMAX, IDTH, ILXT, IUKT, JLXT, JUXT= 9.00 5815 45 53 75 83
WRTMSK -- XOT, YOT, NXT, NYT = 0.79950E+01 0.47998E+02 1600 2400

V-5
OXTM.DYTM = 0.50000E-02 -0.25000E-02
VRTMSK -- NXTM. NDTM. XSUB. XOA. YOA = 98 122 0 0.11380E-02 0.51105E-02
OXTM.DYTM. XATHM. YATHM = 0.50000E-02 0.25000E-02 0.49680E-02
0.61960E-02
VRTMSK -- NRMNT. YTMNT. DRYMT. DTMNT = 60 -60 0.15000E-02 0.113659E-02
VRTMSK -- NEARBY ALTS. HMT = 1.150E-02 1.120E-02 1.150E-02 1.150E-02
1.171E-02

(STAT ADD THRT 2 999)

(After performing terrain masking, all of the threats in the THRT table are added to the three dimensional statespace (TH3D).)

*************** STATES "AD" EXECUTING ***************

<table>
<thead>
<tr>
<th>RMAX, IDTH, ILAT, IUTX. JLXT, JUXT</th>
<th>RMAX, IDTH, ILAT, IUTX. JLXT, JUXT</th>
<th>RMAX, IDTH, ILAT, IUTX. JLXT, JUXT</th>
<th>RMAX, IDTH, ILAT, IUTX. JLXT, JUXT</th>
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</thead>
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<td>18.50 601 41 57 56 72</td>
<td>18.50 602 42 58 51 67</td>
<td>18.50 603 44 60 47 63</td>
<td>18.50 604 46 62 44 59</td>
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<tr>
<td>9.00 812 33 41 57 66</td>
<td>9.00 813 45 54 57 65</td>
<td>9.00 814 11 19 62 70</td>
<td>9.00 815 45 53 75 83</td>
</tr>
</tbody>
</table>

(STAT ADD STCH 2 999)

(Next, all of the stochastic threats in the STCH table are added to the three dimensional statespace (TH3D). Note that stochastic threats are not terrain masked.)

*************** STATES "AD" EXECUTING ***************

<table>
<thead>
<tr>
<th>RMAX, IDSC, ILAT, IUTX. JLXT, JUXT</th>
<th>RMAX, IDSC, ILAT, IUTX. JLXT, JUXT</th>
<th>RMAX, IDSC, ILAT, IUTX. JLXT, JUXT</th>
<th>RMAX, IDSC, ILAT, IUTX. JLXT, JUXT</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.50 601 19 45 81 97</td>
<td>18.50 602 8 40 71 93</td>
<td>18.50 603 6 37 50 80</td>
<td>18.50 604 51 67 36 51</td>
</tr>
<tr>
<td>NXSC, NYSY, DSC, DSYC, XMINSC, TMINSC = 11 8 0.0648 0.0417 10.6759</td>
<td>16 7 0.0648 0.0417 10.0138</td>
<td>15 15 0.0648 0.0417 9.8792</td>
<td>50.3753</td>
</tr>
</tbody>
</table>

V-6
STATES "AO" EXECUTING
ALTITUDE OPTIMIZATION LEVEL: < 1>

(The user must input the desired altitude level at this time. In this case, the user is building his routes at 60 meters (around 200 feet). The user could have entered "PROC 1" and this prompt would have been skipped.)

(NODES)

TROPSQ - BUILDING TREE NUMBER 1 FOR LLTR ENTRY POINT NO01 ( 21) EXIT POINT NO05 ( 48) DISTANCE = 106.40 PA = 0.9960
TROPSQ - BUILDING TREE NUMBER 2 FOR LLTR ENTRY POINT NO31 ( 22) EXIT POINT NO05 ( 48) DISTANCE = 144.44 PA = 0.9946 EXIT POINT NO28 ( 49) DISTANCE = 134.20 PA = 0.9950
TROPSQ - BUILDING TREE NUMBER 3 FOR LLTR ENTRY POINT SO79 ( 23) EXIT POINT SO92 ( 50) DISTANCE = 179.11 PA = 0.9933 EXIT POINT S133 ( 51) DISTANCE = 261.45 PA = 0.9902
TROPSQ - BUILDING TREE NUMBER 4 FOR LLTR ENTRY POINT S113 ( 24) EXIT POINT S133 ( 51) DISTANCE = 208.66 PA = 0.9922

(The NODES command outputs the above data while preprocessing the LLTR network.)

(ACCESS)

ACCESS EXECUTING

(The ACCESS command does not output any debug output other than the access executing message.)
GETARC -- RETRIEVE TRAJECTORIES FROM EXIT TO TGT Target: PANENSKY (121)
GETARC -- TO EXIT N005 (48) DIST,PS = 247.1 0.67258
GETARC -- TO EXIT N028 (49) DIST,PS = 212.4 0.56051
GETARC -- TO EXIT S092 (50) DIST,PS = 93.8 0.68223
GETARC -- TO EXIT S133 (51) DIST,PS = 154.3 0.47759

GETARC -- RETRIEVE TRAJECTORIES FROM TGT TO EXIT Target: PANENSKY (121)
GETARC -- TO EXIT N005 (48) DIST,PS = 255.5 0.60524
GETARC -- TO EXIT N028 (49) DIST,PS = 220.8 0.59437
GETARC -- TO EXIT S092 (50) DIST,PS = 104.1 0.61299
GETARC -- TO EXIT S133 (51) DIST,PS = 164.6 0.43727

GETARC -- RETRIEVE TRAJECTORIES FROM EXIT TO TGT Target: PRAGUE (126)
GETARC -- TO EXIT N005 (48) DIST,PS = 258.8 0.65622
GETARC -- TO EXIT N028 (49) DIST,PS = 224.2 0.64443
GETARC -- TO EXIT S092 (50) DIST,PS = 105.6 0.66563
GETARC -- TO EXIT S133 (51) DIST,PS = 166.0 0.46597

GETARC -- RETRIEVE TRAJECTORIES FROM TGT TO EXIT Target: PRAGUE (126)
GETARC -- TO EXIT N005 (48) DIST,PS = 265.4 0.58081
GETARC -- TO EXIT N028 (49) DIST,PS = 230.7 0.57038
GETARC -- TO EXIT S092 (50) DIST,PS = 114.0 0.58825
GETARC -- TO EXIT S133 (51) DIST,PS = 174.5 0.41333

(The ARCS command computes the optimal ingress and egress for every target to all accessible LLTR exit points. A briefer debug output will be produced under debug level 4.)

ROUTES EXECUTING

 ROUTES TO TARGET PANENSKY
 ROUTES TO TARGET ZOLLISCHN
 ROUTES TO TARGET PRESCHEN
 ROUTES TO TARGET CASLAV
 ROUTES TO TARGET LEIPZIG
 ROUTES TO TARGET PRAGUE

ROUTINE ROUTES FINISHED.
A TOTAL OF 38 ROUTES ASSEMBLED TO

V-8
A TOTAL OF 6 TARGETS. RESULTS APPEAR IN ARRAY ROUT

(The ROUTES command constructs the optimal routes from each staging base to each accessible target. Note that every target is accessible to many staging bases.)

(ALLOCATE)

***********************************************************************
ALLOC EXECUTING

ALLOCATION COMPLETED FOR 6 TARGETS.
RESULTS APPEAR IN TARGET STATUS ARRAY : TGUS

(The weapons allocation algorithm has allocated weapons to all 6 of the targets. Had there not been enough aircraft available to attack all of the targets, weapons would have been allocated to the high priority targets first. In that case, only the lowest priority targets would not have been allocated attack aircraft.)

CPUTIM,WALLTIM,PAGEFLTS= 1138.670 4087.723 6592.000

(It has taken 1138 and 4087 seconds of CPU and wall clock time respectively, to execute PROC. Most of this time is taken up by the STAT MASK, STAT ADD, and ARCS commands. Because so much time has gone into building this set of files, the user next issues a SAVE command. This will protect the work he has done so far. It will also open a new log file.)

: < SAVE >

FLAPS -- DATE = 1-JAN-86 TIME = 12:08:13
(The date and time are always reissued after a SAVE command.)

: < HE ON >

CPUTIM,WALLTIM,PAGEFLTS= 0.010 0.012 1.000

(Here, the user has turned on the HELP option. This command, like many, takes a very short amount of time to run.)

: < SH ALGP 2 >

CRSHOW -- RECORD 2 IDWORD=ALGP
ID = ALGP
DELE= 2.5000E+00
DELN= 2.5000E+00
XMIN= 9.0000E+00
XMAX= 1.6000E+01
YMIN= 4.8000E+01

V-9
(The Algorithm Parameters Table defines the scenario. Note the definition of the scenario and the statespace.)

CHAN CURR 1 IDEV PTX

CPUTIM, WALLTIM, PAGEFLTS = 0.140 1.168 8.000

(The graphic displays normally appear on the Tektronix 4115B terminal. For the purposes of this User's Manual, we have changed the graphical device to the Printronix Printer/Plotter.)

DI B L

CPUTIM, WALLTIM, PAGEFLTS = 8.000 14.777 274.000

(Here the user has displayed the scenario. The "BORDERS" option automatically displays the political borders. The L option draws the longitude - latitude grid. The resulting graphic display is shown in Figure V-1. The user must hit a carriage return to get the : prompt.)

DI B M

CPUTIM, WALLTIM, PAGEFLTS = 6.630 10.457 85.000

(The user has turned off the border option and turned on the mission option. The resulting display is shown in Figure V-2. Note that the mission option includes the borders, and the staging bases, LLTR's, and targets. These are referred to as the nodes.)

DI B AR / FAIRFORD

CPUTIM, WALLTIM, PAGEFLTS = 9.470 12.902 30.000
(Here the user has displayed the "ARCS" around the node FAIRFORD, FAIRFORD is a staging base and so the ARCS show the paths through the current LLTR network, from FAIRFORD to the LLTR exit points. The plot is shown in Figure V-3.)

: < DI SC ST >

CPUTIM, WALLTIM, PAGEFLTS= 0.050 0.129 0.000

(This command rescales the display to include only the statespace. No plot is generated.)

: < DI P / >

CPUTIM, WALLTIM, PAGEFLTS= 0.053 0.145 0.000

(This command purges the current options (M, AR, L). The result is a clear screen.)

: < DI M L D / STAT D 7 >

CPUTIM, WALLTIM, PAGEFLTS= 15.920 41.949 58.000

(This command displays the mission, longitude-latitude grid, and danger contours for the statespace, using the default danger contour levels. The program will prompt the user for the suboptions if he is not sure what they should be. Danger from direction 7 (east) was selected. The plot is shown in Figure V-4.)
: < DI D / TH3D D 7 1 >
CPUTIM, WALLTIM, PAGEFLTS= 23.490 70.473 0.000

(This command displays the danger contours from the TH3D file. Level 1
(60 meters) and direction 7 (east) were selected. Entering the "D" option a
second time will cancel the previous danger contour settings. The user
will be prompted for the new settings. Because the current altitude
level is 1 (from STAT A0PT), the STAT file is the same as TH3D level 1.
The last display was made using STAT in direction 7, so this plot is
exactly the same as the last one! Refer to Figure 7-4, again.)

: < DI D / TH3D D 4 1 >
CPUTIM, WALLTIM, PAGEFLTS= 23.610 90.211 0.000

: < DI D / TH3D D 7 2 >
CPUTIM, WALLTIM, PAGEFLTS= 23.250 82.449 0.000

: < DI D / TH3D D 7 3 >
CPUTIM, WALLTIM, PAGEFLTS= 22.420 73.520 0.000

(These commands result in three different danger plots of TH3D. They
are shown in Figures 7-5, 7-6, and 7-7. Figure 7-5 is at level 1 (60 m),
direction 4 (south). Notice how it is slightly different from the
danger at the same altitude but at direction east (Figure 7-4). Figure
7-6 is at altitude level 2 (150 m), direction 7 (east). Notice how the threat
coverage has spread. Figure 7-7 is at level 3 (300 m), direction 7.
Again the threat coverage has spread.)
(Now the SHOW command will be demonstrated. First, consider the arrays generated by the NODES command. These are NLIS, NPOS, ITRC, and TRPE.)

: < SHOW NLIS >

<table>
<thead>
<tr>
<th>INDEX</th>
<th>ID NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FAIRFORD</td>
</tr>
<tr>
<td>2</td>
<td>LAKENHTH</td>
</tr>
<tr>
<td>3</td>
<td>MILDENHA</td>
</tr>
<tr>
<td>4</td>
<td>BENTVATE</td>
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<td>BITBURG</td>
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<td>NO02</td>
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<td>S131</td>
<td>46</td>
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<tr>
<td>S132</td>
<td>47</td>
</tr>
</tbody>
</table>
BRANCH FOR LLTR EXIT NO05 ( 48) DIST = 144.44 PA = 0.9946
1 NO31 ( 22)
2 NO30 ( 33)
3 NO23 ( 28)
4 NO02 ( 25)
5 NO03 ( 26)
6 NO04 ( 27)
8 NO05 ( 48)

BRANCH FOR LLTR EXIT NO28 ( 49) DIST = 134.20 PA = 0.9950
1 NO31 ( 22)
2 NO30 ( 33)
3 NO23 ( 28)
4 NO24 ( 29)
5 NO25 ( 30)
6 NO26 ( 31)
7 NO27 ( 32)
9 NO28 ( 49)

: < SHOW TRPE NO31 >

WRTRPE -- THERE ARE 2 EXITS ACCESSIBLE TO LLTR ENTRY POINT NO31 ( 22)

LLTR EXIT DISTANCE PROB OF ARRIVAL
1 NO05 ( 48) 144.44 0.9946
2 NO28 ( 49) 134.20 0.9950

V-22
These arrays are described in Chapter IV. The indices listed in NLIS and LPOS are quite useful. For many FLAPS prompts, where a node name is needed, the user can enter these integer numbers instead of the longer node name.

(The arrays ITGC, SXPE, and NBOX are created by the ACCESS command. They contain data about the paths through the LLTR network to the targets.)

: < SHOW ITGC CASLAV >

WRAACC -- THERE ARE 24 PATHS TO TARGET CASLAV (124) IN ARRAY ITGC

<table>
<thead>
<tr>
<th>STAGING BASE</th>
<th>LLTR ENTRY</th>
<th>LLTR EXIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 FAIRFORD (1)</td>
<td>N001 (21)</td>
<td>N005 (48)</td>
</tr>
<tr>
<td>2 FAIRFORD (1)</td>
<td>N031 (22)</td>
<td>N028 (49)</td>
</tr>
<tr>
<td>3 FAIRFORD (1)</td>
<td>S079 (23)</td>
<td>S092 (50)</td>
</tr>
<tr>
<td>4 FAIRFORD (1)</td>
<td>S113 (24)</td>
<td>S133 (51)</td>
</tr>
<tr>
<td>5 LAKENHHT (2)</td>
<td>N001 (21)</td>
<td>N005 (48)</td>
</tr>
<tr>
<td>6 LAKENHHT (2)</td>
<td>N031 (22)</td>
<td>N028 (49)</td>
</tr>
<tr>
<td>7 LAKENHHT (2)</td>
<td>S079 (23)</td>
<td>S092 (50)</td>
</tr>
<tr>
<td>8 LAKENHHT (2)</td>
<td>S113 (24)</td>
<td>S133 (51)</td>
</tr>
<tr>
<td>9 MILDENHA (3)</td>
<td>N001 (21)</td>
<td>N005 (48)</td>
</tr>
<tr>
<td>10 MILDENHA (3)</td>
<td>N031 (22)</td>
<td>N028 (49)</td>
</tr>
<tr>
<td>11 MILDENHA (3)</td>
<td>S079 (23)</td>
<td>S092 (50)</td>
</tr>
<tr>
<td>12 MILDENHA (3)</td>
<td>S113 (24)</td>
<td>S133 (51)</td>
</tr>
<tr>
<td>13 RAMSTEIN (8)</td>
<td>N031 (22)</td>
<td>N005 (48)</td>
</tr>
<tr>
<td>14 RAMSTEIN (8)</td>
<td>N031 (22)</td>
<td>N028 (49)</td>
</tr>
<tr>
<td>15 RAMSTEIN (8)</td>
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<td>S092 (50)</td>
</tr>
<tr>
<td>16 RAMSTEIN (8)</td>
<td>S113 (24)</td>
<td>S133 (51)</td>
</tr>
<tr>
<td>17 SEMBACH (9)</td>
<td>N001 (21)</td>
<td>N005 (48)</td>
</tr>
<tr>
<td>18 SEMBACH (9)</td>
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<td>S092 (50)</td>
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<tr>
<td>20 SEMBACH (9)</td>
<td>S113 (24)</td>
<td>S133 (51)</td>
</tr>
<tr>
<td>21 LAHR (10)</td>
<td>N031 (22)</td>
<td>N005 (48)</td>
</tr>
<tr>
<td>22 LAHR (10)</td>
<td>N031 (22)</td>
<td>N028 (49)</td>
</tr>
<tr>
<td>23 LAHR (10)</td>
<td>S079 (23)</td>
<td>S092 (50)</td>
</tr>
<tr>
<td>24 LAHR (10)</td>
<td>S113 (24)</td>
<td>S133 (51)</td>
</tr>
</tbody>
</table>

CPUTIM, WALLTIM, PAGEFLTS = 0.190 2.340 0.000

: < SH SXPE PRESCHEN >

WRSXPE -- THERE ARE 24 PATHS TO TARGET PRESCHEN (123)

PATHS FOR STAGING BASE FAIRFORD (1)

<table>
<thead>
<tr>
<th>LLTR EXIT</th>
<th>DISTANCE</th>
<th>PROB OF ARRIVAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>V-23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PATHS FOR STAGING BASE LAKENHUTH ( 2)</td>
<td>LLTR EXIT</td>
<td>DISTANCE</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>-----------</td>
<td>----------</td>
</tr>
<tr>
<td>5  NO05 ( 48)</td>
<td>371.29</td>
<td>0.9861</td>
</tr>
<tr>
<td>6  NO28 ( 49)</td>
<td>431.36</td>
<td>0.9839</td>
</tr>
<tr>
<td>7  SO92 ( 50)</td>
<td>505.42</td>
<td>0.9812</td>
</tr>
<tr>
<td>8  SI33 ( 51)</td>
<td>579.59</td>
<td>0.9784</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>PATHS FOR STAGING BASE MILDENHA ( 3)</th>
<th>LLTR EXIT</th>
<th>DISTANCE</th>
<th>PROB OF ARRIVAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>9  NO05 ( 48)</td>
<td>373.30</td>
<td>0.9861</td>
<td></td>
</tr>
<tr>
<td>10 NO28 ( 49)</td>
<td>432.91</td>
<td>0.9839</td>
<td></td>
</tr>
<tr>
<td>11 SO92 ( 50)</td>
<td>506.96</td>
<td>0.9811</td>
<td></td>
</tr>
<tr>
<td>12 SI33 ( 51)</td>
<td>581.01</td>
<td>0.9784</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PATHS FOR STAGING BASE RAMSTEIN ( 8)</th>
<th>LLTR EXIT</th>
<th>DISTANCE</th>
<th>PROB OF ARRIVAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 NO05 ( 48)</td>
<td>165.97</td>
<td>0.9938</td>
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<td>14 NO28 ( 49)</td>
<td>155.72</td>
<td>0.9942</td>
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<td>15 SO92 ( 50)</td>
<td>188.46</td>
<td>0.9929</td>
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</tr>
<tr>
<td>16 SI33 ( 51)</td>
<td>264.10</td>
<td>0.9901</td>
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<table>
<thead>
<tr>
<th>PATHS FOR STAGING BASE SEMBACH ( 9)</th>
<th>LLTR EXIT</th>
<th>DISTANCE</th>
<th>PROB OF ARRIVAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 NO05 ( 48)</td>
<td>173.99</td>
<td>0.9935</td>
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<td>18 NO28 ( 49)</td>
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<td>19 SO92 ( 50)</td>
<td>194.66</td>
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<td>20 SI33 ( 51)</td>
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V-24
PATHS FOR STAGING BASE LAHR (10)

<table>
<thead>
<tr>
<th>LLTR EXIT</th>
<th>DISTANCE TO EXIT</th>
<th>PROB OF ARRIVAL AT EXIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 N005</td>
<td>225.44</td>
<td>0.9916</td>
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<td>22 N028</td>
<td>215.19</td>
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<td>23 S092</td>
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<td>24 S133</td>
<td>232.43</td>
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CPUTIM, WALLTIM, PAGEFLTS= 0.270 3.383 0.000

: < SHOW NBOX >

WRBOX -- ARRAY NBOX -- DPA BOX LIMITS

<table>
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<tr>
<th>ID</th>
<th>INDEX</th>
<th>MIN LONG</th>
<th>MAX LONG</th>
<th>MIN LAT</th>
<th>MAX LAT</th>
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<tr>
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<td>14.1</td>
<td>49.0</td>
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<td>ZOLLSCHN</td>
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<td>51.8</td>
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<td>CASLAV</td>
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<td>9.2</td>
<td>15.5</td>
<td>49.0</td>
<td>51.3</td>
</tr>
<tr>
<td>LEIPZIG</td>
<td>125</td>
<td>9.2</td>
<td>13.0</td>
<td>49.0</td>
<td>51.6</td>
</tr>
<tr>
<td>PRAGUE</td>
<td>126</td>
<td>9.2</td>
<td>14.4</td>
<td>49.0</td>
<td>51.3</td>
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</table>

CPUTIM, WALLTIM, PAGEFLTS= 0.090 0.617 2.000

(These arrays are also described in Chapter IV.)

(Now consider the two arrays generated by the ARCS command. These are ARPE and ARCS. The arc performance data below is for the ingress and egress routes from targets LEIPZIG and PRAGUE.)

: < SH ARPE LEIPZIG >

WRPERF -- ARRAY ARPE -- ARC PERFORMANCES FROM LEIPZIG (125)

<table>
<thead>
<tr>
<th>INGRESS</th>
<th>EGRESS</th>
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<tbody>
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<tr>
<td>1 N005</td>
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<tr>
<td>2 N028</td>
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</tr>
<tr>
<td>3 S092</td>
<td>50</td>
</tr>
<tr>
<td>4 S133</td>
<td>51</td>
</tr>
</tbody>
</table>

CPUTIM, WALLTIM, PAGEFLTS= 0.050 0.539 0.000

: < SH ARPE PRAGUE >

WRPERF -- ARRAY ARPE -- ARC PERFORMANCES FROM PRAGUE (126)

<table>
<thead>
<tr>
<th>INGRESS</th>
<th>EGRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>V-25</td>
<td></td>
</tr>
<tr>
<td>ID</td>
<td>INDEX</td>
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<tr>
<td>-----</td>
<td>-------</td>
</tr>
<tr>
<td>1</td>
<td>NO05</td>
</tr>
<tr>
<td>2</td>
<td>NO28</td>
</tr>
<tr>
<td>3</td>
<td>S092</td>
</tr>
<tr>
<td>4</td>
<td>S133</td>
</tr>
</tbody>
</table>

CPU, TAILTIM, PAGEFLTS = 0.060 0.527 0.000

(The actual waypoints for the arcs may be shown by entering "SHOW ARCS". The user must enter a target name and an LLTR exit point name. The LLTR exit point must be accessible to the target. The list of accessible LLTR exit points for a target may be found in the APE and ITGC arrays. Below are the optimal ingress and egress arcs from LLTR exit point S092 to target CASLAV.)

< SH ARCS CASLAV S092 >

**VRARCS - ARRAY ARCS - 12 POINT INGRESS ARC FROM CASLAV (124) TO S092**

<table>
<thead>
<tr>
<th>TIME</th>
<th>LONGITUDE</th>
<th>LATITUDE</th>
<th>ALTITUDE</th>
<th>NODE</th>
</tr>
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<tbody>
<tr>
<td>0.000</td>
<td>11.914</td>
<td>49.738</td>
<td>60.100</td>
<td>S092</td>
</tr>
<tr>
<td>0.057</td>
<td>12.436</td>
<td>50.042</td>
<td>60.100</td>
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<tr>
<td>0.125</td>
<td>13.278</td>
<td>50.042</td>
<td>60.100</td>
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<tr>
<td>0.209</td>
<td>14.315</td>
<td>49.958</td>
<td>60.100</td>
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<tr>
<td>0.216</td>
<td>14.380</td>
<td>49.917</td>
<td>60.100</td>
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<tr>
<td>0.227</td>
<td>14.510</td>
<td>49.917</td>
<td>60.100</td>
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<tr>
<td>0.234</td>
<td>14.575</td>
<td>49.875</td>
<td>60.100</td>
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<tr>
<td>0.239</td>
<td>14.639</td>
<td>49.875</td>
<td>60.100</td>
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</tr>
<tr>
<td>0.251</td>
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<td>49.917</td>
<td>60.100</td>
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<tr>
<td>0.306</td>
<td>15.383</td>
<td>49.950</td>
<td>60.100</td>
<td>CASLAV</td>
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</table>

**VRARCS - ARRAY ARCS - 18 POINT EGRESS ARC FROM CASLAV (124) TO S092**

<table>
<thead>
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<th>TIME</th>
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<th>LATITUDE</th>
<th>ALTITUDE</th>
<th>NODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000</td>
<td>15.383</td>
<td>49.950</td>
<td>60.100</td>
<td>CASLAV</td>
</tr>
<tr>
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<tr>
<td>0.026</td>
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<td></td>
</tr>
<tr>
<td>0.056</td>
<td>15.158</td>
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<td>60.100</td>
<td></td>
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<tr>
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<tr>
<td>0.069</td>
<td>15.028</td>
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<td>60.100</td>
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</tr>
<tr>
<td>0.092</td>
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<td>50.125</td>
<td>60.100</td>
<td></td>
</tr>
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<td>0.114</td>
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<td>0.221</td>
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<td>50.042</td>
<td>60.100</td>
<td></td>
</tr>
</tbody>
</table>

V-26
(The data in the ARCS is often interesting to display. Again the AR option is selected, and the target name or index is given.)

: < DI P / >  
(purge the display option list)

CPUTIM, WALLTIM, PAGEFLTS= 0.280 2.180 30.000

: < DI SC SC / >  
(scale for the scenario space)

CPUTIM, WALLTIM, PAGEFLTS= 0.053 0.145 0.000

: < DI M AR / ZOLLSCHN > (display arcs for target ZOLLSCHN)

CPUTIM, WALLTIM, PAGEFLTS= 4.500 5.172 261.000

(See Figure V-8.)

(The ROUTES command creates the ROUT array. Recall that there are many routes for target ZOLLSCHN. All of these routes are shown below.)

: < SHOW ROUTES ZOLLSCHN >

<table>
<thead>
<tr>
<th>TARGET: ZOLLSCHN</th>
<th>PD ACHIEVED: 0.9900</th>
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</thead>
<tbody>
<tr>
<td>STAGING LLTR LLTR DIST (NM) PS A/C TYPE LOSSES</td>
<td></td>
</tr>
<tr>
<td>BASE ENTRY INIT EXIT</td>
<td></td>
</tr>
<tr>
<td>IN FAIRFORD NO01 NO05 564.0 0.194</td>
<td></td>
</tr>
<tr>
<td>EG FAIRFORD NO01 NO05 559.5 0.321</td>
<td></td>
</tr>
<tr>
<td>TOTAL 1123.5 0.062 4 F111 MARK-S4 3.752</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
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V-27
### Target: Zollsdorf

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### Target: Zollsdorf

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### Target: Zollsdorf

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**CPUTIM, WALTIM, PAGEFLTS**

0.310 4.488 0.000

(Any time after the ROUTES command has been run, the routes may be selected into the SPED table and displayed. Here the route from staging)

V-28
base FAIRFORD to target ZOLLSCHN is selected.)

: < SELECT / ZOLLSCHN FAIRFORD FAIR.ZOLLSCH >

SPWRT -- SELECTED ROUTE WRITTEN TO SPED: ID FAIR.ZOLLSCH RECORD 2

CPUTIM,WALLTIM,PAGEFLTS= 0.290 0.840 55.000

(In this case, the user entered his own ID name for the SPED record. The program would have generated a name automatically, if the user had entered a "/" instead of "FAIR.ZOLLSCH". The route may now be displayed using the RO option.)

: < DI P / >

CPUTIM,WALLTIM,PAGEFLTS= 0.040 0.121 1.000

: < DI M L RO / FAIR.ZOLLSCH >

CPUTIM,WALLTIM,PAGEFLTS= 6.760 8.102 5.000

(The result is in Figure V-9. Recall that the SPED record can be written out in an easy to interpret form. This is the SHOW PLAN feature. The route FAIR.ZOLLSCH is shown below.)
Flight Plan for Sortie: FAIR.ZOLLSCH

Staging Base: FAIRFORD (1) to Target: ZOLLSCHEN (122)

Prob of Survival: 0.0621  Threat PK: 0.9379

Flight Distance: 1123.52 NM

Time Off Time: 0.0000  Time on Target: 70.6784  Of Waypoints: 39

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<thead>
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<th>Longitude (DMS)</th>
<th>Altitude (Feet)</th>
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</table>

V-32
(The result of ALLOCATE is the TGUS array. This is the data that would go into an Air Tasking Order. For the allocation generated in this run, the TGUS array is shown below.)

SHOW TGUS

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</tbody>
</table>

Notice that weapons were available for all targets. The current allocation can be displayed, again using the SELECT command. First the old records in the SPED file are deleted. Then the current allocation is loaded into SPED.

DE SPED 2 999

SPRIT -- SELECTED ROUTE WRITTEN TO SPED: ID HAHNPRAG01 RECORD 2
SPRIT -- SELECTED ROUTE WRITTEN TO SPED: ID RAMSLEIP01 RECORD 3
SPRIT -- SELECTED ROUTE WRITTEN TO SPED: ID MILDCASLO1 RECORD 4
SPRIT -- SELECTED ROUTE WRITTEN TO SPED: ID RAMSPRES01 RECORD 5
SPRIT -- SELECTED ROUTE WRITTEN TO SPED: ID FAIRZOLLO1 RECORD 6
SPRIT -- SELECTED ROUTE WRITTEN TO SPED: ID LAKEPANE01 RECORD 7

(The allocation may be displayed as follows. The result is in Figure V-10.)

DI RO / 2 7

SPRIT -- SELECTED ROUTE WRITTEN TO SPED: ID HAHNPRAG01 RECORD 2
SPRIT -- SELECTED ROUTE WRITTEN TO SPED: ID RAMSLEIP01 RECORD 3
SPRIT -- SELECTED ROUTE WRITTEN TO SPED: ID MILDCASLO1 RECORD 4
SPRIT -- SELECTED ROUTE WRITTEN TO SPED: ID RAMSPRES01 RECORD 5
SPRIT -- SELECTED ROUTE WRITTEN TO SPED: ID FAIRZOLLO1 RECORD 6
SPRIT -- SELECTED ROUTE WRITTEN TO SPED: ID LAKEPANE01 RECORD 7
At this point the threat suppression features will be exercised. The first example will show how to analyze a route for threat exposure.

AN FAIRZOLLO1

ANALYZ

NUMBER OF CRITICAL POINTS: 39
NUMBER OF THREATS: 67
ALTITUDE OF ROUTE: 60.10
TOTAL PROB OF SURVIVAL: 0.061770
TOTAL DISTANCE OF ROUTE: 1123.5223

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<th>LONGITUDE (DMS)</th>
<th>HEADING (DEG)</th>
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V-35
ANALIZ -- THREAT EXPOSURE ANALYSIS FOR BOMBER ROUTE: FAIRZOLLO1 ( 3 )
TIME ON TARGET: 70.7 MINUTES

ANALIZ -- THREAT: S613 (SA-6 / 18.50 NM RADIUS)

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V-36
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V-37
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</table>

**CPUTIM, WALLTLM, PAGEFLTS:** 4.650 19.430 0.000

(This is the route analysis feature. First, the leg-by-leg probability of survival is computed and printed out along with the route waypoints. Next, a threat exposure report is given. A list is generated for each threat through which the user selected route flies. The time at which the route enters the threat coverage (time-in) and the time the route leaves threat coverage (time-out) for both ingress and egress is given. In addition, the times at which the route is masked and unmasked are also given, along with the Pk contribution of that threat to the total route Pk.

**NOTE:** At this time, the route analysis feature is still under development. The Pk contributions for the individual threats is not always consistent with the total route Pk. A major reason for this is that stochastic threats are not yet considered by the analysis feature.
Therefore, the user is advised to use the Pk numbers with care. At present, they indicate which fixed threats are the most dangerous and therefore, which threats should be suppressed.

(Now the user will input the locations of the threat suppression assets he wishes to use in this scenario. First, there are three records in the SUPM table which are of interest to the user. These are the three suppressor models.)

: < SHOW SUPM 2 4 >

<table>
<thead>
<tr>
<th>RECORD</th>
<th>IDWORD</th>
<th>ID</th>
<th>RAD</th>
<th>ICAP</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>EF-111</td>
<td>EF-111</td>
<td>3.5000E+01</td>
<td>12</td>
<td>SA-2B, SA-2F, SA-3</td>
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<td>BARLOCK, BIGBAR</td>
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<td></td>
<td></td>
<td>NYSAC, SPONREST</td>
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<tr>
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<td></td>
<td></td>
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<td>FLATFACE, SQUATEYE</td>
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<td></td>
<td></td>
<td></td>
<td>FARMGATE, TALLKING</td>
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<td>BACKNET, BACKTRAP</td>
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<table>
<thead>
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<th>IDWORD</th>
<th>ID</th>
<th>RAD</th>
<th>ICAP</th>
<th>TYPE</th>
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<tr>
<td>3</td>
<td>COMPCALL</td>
<td>COMPCALL</td>
<td>4.0000E+01</td>
<td>20</td>
<td>SA-2B, SA-2F, SA-3</td>
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<td>BARLOCK, BIGBAR</td>
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<td>NYSAC, SPONREST</td>
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<td></td>
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<td>FARMGATE, TALLKING</td>
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<td>BACKNET</td>
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</table>

| DEGR   | 8.0000E-01   | 8.0000E-01 | 8.0000E-01   | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 |
|        | 8.0000E-01   | 8.0000E-01 | 8.0000E-01   | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 |
|        | 8.0000E-01   | 8.0000E-01 | 8.0000E-01   | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 |
|        | 8.0000E-01   | 8.0000E-01 | 8.0000E-01   | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 |
|        | 8.0000E-01   | 8.0000E-01 | 8.0000E-01   | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 | 8.0000E-01 |

V-39
CRSHOW -- RECORD  4  IDWORD=WILDWEAS
ID = WILDWEAS  
RAD = 1.5000E-01
ICAP= 5
TYPE= SA-6CC  SA-8CC

DEGR= 8.0000E-01 8.0000E-01 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00

IDC = 85/11/22 16:43
IDM = 85/11/22 16:43

CPUTIM, WALLTIN, PAGEFLTS = 0.240 3.457 6.000

(Suppressors are positioned with the LOCATE command. The user must first scale the display and choose the display options he wants.)

: < DI SC 8 16 48.75 51.75 > (Rescale the display)
CPUTIM, WALLTIN, PAGEFLTS = 0.030 0.121 0.000

: < DI M D RO / >

PROMPL-RCID:

ENTER ID OR RECORD NUMBER FOR A SINGLE RECORD IN SPED
OR ENTER STARTING AND ENDING RECORD NUMBERS SEPARATED BY SPACE OR COMMA FOR A RANGE OF RECORDS
"REC1 "to" REC2 or IDWORD:

< FAIRZOLL01 >

PROMPL-FILE:

V-40
ENTER ALTG TO PLOT OPTIMAL ALTITUDES ABOVE GROUND
ALTS  OPTIMAL ALTITUDES (MSL)
CL3D  DANGER FROM Clobber
STAT  TOTAL DANGER AT OPTIMAL ALT
TH2D  THREAT DANGER AT OPTIMAL ALT
TH3D  THREAT DANGER AT ANY ALTITUDE

FILE--ALTG, ALTS, CL3D, STAT, TH2D, TH3D:

< STAT >

PROMPT-LEVE:

ENTER VALUE OF FIRST CONTOUR LEVEL
OR ENTER "D" TO USE DEFAULT LEVELS:
0.3000 0.2000 0.1000 0.0500 0.0100
NEXT CONTOUR LEVEL, DEFAULT(D), or /:

< D >

PROMPT-DIRE:

ENTER 0 FOR DANGER AVERAGED OVER ALL 8 DIRECTIONS
1 FOR DANGER HEADING NORTHWEST
2   WEST
3   SOUTHWEST
4   SOUTH
5   NORTH
6   NORTHEAST
7   EAST
8   SOUTHEAST

DIRECTION (0=ave or 1-8):

< 7 >

CNTDGR--NH, NV, LVSEG, NVSEG, NADE, LREAD= 73 109 19 6 8 584
CPUTIM, WALLTIM, PAGEFLTS= 8.720 49.598 6.000

(The results of this plot are shown in Figure V-11. These are the
unsuppressed danger contours, together with the route "FAIRZOLL01".
Note that FLAPS provided helpful prompts when the type ahead feature was
not used.)
(The user will now position two suppressors of each type using the LOCATE command. One suppressor of each type will be placed in the north, and the other in the south.)

: < LOCATE >

MOVE CURSOR TO SUPPRESSION POSITION

(Here the user moves the cursor to the position he wants to put the suppressor.)

CHOOSE SUPPRESSION MODEL (ID) or "AB" TO ABORT:
< EF-111 >
ENTER 8 CHAR SUPP ID, "/" FOR PROGRAM SELECTION or "AB"ort:
< / >

LOCATE -- NEW SUPP ID EF-111.1 WRITTEN TO RECORD 2

CPUTIM, WALLTIM, PAGEFLTS = 0.130 9.336 1.000

: < LOCATE >

MOVE CURSOR TO SUPPRESSION POSITION

CHOOSE SUPPRESSION MODEL (ID) or "AB" TO ABORT:
< EF-111 >
ENTER 8 CHAR SUPP ID, "/" FOR PROGRAM SELECTION or "AB"ort:
< / >

LOCATE -- NEW SUPP ID EF-111.2 WRITTEN TO RECORD 3

CPUTIM, WALLTIM, PAGEFLTS = 0.130 9.336 1.000

: < LOCATE >

MOVE CURSOR TO SUPPRESSION POSITION

CHOOSE SUPPRESSION MODEL (ID) or "AB" TO ABORT:
< COMPCALL >
ENTER 8 CHAR SUPP ID, "/" FOR PROGRAM SELECTION or "AB"ort:
< / >

LOCATE -- NEW SUPP ID COMPCA.1 WRITTEN TO RECORD 4

CPUTIM, WALLTIM, PAGEFLTS = 0.130 9.336 1.000

: < LOCATE >

MOVE CURSOR TO SUPPRESSION POSITION

CHOOSE SUPPRESSION MODEL (ID) or "AB" TO ABORT:
< COMPCALL >
ENTER 8 CHAR SUPP ID, "/" FOR PROGRAM SELECTION or "AB"ort:
< / >
LOCATE -- NEW SUPP ID COMPCA.2 WRITTEN TO RECORD 5
CPUTIM, WALLTIM, PAGEFLTS = 0.130 9.336 1.000

MOVE CURSOR TO SUPPRESSION POSITION

CHOOSE SUPPRESSION MODEL (ID) or "AB" TO ABORT:
< WILDWEAS >
ENTER 8 CHAR SUPP ID, "/" FOR PROGRAM SELECTION or "AB"ort:
< / >

LOCATE -- NEW SUPP ID WILDWE.1 WRITTEN TO RECORD 6
CPUTIM, WALLTIM, PAGEFLTS = 0.130 9.336 1.000

MOVE CURSOR TO SUPPRESSION POSITION

CHOOSE SUPPRESSION MODEL (ID) or "AB" TO ABORT:
< WILDWEAS >
ENTER 8 CHAR SUPP ID, "/" FOR PROGRAM SELECTION or "AB"ort:
< / >

LOCATE -- NEW SUPP ID WILDWE.2 WRITTEN TO RECORD 7
CPUTIM, WALLTIM, PAGEFLTS = 0.130 9.336 1.000

(The user can check these positions as follows.)

<THTYPE-SMDL:

ENTER ALL TO SELECT ALL MODELS
OR / TO USE CURRENT SELECTION
OR ENTER A NAME OF A MODEL TO BE ADDED TO LIST
NAME-STATUS NAME-STATUS NAME-STATUS NAME-STATUS NAME-STATUS NAME-STATUS

EF-111 - COMP- CALL - WILDWEAS -
CHOOSE SUPPRESSOR MODEL (ID), ALL OR /:

< ALL >
CNDDR=NH,NV,LVSEG,NVSEG,NAVE,LREAD= 73 109 19 6 8 584
CPUTIM, WALLTIM, PAGEFLTS = 9.040 14.371 8.000

(The results of this display can be seen in Figure V-12. The suppressors all seem to be in the right place. This deployment should open two corridors through the FEBA. Now FLAPS will calculate the suppressor effectiveness using the SUPRES command.)
SUPRES - SUPPRESSOR EF-111 (EF-111) IN RANGE OF 4.0 FIXED THREATS AND 0.0 STOCHASTIC THREATS. CAPACITY IS 12 TOTAL THREATS.
RMAX, IDSC, ILXT, IJX, JUXT, JUXT = 9.00 M804 51 67 36 51
NXSC, NYSC, DXSC, DYSC, XMISM, YMNSC = 8 7 0.0648 0.0417 12.5231 49.6325

PRESTC--NTOT, NSUP, FSUP = 34 11 0.3235
RMAX, IDSC, ILXT, IJX, JUXT, JUXT = 9.00 M806 35 59 45 65
NXSC, NYSC, DXSC, DYSC, XMISM, YMNSC = 17 13 0.0648 0.0417 11.4564 50.0000

SUPRES - SUPPRESSOR EF-112 (EF-111) IN RANGE OF 10.0 FIXED THREATS AND 0.0 STOCHASTIC THREATS. CAPACITY IS 12 TOTAL THREATS.
RMAX, IDSC, ILXT, IJX, JUXT, JUXT = 18.50 M603 6 37 50 80
NXSC, NYSC, DXSC, DYSC, XMISM, YMNSC = 15 15 0.0648 0.0417 9.8793 50.3753

PRESTC--NTOT, NSUP, FSUP = 181 56 0.3094
RMAX, IDSC, ILXT, IJX, JUXT, JUXT = 9.00 M801 16 40 73 97
NXSC, NYSC, DXSC, DYSC, XMISM, YMNSC = 17 16 0.0648 0.0417 10.2314 51.1875

SUPRES - SUPPRESSOR VILDWE2 (VILDWEAS) IN RANGE OF 0.0 FIXED THREATS AND 0.6 STOCHASTIC THREATS. CAPACITY IS 6 TOTAL THREATS.
SUPRES - SUPPRESSOR COMPCA2 (COMPCALL) IN RANGE OF 13.0 FIXED THREATS AND 0.0 STOCHASTIC THREATS. CAPACITY IS 20 TOTAL THREATS.
SUPRES-CONT:

SUPPRESSION IS FAIRLY TIME CONSUMING -- REVIEW PREVIOUS LIST OF THREATS AFFECTED BY SUPPRESSORS AND DECIDE WHETHER TO APPLY SUPPRESSION
DO YOU WISH TO CONTINUE (YES OR NO) ?:

< YES >

(No capacities have been exceeded, so continue)

************************ STATES "RS" EXECUTING************************

RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 20.00 S203 7 25 73 90
RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 20.00 S204 11 28 69 86
RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 20.00 S205 8 26 64 81
RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 20.00 S206 9 26 69 86
RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 20.00 S207 8 25 60 77
RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 20.00 S208 47 64 40 57
RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 31.00 S211 4 30 60 85
RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 31.00 S212 4 30 58 84
RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 31.00 S213 37 62 44 70
RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 31.00 S214 27 53 46 72
RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 3.00 S215 16 20 62 66
RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 3.00 S216 16 19 72 75
RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 3.00 S217 16 31 58 66
RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 43.00 S401 1 36 47 82
RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 51.23 S311 38 80 29 71
RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 51.23 S312 1 42 58 97
RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 47.62 S313 1 39 46 85
RMAX, IDTH, ILXT, IUXT, JLXT, JUXT = 18.50 M603 6 37 50 80

NXSC, NYSC, DXSC, DYSC, XMINSC, YMINSC = 15 15 0.0648 0.0417 9.8792

PRESTC--NTOT, NSUP, FSUP = 181 56 0.3094

RMAX, IDSC, ILXT, IUXT, JLXT, JUXT = 9.00 M804 51 67 36 51

NXSC, NYSC, DXSC, DYSC, XMINSC, YMINSC = 8 7 0.0648 0.0417 12.5231

PRESTC--NTOT, NSUP, FSUP = 34 11 0.3235

RMAX, IDSC, ILXT, IUXT, JLXT, JUXT = 9.00 M806 35 59 45 65

NXSC, NYSC, DXSC, DYSC, XMINSC, YMINSC = 17 13 0.0648 0.0417 11.4564

PRESTC--NTOT, NSUP, FSUP = 64 13 0.2031

CPUTIM, WALLTIM, PAGEFLTS = 47.770 134.629 2161.000

(CPUTIM, WALLTIM, PAGEFLTS = 0.030 0.121 0.000

V-46

(This is the output produced by the statespace suppression routine. These threats have been suppressed by the appropriate amount. The rest of the threats are unaffected by the current set of suppression aircraft.)

: < DI ? / >
THTYPE-SMDL:

ENTER ALL TO SELECT ALL MODELS
OR / TO USE CURRENT SELECTION
OR ENTER A NAME OF A MODEL TO BE ADDED TO LIST
NAME-STATUS NAME-STATUS NAME-STATUS NAME-STATUS NAME-STATUS

EF-111 - COMPCALL- WILDWEAS-

CHOOSE SUPPRESSOR MODEL (ID), ALL OR /:

< ALL>

PROMPL-FILE:

ENTER ALTG TO PLOT OPTIMAL ALTITUDES ABOVE GROUND
ALTS OPTIMAL ALTITUDES (MSL)
CL3D DANGER FROM CLOBBER
STAT TOTAL DANGER AT OPTIMAL ALT
TH2D THREAT DANGER AT OPTIMAL ALT
TH3D THREAT DANGER AT ANY ALTITUDE

FILE-ALTG,ALTS,CL3D,STAT,TH2D,TH3D:

< STAT >

PROMPL-LEVE:

ENTER VALUE OF FIRST CONTOUR LEVEL
OR ENTER "D" TO USE DEFAULT LEVELS:
0.3000 0.2000 0.1000 0.0500 0.0100
NEXT CONTOUR LEVEL, DEFAULT(D), or /:

< D 7 >

CNTDGR--NH,NV,LVSEG,NVSEG,NAVE,LREAD= 73 109 19 6 8 584
CPUTIM,WALLTIM,PAGEFITS= 9.500 34.480 289.000

(This display shows the effect of the suppression on the statespace.
The result of this command is shown in Figure V-13. Compare this Figure
CPUTIM,WALLTIM,PAGEFITS=

V-47
allocation using the REROUTE command.

: < RR >

******************************************************************************

ARCSS EXECUTING

GETARC -- RETRIEVE TRAJECTORIES FROM EXIT TO TGT TARGET: PANENSKY (121)
GETARC -- TO EXIT NO05 ( 48) DIST,PS = 247.1 0.67258
GETARC -- TO EXIT NO28 ( 49) DIST,PS = 212.4 0.66051
GETARC -- TO EXIT S092 ( 50) DIST,PS =  93.8 0.68223
GETARC -- TO EXIT S133 ( 51) DIST,PS = 154.3 0.47759

GETARC -- RETRIEVE TRAJECTORIES FROM TGT TO EXIT TARGET: PANENSKY (121)
GETARC -- TO EXIT NO05 ( 48) DIST,PS = 255.5 0.60524
GETARC -- TO EXIT NO28 ( 49) DIST,PS = 220.8 0.59437
GETARC -- TO EXIT S092 ( 50) DIST,PS = 104.1 0.61299
GETARC -- TO EXIT S133 ( 51) DIST,PS = 164.6 0.43072

GETARC -- RETRIEVE TRAJECTORIES FROM EXIT TO TGT TARGET: PRAGUE (126)
GETARC -- TO EXIT NO05 ( 48) DIST,PS = 258.8 0.65622
GETARC -- TO EXIT NO28 ( 49) DIST,PS = 224.2 0.64443
GETARC -- TO EXIT S092 ( 50) DIST,PS = 105.6 0.66563
GETARC -- TO EXIT S133 ( 51) DIST,PS = 166.0 0.46597

GETARC -- RETRIEVE TRAJECTORIES FROM TGT TO EXIT TARGET: PRAGUE (126)
GETARC -- TO EXIT NO05 ( 48) DIST,PS = 265.4 0.58081
GETARC -- TO EXIT NO28 ( 49) DIST,PS = 230.7 0.57038
GETARC -- TO EXIT S092 ( 50) DIST,PS = 114.0 0.58825
GETARC -- TO EXIT S133 ( 51) DIST,PS = 174.5 0.41333

******************************************************************************

ROUTES EXECUTING

6 ROUTES CREATED TO TARGET PANENSKY
6 ROUTES CREATED TO TARGET ZOLLSCHN
6 ROUTES CREATED TO TARGET PRESCHEN
6 ROUTES CREATED TO TARGET CASLAV
7 ROUTES CREATED TO TARGET LEIPZIG
7 ROUTES CREATED TO TARGET PRAGUE

ROUTINE ROUTES FINISHED.
A TOTAL OF 38 ROUTES ASSEMBLED TO
A TOTAL OF  6 TARGETS. RESULTS
APPEAR IN ARRAY ROUT

***********************************************************************
ALLOC EXECUTING

ALLOCATION COMPLETED FOR 6 TARGETS.
RESULTS APPEAR IN TARGET STATUS ARRAY: TGUS

CPUTIM, WALLTIM, PAGEFLTS = 39.570 55.063 828.000

: < SELECT ALL >

SPVRIT -- SELECTED ROUTE WRITTEN TO SPED: ID HAHNPRAG01 RECORD 2
SPVRIT -- SELECTED ROUTE WRITTEN TO SPED: ID RAMSLEIPO1 RECORD 3
SPVRIT -- SELECTED ROUTE WRITTEN TO SPED: ID MILDCASLO1 RECORD 4
SPVRIT -- SELECTED ROUTE WRITTEN TO SPED: ID RAMSPRES01 RECORD 5
SPVRIT -- SELECTED ROUTE WRITTEN TO SPED: ID FAIRZOLL01 RECORD 6
SPVRIT -- SELECTED ROUTE WRITTEN TO SPED: ID LAKEPANE01 RECORD 7

CPUTIM, WALLTIM, PAGEFLTS = 0.880 2.461 57.000

: < SHOW TGUS >

<table>
<thead>
<tr>
<th>TARGET</th>
<th>STAGING BASE</th>
<th>AIRCRAFT ALLOCATED</th>
<th>AIRCRAFT TYPE</th>
<th>WEAPON TYPE</th>
<th>PD ACHIEVED</th>
<th>ROUTE PS</th>
<th>ROUTE DIST (NM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PANENSKY</td>
<td>LAKENTH</td>
<td>2 F111</td>
<td>CBU-38</td>
<td>0.878</td>
<td>0.40</td>
<td>1208.8</td>
<td></td>
</tr>
<tr>
<td>ZOLLSCHN</td>
<td>FAIRFORD</td>
<td>4 F111</td>
<td>MARK-84</td>
<td>0.990</td>
<td>0.22</td>
<td>1398.8</td>
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<tr>
<td>PRESCHEN</td>
<td>RAMSTEIN</td>
<td>2 F-16</td>
<td>MARK-20</td>
<td>0.900</td>
<td>0.33</td>
<td>709.8</td>
<td></td>
</tr>
<tr>
<td>CASLAV</td>
<td>MILDENHA</td>
<td>2 F111</td>
<td>MARK-20</td>
<td>0.961</td>
<td>0.37</td>
<td>1326.2</td>
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<tr>
<td>LEIPZIG</td>
<td>RAMSTEIN</td>
<td>4 F-16</td>
<td>AGM-65</td>
<td>0.999</td>
<td>0.37</td>
<td>695.7</td>
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<tr>
<td>PRAGUE</td>
<td>HAHN</td>
<td>4 F-16</td>
<td>AGM-65</td>
<td>0.999</td>
<td>0.39</td>
<td>661.3</td>
<td></td>
</tr>
</tbody>
</table>

CPUTIM, WALLTIM, PAGEFLTS = 0.090 0.949 22.000

(Compare the survivability of these routes with those created without suppression.)

: < DI RO / 2 7 >

CPUTIM, WALLTIM, PAGEFLTS = 14.790 31.898 55.000

(The results of this display can be seen in Figure V-14. Note that, even though the routes used the northern corridor before suppression, all of the routes now take advantage of the new southern corridor.)

: < DI RO / FAIRZOLL01 >

CPUTIM, WALLTIM, PAGEFLTS = 11.710 38.500 2.000

(The results of this display can be seen in Figure V-15. The route has changed to take advantage of the threat suppression corridor and the probability of survival has improved significantly.)
(The user could restore the pre-suppression files at this time using the RESTORE command. He could then try a new set of suppressor locations. The current locations have successfully opened two corridors, however, no routes use the northern corridor. This is because all of the targets are accessible from the southern corridor and the southern routes have a higher survival rate than the northern ones.

The user would probably cancel the suppression assets at the northern corridor or reposition them with the other suppressors in the south. Instead, to demonstrate some more FLAPS features, the user will create a manual route that uses the northern corridor. First the user will rescale to the whole scenario and display all of the routes on the suppressed statespace in order to see the big picture (Figure V-16).

: < DISC SC >

: < DISC SU D RO / ALL 2 7 STAT D 7 >

CNTDGR--NH,NV,LVSEG,NVSEG,NAVE,LREAD= 73 109 19 6 8 584
CPUTIM,WALLTIM,PAGEFLTS= 7.650 26.510 200.000

(The user does not like the fact that the northern most target is accessed through the southern corridor. Simply selecting another route (using the SELECT command) would not guarantee that it would use the northern corridor. Therefore, the user will create a manual route to the target. But, what target is it? This can easily be determined by using the FIND command.)

: < FIND >

CHOOSE A PARTICULAR TYPE OF ID YOU WANT TO FIND
THEN PLACE THE CURSOR CLOSE TO THE CENTER OF THE
OBJECT YOU WISH TO IDENTIFY

CHOOSE ONE: STGB(SB), TARGET(TG), LLTR(LL), THREAT(TH)
SUPPRESSOR(SU), COORDINATE(CO) OR ABORT(AB)

: < TG >

Hit SPACE BAR to continue, S to select new id type or A to abort

(The user wants to find a target. Once the cursor has been positioned using the thumbwheels on the desired target as shown in Figure V-17, the spacebar is depressed.)

: < spacebar >

ID = PRESCHEN AT 14.6500 LONG 51.6500 LAT

<table>
<thead>
<tr>
<th>TARGET</th>
<th>STAGING</th>
<th>AIRCRAFT</th>
<th>WEAPON</th>
<th>PD</th>
<th>ROUTE</th>
<th>ROUTE DIST (NM)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>BASE ALLOCATED</td>
<td>TYPE</td>
<td>ACHIEVED</td>
<td>PS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRESCHEN</td>
<td>RAMSTEIN</td>
<td>2-F-16</td>
<td>MARK-20</td>
<td>0.900</td>
<td>0.33</td>
<td>709.8</td>
</tr>
</tbody>
</table>

V-54
Hit SPACE BAR to continue, S to select new id type or A to abort

(The desired target is PRESCHEN. Its sortie comes from RAMSTEIN. The user has forgotten where RAMSTEIN is, so the find command will be used again.)

: < S >                           (Indicate desire to select something else to find.)

CHOOSE ONE: STGB(SB), TARGET(TG), LLTR(LL), THREAT(TH)
SUPPRESSOR(SU), COORDINATE(CO) OR ABORT(AB)

: < SB >

(Select the find staging base option. Then move cursor to first RAMSTEIN position guess and hit the spacebar (see Figure V-18).)

Hit SPACE BAR to continue, S to select new id type or A to abort

: < spacebar >  

<table>
<thead>
<tr>
<th>ID</th>
<th>TARGET</th>
<th>STAGING</th>
<th>AIRCRAFT</th>
<th>WEAPON</th>
<th>PD</th>
<th>ROUTE</th>
<th>ROUTE DIST (NM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAHN</td>
<td>PRAGUE</td>
<td></td>
<td>4 F-16</td>
<td>AGM-65</td>
<td>0.999</td>
<td>0.39</td>
<td>661.3</td>
</tr>
</tbody>
</table>

Hit SPACE BAR to continue, S to select new id type or A to abort

(The user was wrong and found HAHN instead of RAMSTEIN. To try again, the cursor is simply repositioned (Figure V-19) and the spacebar is depressed again.)

: < spacebar >  

<table>
<thead>
<tr>
<th>ID</th>
<th>TARGET</th>
<th>STAGING</th>
<th>AIRCRAFT</th>
<th>WEAPON</th>
<th>PD</th>
<th>ROUTE</th>
<th>ROUTE DIST (NM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAMSTEIN</td>
<td>PRESCHEN</td>
<td></td>
<td>2 F-16</td>
<td>MARK-20</td>
<td>0.900</td>
<td>0.33</td>
<td>709.8</td>
</tr>
<tr>
<td>LEIPZIG</td>
<td>RAMSTEIN</td>
<td></td>
<td>4 F-16</td>
<td>AGM-65</td>
<td>0.999</td>
<td>0.37</td>
<td>695.7</td>
</tr>
</tbody>
</table>

Hit SPACE BAR to continue, S to select new id type or A to abort

(The user is through finding things, so the abort command is given)

< A >

CPUTIM, WALLTIM, PAGEFLTS= 0.460 118.689 12.000

(RAMSTEIN seems like a reasonable staging base to use for the PRESCHEN

V-55
sortie, so the user will create a manual route between them. In order to prepare for this, the screen is cleared of the suppressor location circles and all of the routes (Figure 7-20).

DO YOU WISH TO CONSTRUCT A NEW ROUTE OR CHANGE THE WAYPOINTS OF A ROUTE IN THE SED FILE?

TYPE IN "NEW", or A SPED RECORD or ID:

< NEW >

INPUT A STGB ID OR INDEX:

< RAMSTEIN >

INPUT A TARGET ID or INDEX:

< PRESCHEN >

(FLAPS draws a straight line from RAMSTEIN to PRESCHEN with a circle around RAMSTEIN (Figure V-21). The circled point is the selected waypoint. If the user types a D, the selected waypoint will be deleted from the route. If the user types a W, a waypoint will be added to the route after the selected waypoint wherever the cursor is positioned and the new waypoint will become the selected waypoint. The selected waypoint can be changed by moving the cursor to the waypoint you want to select and typing S.)

Enter S to select, E for egress, I for ingress
W for add wp, D for delete, O for optimize
H for half optimize, F for finished, or A to abort

(The user wants to force the ingress path through the northern corridor. This is accomplished by using the half optimize command. When the cursor is positioned by an LLTR exit point and an H is entered, FLAPS finds the best path from the staging base to the LLTR exit point through the LLTR network and then draws a straight line from the LLTR exit to the target as shown in Figure V-22.)

< H >

Enter S to select, E for egress, I for ingress
W for add wp, D for delete, O for optimize
H for half optimize, F for finished, or A to abort

V-56
(The staging base is still the selected waypoint. The user wants to add waypoints after the LLTR exit, so the LLTR exit must be made the selected waypoint. This is accomplished by moving the cursor to the LLTR exit and typing S (Figure V-23).)

: < S >

INGRESS VP = 9 LONG = 9.56 LAT = 50.60

Enter S to select, E for egress, I for ingress
W for add wp, D for delete, O for optimize
H for half optimize, F for finished, or A to abort

(Now the user will add a waypoint in the corridor. This is done by positioning the cursor where the desired waypoint will be and typing V. Notice that the inserted waypoint becomes the selected waypoint (see Figure V-24).)

: < V >

INGRESS VP = 10 LONG = 9.92 LAT = 50.77

Enter S to select, E for egress, I for ingress
W for add wp, D for delete, O for optimize
H for half optimize, F for finished, or A to abort

(The user will add another waypoint after the one just added. Since, the proper waypoint is selected, the user simply moves the cursor to the desired waypoint position and types V (Figure V-25).)

: < V >

INGRESS VP = 11 LONG = 11.28 LAT = 51.01

Enter S to select, E for egress, I for ingress
W for add wp, D for delete, O for optimize
H for half optimize, F for finished, or A to abort

(The user wants to add one final waypoint, the results appear in Figure V-26.)

: < V >

INGRESS VP = 12 LONG = 12.56 LAT = 51.01

Enter S to select, E for egress, I for ingress
W for add wp, D for delete, O for optimize
H for half optimize, F for finished, or A to abort

(The user is satisfied with the ingress half of the route. Typing E will let the user work on the egress half of the route. As Figure V-27 shows, a straight line is drawn from the target to the staging base with

V-64
the target circled to signify that it is the selected waypoint.)

: < E >

EGRESS WP = 13 LONG = 14.65 LAT = 51.65

Enter S to select, E for egress, I for ingress
W for add wp, D for delete, 0 for optimize
H for half optimize, F for finished, or A to abort

(The user wants FLAPS to find the best egress path from the target to
the staging base. This is accomplished by giving the optimize command.
The results are shown in Figure V-28. Notice that FLAPS chose the
southern corridor.)

: < 0 >

EGRESS WP = 13 LONG = 14.65 LAT = 51.65

Enter S to select, E for egress, I for ingress
W for add wp, D for delete, 0 for optimize
H for half optimize, F for finished, or A to abort

(Finished building the route, the user types F and FLAPS saves it.)

: < F >

Enter a CHAR*12 ID, "/" for program selection or "AB"ort:
</>

(FLAPS will name the route)

MANUAL -- SELECTED ROUTE WRITTEN TO SPED: ID RAMSPRES02 RECORD 8
CPUTIM,WALLTIM,PAGEFLTS= 3.040 160.070 34.000

(Now that the manual route is saved, the user can look at it just like
any other route (Figure V-29).)

: < DI RO / RAMSPRES02 >

CPUTIM,WALLTIM,PAGEFLTS= 0.110 0.311 1.000

(The user can also show the plan for the manual route.)

: < SH PLAN RAMSPRES02>

WRPLAN - FLIGHT PLAN FOR SORTIE: RAMSPRES02

STAGING BASE RAMSTEIN ( 8) TO TARGET PRESCHEN ( 123)
PROB OF SURVIVAL: 0.1044 THREAT PK: 0.8956
FLIGHT DISTANCE: 715.41 NM
TAKE OFF TIME: 0.0000 TIME ON TARGET: 45.3510 OF WAYPOINTS: 34

V-65
<table>
<thead>
<tr>
<th>TIME (MIN)</th>
<th>LATITUDE (DMS)</th>
<th>LONGITUDE (DMS)</th>
<th>ALTITUDE (FEET)</th>
<th>HEADING</th>
<th>NODE ID</th>
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<tr>
<td>0.000</td>
<td>49 25 59</td>
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<td>2.697</td>
<td>49 35 34</td>
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<td>NO31</td>
</tr>
<tr>
<td>4.993</td>
<td>49 53 18</td>
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<td>19.13</td>
<td>NO30</td>
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<td>6.936</td>
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<td>338.57</td>
<td>S079</td>
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<tr>
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<td>49 25 59</td>
<td>7 34 00</td>
<td>197.18</td>
<td>338.57</td>
<td>RAMSTEIN</td>
</tr>
</tbody>
</table>

(CPUTIM, WALLTIM, PAGEFLTS= 0.280 3.121 24.000)

(After seeing that the probability of survival for the FLAPS planned route is about three times higher than for the manually planned route, the user in this example is now happy with the FLAPS routes and is ready to end the current session. Before quitting, the user decides to display the Weapons Free Zones (Figure V-30).)

: < DI P / >

CPUTIM, WALLTIM, PAGEFLTS= 2.210 3.240 0.000

(Clear the display)

: < DI W F / >

CPUTIM, WALLTIM, PAGEFLTS= 3.930 5.301 0.000

(Display the Weapons Free Zones)

V-66
(Oops! One of the expected Weapons Free Zones is missing. Someone forgot to put it in the data base. The FLAPS results obtained so far are still good since Weapons Free Zones are currently used only for display purposes and hence are not used in any calculations. The user could enter the missing Weapons Free Zone textually, but chooses to enter it graphically instead. This is accomplished with the DRAW command.)

: < DRAW >

DO YOU WISH TO BUILD A WFZ(W) or ROZ(R) POLYGON?:

: < W >

MOVE CURSOR TO BOUNDARY POINT CLOCKWISE
Hit SPACE BAR to continue, F if finished
D to delete last line or A to abort

(The user moves the cursor to the first vertex of the Weapons Free Zone as shown in Figure V-31.)

: < space bar >

MOVE CURSOR TO BOUNDARY POINT CLOCKWISE
Hit SPACE BAR to continue, F if finished
D to delete last line or A to abort

(The user moves the cursor to the second vertex and pushes the space bar. FLAPS connects the two vertices (Figure V-32).)

: < space bar >

MOVE CURSOR TO BOUNDARY POINT CLOCKWISE
Hit SPACE BAR to continue, F if finished
D to delete last line or A to abort

(The user moves the cursor to the third vertex and hits the space bar. FLAPS adds the second line to the first (Figure V-33).)

MOVE CURSOR TO BOUNDARY POINT CLOCKWISE
Hit SPACE BAR to continue, F if finished
D to delete last line or A to abort

(The Weapons Free Zone is finished, so the user types F. Figure V-34 shows the completed Weapons Free Zone.)

: < F >

(FLAPS prompts the user for the name of the new Weapons Free Zone.)

V-67
ENTER A CHAR*8 ID or "AB"sort:

< OCTOPUS >

(The WFZ is named OCTOPUS)

CPUTIM, WALTIM, PAGESPTS = 0.170 119.920 3.000

(To make sure that the Weapons Free Zone has been added correctly, the user shows its record.)

/show WFZ OCTOPUS /

CRSHOW -- RECORD 5 IDWORD=OCTOPUS
ID = OCTOPUS
NPTS = 3
X = 9.7738E-00 4.9974E-01 9.3970E-00 4.9761E-01
9.9203E-00 4.9628E-00 0.0000E-00 0.0000E-00
0.0000E-00 0.0000E-00 0.0000E-00 0.0000E-00
0.0000E-00 0.0000E-00 0.0000E-00 0.0000E-00
0.0000E-00 0.0000E-00 0.0000E-00 0.0000E-00
IDC = 86/01/01 12:12
IDM = 86/01/01 12:12
CPUTIM, WALTIM, PAGESPTS = 0.050 0.598 1.000

(The missing Weapons Free Zone has been added correctly. The user is finished. To end the current session, the user enters QUIT.)

< QU >
APPENDIX A

HOW TO SET UP AND RUN FLAPS

A.1 INTRODUCTION

As Systems Control Technology develops updated versions of FLAPS, it will be necessary to install the new versions of FLAPS on your computer. This appendix contains the information needed to install a new version of FLAPS when the update tape arrives from SCT. Once the directory architecture and LOGIN.COM are set up, installing the updated FLAPS and all future updated versions of FLAPS is a simple process.

The FLAPS update tape contains seven different labeled areas. These areas are stored as a separate DCL BACKUP "SAVESET". After setting the directories described below, the user should load these files onto his or her system using the DCL BACKUP command.

Each saveset area contains important information that must be loaded in the correct directory of your computer in order for FLAPS to work properly. The next section explains how to set up these directories. The following is an explanation of the names of the seven areas and what they contain.
SOURCE.BCK is the area that contains the FLAPS source code. These are FORTRAN-77 files whose names end in ".FOR" (the ".FOR" part is called the file's extension). The FLAPS executable file is also in this area. Its name is FLAPS.EXE.

COMMON.BCK is the area that contains the FLAPS commons. These are special FORTRAN files that contain memory shared by several FLAPS subroutines. All of the common files have a ".CMN" extension.

EUROPE.BCK is the area that contains the files necessary to run the FLAPS European scenario. The European scenario is the area that runs from 48 N to 53 N in latitude and 2 W to 18 E in longitude. Also in this area are the Z series of initialization command files for the European scenario. Their use is explained in Appendix C. Normally the user will never have to worry about the Z series of files since the other files in this area contain the same information already processed into a form that FLAPS understands. The Z series files all have a ".DAT" extension. The FLAPS data files have a ".FIL" extension.

LIBYA.BCK is the area that contains the files necessary to run the FLAPS Libyan scenario. The Libyan scenario is the geographic area that runs from 25 N to 53 N in latitude and from 15 W to 30 E in longitude. As in EUROPE.BCK, this area contains the Z series of ".DAT" command files and the FLAPS ".FIL" files.

SCILIB.BCK is the area that contains the system library routines that drive certain FLAPS processes, for example, the FLAPS graphics. If these files are not loaded into the proper directory, the user will be unable to link FLAPS and create an executable image (FLAPS.EXE).
DTED.BCK is the area that contains the Defense Mapping Agency Digitized Terrain Elevation Data (Level 1) which is used by FLAPS to do terrain masking of threats in the European scenario. Currently, the Libyan scenario uses a "bald earth" model because the DTED which it requires is not yet available. When it is obtained, it will be included in the DTED.BCK area. DTED files have a ".ZOT" extension.

A.2 SOFTWARE CONFIGURATION

Simply understanding the contents of an SCT FLAPS update tape is not enough if one has the goal of loading and using the tape. The computer onto which the tape is being loaded must have a directory configuration suitable to receive the data from the tape. While there are many ways of setting up suitable directories, the approach described below is a useful way to avoid confusion. This section discusses the directories necessary to run FLAPS, and how to set up these areas.

A.2.1 Directory Architecture

Figure A-1 shows the directory architecture necessary to run FLAPS properly. It consists of a main directory with three sub-directories. For the purpose of this discussion, the main directory will be called FLAPS. Although you need not call your main directory FLAPS, it is recommended that you do, since this will make your system match the comments in this appendix. Regardless of what you call your main directory, it must have three sub-directories called COMMON, EUROPE, and LIBYA. A directory is an area in the computer where logical groupings of files are stored. A sub-directory is a directory that is contained inside of another directory. The exact
sub-directory name is made by concatenating the main directory name with that of the sub-directory. Therefore, the actual name of the COMMON sub-directory (if FLAPS is the name of the main directory) would be FLAPS.COMMON. Each of the directories must have specific parts of the tape loaded into them. The following is an explanation of what must be loaded where.
Figure A-1 The FLAPS Directory Architecture
FLAPS is the main directory. It is the area that must contain the FLAPS source code, executable, and system libraries. Therefore, all of the information in the SOURCE.BCK and SCILIB.BCK, areas of the SCT FLAPS update tape must be loaded into the FLAPS main directory.

FLAPS.COMMON is the sub-directory where the common files are to be kept. FLAPS will expect these files to be there whenever its code is recompiled. If it does not find them, then error messages will result and FLAPS will not work properly. All of the files in the COMMON.BCK area of the FLAPS update tape must be loaded into the FLAPS.COMMON sub-directory.

FLAPS.EUROPE is the sub-directory a user must be in to run the European scenario. All of the files in the EUROPE.BCK area of the FLAPS update tape must be loaded into the FLAPS.EUROPE sub-directory. Additionally, since the European scenario of FLAPS uses DTED for terrain masking, all of the files in the DTED.BCK area of the update tape must be loaded into this sub-directory.

FLAPS.LIBYA is the sub-directory where a user must be in to run the Libyan scenario. All of the files in the LIBYA.BCK area of the FLAPS update tape must be loaded into the FLAPS.LIBYA sub-directory.

A.2.2 LOGIN Initialization

Now that you understand the need for these different directories, you are probably wondering how you can set them up. If FLAPS has already been installed on your computer, then they have probably already been established. If so, you can skip this section. Otherwise, read on.
Directories are created by using the create directory command. When your account is established, it will have only one directory and that will have the name of your account. When you create a directory, it becomes a sub-directory of the directory you are in.

Therefore, if your account was named FLAPS, this would be perfect. You would simply have to log on and you would be in the FLAPS directory. While in the FLAPS directory, if you issued the following commands, you would set up the directory structure FLAPS needs to operate.

CREATE/DIRECTORY [FLAPS.COMMON]
CREATE/DIRECTORY [FLAPS.EUROPE]
CREATE/DIRECTORY [FLAPS.LIBYA]

As mentioned previously, your main directory does not have to be named FLAPS. Whatever name you choose for your main directory will need to be substituted for FLAPS in the above directory commands, as well as any following ones. For example, if you call your main directory BRUCE, the command to create the COMMON sub-directory would be:

CREATE/DIRECTORY [BRUCE.COMMON]

There is a file called the LOGIN.COM file which permits a user to customize an account by giving special names to various frequently executed commands. Every time you log onto your account, the LOGIN.COM command file is executed. Any special function commands that are defined in this file will then be available to you for the rest of your session.
In order to make your FLAPS sessions easier, add the following short-cut command lines to your LOGIN.COM file.

To display the name of the directory you are in, add the following SD (Show Directory) command to your LOGIN.COM file:

`$ SD:=SHOW DEF`

Whenever you are unsure of the directory you are in, simply type "SD" after the dollar sign prompt and the directory name will be displayed.

Next, expedite moving from one directory to another by adding the following lines:

`$ EUROPE:=SET DEF [FLAPS.EUROPE]`
`$ LIBYA:=SET DEF [FLAPS.LIBYA]`
`$ COMMON:=SET DEF [FLAPS.COMMON]`
`$ MAIN:=SET DEF [FLAPS]`

Once this is done, typing the word to the left of the colon (i.e. EUROPE) in response to the dollar sign prompt, will place you in its corresponding directory.

The reason that MAIN was used in the above example, is that there is a special use for word FLAPS. Add the following line to your LOGIN.COM file.

`$ FLAPS:=RUN/NODEBUG [FLAPS]FLAPS`

This way, whenever you type FLAPS to the dollar sign prompt, you will run the FLAPS program.
After you are finished with your LOGIN.COM file, you can execute it by logging off and then logging back on, or by typing "@LOGIN" <cr>. This will set up the command words. From now on, whenever you log into the VAX, these command words will be automatically set.

A.2.3 A Normal FLAPS Run

Now that your LOGIN.COM has been initialized and your directories have been set up, you should load the update tape savesets into their proper directories using the DCL BACKUP command. After that, you are ready to run FLAPS. This is where setting up your LOGIN.COM pays off.

Before you can run, you must be in the sub-directory of the scenario which you want to run. To get there, simply type the name of the desired scenario in response to the dollar sign prompt. For example, if you wanted to run the European scenario, type "EUROPE". Although you do not have to, if you would like to verify that you are now in the correct directory, type "SD".

Finally, to run, simply type "FLAPS" in response to the dollar sign prompt. Once inside FLAPS, typing "QV" to the colon prompt will end the FLAPS session.
APPENDIX B

HOW TO RECOMPILE THE SOURCE CODE

B.1 INTRODUCTION

A FLAPS user should never have to recompile code. It is possible to get into a lot of trouble if one does not do the recompilation process correctly. For this reason, the FLAPS update tapes that you will receive from SCT already have the compilation process completed. By following the directions in Appendix A, you will be able to run FLAPS.

However, in the interest of completeness, and recognizing that an emergency situation may arise requiring the recompilation of code, we have included this appendix. An example of the type of emergency that would require recompilation would be a case where the FLAPS program does not run properly, the solution to the problem is known, but there is not time to send a tape from SCT. Assuming the problem can be solved by correcting one or two lines of code, the user could correct the problem (as instructed by SCT engineers) and then recompile the code. This would permit the user to continue operations until a FLAPS update tape arrives.
B.2 PROCEDURE

This procedure assumes that your computer is set up as described in Appendix A. If this is not the case, then you must read Appendix A and follow the procedures to set up the files for FLAPS before proceeding.

Once the set up is complete, you are ready to make your one line code fix. This should only be done with the approval of an SCT engineer. SCT cannot be held responsible for any code changes made without their approval. Since the source code is kept in the main directory (FLAPS in Appendix A), you must be in the main directory to change the code and perform all of the other steps in this appendix. You can determine which directory you are in by typing "SD" to the dollar sign prompt. If you are not in the main directory, you can get there by typing "MAIN" to the dollar sign prompt.

The user will make the needed corrections using the VAX text editor. After the code has been fixed, the user may either recompile all of the code or recompile only the affected subroutines. To recompile all of the code, the user should type "@FORLIS" after the dollar sign prompt. This will execute a command file called FORLIS.COM (FORTRAN compile and source listing) in the main directory. Remember that FORLIS.COM recompiles every FLAPS subroutine.

To recompile an individual subroutine, the user types:

FORTRAN/NOOP/DEBUG/LIST <subroutine name (no extension)> <cr>
The user should use the debug (DEBU) and no-optimize (NOOP) suboptions, as shown above. The listing (LIST) suboption is not necessary. The user may wish to define a FORTRAN compile command word in his or her LOGIN.COM file as follows:

```
F: ==FORTRAN/NOOP/DEBUG/LIST
```

Using this command word (or letter), the compile command would look like this:

```
$ F <subroutine name (no extension)>
```

Once all of the routines have been recompiled, it is necessary to place them into an object library. In this case, the object library is named FLAPS.OLB. If the user is recompiling all of the routines, the BLDLIB.COM command file should be used. However, before you can use it on your computer, you will have to edit the BLDLIB.COM file and remove the following line.

```
$ SET DEFAULT (FLAPS.CURCODE]
```

In addition, you should delete any existing FLAPS.OLB files that exist in the main directory and create a new one. The old FLAPS.OLB is deleted using the DCL DELETE command. The new version is created by typing:

```
$ LIB/CREATE FLAPS.OLB
```

The BLDLIB.COM file can then be executed by typing "@BLDLIB" to the dollar sign prompt.
If the user is only compiling an individual routine, the FLAPS.OLB file does not need to be created from scratch; the existing one can be modified. To do this type:

$ LIB/REPLACE FLAPS <subroutine name (no extension)>

Now that the library has been built or modified, the final step is to link the object library with the system library. This is accomplished with the help of the FLAPS.COM command file. Once again, the command file must be altered before you can use it on your system. First, you must remove the following line:

SSET DEF [FLAPS.CURCODE]

Then, you will have to change the line that says

DRAO:[SCI.LIB]SCILIB/LIB

so that it says

SCILIB/LIB

The easiest way to accomplish this is simply to delete the DRAO:[SCI.LIB] part of the line.

After the FLAPS.COM file has been altered, you will be able to execute it by typing "$FLAPS" to the dollar sign prompt. When the FLAPS.COM file finishes its execution, you will be able to run FLAPS in the normal manner (as described in Appendix A).
It is sometimes necessary to relink the program without doing a recompile. This is the case when differences in VAX/VMS operating systems at different installations cause the FLAPS executable not to run. To relink, the user must execute the FLAPS.COM command file as described above. The user should make sure that the FLAPS.COM file is consistent with the directory names he or she is using. The user should also make sure that the FLAPS object library FLAPS.OLB is in the main FLAPS directory. The FLAPS.OLB object library is delivered in the SOURCE.BCK area of the update tape.

B.3 A SAMPLE FLAPS.COM COMMAND FILE

The FLAPS.COM command file links the FLAPS object library with the system library creating a FLAPS.EXE file. Whether you are recompiling code or simply relinking, the following is a sample FLAPS.COM file that will work for you. Note that this is what the FLAPS.COM file that comes on your FLAPS update tape will look like after the changes described in the previous section have been made.

```plaintext
$ !
$ ! PROC TO LINK ALL ROUTINES IN FLAPS
$ !
$LINK/DEBU/MAP/FULL/CROSS_REFERENCE FLAPS/LIB/INCLUDE=(FLAPS,FLPBLK),-
       SCILIB/LIB
$ !
```

B-5
APPENDIX C
HOW TO BUILD FILES FROM SCRATCH

C.1 INTRODUCTION

A FLAPS user should never have to build data files from scratch. This is another area where it is possible to get into a lot of trouble quickly if the process is done incorrectly. For this reason, the FLAPS update tapes that you receive from SCT will have all of the files built for both of the scenarios (European and Libyan). By following the directions in Appendix A, you will be able to run FLAPS using the files on the update tape.

An example of a time when files might have to be rebuilt is hard to imagine. In a FLAPS session, if a user wishes to replace part of the data base he or she may delete the undesired records in a file (table) and then replace them with new records. For example, if the user needed a different target set, then all of the targets in the TG table should be deleted and the new targets added, either by hand or from a command file. This would be faster and less work than rebuilding all of the files from scratch.
Still, it is possible to think of extreme situations which necessitate the building of files from scratch. (A user may destroy all of the files accidentally, only to discover that the latest FLAPS update tape is either unavailable or has been destroyed.) Therefore, we are including the directions which one must follow when building files.

C.2 PROCEDURE

This procedure assumes that your computer is set up as described in Appendix A. If this is not the case, then you must read Appendix A and follow the procedures for setting up the computer for FLAPS.

The procedure for building files from scratch is the same whether you are building files for the European or Libyan scenarios. The sub-directory in which you are working determines the scenario which you will build. Thus, if you want to build the European scenario, you must type "EUROPE" to the dollar sign prompt before beginning. This will place you in the EUROPE sub-directory. Typing "LIBYA" will place you in the LIBYA sub-directory so that you can build files for the Libyan scenario. For the purposes of this example, the rest of this appendix will use the European scenario as its sample case. Examples of each of the command files for the European scenario together with a brief explanation of what each does, appear in the last section of this appendix.

Before building new files, it is a good idea to verify that you are in the correct sub-directory. This can be done by typing "SD" to the dollar sign prompt. If you are in the wrong sub-directory, for the scenario you are trying to build, go back and repeat the previous paragraph.
Now it is time to start building new files. You will have to make three separate FLAPS runs before the new files will be in a condition that they can be used normally. Failure to make any of the three runs correctly, or making the runs in the wrong order, will guarantee that FLAPS will not work properly. If that should happen, rebuild the files making sure that all of the instructions are being followed. Before beginning the first run, take a moment and verify that rebuilding these files is really necessary.

The first run initializes the table structures. Type "FLAPS" to the dollar sign prompt to begin the session. FLAPS will ask you if you want to have a normal session. Type "NO" and then type "READ ZDEFINE.DAT YES" to the colon prompt. When FLAPS is finished reading this file, it will give you a colon prompt. You are finished with the first run, so type "QUIT".

The next run initializes the array structures. Type "FLAPS" to the dollar sign prompt to begin the session and then type "NO" to indicate that this is not a normal run. To the colon prompt type "READ ZDEFA.R.DAT YES". When FLAPS is finished reading this file, it will give you another colon prompt. Typing "QUIT" will end the session.

The third, and final run is the most complex. It is also the most time consuming. The amount of time that it takes varies depending on what scenario you are building and what type of computer you are using. Budget at least an hour and a half for this run; it may take longer.
The third run initializes the data base. Type "FLAPS" to the dollar sign prompt to begin the session and then type "NO" to indicate that this is not a normal run. To the colon prompt type "READ ZOPEN.DAT YES". This will open all of your new files. When FLAPS is finished reading the file, it will give you another colon prompt to which you must type "READ ZINIT.DAT YES". When you get another colon prompt, type "READ ZDEMO.DAT YES". This is a long file that initializes all of the tables. After the tables are built, you must instruct FLAPS to build the arrays. The command for this is "PROCESS" followed by a carriage return. Then type "1" followed by another carriage return. FLAPS will calculate the statespace, nodes, accessibility, arcs and routes. When it is finished, it will give you another colon prompt. Type "SELECT ALL" to write the routes to the SPED file. You will then be ready to type "QUIT" and end the session.

At this point, you have built new files from scratch. You can now do normal runs by following the directions in Appendix A. It would be a good idea to test your files by trying to do a normal run. If this work, then clean up the old files by typing "PURGE *.*FIL" to the dollar sign prompt.

C.2.1 SAMPLE COMMAND FILES

The remainder of this appendix contains the most important and frequently used FLAPS command files. The first three command files are used to initialize the FLAPS data base manager. The normal user should never have to use these files. The next three files define the scenario. This is the same scenario which was used to generate the examples in Chapter V. The following is a brief description of each command file and its use. They are listed in the order in which they are normally run when building files from scratch. With the
exception of ZCONTNU.DAT, a user should not have to use any of these files
during a normal run. In fact, since the use of ZCONTNU.DAT is now transparent
to the user, that is the user sees only the results of running the file and
neither initializes nor sees the process of the run itself, persons desiring to
perform a normal FLAPS run need not concern themselves with the following files.

ZDEFINE.DAT ------------ Initialize Table Structures
ZDEFA.R.DAT ------------ Initialize Array Structures
ZOPEN.DAT ------------ Open and Initialize Tables and Arrays
ZINIT.DAT ------------ Initialize the Scenario (ALGP)
ZDEMO.DAT ------------ Enter Scenario Data Base
ZCONTNU.DAT ------------ Begin Standard Run

C.2.2 The ZDEFINE.DAT Command File

The ZDEFINE.DAT command file is the first command file read when
initializing FLAPS. A FLAPS user will probably never have to use this command
file.

The ZDEFINE.DAT command file defines the structure of all of the FLAPS
tables. The following is a sample of a ZDEFINE.DAT command file.

; ; STRUCTURE TABLE
; OPEN TSTR NEW TSTR.FIL R/W
SHOW TSTR HELP
ABOR
; ; DEFINE ASTR STRUCTURE
; ADD TSTR ASTR 60 0 5 "ARRAY STRUCTURE
NAMA NXRC ITIT IDC IDM /
CH04 INT CH24 TIME TIME /
1 1 1 1 /
"ARRAY NAME "
"MAX NUMBER OF RECORDS "
"TITLE OF ARRAY "
"RECORD CREATION DATE "
"RECORD MODIFICATION DATE" /
DEFINE ALGP STRUCTURE
ADD TSTR ALGP 3 0 21 "ALGORITHM PARAMS"
ID DELE DELN XMIN XMAX YMIN YMAX NALT NDIR IDUM
IDVE ARMX FLAM ALT5 XSCL YSCU YSCU PCAP IDC
IDM /
CHO4 REAL REAL REAL REAL REAL REAL INT INT INT
CHO4 REAL REAL REAL REAL INT INT INT
TIME /
1 1 1 1 1 1 1 1 1 1 1
1 1 1 5 1 1 1 1 5 1 1
1 /
"ID = ALGP"
"LONGITUDE GRID(NM)"
"LATITUDE GRID(NM)"
"MIN LON OF STATESPACE"
"MAX LON OF STATESPACE"
"MIN LAT OF STATESPACE"
"MAX LAT OF STATESPACE"
"NUMBER OF ALTITUDES"
"NUMBER OF DIRECTIONS"
"OF MASKING POINTS"
"VEHICLE NAME FOR STATES"
"LAMDA - AIR DAMAGE"
"LAGRANGE MULTIPLIER"
"ALTITUDE GRID (M)"
"MIN LON OF SCENARIO"
"MAX LON OF SCENARIO"
"MIN LAT OF SCENARIO"
"MAX LAT OF SCENARIO"
"PROB OF CLOBBER GRID"
"RECORD CREATION DATE"
"RECORD MODIFICATION DATE"
/ 
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 -5 -5
-5 /
0 1 1 1 1 1 1 1 1 0 0
0 0 0 1 1 1 1 1 1 0 0
0 /
A 0.0 0.0 -180 -180 -90 -90 1 1 0
A 0.0 0.0 0.0 -180 -180 -90 -90 0.0 0
0 /
0 99.0 99.0 180 180 90 90 10 8 50
999 0 0 45000.0 180 180 90 90 .0001 0
DEFINE CMDL STRUCTURE

ADD TSTR CMDL 3 100 21 "Clobber Model"
ID ISE1 ISE2 CLO1 CLO2 CLOK CLK1 CLK2 PCMA DUM1
DUM2 DUM3 DUM4 DUM5 ULF PCS CONS COSI COMX IDC
IDM /
CHO4 INT INT REAL REAL REAL REAL REAL REAL REAL TIME /
1 1 1 1 1 1 1 1 1
1 1 1 1 3 12 33 33 33 1
1 /
"ID OF VEHICLE"
"RANDOM SEED"
"RANDOM SEED"
"FULL GLOAD PARAMETER"
"GLOAD SLOPE PARAMETER"
"ROUGHNESS PARAMETER"
"CLOB BREAK PT PARAMETER"
"CLOB SLOPE PARAMETER"
"MAX PROB OF CLOBBER"
"DUMMY NOT USED YET"
"DUMMY NOT USED YET"
"DUMMY NOT USED YET"
"DUMMY NOT USED YET"
"DIV LINES LO FACTOR BAND"
"DIV LINES PROB BETWEEN BAND"
"CONS IN HC EQ FOR BAND"
"COEF SIGRH HC EQ 4 BAND"
"COEF MXM2 HC EQ 4 BAND"
"RECORD CREATION DATE"
"RECORD MODIFICATION DATE" /
/ 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 -5
-5 /
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 /
A 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 /
ZZZZ 9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
9999 9999 9999 9999 9999 9999 9999 9999 9999 9999
9999 /
201 900 900 900 900 900 900 900 900 900 900 900
900 900 900 900 900 900 900 900 900 900 900 900
900 /
DEFINE CURR STRUCTURE

ADD TSTR CURR 3 600 24 "CURRENT STATUS"
ID IADD IALT IAOP ICLO ISTO ILST INDEX IPRO ITYP
IMSK IDEV IDM1 IDM2 IDM3 IDM4 IDM5 IDM6 IDM7 IDM8
IMD9 IDM0 IDC IDM /
CHO4 INT INT INT INT INT INT INT INT
INT CH04 INT INT INT INT INT INT
INT INT TIME TIME /
1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1
1 1 1 1 /
"ID = CURR"
"OF THREATS ADDED"
"TERRAIN ALT INICATOR"
"ALTITUDE LEVEL"
"CLOBBER INDICATOR"
"OF STCH THREATS ADDED"
"LAST COMMAND GIVEN"
"INDEX OF LAST ARC DONE A"
"STATUS OF PROC COMMAND"
"TYPE OF LAST ARC DONE A"
"OF THREATS MASKED"
"DEVICE CHARACTER"
"DUMMY NOT YET USED"
"DUMMY NOT YET USED"
"DUMMY NOT YET USED"
"DUMMY NOT YET USED"
"DUMMY NOT YET USED"
"DUMMY NOT YET USED"
"DUMMY NOT YET USED"
"DUMMY NOT YET USED"
"DUMMY NOT YET USED"
"DUMMY NOT YET USED"
"DUMMY NOT YET USED"
"DUMMY NOT YET USED"
"DUMMY NOT YET USED"
"DUMMY NOT YET USED"
"DUMMY NOT YET USED"
"DUMMY NOT YET USED"
"DUMMY NOT YET USED"
"RECORD CREATION DATE"
"RECORD MODIFICATION DATE"/
/ 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 -5 -5 /
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 /
0 0 0 0 0 0 0 0 0
0 0 0 0 /
0 0 0 0 0 0 0 0 0
0 0 0 0 /
0 0 0 0 0 0 0 0 0
0 0 0 0 /
0 0 0 0 0 0 0 0 0
0 0 0 0 /
0 0 0 0 0 0 0 0 0
0 0 0 0 /
/
DEFINE DISP STRUCTURE

ADD TSTR DISP 6 600 39 "DISPLAY PARAMS"
IDEV LMIN LMAX MMIN MMAX XSCL YSCL XSUB YSUB XMIN
YMIN XMAX YMIN JMIN JMAX YLB1 DYLX NXLB
YLB1 DXLB NLYL LAT1 LAT2 Xcen RCON TSCL LSCL MSCL
LCON MCON DUM1 DUM2 DUM3 DUM4 DUM5 IDC IDM /
CHO4 INT INT INT INT REAL REAL REAL REAL REAL
REAL REAL INT INT INT INT REAL REAL INT /
1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1
"PLOTTING DEVICE"
"MIN HORIZONTAL RASTER"
"MIN VERTICAL RASTER"
"MAX HORIZONTAL RASTER"
"MAX VERTICAL RASTER"
"HORIZ RASTER / DEG LONG."
"VERT RASTER / DEG LAT."
"LONG AT HORIZ RASTER = 0"
"LAT AT VERT RASTER = 0"
"MIN LONG IN WINDOW (DEG)"
"MIN LAT IN WINDOW (DEG)"
"MAX LONG IN WINDOW (DEG)"
"MAX LAT IN WINDOW (DEG)"
"MINIMUM I IN WINDOW"
"MINIMUM J IN WINDOW"
"MAXIMUM I IN WINDOW"
"MAXIMUM J IN WINDOW"
"1ST LABELLED LONG. (DEG)"
"DELTA LABELLED LONG (DEG)"
"NUMBER OF LABELLED LONDS"
"1ST LABELLED LAT (DEG)"
"DELTA LABELLED LAT (DEG)"
"NUMBER OF LABELLED LATS"
"1ST ZERO DISTORTION LAT"
"2ND ZERO DISTORTION LAT"
"CENTRAL LONITUDE"
"DEG FR YMAX TO PROJ POLE"
"ANGULAR SCALE (DEG/LONG)"
"LAMBERT LON SCALE FACTOR"
"LAMBERT LAT SCALE FACTOR"
"LAMBERT LON CONSTANT"
"LAMBERT LAT CONSTANT"
"DUMMY NOT USED YET"
"DUMMY NOT USED YET"
"DUMMY NOT USED YET"
"DUMMY NOT USED YET"
"DUMMY NOT USED YET"
"DUMMY NOT USED YET"

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DEFINE GEOM STRUCTURE

ADD TSTR GEOM 3 0 16 "COORD TRANSFMTN"
ID NI NJ NK NL XMAX XMIN YMAX YMIN AL
DX IDEL JDEL XO IDC IDM /
CHO4 INT INT INT INT REAL REAL REAL REAL REAL
REAL INT INT REAL TIME TIME /
11111111115
388311 /
"ID = GEOM"
"NUMBER OF LONGITUDES"
"NUMBER OF LATITUDES"
"NUMBER OF AGLS"
"NUMBER OF DIRECTIONS"
"MAXIMUM LONGITUDE"
"MINIMUM LONGITUDE"
"MAXIMUM LATITUDE"
"MINIMUM LATITUDE"
"STATESPACE ALTITUDES (M)"
"STATESPACE DELTS (DEG,M)"
"DELTA I (LTH DIRECTION)"
"DELTA J (LTH DIRECTION)"
"STATESPACE ORIGIN(DEG,M)"
"RECORD CREATION DATE"
"RECORD MODIFICATION DATE" /
/
DEFINE LLTR STRUCTURE
ADD TSTR LLTR 101 200 "LLTR NODE PARAMETERS"
ID X CLNG ITYP ICON IDC IDM /
CH08 REAL REAL INT CH08 TIME TIME /
1 2 1 1 1 3 1 1 /
"ID OF TRANSIT ROUTE NODE"
"LONG-LAT OF LLTR NODE"
"TRANSIT ROUTE CEILING"
"TRANSIT ROUTE TYPE"
"LLTR NODE CONNECTIONS"
"RECORD CREATION DATE"
"RECORD MODIFICATION DATE" /
0 0 0 0 0 -5 -5 /
0 0 0 0 0 0 /
A 0 0 -999 A 0 0 /
ZZZZZZZZ 360 99999 999 999999 999999 /
900 301 900 900 900 301 301 /

DEFINE NODP STRUCTURE
ADD TSTR NODP 3 250 "NODE PARAMETERS"
ID NSB NTR NTG NTR1 NTR2 NTR3 IDC IDM /
CR04 INT INT INT INT INT TIME TIME /
1 1 1 1 1 1 1 1 1 /
"ID = NODP"
"NUMBER OF STAGING BASES"
"NUMBER OF LLTR NODES"
"NUMBER OF TARGETS"
"NBR OF LLTR ENTRY NODES"
"OF LLTR INTERMED NODES"
"NBR OF LLTR EXIT NODES"
"RECORD CREATION DATE"
"RECORD MODIFICATION DATE" /
0 0 0 0 0 0 -5 -5 /
0 0 0 0 0 0 0 /
A 0 0 0 0 0 0 /
ZZZZ 999 999 999 999 999 999999 999999 /
900 301 301 301 301 301 301 301 /

DEFINE PBOR STRUCTURE
ADD TSTR PBOR 51 600 "POLITICAL BORDERS"
ID NPTS XPB IDC IDM /
CH08 INT REAL TIME TIME /
1 1 200 11
"ID OF POLITICAL BORDERS"
"NBR OF PBOR BOUNDARY PTS"
"LONG-LAT OF BNDRY POINTS"
"RECORD CREATION DATE"
"RECORD MODIFICATION DATE"

0 0 0 -5 -5
0 0 0 0 0
0 0 0 0 0
ZZZZZZZZ 1009 360 999999 999999
301 301 301 301 301

DEFINE ROZ STRUCTURE
ADD TSTR ROZ 11 600 7 "RESTRICTED OPERATING ZONE"
ID NPTS X TON TOFF IDC IDM /
CH08 INT REAL REAL REAL TIME TIME /
1 1 20 1 1 1 1 /
"ID OF ROZ"
"NBR OF ROZ BOUNDARY PTS"
"LONG-LAT OF BNDRY POINTS"
"TIME ON OF ROZ"
"TIME OFF OF ROZ"
"RECORD CREATION DATE"
"RECORD MODIFICATION DATE"

0 0 0 0 0 -5 -5
0 0 0 0 0 0
A 0 0 0 0 0 0
ZZZZ 99 360 9999 9999 999999 999999
301 301 301 301 301 301

DEFINE SPED STRUCTURE
ADD TSTR SPED 51 600 12 "SORTIE RECORDS"
ID ISB ITG PS PTH DFLT TTOT TOT NPT COOR
IDC IDM /
CH12 INT REAL REAL REAL TIME TIME /
1 1 1 1 1 1 1 1 720
1 1 /
"SORTIE ID (USER CHOSEN)"
"STAGING BASE INDEX"
"TARGET INDEX"
"PROB OF SURVIVAL"
"PROB KILL DUE TO THREATS"
"DISTANCE"
"TAKE OFF TIME"
"TIME ON TARGET"
"OF COORDS IN PATH"
"T,X,Y,A,HEADING,NODE"

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DEFINE STCH STRUCTURE

ADD TSTR STCH 201 100 11 "STOCHASTIC REGIONS"
ID ITYP XSC EXNT PEX RUNC NBPS XPBS FGRD IDC
IDM /CHO4 CHO8 REAL REAL REAL REAL INT REAL REAL TIME TIME /
1 1 3 1 1 1 1 100 1 11/
"THREAT ID"
"THREAT TYPE NAME"
"THREAT LON, LAT, ALT"
"EXPECTED OF THREATS"
"PROB THREAT EXISTS"
"RADIUS OF UNCERTAINTY"
"OF PTS ON STCH BORDER"
"LON LAT OF NTH POINT"
"RATIO OF INT/GEO GRID"
"RECORD CREATION DATE"
"RECORD MODIFICATION DATE" /
0 0 0 0 0 0 0 0 0 -5
-5 /
0 0 1 1 1 1 1 1 0
0 /
A A -180 0.0000 0 0.0 -180 0.0 0
0 /
ZZZZ ZZZZZZZZ 180 3000.0 999.0 999.9 50 180 1.0 0
0 /201 201 201 201 201 201 201 201 201 201 201
201 /

DEFINE STGB STRUCTURE

ADD TSTR STGB 14 200 7 "STAGING BASE PARAMETERS"
ID X ITYP MACR NWEP IDC IDM /CHO8 REAL CHO4 INT INT TIME TIME /
1 2 1 1 10 1 1 /
"ID OF STAGING BASE"

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<table>
<thead>
<tr>
<th>LONG-LAT OF STAGING BASE</th>
<th>TYPE OF AIRCRAFT AT BASE</th>
<th>NUMBER OF AIRCRAFT</th>
<th>NUMBER OF WEAPONS</th>
<th>RECORD CREATION DATE</th>
<th>RECORD MODIFICATION DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0 0 0 0 -5 -5</td>
<td></td>
<td>0 0 0 0 0 0 0</td>
<td>A 0 A 0 0 0 0</td>
<td>ZZZZ 360 ZZZZ 999 999 99999 99999 / 900 301 301 900 900 301 301 /</td>
<td></td>
</tr>
</tbody>
</table>

DEFINE SUPM STRUCTURE

ADD TSTR SUPM 5 100 7 "SUPPRESSION MODEL"
ID RAD ICAP TYPE DEGR IDC IDM /
CH08 REAL INT: CH08 REAL TIME TIME /
1 1 1 25 25 1 1 /
"SUPP MODEL IDENTIFIER"
"MAX RADIUS OF THE SUPPRE"
"SUPP CAPACITY"
"LIST THRT TYPE EFFECTIVE"
"DEGRADE THRT CAPACITY"
"DATE SUPP MODEL CREATED"
"DATE SUPP MODEL MODIFIED" /
0 0 0 0 0 -5 -5 /
0 0 0 0 0 0 /
AAAA 0.0 0 AAAA 0.0 0 0 /
ZZZZ 9999 9999 ZZZZ 1.0 9999 9999 /
200 900 900 900 900 900 900 /

DEFINE SUPP STRUCTURE

ADD TSTR SUPP 11 100 5 "SUPPRESSOR TYPE"
ID TYPE XSU IDC IDM /
CH08 CH08 REAL TIME TIME /
1 1 3 1 1 /
"SUPPRESSOR IDENTIFIER"
"SUPPRESSOR TYPE"
"LONG,LAT,TERR CLEAR ALT"
"DATE SUPP REC CREATED"
"DATE MODIFICATION" /
0 0 0 -5 -5 /
0 1 1 0 0 /
AAAA AAAA -9999.0 0 0 /
ZZZZ ZZZZ 9999 9999 9999 /
201 900 900 900 900 /

DEFINE SWCH STRUCTURE
ADD TSTR SUCH 3 100 28 "VARIOUS SWITCHES"
ID IAOP IARP IBYT ICLB ICVB IDCN IDUL IEND IFES
IGDS IGLD IMSK IPCS IREQ IRST JRST IRUF ISPD ISRD
ITAV ISHK ICAN IDM1 IDM2 IDM3 IDC IDM /
CHO4 INT INT INT INT INT INT INT INT INT
INT INT INT INT INT INT INT INT
INT INT INT INT INT INT INT INT
1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1
"ID"
"ALTITUDE OPTIMIZATION"
"ARRAY PROCESSOR: ON, OFF"
"BYTE PACKED TERRAIN"
"Clobber"
"CL Model: 0 = Berman, 1 = GD"
"DECONFLICTION"
"DUAL CONTROL: 0 = Y, 1, 2 = NO"
"END POINTS OF ARCS"
"INFEASIBLE TRANSITIONS"
"GD RUN"
"G LOAD: 0 = NO, 1 = YES"
"MASKING ( - = GD APPROX)"
"CONST PROB OF Clobber"
"REQUANTIZATION"
"RESTART ARCS"
"RESTART TARCS"
"ROUGHNESS FILE"
"WRITE SPED FILE: YES R NO"
"LOOK AT ALL STATE SPACE"
"TARGET AVOID"
"SHRINK ACCESS BOX"
"LABEL DISPLAYS (SECRET)"
"DUMMY NOT USED YET"
"DUMMY NOT USED YET"
"DUMMY NOT USED YET"
"RECORD CREATION DATE"
"RECORD MODIFICATION DATE" /
/ 1 0 0 0 0 0 0 0 0 0
1 0 0 0 0 0 0 0 0 0
1 0 0 0 0 0 0 0 0 0
1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1
1 1 1 1 0 0 0 0 0 0/
1 0 0 0 0 0 0 0 0 0
1 0 0 0 0 0 0 0 0 0
1 0 0 0 0 0 0 0 0 0
1 0 0 0 0 0 0 0 0 0
0 1 1 1 1 1 1 1 1 1
0 1 1 1 1 1 1 1 1 1
0 1 1 1 1 1 1 1 1 1
0 1 1 1 1 1 1 1 1 1
0 1 1 1 1 1 1 1 1 1
1 1 3 0 0 0 0 0 0
DEFINE TG STRUCTURE
ADD TSTR TGG 51 200 8 "TARGET PARAMS"
ID XTG CLAS IPRI ITYP PDMN IDC IDM /
CHO8 REAL CHO4 INT INT REAL TIME TIME /
1 2 1 1 1 1 1 /
"TARGET ID"
"LONG-LAT OF TARGET"
"CLASSIFICATION OF TARGET"
"TARGET PRIORITY"
"TYPE OF TARGET"
"MIN PROB DAMAG THRES TAR"
"RECORD CREATION DATE"
"RECORD MODIFICATION DATE" /
/ 0 0 0 0 0 0 -5 -5 /
/ 0 0 0 0 0 0 0 0 /
/ A O A 0 1 0 0 0 /
/ ZZZZ 999999 ZZZZ 9999 999999 0 0 /
301 900 900 900 900 900 900 900 /

DEFINE THRT STRUCTURE
ADD TSTR THRT 501 100 6 "THREAT LOCATIONS"
ID ITYP XTH PEX IDC IDM /
CHO4 CH08 REAL REAL TIME TIME /
1 1 3 1 1 1 /
"THREAT ID"
"THREAT TYPE"
"GEOD LON, LAT, ELE OF DEF"
"PROBABILITY THREAT EXISTS"
"RECORD CREATION DATE"
"RECORD MODIFICATION DATE" /
/ 0 0 0 0 -5 -5 /
/ 0 0 1 1 0 0 /
/ A A -180 0.0 0 0 /
/ ZZZZ ZZZZ 180 999.0 0 0 /
/ 201 201 201 201 900 900 /

DEFINE TMDL STRUCTURE
ADD TSTR TMDL 22 100 19 "THREAT MODELS"
ID RMAX DMIN NDRG NCRG DRG1 CRG1 DDRG DCRG DLOG DUN1 DUM2 DUM3 DUM4 DUM5 HIGH FLOR IDC IDM /
CHO8 REAL REAL INT INT REAL REAL REAL REAL REAL REAL /
GOOD REAL REAL REAL REAL REAL REAL REAL REAL REAL TIME TIME /
1 1 1 1 1 1 1 1 1 1 200
DEFINE VEHP STRUCTURE
ADD TSTR VEHP 10 0 14 "VEHICLE PARAMETERS"
ID VNOM CLM DIV FCAP FCEG FCIN NMFC ISCL RCS
TRAD TYP IDC IDM /
CH04 REAL REAL REAL REAL REAL REAL INT INT REAL
REAL CH04 TIME TIME TIME /
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 -5 -5 -5 -5 -5 -5 0 0 -5 -5 /
0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 /
A 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 /
99999999 500.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 /
/
 DEFINE VEAP STRUCTURE

ADD TSTR VEAP 5 400 6 "WEAPON PARAMETERS"

ID WP PD WP NMTY NAME IDC IDM /
CH04 REAL INT CH08 TIME TIME /
1 250 1 10 1 1 /
"ID = VEAP"
"PK WEAP BY TG TYPE"
"NUMBER OF WEAP TYPES"
"NAME OF WEAPON"
"RECORD CREATION DATE"
"RECORD MODIFICATION DATE" /
0 0 0 0 -5 -5 /
0 0 0 0 0 /
A 0 0 0 /
ZZZZ 1 9999 ZZZZ 9999 9999 /
9999 ZZZZ 99999 9999 /

 DEFINE WFZ STRUCTURES

ADD TSTR WFZ 12 600 5 "WEAPON FREE ZONE"

ID NPTS X IDC IDM /
CH08 INT REAL TIME TIME /
1 1 20 1 1 /
"ID OF WEAPON FREE ZONE"
"NUMBER OF BOUNDARY POINT"
"LONG-LAT OF WFZ BNDRY PT"
"RECORD CREATION DATE"
"RECORD MODIFICATION DATE" /
0 0 0 -5 -5 /
0 0 0 0 /
A 0 0 0 /
ZZZZ 10 360 999999 999999 /
500 301 301 301 301 /

INITIALIZE AND SHOW STRUCTURES

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C.2.3 The ZDEFAR Command File

The ZDEFAR.DAT command file will not normally be used by someone running FLAPS. It is another initialization file.

The ZDEFAR command file defines the structure of the FLAPS arrays. The following is a sample of a ZDEFAR command file.

```
OPEN TSTR OLD TSTR.FIL R
INIT
OPEN ASTR NEW ASTR.FIL R/W
;
  ADD ASTR ALTG 4 "ALTITUDE ARRAY"
  ADD ASTR ALTS 4 "ALTITUDE ARRAY"
  ADD ASTR ARCS 4 "ARC WAYPOINT ARRAY"
  ADD ASTR ARPE 4 "TARG INGRESS/EGRESS PERF"
  ADD ASTR CL3D 4 "CLOBBER MODEL FOR 3-D"
  ADD ASTR ITGC 4 "TARG ACCESSIBLE TO STGB"
  ADD ASTR ITRC 4 "TREX ACCESSIBLE TO TREN"
  ADD ASTR MASK 4 "TERRAIN MASKING"
  ADD ASTR NBOX 4 "LIST OF TG BOX CORNERS"
  ADD ASTR NLIS 4 "LIST OF NODES"
  ADD ASTR NPOS 4 "NODE POSITIONS"
  ADD ASTR ROUT 4 "ROUT NODES DIST AND PERF"
  ADD ASTR STAT 20 "STATESPACE"
  ADD ASTR SXPE 4 "STGB TO LLTR EXIT PERF"
  ADD ASTR TGBS 4 "TARGET STATUS ARRAY"
  ADD ASTR TH2D 4 "TWO-D THREAT DANGER"
  ADD ASTR TH3D 4 "THREE-D THREAT DANGER"
  ADD ASTR TOBS 200 "THREAT OBSERVABILITY"
  ADD ASTR TRPE 4 "LLTR TREE PERFORMANCE"
```

C.2.4 The ZOPEN Command File

The ZOPEN.DAT command file is an initialization file which opens all of the FLAPS files. It will not normally be used when running FLAPS.
The following is a sample ZOPEN command file.

```
NORMAL RUN
OPEN TSTR OLD TSTR.FIL R
INIT
OPEN ASTR OLD ASTR.FIL R
INIT

OPEN TABLES
OPEN ALGP NEW ALGP.FIL R/W
OPEN CMDL NEW CMDL.FIL R/W
OPEN CURR NEW CURR.FIL R/W
OPEN DISP NEW DISP.FIL R/W
OPEN GEOM NEW GEOM.FIL R/W
OPEN LLTR NEW LLTR.FIL R/W
OPEN NODP NEW NODP.FIL R/W
OPEN PBOR NEW PBOR.FIL R/W
OPEN ROZ NEW ROZ.FIL R/W
OPEN SPED NEW SPED.FIL R/W
OPEN STCH NEW STCH.FIL R/W
OPEN STGB NEW STGB.FIL R/W
OPEN SUPM NEW SUPM.FIL R/W
OPEN SUPP NEW SUPP.FIL R/W
OPEN SVCH NEW SVCH.FIL R/W
OPEN TG NEW TG.FIL R/W
OPEN THRT NEW THRT.FIL R/W
OPEN TMDD NEW TMDD.FIL R/W
OPEN WEAP NEW WEAP.FIL R/W
OPEN WFPZ NEW WFPZ.FIL R/W

OPEN ARRAYS
OPEN ALTG NEW ALTG.FIL R/W
OPEN ALTS NEW ALTS.FIL R/W
OPEN ARCS NEW ARCS.FIL R/W
OPEN ARPE NEW ARPE.FIL R/W
OPEN CL3D NEW CL3D.FIL R/W
OPEN ITGC NEW ITGC.FIL R/W
OPEN ITRC NEW ITRC.FIL R/W
OPEN MASK NEW MASK.FIL R/W
OPEN NBOX NEW NBOX.FIL R/W
OPEN NLIS NEW NLIS.FIL R/W
OPEN NPOS NEW NPOS.FIL R/W
OPEN ROUT NEW ROUT.FIL R/W
OPEN STAT NEW STAT.FIL R/W
OPEN SXPE NEW SXPE.FIL R/W
OPEN TGUS NEW TGUS.FIL R/W
OPEN TH2D NEW TH2D.FIL R/W
```
The ZINIT Command File

The ZINIT.DAT command file is not normally used during a FLAPS session. It initializes the data in all of the one record tables and arrays.

The following is a sample of a ZINIT command file.

```
; ADD ONE RECORD ARRAYS
; ADD ALGP ALGP 2.5 2.5 9.0 16.0 48.0 52.0 3 8 2 F-4 5.0E-6 1.5E-4
   60.1 152.4 304.8 0.0 0.0 -2.0 16.0 48.0 53.0 /
; ADD CURR CURR 0 0 0 0 A 0 0 0 0 "4115" 0 0 0 0 0 0 0 0 0 0 0 /
; ADD SWCH SWCH 0 0 1 0 0 0 1 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
PROC /
; USE ALGP TO INITIALIZE GEOM
; GEOM
```

The ZDEMO Command File

The ZDEMO.DAT command file initializes all of the multiple record tables (and arrays where appropriate). It is an initialization command file and therefore is not normally used during a FLAPS session.

The following is a sample ZDEMO command file.

```
; FILE TO ADD LLTR NETWORK
; ADD LLTR N001 6.9378 50.4483 320 1 N002 /
ADD LLTR N002 7.4425 50.4498 320 2 N003 /
ADD LLTR N003 7.9900 50.7805 320 2 N004 /
ADD LLTR N004 8.5915 51.0297 320 2 N005 /
ADD LLTR N005 9.3785 51.1868 320 3 /
ADD LLTR N006 8.9770 50.9815 320 0 /
```

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ADD LLTR N007 8.5125 50.9225 320 0 /
ADD LLTR N008 8.3538 50.8180 320 0 /
ADD LLTR N010 7.9017 50.4547 320 0 /
ADD LLTR N011 8.2757 50.5678 320 0 /
ADD LLTR N012 8.5040 50.7807 320 0 /
ADD LLTR N013 9.4997 51.0210 320 0 /
ADD LLTR N014 9.1385 50.8112 320 0 /
ADD LLTR N015 8.7125 50.6575 320 0 /
ADD LLTR N016 8.5043 50.4312 320 0 /
ADD LLTR N017 9.0455 50.6427 320 0 /
ADD LLTR N018 9.5968 50.7807 320 0 /
ADD LLTR N019 9.3957 50.6417 320 0 /
ADD LLTR N020 8.7817 50.4632 320 0 /
ADD LLTR N021 7.8698 50.3162 320 0 /
ADD LLTR N022 7.2070 50.0882 320 2 N002 N024 /
ADD LLTR N023 7.6533 50.1813 320 2 N025 /
ADD LLTR N024 8.4563 50.2405 320 2 N026 /
ADD LLTR N025 9.1230 50.4962 320 2 N027 /
ADD LLTR N026 7.6542 50.2880 320 1 N030 /
ADD LLTR S070 10.6342 49.7560 320 0 /
ADD LLTR S071 10.8725 49.0887 320 0 /
ADD LLTR S072 10.8048 49.7668 320 0 /
ADD LLTR S073 10.0163 49.5185 320 0 /
ADD LLTR S074 9.3660 49.3248 320 0 /
ADD LLTR S075 8.8665 49.2565 320 0 /
ADD LLTR S076 7.6542 49.2880 320 1 S080 /
ADD LLTR S080 8.1150 49.2047 320 2 S081 S112 /
ADD LLTR S081 8.9085 49.1382 320 2 S082 /
ADD LLTR S082 9.3097 49.1592 320 2 S085 /
ADD LLTR S083 9.9757 49.3012 320 0 /
ADD LLTR S084 10.3208 49.4438 320 0 /
ADD LLTR S085 10.0738 49.1372 320 2 S086 /
ADD LLTR S086 10.5082 49.3580 320 2 S091 /
ADD LLTR S087 11.0605 49.7112 320 0 /
ADD LLTR S088 11.5813 50.0980 320 0 /
ADD LLTR S089 11.5548 49.7602 320 0 /
ADD LLTR S090 11.3172 49.5242 320 0 /
ADD LLTR S091 11.2045 49.3985 320 2 S092 /
ADD LLTR S092 11.9140 49.7382 320 3 /
ADD LLTR S093 11.0708 49.3368 320 0 /
ADD LLTR S094 10.6817 49.2088 320 0 /
ADD LLTR S095 9.7490 49.0492 320 0 /
ADD LLTR S096 9.0707 49.0788 320 0 /
ADD LLTR S097 8.6872 49.0390 320 0 /
ADD LLTR S098 8.4423 48.9477 320 0 /
ADD LLTR S099 10.1288 48.9783 320 0 /
ADD LLTR S100 10.8548 49.0155 320 0 /
ADD LLTR S101 11.4657 49.2792 320 0 / 
ADD LLTR S102 12.0052 49.5522 320 0 / 
ADD LLTR S103 11.7370 49.1627 320 0 / 
ADD LLTR S112 8.2528 48.9760 320 2 S113 / 
ADD LLTR S113 8.3368 48.6590 320 1 S126 / 
ADD LLTR S114 8.8417 48.6213 320 0 / 
ADD LLTR S115 9.4502 48.6392 320 0 / 
ADD LLTR S116 8.2528 48.9760 320 2 S113 / 
ADD LLTR S117 11.9315 48.9042 320 0 / 
ADD LLTR S118 11.3923 48.5975 320 0 / 
ADD LLTR S119 10.6955 48.5643 320 0 / 
ADD LLTR S120 10.7493 48.7303 320 0 / 
ADD LLTR S121 11.9315 48.9042 320 0 / 
ADD LLTR S122 11.3923 48.5975 320 0 / 
ADD LLTR S123 10.6955 48.5643 320 0 / 
ADD LLTR S124 9.7680 48.5238 320 0 / 
ADD LLTR S125 9.2963 48.3935 320 0 / 
ADD LLTR S126 8.5155 48.3517 320 2 S127 / 
ADD LLTR S127 8.9790 48.3557 320 2 S128 / 
ADD LLTR S128 9.5508 48.3212 320 2 S129 / 
ADD LLTR S129 10.3640 48.2665 320 2 S130 / 
ADD LLTR S130 11.1328 48.4627 320 2 S131 / 
ADD LLTR S131 11.7902 48.6482 320 2 S132 / 
ADD LLTR S132 12.2192 48.9285 320 2 S133 / 
ADD LLTR S133 12.8697 49.1843 320 3 / 
ADD LLTR S134 13.0070 48.9877 320 0 / 
ADD LLTR S135 12.5002 48.5810 320 0 / 
ADD LLTR S136 11.6235 48.3253 320 0 / 
ADD LLTR S137 12.1932 48.1695 320 0 / 

DATA FILE TO READ IN ROZ INFORMATION

ADD ROZ T1ROZ1 8
8.5807E+00 5.1252E+01 8.4132E+00 5.1652E+01
8.6016E+00 5.1998E+01 9.3551E+00 5.2211E+01
1.0171E+01 5.2024E+01 1.0255E+01 5.1732E+01
9.8257E+00 5.1452E+01 9.4807E+00 5.1292E+01 / /)

ADD ROZ T1ROZ2 8
8.7508E+00 5.0853E+01 9.1877E+00 5.0959E+01
9.4598E+00 5.0840E+01 9.4598E+00 5.0666E+01
8.9939E+00 5.0560E+01 8.4551E+00 5.0507E+01
8.4746E+00 5.0626E+01 8.4760E+00 5.0746E+01 / /)

ADD ROZ T1ROZ3 5
9.7947E+00 5.0200E+01 1.1009E+01 5.0001E+01
1.1555E+01 4.9655E+01 9.7528E+00 4.9468E+01
8.7900E+00 4.9708E+01 / /)

ADD ROZ T1ROZ4 6
1.2034E+01 4.9442E+01 1.2265E+01 4.9255E+01
1.1344E+01 4.8789E+01 1.0213E+01 4.8536E+01

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ADD ROZ TIROZ5 4
1.3018E-01 4.8936E-01 1.3499E-01 4.8563E-01
1.2579E-01 4.8163E-01 1.1385E-01 4.8217E-01

FILE TO ADD STAGING BASES

ADD STGB FAIRFORD -1.750 51.58333 FI11 4 99 99 99 99 99 0 0 0 0 0
ADD STGB LAKENHTH 0.5833 52.40000 FI11 2 99 99 99 99 99 0 0 0 0 0
ADD STGB MILDENHA 0.5000 52.36667 FI11 2 99 99 99 99 99 0 0 0 0 0
ADD STGB BENTVATE 1.4167 52.13333 F-4 6 99 99 99 99 99 0 0 0 0 0
ADD STGB BITBURG 6.533 49.9667 F-4 2 99 99 99 99 99 0 0 0 0 0
ADD STGB SPANGDAH 6.667 49.933 F-4 2 99 99 99 99 99 0 0 0 0 0
ADD STGB HAHN 7.25 49.933 F-16 4 0 99 0 0 0 0 0 0 0 0
ADD STGB RAMSTEIN 7.5667 49.433 F-16 6 99 99 99 99 99 0 0 0 0 0
ADD STGB SEHBACH 7.8833 49.5 F-4 2 99 99 99 99 99 0 0 0 0 0
ADD STGB LAHR 7.933 50.05 F-4 10 99 99 99 99 99 0 0 0 0 0
ADD STGB SOLLING 8.0833 48.7833 F-4 8 99 99 99 99 99 0 0 0 0 0
ADD STGB VIESBADN 8.33 50.05 F-4 2 99 99 99 99 99 0 0 0 0 0

ADD TG PANENSKY 13.9333 50.31667 OCA 1 2 .85
ADD TG ZOLLSCHN 12.1167 51.2667 OCA 2 3 .97
ADD TG PRESCHEN 14.65 51.65 OCA 3 1 .87
ADD TG CASLAV 15.3833 49.95 OCA 4 3 .95
ADD TG LEIPZIG 12.45 51.433 OCA 5 7 .99
ADD TG PRAGUE 14.2667 50.11667 OCA 6 7 .98

FILE TO ADD VEHP DATA

ADD VEHP F-4 0.133 22 35 50000 0 3.33 0
4.36 0.0 4.17 4.72 4.72 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
1
10 0 4 10 10 0 0 0 0 0
0 0 0 0 0 0 0 0
-2.2 -2.2 -2.2 -2.2 -2.2 -2.2 -2.2 -2.2
120 FI11 /

ADD VEHP F-4 0.133 22 35 16800 0 3.33 0
4.17 4.44 4.17 4.72 3.89 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
1
6 6 2 6 6 0 0 0 0
0 0 0 0 0 0 0 0
-2.2 -2.2 -2.2 -2.2 -2.2 -2.2 -2.2 -2.2
120 F-4 /

ADD VEHP F-16 0.133 22 35 14500 0 1.67 0
```
1.94 2.78 4.61 2.42 2.08 0.00 0.00 0.00 0.00 0.00
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
1
4 6 2 4 4 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
-2.2 -2.2 -2.2 -2.2 -2.2 -2.2 -2.2 -2.2 -2.2 -2.2
120 F-16

; FILE TO ADD WEAPONS PARAMETERS

; ADD WEAP WEAP
.10 .0 .35 .12 .25 0 0 0 0 0
.08 .0 .30 .10 .20 0 0 0 0 0
.06 .0 .25 .08 .15 0 0 0 0 0
.04 .0 .22 .07 .12 0 0 0 0 0
.03 .0 .20 .06 .10 0 0 0 0 0
.08 .30 .30 .19 .25 0 0 0 0 0
.07 .26 .25 .17 .19 0 0 0 0 0
.05 .22 .20 .15 .13 0 0 0 0 0
.03 .18 .17 .13 .09 0 0 0 0 0
.02 .15 .14 .11 .07 0 0 0 0 0
.0 .28 .22 .0 .0 0 0 0 0 0
.0 .23 .17 .0 .0 0 0 0 0 0
.0 .20 .13 .0 .0 0 0 0 0 0
.0 .20 .11 .0 .0 0 0 0 0 0
.0 .20 .08 .0 .0 0 0 0 0 0
5
MARK-82 AGM-65 MARK-84 CBU-38 MARK-20

; FILE TO ADD WEAPONS FREE ZONES

ADD WFZ DUSLDORF 4 6.25 51.45 7.25 51.76667 7.6667 51.5 7.00 51.0833
ADD WFZ FRANKFRT 4 8.3833 50.11667 8.667 50.2333 9.0 50.0833 8.633 49.75
ADD WFZ STUTGART 3 9.0 49.0 9.5 48.8333 9.0 48.667

; DATA FILE TO ADD THREAT MODELS TO TMDL TABLE

ADD TMDL SA-2B
20.0
0.0
6
1
0.0
0.0
4.0
0.0
0.0007 0.0005 0.00035 0.00030 0.00025 0.00020
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 /
1.5240E+04
250.0 /
```
ADD TMDL SA-2F
31.0
0.0
9
1
0.0
0.0
3.875
0.0
0.0010 0.0007 0.0006 0.0005 0.0004 0.00035
0.00030 0.00025 0.00020
0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0
/ 1.5240E-04
250.0 /

ADD TMDL SA-3
12.5
0.0000E+00
4
1
0.0
0.0
4.1667
0.0
0.001 0.0007 0.0003 0.0002 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
/ 1.5240E+04
0.0 /

ADD TMDL SA-4
43.0
0.0
11
6
-43.0
0.0
8.6
8.6
0.0000 0.0004 0.0009 0.0012 0.0014
0.0016 0.0015 0.0009 0.0004 0.0002
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0007 0.0013 0.0017 0.0021
0.0022 0.0016 0.0009 0.0004 0.0001
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0010 0.0000 0.0000 0.0000
0.0000 0.0009 0.0017 0.0026 0.0027
0.0021 0.0014 0.0008 0.0004 0.0001

C-26
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
1.5240E+04
250.0
ADD TMDL SA-6
18.5
0.0
11
6
-18.5
0.0
3.7
3.7
0.0000 0.0010 0.0020 0.0030 0.0035
0.0060 0.0010 0.0005 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
C-27
1.5240E-04
0.0000E+00 /

ADD TMDL SA-7
2.15
0.0
1
0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
1.5240E-04
0.0000E+00 /

ADD TMDL SA-8
9.0
0.0
7
4
-9.0
0.0
3.0
3.0
0.0 0.020 0.030 0.00 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.04 0.020 0.00 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
1.5240E-04
0.0000E+00 /

ADD TMDL SA-9
5.0
0.0
1
0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
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0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
/
1.5240E+04
0.0 /
;
ADD TMDL SA-11
18.5
0.0
11.
6
-18.5
0.0
3.7
3.7
0.0 0.004 0.008 0.016 0.010 0.004 0.001
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.004 0.008 0.012 0.008 0.004 0.001
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.003 0.006 0.010 0.006 0.002 0.000
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.004 0.006 0.004 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.004 0.002 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.005 0.0 0.0 0.0 0.0 0.0 0.0
/
1.5240E+04
0.0000E+00 /
;
ADD TMDL ZSU-23-4
3.0
0.0
1
0
0.0
0.0
0.0
0.0
0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
/
1.5240E+04
0.0 /
;
ADD TMDL BARLOCK
44.4
0.0
1
0
0.0

C-29
0.0
0.0
0.0
0.0002 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
/
1.5240E-04
0.0000E-00 /

; ADD TMDL BIGBAR
44.4
0.0
1
0
0
0
0
0
0.0002 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
/
1.5240E-04
0.0000E-00 /

; ADD TMDL NYSAC
44.4
0.0
1
0
0
0
0
0
0.0002 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
/
1.5240E-04
0.0000E-00 /

; ADD TMDL SPONREST
42.81
0.0
1
0
0
0
0
0
0.0002 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
/
1.5240E-04
0.0000E-00 /

; ADD TMDL FLATFACE
42.81
0.0
1
0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
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0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
1.5240E+04
0.0000E+00
/
ADD TMDL SQUATEYE
51.23
0.0
1
0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
1.5240E+04
0.0000E+00
/
ADD TMDL FARMGATE
42.81
0.0
1
0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
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0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
1.5240E+04
0.0000E+00
/
ADD TMDL TALLKING
47.62
0.0
1
0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
1.5240E+04

C-31
0.0000E+00 /
;
ADD TMDL BACKNET
42.81
0.0
1
0
0.0
0.0
0.0
0.0
0.0
0.002 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
/
1.5240E+04
0.0000E+00 /
;
ADD TMDL SA-6CC
18.5
0.0
1
0
0.0
0.0
0.0
0.0
0.030 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
/
1.5240E+04
0.0000E+00 /
;
ADD TMDL SA-8CC
9.0
0.0
1
0
0.0
0.0
0.0
0.0
0.022 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
/
1.5240E+04
0.0000E+00 /
;
FILE TO ADD FIXED THREATS TO THRT TABLE
;
ADD THRT S601
SA-6
1.2082E+01 5.0615E+01 3.05
1.0000E+00 /
;
ADD THRT S602

C-32
SA-6
1.2197E+01 5.0427E+01 3.05
1.0000E+00 /
ADD THRT S603
SA-6
1.2293E+01 5.0264E+01 3.05
1.0000E+00 /
ADD THRT S604
SA-6
1.2440E+01 4.9740E+01 3.05
1.0000E+00 /
ADD THRT S605
SA-6
1.2660E+01 4.9391E+01 3.05
1.0000E+00 /
ADD THRT S606
SA-6
1.2938E+01 4.9270E+01 3.05
1.0000E+00 /
ADD THRT S607
SA-6
1.3310E+01 4.9159E+01 3.05
1.0000E+00 /
ADD THRT S608
SA-6
1.3690E+01 4.9050E+01 3.05
1.0000E+00 /
ADD THRT S609
SA-6
1.4013E+01 4.9038E+01 3.05
1.0000E+00 /
ADD THRT S610
SA-6
1.4560E+01 4.8863E+01 3.05
1.0000E+00 /
ADD THRT S611
SA-6
1.5204E+01 4.8838E+01 3.05
1.0000E+00 /
ADD THRT S612
SA-6
1.5849E+01 4.8782E+01 3.05
C-33
1.00000E+00 /

ADD THRT S613
SA-6
10.1000 50.7500 3.05
1.00000E+00 /

ADD THRT S614
SA-6
10.2000 50.6500 3.05
1.00000E+00 /

ADD THRT S615
SA-6
10.1500 50.800 3.05
1.00000E+00 /

ADD THRT S616
SA-6
10.1740 50.8967 3.05
1.00000E+00 /

ADD THRT S617
SA-6
10.2973 50.4333 3.05
1.00000E+00 /

ADD THRT S618
SA-6
10.2515 50.7138 3.05
1.00000E+00 /

ADD THRT S619
SA-6
10.7184 51.0000 3.05
1.00000E+00 /

ADD THRT S620
SA-6
10.8324 51.7534 3.05
1.00000E+00 /

ADD THRT S621
SA-6
10.8996 50.4023 3.05
1.00000E+00 /

ADD THRT S622
SA-6
11.0476 50.3843 3.05
1.00000E+00 /

C-34
ADD THRT S623
  SA-6
  11.2339 50.4023 3.05
  1.00000E+00

ADD THRT S624
  SA-6
  11.5034 50.4145 3.05
  1.00000E+00

ADD THRT S625
  SA-6
  11.9971 50.4053 3.05
  1.00000E+00

ADD THRT S201
  SA-2B
  10.6602 51.9875 6.10
  1.00000E+00

ADD THRT S202
  SA-2B
  10.3127 51.5167 6.10
  1.00000E+00

ADD THRT S203
  SA-2B
  9.9872 51.3667 6.10
  1.00000E+00

ADD THRT S204
  SA-2B
  10.2003 51.1667 6.10
  1.00000E+00

ADD THRT S205
  SA-2B
  10.0354 50.9833 6.10
  1.00000E+00

ADD THRT S206
  SA-2B
  10.078 51.1967 6.10
  1.00000E+00

ADD THRT S207
  SA-2B
  10.0204 50.8333 6.10
  1.00000E+00

ADD THRT S208
  SA-2B

C-35
ADD THRT S209
SA-2B
12.5093 49.9872 6.10
1.0000E+00 /

ADD THRT S210
SA-2E
13.0894 49.0252 6.10
1.0000E+00 /

ADD THRT S211
SA-2F
10.0301 50.9833 6.10
1.0000E+00 /

ADD THRT S212
SA-2F
10.0600 50.9167 6.10
1.0000E+00 /

ADD THRT S213
SA-2F
12.1433 50.3167 6.10
1.0000E+00 /

ADD THRT S214
SA-2F
13.0105 49.3333 6.10
1.0000E+00 /

ADD THRT S215
SA-2F
13.7603 48.5197 6.10
1.0000E+00 /

ADD THRT S216
SA-2F
11.5333 50.4023 6.10
1.0000E+00 /

ADD THRT S217
SA-2F
11.3901 51.8347 6.10
1.0000E+00 /

ADD THRT S218
SA-2F
12.1205 51.2501 6.10
1.0000E+00 /

C-36
ADD THRT S219
  SA-2F
  12.6923  51.3067  6.10
  1.0000E+00 /

ADD THRT S220
  SA-2F
  15.3901  49.9420  6.10
  1.0000E+00 /

ADD THRT A001
  ZSU-23-4
  1.2850E+01  5.0245E+01  1.5
  1.0000E+00 /

ADD THRT A002
  ZSU-23-4
  1.2938E+01  5.0283E+01  1.5
  1.0000E+00 /

ADD THRT A003
  ZSU-23-4
  1.2235E+01  5.1319E+01  1.5
  1.0000E+00 /

ADD THRT A004
  ZSU-23-4
  1.2293E+01  5.1394E+01  1.5
  1.0000E+00 /

ADD THRT A005
  ZSU-23-4
  1.2410E+01  5.1287E+01  1.5
  1.0000E+00 /

ADD THRT A006
  ZSU-23-4
  1.2528E+01  5.1331E+01  1.5
  1.0000E+00 /

ADD THRT A007
  ZSU-23-4
  1.3593E+01  5.0327E+01  1.5
  1.0000E+00 /

ADD THRT A008
  ZSU-23-4
  10.1089  50.6167  1.5
  1.0000E+00 /

ADD THRT A009

C-37
ZSU-23-4
10.0600 51.0167 1.5
1.0000E+00 /

ADD THRT A010
  ZSU-23-4
  10.0979 50.6245 1.5
  1.0000E+00 /

ADD THRT S401
  SA-2
  10.1074 50.6347 3.05
  1.0000E+00 /

ADD THRT S402
  SA-2
  10.6845 50.5324 3.05
  1.0000E+00 /

ADD THRT S403
  SA-2
  11.9874 50.5023 3.05
  1.0000E+00 /

ADD THRT S404
  SA-2
  10.8324 51.7430 3.05
  1.0000E+00 /

ADD THRT S405
  SA-2
  1.4539E+01 5.0182E+01 3.05
  1.0000E+00 /

ADD THRT S406
  SA-2
  14.2667 50.1742 3.05
  1.0000E+00 /

ADD THRT S407
  SA-2
  14.3057 49.1102 3.05
  1.0000E+00 /

ADD THRT S408
  SA-2
  14.7147 51.7034 3.05
  1.0000E+00 /

ADD THRT S409
  SA-2
  14.5478 51.8477 3.05
  1.0000E+00 /

C-38
ADD THRT S410
   SA-4
   13.6034 50.3792 3.05
   1.0000E+00 /

ADD THRT SE01
   SQUATEYE
   1.2782E+01 5.0025E+01 30.5
   1.0000E+00 /

ADD THRT SE02
   SQUATEYE
   1.2332E+01 5.1294E+01 30.5
   1.0000E+00 /

ADD THRT SE03
   SQUATEYE
   1.2616E+01 5.0389E+01 30.5
   1.0000E+00 /

ADD THRT SE04
   SQUATEYE
   1.4413E+01 5.0031E+01 30.5
   1.0000E+00 /

ADD THRT SE05
   SQUATEYE
   1.5371E+01 4.9918E+01 30.5
   1.0000E+00 /

ADD THRT SE06
   TALLKING
   1.5556E+01 5.1545E+01 13.72
   1.0000E+00 /

ADD THRT SE07
   BARLOCK
   15.4001 49.9520 6.1
   1.0000E+00 /

ADD THRT SE08
   BACKNET
   14.2441 50.1201 3.05
   1.0000E+00 /

ADD THRT SE09
   FARMGATE
   12.2032 51.8143 3.05
   1.0000E+00 /

C-39
ADD THRT SE10
SPONREST
14.9599 51.3348 3.05
1.0000E+00 /

ADD THRT SE11
SQUATEYE
10.9136 51.8782 30.5
1.0000E+00 /

ADD THRT SE12
SQUATEYE
10.2754 51.2543 30.5
1.0000E+00 /

ADD THRT SE13
TALLKING
10.1784 50.6874 13.72
1.0000E+00 /

ADD THRT SE14
BARLOCK
11.1997 50.5832 6.1
1.0000E+00 /

ADD THRT SE15
BACKNET
13.0145 49.4872 3.05
1.0000E+00 /

ADD THRT SE16
FARMGATE
13.8402 49.1854 3.05
1.0000E+00 /

ADD THRT SE17
SPONREST
14.1432 48.7231 3.05
1.0000E+00 /

ADD THRT S801
SA-8
1.5700E-01 4.8937E+01 3.05
1.0000E+00 /

ADD THRT S802
SA-8
1.5500E+01 4.8883E+01 3.05
1.0000E+00 /

ADD THRT S803
SA-8
C-40
1.5200E+01 4.9023E+01 3.05
1.0000E+00 /

ADD THRT S804
SA-8
10.1977 51.1170 3.05
1.0000E+00 /

ADD THRT S805
SA-8
10.2172 51.4798 3.05
1.0000E+00 /

ADD THRT S806
SA-8
10.8667 50.4025 3.05
1.0000E+00 /

ADD THRT S807
SA-8
10.3020 51.5267 3.05
1.0000E+00 /

ADD THRT S808
SA-8
10.7231 50.2032 3.05
1.0000E+00 /

ADD THRT S809
SA-8
10.5956 51.7833 3.05
1.0000E+00 /

ADD THRT S810
SA-8
10.8034 50.4503 3.05
1.0000E+00 /

ADD THRT S811
SA-8
10.9832 50.3982 3.05
1.0000E+00 /

ADD THRT S812
SA-8
11.3201 50.5203 3.05
1.0000E+00 /

ADD THRT S813
SA-8
12.1463 50.4972 3.05
1.0000E+00 /

C-41
ADD THRT S814
   SA-8
   9.9034 50.7167 3.05
   1.0000E+00 /

ADD THRT S815
   SA-8
   12.1284 51.2599 3.05
   1.0000E+00 /

FILE TO ADD MOBILE SAM ENVELOPES

ADD STCH M601 SA-6CC 0.0 0.0 3.05
  5 0.8 0.0 4
  11.333 51.917
  11.000 51.667
  10.667 51.833
  10.833 52.000 /
  1.0 /

ADD STCH M602 SA-6CC 0.0 0.0 3.05
  4 0.95 0.0 5
  10.667 51.250
  10.250 51.250
  10.000 51.333
  10.500 51.500
  11.000 51.500 /
  1.0 /

ADD STCH M603 SA-6CC 10.333 50.667 3.05
  2 0.85 18.0 0
  0.0 0.0 /
  1.0 /

ADD STCH M604 SA-6CC 0.0 0.0 3.05
  1 1.0 0.0 4
  10.667 50.333
  10.833 50.250
  10.583 50.250
  10.583 50.333 /
  1.0 /

ADD STCH M605 SA-6CC 0.0 0.0 3.05
  5 0.90 0.0 4
  13.040 49.440
  12.917 49.390
  12.833 49.430
  13.000 49.540 /
  1.0 /

ADD STCH M801 SA-8CC 10.75 51.50 3.05

C-42
3 0.9 20.0 0
0.0 0.0 /
1.0 /
;
ADD STCH M802 SA-8CC 0.0 0.0 3.05
4 0.75 0.0 3
11.150 50.382
11.421 50.399
11.207 50.350
/
1.0 /
;
ADD STCH M803 SA-8CC 0.0 0.0 3.05
4 0.78 0.0 3
10.333 50.583
10.333 50.500
10.167 50.583 /
1.0 /
;
ADD STCH M804 SA-8CC 0.0 0.0 3.05
4 0.85 0.0 3
13.000 49.750
12.500 49.615
12.500 49.900 /
1.0 /
;
ADD STCH M805 SA-8CC 0.0 0.0 3.05
3 0.95 0.0 6
13.917 49.250
13.667 48.917
13.290 49.000
13.000 49.333
13.000 49.417
13.333 49.417 /
1.0 /
;
ADD STCH M806 SA-8CC 0.0 0.0 3.05
4 0.97 0.0 3
11.450 50.500
12.120 50.421
12.500 50.000 /
1.0 /
;
FILE TO ADD SUPRESSOR MODELS
;
ADD SUPM EF-111 35.0 12
SA-2B SA-2F SA-3 SA-4 BARLOCK BIGBAR NYSAC SPOONREST FLATFACE SQUATEYE FARMGATE TALLKING BACKNET BACKTRAP /
0.9 0.9 0.9 0.9 0.9 0.9 0.9 0.9 0.9
0.9 0.9 0.9 0.9 0.9 0.9 0.9 0.9 0.9
/

C-43
### ADD SUPM COMPCALL 40.0 20
SA-2B SA-2F SA-3 SA-4 SA-11 ZSU-23-4 BARLOCK BIGBAR
NYSAC SPONREST FLATFACE
SQUATETE FARMGATE TALLKING BACKNET

<table>
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### ADD SUPW VILEVEAS 15.0 6
SA-6CC SA-8CC

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### ADD SUPP POSITIONS

<table>
<thead>
<tr>
<th>ADD SUPP EF-1111 EF-111 11.992 49.908 2.0</th>
</tr>
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<tbody>
<tr>
<td>ADD SUPP VILEVE1 VILEVEAS 12.348 49.947 2.0</td>
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<tr>
<td>ADD SUPP COMPC1 COMPCALL 11.972 49.788 2.0</td>
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<td>ADD SUPP EF-1112 EF-111 9.836 50.946 2.0</td>
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<td>ADD SUPP VILEVE2 VILEVEAS 10.109 50.933 2.0</td>
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<td>ADD SUPP COMPC2 COMPCALL 9.648 50.946 2.0</td>
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### DATA FILE TO READ IN PBOR INFORMATION

15.0000 49.0333 15.1667 49.0000 15.1667 48.9500 15.3333 49.0000
17.1500 48.0167 17.2500 48.0167 17.2667 48.0000 |

#### ADD PBOR POLCZE 50 14.9833 51.0000 15.0333 51.0167 15.0500 51.1067
15.0667 51.0167 15.1500 50.9833 15.1500 51.0167 15.1833 51.0167
15.1833 50.9833 15.2500 51.0000 15.2500 50.9833 15.2833 50.9833
15.3000 50.9667 15.2667 50.9333 15.3000 50.8667 15.3667 50.8333
15.3667 50.7833 15.4000 50.7667 15.4500 50.8167 15.7000 50.7333
15.8333 50.7500 15.8667 50.6667 16.0000 50.6833 16.0333 50.6333
16.0000 50.6000 16.0667 50.6167 16.1000 50.6667 16.1667 50.6500
17.0000 50.2500 17.1000 50.4000 17.1500 50.3833 17.2000 50.3833
17.2833 50.3167 17.3500 50.3167 17.3500 50.2667 17.4000 50.2833
17.4333 50.2500 17.5000 50.2667 17.6000 50.2667 17.6833 50.3167
17.7500 50.3000 17.7500 50.2000 17.6000 50.1667 17.6667 50.1000
17.7333 50.1000 17.8333 49.9667 18.0000 50.0167 |

#### ADD PBOR VESGER 26 11.0000 50.3500 11.1167 50.3500 11.2500 50.2667
11.2500 50.4833 11.3500 50.5333 11.5333 50.3833 11.9167 50.4167
12.0000 50.3500 12.1333 50.3167 12.2833 50.0500 12.4333 50.0000

C-44
| ADD PBOR BERLIN | 38 | 13.5500 | 52.3833 | 13.5667 | 52.3667 | 13.6500 | 52.3667 |
| ADD PBOR NWGGER | 82 | 7.2167 | 53.0000 | 7.1000 | 52.8500 | 7.0667 | 52.6333 |
| ADD PBOR SWGGER | 59 | 6.1333 | 50.1333 | 6.1167 | 50.1667 | 6.0333 | 50.1833 |
| ADD PBOR FRBEAC | 92 | -2.0000 | 48.6667 | -1.9833 | 48.6833 | -1.8500 | 48.7167 |

**Data in Table:**
- Data entries in columns include various coordinates and values, possibly indicating geographic or other data points.
- The table continues with similar data entries.
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The ZCONTNU.DAT (z-continue) command file is the command file that is normally read to begin a FLAPS session. It re-opens all of the data files from the last FLAPS session. This permits a user to continue from the point where they quit at the end of their last session. The ZCONTNU.DAT command file is
read automatically by FLAPS when a user answers "YES" to the prompt asking whether the previous FLAPS files should be read.

The following is a sample of a ZCONTNU command file.

```
; NORMAL RUN
; OPEN TSTR OLD TSTR.FIL  R
  INIT
OPEN ASTR OLD ASTR.FIL  R
  INIT
; OPEN TABLES
; OPEN ALGP OLD ALGP.FIL  R/V
OPEN CURR OLD CURR.FIL  R/W
OPEN CMDL OLD CMDL.FIL  SR
OPEN DISP OLD DISP.FIL  R/SW
OPEN GEOM OLD GEOM.FIL  R/SW
OPEN LLTR OLD LLTR.FIL  R/W
OPEN NODP OLD NODP.FIL  R/SW
OPEN PBOR OLD PBOR.FIL  R
OPEN ROZ OLD ROZ.FIL  R/W
OPEN SPED OLD SPED.FIL  R/SW
OPEN STCH OLD STCH.FIL  R/V
OPEN STGB OLD STGB.FIL  R/W
OPEN SUPM OLD SUPM.FIL  R/V
OPEN SUPP OLD SUPP.FIL  R/W
OPEN SVCH OLD SVCH.FIL  R/V
OPEN TG OLD TG.FIL  R/W
OPEN THRT OLD THRT.FIL  R/W
OPEN TMDL OLD TMDL.FIL  R/W
OPEN VEHP OLD VEHP.FIL  R/W
OPEN WEAP OLD WEAP.FIL  R/W
OPEN WFZ OLD WFZ.FIL  R/W
; OPEN ARRAYS
; OPEN ALTG OLD ALTG.FIL  SR/W
OPEN ALTS OLD ALTS.FIL  SR/W
OPEN ARCS OLD ARCS.FIL  R/SW
OPEN ARPE OLD ARPE.FIL  R/SW
OPEN CL3D OLD CL3D.FIL  SR/W
OPEN ITGC OLD ITGC.FIL  R/SW
OPEN ITRC OLD ITRC.FIL  R/SW
OPEN NBOX OLD NBOX.FIL  R/SW
OPEN NLIS OLD NLIS.FIL  R/SW
OPEN NPOS OLD NPOS.FIL  R/SW
OPEN ROUT OLD ROUT.FIL  R/SW
```
OPEN STAT OLD STAT.FIL SR/V
OPEN SXPE OLD SXPE.FIL R/SV
OPEN TGUS OLD TGUS.FIL R/SW
OPEN TH2D OLD TH2D.FIL SR/V
OPEN TH3D OLD TH3D.FIL SR/V
OPEN TOBS OLD TOBS.FIL SR/V
OPEN TRPE OLD TRPE.FIL R/SV

; TEMPORARY TERRAIN MASKED FILE
; OPEN MASK OLD MASK.FIL SR/V
; OPEN BYTE PACKED TERRAIN DATA

OPEN BYTE OLD DRA1:[FLAPS.TEST]Z8E48N.ZOT SR
PR GE
DB 5
END
FILMED
4-86
DTIC