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DLA-92-P00223

**DEPOT MACRO ANALYSIS PROGRAM
USER GUIDE DOCUMENTATION
VERSION 1.0**

September 1992



OPERATIONS RESEARCH AND ECONOMIC ANALYSIS OFFICE

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**DEPARTMENT OF DEFENSE
DEFENSE LOGISTICS AGENCY**

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USER GUIDE DOCUMENTATION
VERSION 1.0**

September 1992

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**Benedict C. Roberts
Thomas P. Lanagan**

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DEFENSE LOGISTICS AGENCY
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DEFENSE LOGISTICS AGENCY

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DLA-LO

FOREWORD

In reviewing the analysis needs which would be required to support various Defense Management Report Decisions (DMRD) within the Defense Logistics Agency (DLA), it was determined that DLA required more responsive analytical support tools for assisting senior management in developing strategic insight of critical Agency business operations. Consequently, the Office of Policy and Plans (DLA-L), together with the Directorate of Supply Operations (DLA-O), directed that a macro-level graphical model be prototyped for use by Agency support staff for rapidly evaluating Agency business patterns under alternative decision options.

The authors of this user guide are indebted to the staffs of the Weapons System Support Office (DLA-ORW), the Logistics Management Branch of the Supply Operations Division (DLA-OSL), the Consumable Item Management Office (DLA-UM), and the Distribution Programs Branch of the Depot Operations Divisions (DLA-OWP) who participated in various reviews of the model design. Additionally, our appreciation is expressed to Mr. Patrick F. Miller, who is currently assigned to the Defense General Supply Center Operations Research and Economic Analysis Office, for his initial software engineering support under this project.

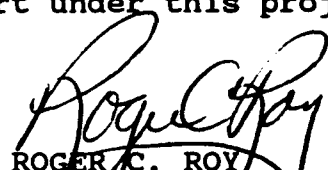

ROGER C. ROY
Assistant Director
Policy and Plans

TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
	FOREWORD	iii
	TABLE OF CONTENTS	v
	LIST OF COMPUTER SCREENS	vii
	EXECUTIVE SUMMARY	ix
1	INTRODUCTION	1-1
1.1	Purpose	1-1
1.2	Background	1-1
1.3	Scope	1-2
1.4	Visual Interactive Modeling	1-3
1.5	Benefits	1-3
1.6	Acquiring DMAP Software	1-3
2	USING DMAP	2-1
2.1	Installing DMAP	2-1
2.1.1	System Requirements	2-1
2.1.2	Installation Instructions	2-1
2.2	Executing DMAP	2-2
2.2.1	DMAP Commands	2-2
2.2.2	Quick Reference Guide	2-3
2.2.3	Data Files	2-3
2.3	Types of DMAP Applications	2-4
2.3.1	Advanced User Features	2-4
3	DMAP EXAMPLE SESSION	3-1
3.1	DMAP Introduction and Log System	3-1
3.2	DMAP Files Option	3-3
3.2.1	Load Locations	3-4

TABLE OF CONTENTS (Continued)

<u>Section</u>	<u>Title</u>	<u>Page</u>
3.2.2	Load Capacities	3-8
3.2.3	Load Location Information	3-10
3.2.4	Load Materiel Flows	3-13
3.3	DMAP Analysis Option	3-15
3.3.1	Locations	3-16
3.3.2	Categories	3-18
3.3.3	Options	3-19
3.4	DMAP Set Color Option	3-32
3.5	DMAP Help Option	3-33
3.6	DMAP Exit to DOS Option	3-34
	APPENDIX A: USER DATA FILES	A-1
	APPENDIX B: MATH TECHNIQUES	B-1
	APPENDIX C: CLUSTER REGIONS	C-1

LIST OF COMPUTER SCREENS

<u>Number</u>	<u>Title</u>	<u>Page</u>
3-1	Introductory Screen	3-1
3-2	Log Screen	3-2
3-3	Main Menu Screen	3-3
3-4	Files Sub-Menu Screen	3-4
3-5	Load Locations Path Screen	3-5
3-6	Load Locations Directory Listing	3-6
3-7	Displayed Locations Screen	3-7
3-8	Load Capacities Directory Listing	3-8
3-9	Capacities Successfully Loaded Screen	3-9
3-10	Load Location Information Directory Listing	3-10
3-11	Unmatched Locations Listing	3-11
3-12	Location Information Successfully Loaded Screen	3-12
3-13	Load Materiel Flows Directory Listing	3-13
3-14	Materiel Flows Successfully Loaded Screen	3-14
3-15	Analysis Sub-Menu Screen	3-15
3-16	Location Selection List	3-16
3-17	Tracy Selection Screen	3-17
3-18	Category Selection List	3-18
3-19	Options Selection List - Asset Graph	3-19
3-20	Graphical Analysis Option	3-20
3-21	Options Selection List - Materiel Flows	3-21
3-22	Flow Analysis Option - Top 20 Selections	3-22
3-23	Flow Analysis Option - Top 20 Primary Customer Zones for Tracy	3-23
3-24	Flow Analysis Option - Circles The Logistical Crescent	3-24

LIST OF COMPUTER SCREENS (Continued)

<u>Number</u>	<u>Title</u>	<u>Page</u>
3-25	Flow Analysis Option - Circles Sources of Supply	3-25
3-26	Flow Analysis Option - One Way Center of Mass Based on All MROs	3-26
3-27	Flow Analysis Option - One Way Center of Mass Based on Barstow's MROs	3-27
3-28	Options Selection List - Move To	3-28
3-29	Move To Analysis Option	3-29
3-30	Move To Analysis Option Results	3-30
3-31	Flow Analysis Option - Top 20 Primary Customer Zones for Tracy After Augmentation	3-31
3-32	Set Color Option	3-32
3-33	Help Option	3-33
3-34	Exit to DOS Option	3-34

EXECUTIVE SUMMARY

The Defense Logistics Agency's (DLA) Directorate of Supply Operations (DLA-O), together with the Agency's Office of Policy and Plans (DLA-L), recognized the need for a "quick reaction" strategic depot assessment model. This model would provide senior management with a personal computer based graphical tool that could be rapidly applied to evaluate alternative stockage location decisions across all 30 Defense depots. The Depot Macro Analysis Program (DMAP) was developed by the DLA Operations Research and Economic Analysis Management Support Office (DORO) to meet the Agency's need.

This report documents the DMAP development work and provides a user's guide with a description of how the model is to be applied to address strategic stockage location issues. This user's guide is intended as a desk reference for DLA staff and other end users of the model who are supporting Agency management.

SECTION 1 INTRODUCTION

1.1 PURPOSE

The Depot Macro-Analysis Program (DMAP) Version 1.0 provides staff management with a graphical analysis model operating on PC-based workstations. The principal application of this model would be to empower staff management personnel with the capability to rapidly evaluate selected Agency business areas under alternative decisions and to gain macro-level insights through interactive analysis of business patterns.

The very name by which this software tool goes by, DMAP, is derived from the phrase "Depot Macro Analysis Program" which provides an indicator of the kind of analysis functions which this product was designed to support. Specifically, it was envisioned that the Agency could enhance efficiencies by rapidly evaluating policy options that had impacts on materiel flows and associated stock point operations. These types of policy assessments were anticipated to be required to support the various Defense Management Review Decisions (DMRDs) as the Department of Defense (DoD) moves into a more streamlined structure now that the United States has won the Cold War. Providing senior functional staff with a tool such as DMAP, results in the empowerment of that staff to conduct rapid assessments.

The intent of this guide is to provide general information on the DMAP software product, the computer environment in which it was designed and intended for use, as well as instructions on the general use of DMAP for analysis. Section 1 addresses the project history and how the DMAP software may be acquired. Section 2 provides instructions for installing the software plus a quick reference guide. Illustrated by Section 3 is an example of possible uses of DMAP as well as various program features such as the Help Option. Finally, selected technical features are described in the appendices; data files are explained in Appendix A, specialized math techniques are covered in Appendix B, and maps of transportation clusters are depicted in Appendix C.

1.2 BACKGROUND

During Fiscal Year (FY) 91-2, a series of reviews occurred between the Office of Policy and Plans (DLA-L) and the Directorate of Supply Operations (DLA-O). These reviews centered on the various DMRDs in terms of how the Defense Logistics Agency (DLA) could best provide "quick reaction" analytical support tools. These tools would be designed to empower functional staff elements with the capability to rapidly gain strategic insight on selected Agency business areas by means of graphical or statistical pattern analysis. To meet this objective it was deemed necessary to prototype a model which would operate on

PC-based workstations in lieu of the large computer mainframes. This was necessary in order to empower the broadest mix of functional staff personnel with the capability to conduct analysis on an interactive basis.

Following these initial reviews, a strategic initiatives briefing was provided by the DLA Operations Research and Economic Analysis Management Support Office (DORC) to DLA-O in May 1991. This presentation resulted in a task to initiate project work on rapidly developing a macro strategic model. Additionally, this model was to be explicitly designed for conducting high-level business pattern analysis. Further, it was required that the model have the capability to be easily run by the staff within functional offices who might not possess extensive computer expertise and that the model be operational by the end of the "current" calendar year (1991). Lastly, due to the interactions which of necessity exist between stock positioning and distribution functions, it was requested that the model be explicitly designed to facilitate evaluating strategic policy options for those two functional areas.

1.3

SCOPE

DMAP is a PC-based workstation tool which projects data on a macro-level for evaluating Agency business patterns. The model is at this time designed to project data across either national or state maps of the continental United States (U.S.). As a graphical shell analysis tool, DMAP has been structured to represent the 32 depot sites (i.e., since DMAP applications are defined by input data, any number of storage sites could be structured within DMAP) originally planned for wholesale stock distribution management under DLA. All customers and vendors have been grouped into eighty geographic clusters or zones based on an earlier transportation study conducted by DORO. Additionally, DMAP has an embedded underlying road network over which materiel flows are processed. This road network is based on actual road mileages between 89 cities within the lower 48 states. Distances within Alaska and Hawaii are based on air distances.

Materiel flows may be tracked at each of these depot sites for both inbound receipts from vendors and for outbound issues to customers. Consequently, policy impacts on depot capacities (i.e., workloads and storage) may be easily evaluated for alternative stockage decisions. This is easily accomplished since the user may select various stock categories for repositioning and the model will then recalculate the impact of that decision with respect to materiel flows and associated handling costs. These flows and estimated costs may be displayed to easily identify the top twenty customer or vendor zones for whatever category of materiel was selected for analysis.

1.4

VISUAL INTERACTIVE MODELING

The Agency has not previously had the capability to easily evaluate, by graphical analysis, critical business functions and their associated materiel flows. DMAP provides that capability by empowering the Agency's functional staff with a PC-based workstation model that explicitly develops patterns for selected flows. With DMAP and appropriate data files, the staff, whom are most familiar with a given business area, may quickly gain strategic insights at a macro-level by evaluating alternatives. This process is known as **visual interactive modeling**.

DMAP represents a graphical shell program which provides a structured basis for easily evaluating alternative management options. It operates by depicting depot materiel flows (i.e., both inbound and outbound transits) and their associated workloads and costs from a national or state perspective. Business patterns may be easily portrayed for both vendors and customers. These may be viewed from an individual depot or from a regional basis depending upon how the input data has been structured. The model also provides a capability to examine the "center of mass" (i.e., centroid) for any selected materiel flow process over any specified collection of depots.

1.5

BENEFITS

DMAP, when combined with appropriate data, will empower staff management with the capability to conduct **"quick and not so dirty"** policy impact analysis on designated Agency business areas. By graphically representing materiel flows and their associated costs at a macro-level, significant strategic insights will be obtained by evaluating alternative business patterns.

1.6

ACQUIRING DMAP SOFTWARE

This product was designed to meet an Agency need for acquiring an interactive graphical shell program for analysis of materiel flows. Distribution of DMAP for the purpose of meeting Agency analysis and support needs is authorized. Requests for DMAP should be officially directed to DORO through DLA-L. Configuration control of DMAP will be maintained by DORO. All requests for modifications should be directed to DLA-L. To support various Agency initiatives with DMAP, the following is recommended:

- (1) Annually update all depot workload and capacity data and transportation rate data. This can be accomplished by submitting a letter of request for updates to DLA-LO or by editing the capacity data file with the new information. See Appendix A for layout and data elements of the capacity data file.
- (2) When DMAP is employed under an Agency business area which has not previously been reviewed under DMAP, a

Technical Working Group (TWG) will be established by DLA-IO. The TWG will be composed of functional staff, DORO analysts, and DLA-LO. The TWG would conduct a "sanity" check on the use of DMAP under the new business area. This would assure the functional staff analysts that DMAP properly portrayed their specific function in a reasonable manner for conducting macro-level strategic evaluations. In addition, it will provide DORO the insight needed to provide a batch program which would extract data on a user specified time basis; e.g., this could be quarterly or annually and once established would be run on a batch basis with minimal impact on DORO.

SECTION 2 USING DMAP

2.1 INSTALLING DMAP

Procedures to install DMAP for a first time user have been reduced to loading a self-extracting compressed file which is provided on a single diskette (i.e., either a 5 1/4 inch low or high density floppy diskette, or a 3 1/2 inch high density diskette). Prior to these installation instructions, the user should insure that a workstation is available that meets or exceeds the system requirements.

2.1.1 SYSTEM REQUIREMENTS

The following requirements are recommended for DMAP users.

- (1) A PC-based workstation which is compatible with a Zenith 248 or better IBM compatible DOS machine.
- (2) A math coprocessor chip is strongly recommended for a Zenith 248 class of machine.
- (3) A video monitor that is based on an Enhanced Graphics Adapter (EGA) or better.
- (4) Random Access Memory (RAM) of at least 350 kilobytes (KB) for most versions of the DMAP software.
- (5) Disk Operating System (DOS) version 3.0 or higher.
- (6) Dot matrix printer (e.g., EPSON or ALPS compatible).
- (7) Free hard disk storage of at least 1.2 megabytes. This amount of space is required to support the typical executable release version of DMAP together with data files tailored for a specific business area.

2.1.2 INSTALLATION INSTRUCTIONS

Instructions are presented for installation from the A: drive. To install DMAP from the B: drive, substitute "B:" for "A:" in these instructions.

- (1) Insert the DMAP installation diskette into drive A:.
- (2) Make the drive containing the DMAP installation disk the default drive by typing the following command at the DOS prompt.

A:

- (3) To install DMAP in a directory called "DMAP" on the hard drive (e.g., the C: drive) of the computer, simply

type the following command at the DOS prompt.

RUNME C:\DMAP

This command executes a batch program on the installation diskette. The parameter "C:\DMAP", which describes where the DMAP system will be installed, is passed to the batch program. If the directory does not exist, it will be created by the batch program. This command completes the installation process.

- (4) DMAP can be executed by first making the directory containing the DMAP program the default directory. For example, if the DMAP executable code and data files have been loaded into a directory which is also called DMAP on the C: drive, type the following three DOS commands:

**C:
CD\DMAP
DMAP**

2.2 EXECUTING DMAP

Now that DMAP is fully installed, you are now ready to begin familiarization with the DMAP environment and applying this graphical shell program for interactive visual analysis of your specified business area. Before we do that, however, we will provide you with an abbreviated summary of the command keys which are available.

2.2.1 DMAP COMMANDS

DMAP has a complete menu-driven user interface. The user moves between menu options using the **Right**, **Left**, **Up**, and **Down** arrow keys. If a Mouse is installed, Mouse movements right, left, up, and down perform the same tasks as the arrow keys. Both the **Enter** key and the **Left Mouse** button can be used to select menu options. The **Escape** key or the **Right Mouse** Button will exit from any sub-menu. Repeated use of the **Escape** key will ultimately return the user to the main menu. To obtain on-line help for any menu option, highlight the option then press the **<F1>** key. Sub-menu definitions can be displayed at any time by pressing the **<F2>** key. If a dot-matrix printer is available, the **<F10>** key will activate a screen print of any DMAP screen.

2.2.2

QUICK REFERENCE GUIDE

Depicted below is a quick reference guide that illustrates the first and second level menu options of the DMAP program. Section 3 describes these options and others in detail. The purpose of this guide is to orient the new DMAP user as quickly as possible to the menu layout. Specific screen numbers have been included to aid in cross referencing with Section 3.

Files	Analysis	Set Color	Help	Exit to DOS
				(Screen 3-34) quit DMAP session
			(Screen 3-33) General instructions Main Menu options Sub-Menu definitions	
		(Screen 3-32) change Text Background color change Map Border color change Screen Border color change State Line color change Text color		
	(Screens 3-15 to 3-31) Location (select 1 to 3 locations for analysis) Category (select an item category for analysis) Options (select an analysis option) Distances (estimate road mileages) State View (select a state for screen background)			
(Screens 3-1 to 3-14) Restart DMAP (and load new data files) Load Locations (load a file containing site locations) Load Capacities (load a file containing site capacities) Load Loc. Info (load a file containing site distribution data) Load Mat. Flows (load a file containing site materiel flows)				

2.2.3

DATA FILES

All user selected data files which are subject to model analysis under DMAP are handled as ASCII formats. The only data file which is at present embedded in the model executable code is the transportation rate table which is based on Military Traffic Management Command (MTMC) data for less-than-truckload (LTL) and truckload (TL) commercial schedules. Except for the transportation rate table, the type of information contained in the data files is explained on-line. To access this on-line information, highlight the appropriate sub-menu option and press the <F1> key. For example, highlight the "Load Locations" sub-menu option under the "Files" main menu option and press

<F1>. A pop-up window will appear on the screen that enumerates the data contained in a location file.

The DLA Integrated Data Bank (DIDB) serves as the source of the data files which may be used to support specific analysis associated with materiel flows. All depot workload and capacity data has been derived from the Primary Distribution Site (PDS) Location Analysis (DLA-91-P10173). The data files provided on the installation diskette are identified and described in Appendix A.

2.3

TYPES OF DMAP APPLICATIONS

DMAP was specifically designed as a graphical shell to allow greater flexibility for analysis. The analytical ability of DMAP then becomes a function of the types of data available for input. Provided with the DMAP installation diskette, is data relating to distribution workloads and flows. This data allows the user to address questions such as: where does DLA materiel come from (vendors), where is it now stored (depots), and where does it go (customers). This information is structured by categories of items such as binnables, bulk, and hazardous. However by structuring the data in another way, DMAP has the capability to address other questions or issues. The following are possible application areas:

- (1) Stock Positioning Initiatives. This may include asset maps of Consumable Item Transfer (CIT) materiel and visibility of special materiel flows, such as shelf life items, hazardous items, item support at multi-mission depots, and weapon system support items.
- (2) Depot Consolidation Initiatives. This may include location tradeoffs between Primary Distribution Sites and Satellite Distribution Sites, regional boundary analysis for depot groupings, and capital investment options.

To address these, or other possible application areas that you may visualize, please refer to paragraph 1.6 Acquiring DMAP Software.

2.3.1

ADVANCED USER FEATURES

For some DMAP applications, it may be beneficial to group some depots together and evaluate stockage and distribution patterns for the group. An example may be to group the depots located in Pennsylvania together under a single location. In essence this involves "rolling" the business patterns of all of the depots in the group to a single point. This single point then acts as a PDS. This is accomplished by editing the location file.

The first field in the location file provides this grouping mechanism. Listed below are ten records from a file provided on the installation diskette named "DEPOT.LOC."

```
*SC, SC, OH,4976,2389,COLUMBUS
*SM, SM, TN,5404,2107,MEMPHIS DEPOT
*SA, SA, PA,4621,2413,MECHANICSBURG ICP
*SU, SU, UT,6705,2474,DEF DEPOT OGDEN
*SR, SR, VA,4646,2245,RICHMOND DEF SUP
*SB, SB, CA,7290,2262,TRACY
*MA, MA, GA,5045,1896,ALBANY          MSC
*MB, MB, CA,7020,2094,BARSTOW        MSC
*NR, NR, SC,4802,1974,CHARLESTON     NSC
*NG, NG, IL,5270,2538,GREAT LAKES   NTC
```

The asterisk indicates a PDS and the two characters following the asterisk indicate the name of the PDS. Please note that the remaining fields are explained in Appendix A. For the file "DEPOT.LOC," each depot location has it's own identity; there aren't any depot groupings. However suppose some analysis required looking at Albany and Barstow as a single site since they are the only Marine Corps sites contained in "DEPOT.LOC." To accomplish this task, use a text (ASCII) editor to alter the file. First, remove the asterisk from one of the locations. Then give both locations the same PDS or group name. The group name of "MC" was used for this example. Finally save the file under a different name ending with .LOC, for example, "CORPS.LOC." The following ten lines illustrate the changes made to the original file.

```
*SC, SC, OH,4976,2389,COLUMBUS
*SM, SM, TN,5404,2107,MEMPHIS DEPOT
*SA, SA, PA,4621,2413,MECHANICSBURG ICP
*SU, SU, UT,6705,2474,DEF DEPOT OGDEN
*SR, SR, VA,4646,2245,RICHMOND DEF SUP
*SB, SB, CA,7290,2262,TRACY
*MC, MA, GA,5045,1896,ALBANY          MSC
  MC, MB, CA,7020,2094,BARSTOW        MSC
*NR, NR, SC,4802,1974,CHARLESTON     NSC
*NG, NG, IL,5270,2538,GREAT LAKES   NTC
```

Using this new location file, DMAP analyses consider Albany and Barstow as a single site located at Albany and Barstow's business patterns and distribution functions are rolled into Albany's.

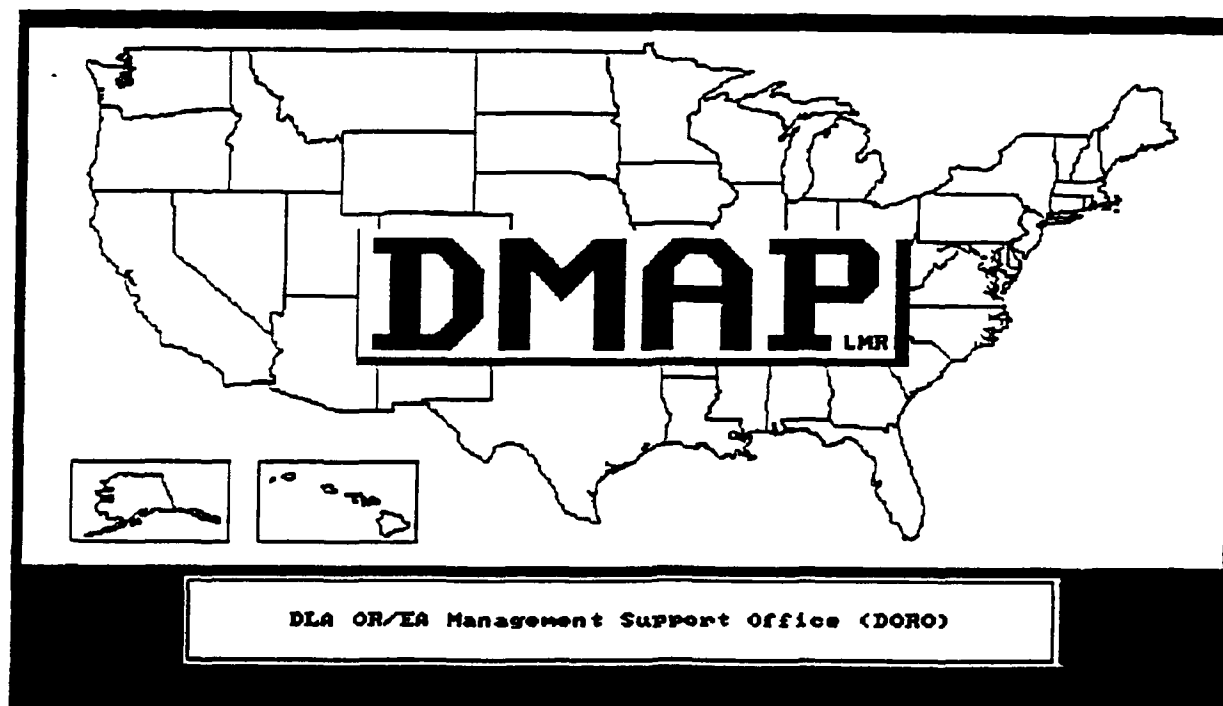
SECTION 3 DMAP EXAMPLE SESSION

In this section, we will examine an in-depth look at executing DMAP. All data files required for this example DMAP session are provided on the installation diskette. See paragraph 2.1 for installation instructions and paragraph 2.2 for executing DMAP. This section will be written, so that you can follow along. We will begin with a discussion of how DMAP automatically keeps track of our work sessions then use DMAP to load all of the requisite data files. For our analysis, we begin with a graphical analysis of the business patterns for Defense Depot Tracy. Secondly, we will graphically examine where DLA's primary customer and vendor regions exist. Next, we will evaluate the mission of Defense Depot Tracy after the augmentation of the DLA mission at Barstow. Lastly, we will demonstrate some DMAP features designed for user comforts. Before starting you may wish to review the menu commands in Section 2.2.1 then fire-up DMAP and we will begin.

3.1 DMAP INTRODUCTION AND LOG SYSTEM

After typing "DMAP" from the DOS command line (see paragraph 2.1), you should first see the introductory screen, Screen 3-1, on your monitor. Screen 3-1 provides a map of the continental U.S. along with inserts for Alaska and Hawaii. After a brief moment this screen will automatically disappear and Screen 3-2 will appear.

Screen 3-1. Introductory Screen

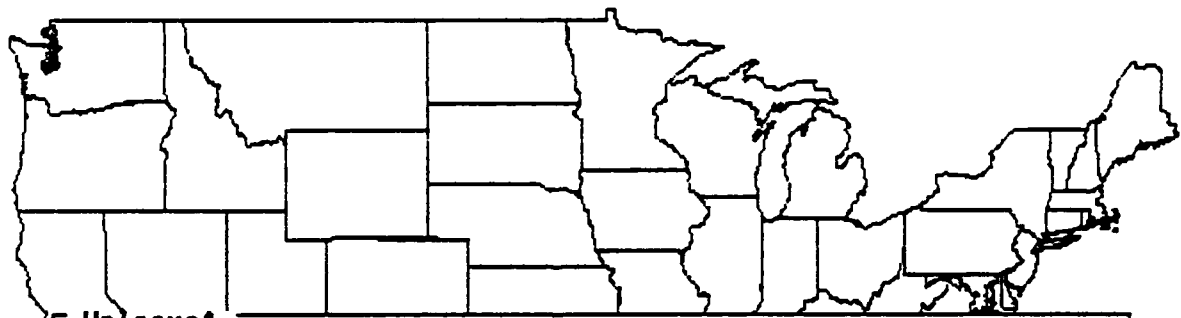


DMAP provides the user with the capability to retain an output log of selected key components for each session in an ASCII file. The output log file automatically retains the names of the input data files used during a session and, optionally, various summary statistics. Once a log file has been created, it can be "loaded" later for another DMAP session. Loading a log file means that DMAP can reload all data files used in a previous DMAP session. The log system is a time saver that also aides analysis documentation. If a log file already exists and you wish to "load" it, simply press <Enter> and select directly from a list. After you select an existing log file, DMAP will ask if you wish to load it, overwrite it, or try another selection.

Assuming that this is your first session with DMAP, no other log files exist. Type in the name of this session using the ".LOG" file name extension next to the pre-printed path information. For our purposes we will use the name "WORK1.LOG" to describe this example session; however, you can use any file prefix that is meaningful or applicable to your session.

Screen 3-2. Log Screen

Files
Analysis
Set Color
Help
Exit to DOS



Welcome!

DMAP will record key parts of this session in a .LOG file.
 The .LOG file:

- 1) Contains the input files selected during a session.
- 2) Is an ASCII file to reload, print, edit, delete, etc.

Type a complete path and name for a new LOG file below- be sure to include the .LOG extension
 or Type a valid path to select from a directory list.





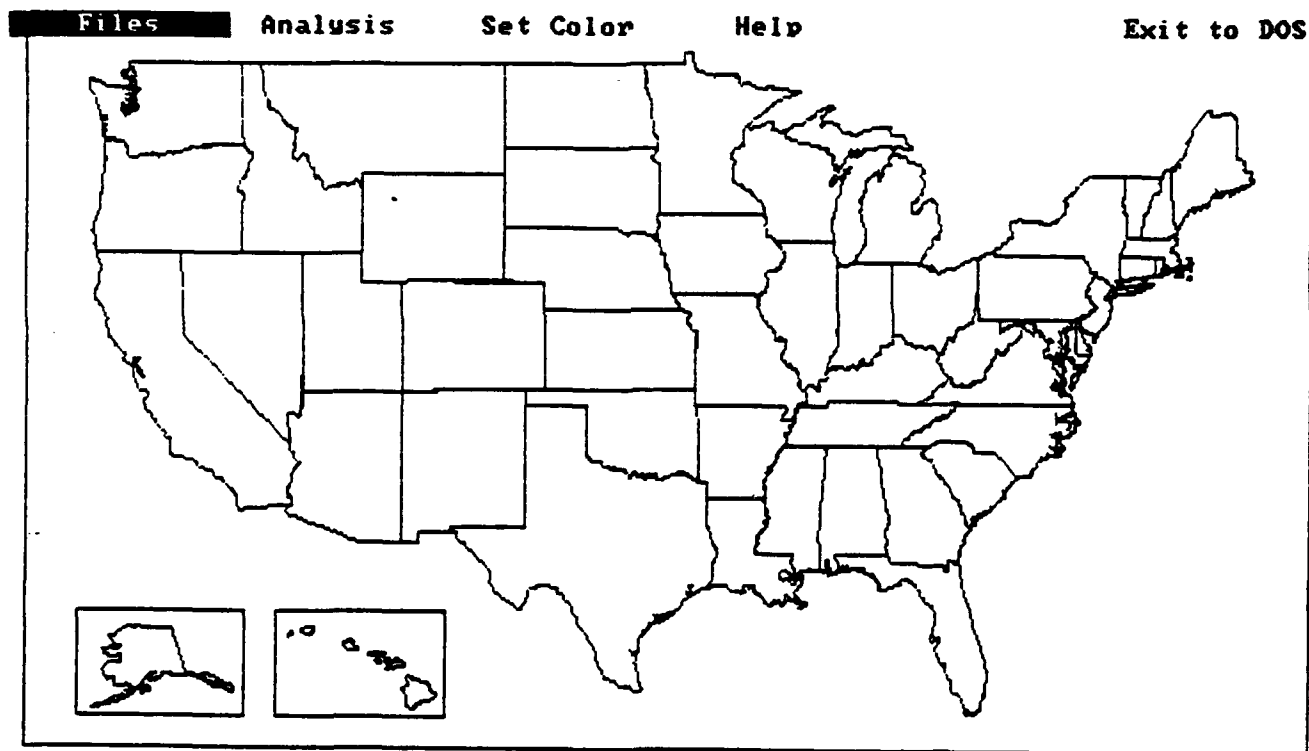
Path> c:\dmap\WORK1.LOG

3.2

DMAP FILES OPTION

After completing the logging in process, the top level menu will be activated which appears across the top of the national map screen. This screen now indicates that the option FILES is active. This permits the user to select a series of files for interactive graphical analysis of materiel flows. The file loading process is segmented into four steps.

Screen 3-3. Main Menu Screen



DMAP 1.0

Depot - Macro Analysis - Program (Prototype)

DORO LMR

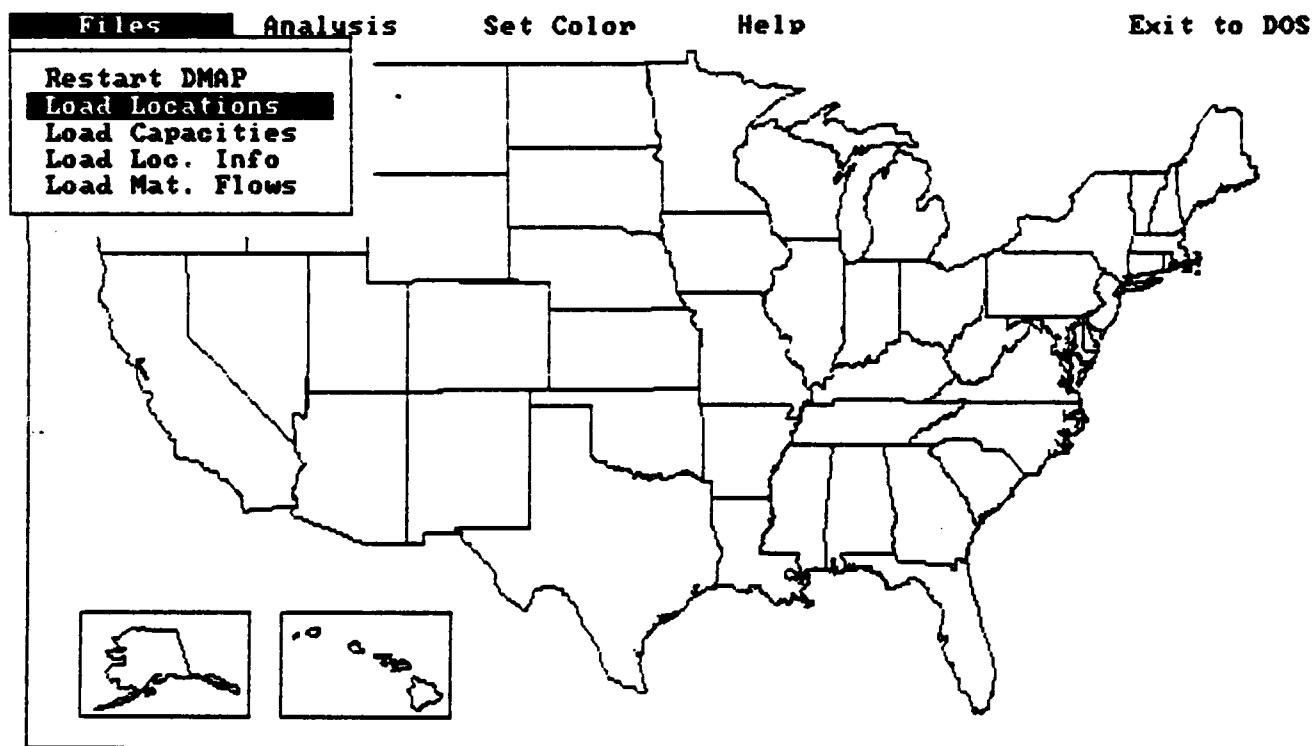
3.2.1

LOAD LOCATIONS

If the user hits <Enter>, a sub-menu will appear which will list the various input files as well as providing an option to restart the DMAP program. By using the arrow keys or moving the mouse, move down the sub-menu selections until the **Load Locations** option is highlighted.

This option provides the first data which must be loaded. The location file contains the information about various depot locations, such as location name, its two digit routing identifier code, and latitude and longitude. Press the <F1> key for on-line help about this option or see Appendix A for more detailed information about this file.

Screen 3-4. Files Sub-Menu Screen



With the **Load Locations** option highlighted, press <Enter> and a cursor will be displayed which indicates the path or directory for the desired files. If this directory does not contain the DMAP data files provided on the installation diskette, it can be edited.

Screen 3-5. Load Locations Path Screen

Files **Analysis** **Set Color** **Help** **Exit to DOS**

Restart DMAP
Load Locations
Load Capacities
Load Loc. Info
Load Mat. Flows



Path> c:\dmap

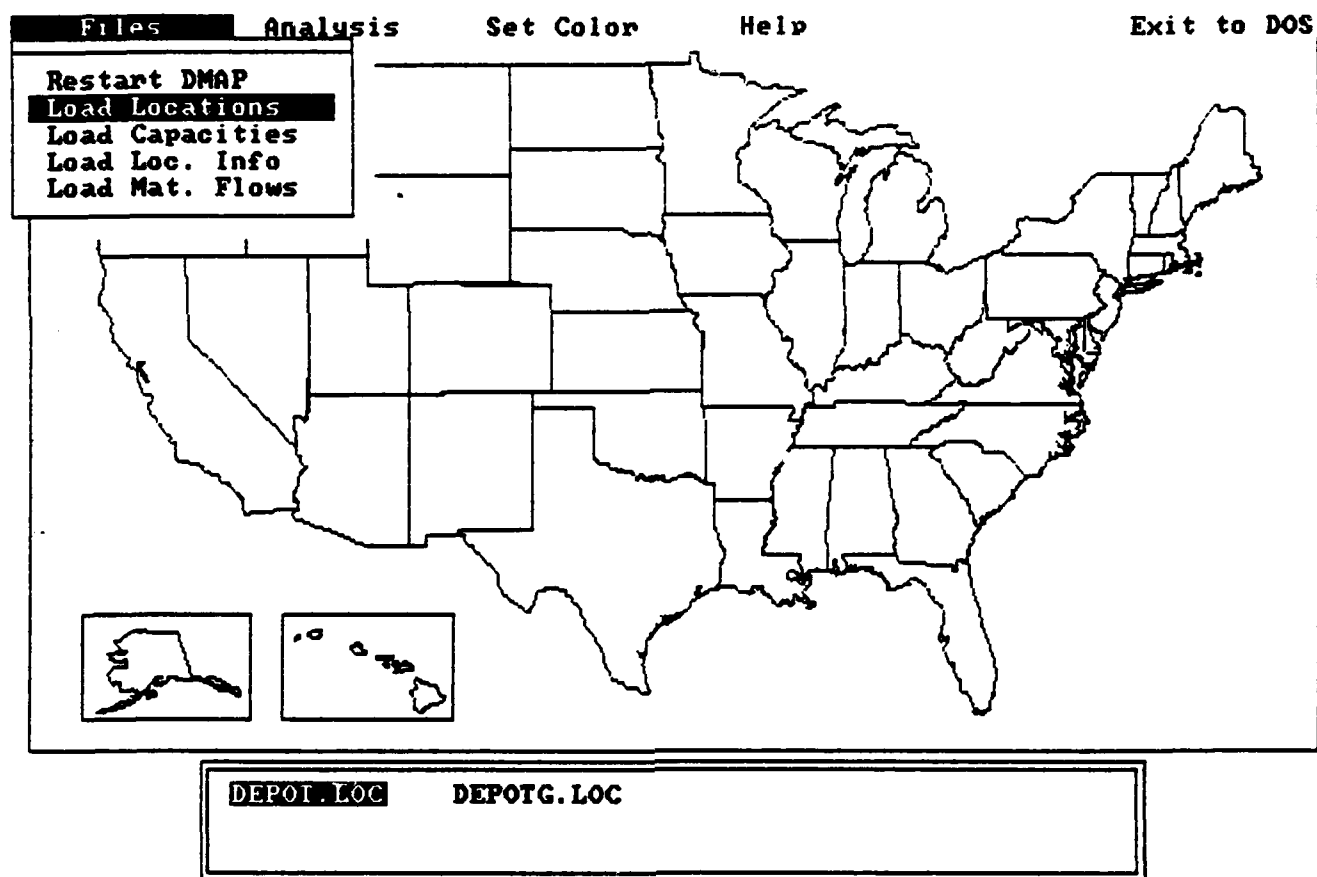
DMAP 1.0

Depot - Macro Analysis - Program (Prototype)

DORO LMR

Assuming that the path does contain the DMAP data files provided on the installation diskette, simply press <Enter> for a directory listing of the ".LOC" or location files. The user will now observe the various location files which are available. Displayed here are two files. The first, which is also highlighted, is under the name of "DEPOT.LOC" and represents thirty-two depots. The second file goes by the file name of "DEPOTG.LOC" which represents the three Primary Distribution Sites (PDS).

Screen 3-6. Load Locations Directory Listing



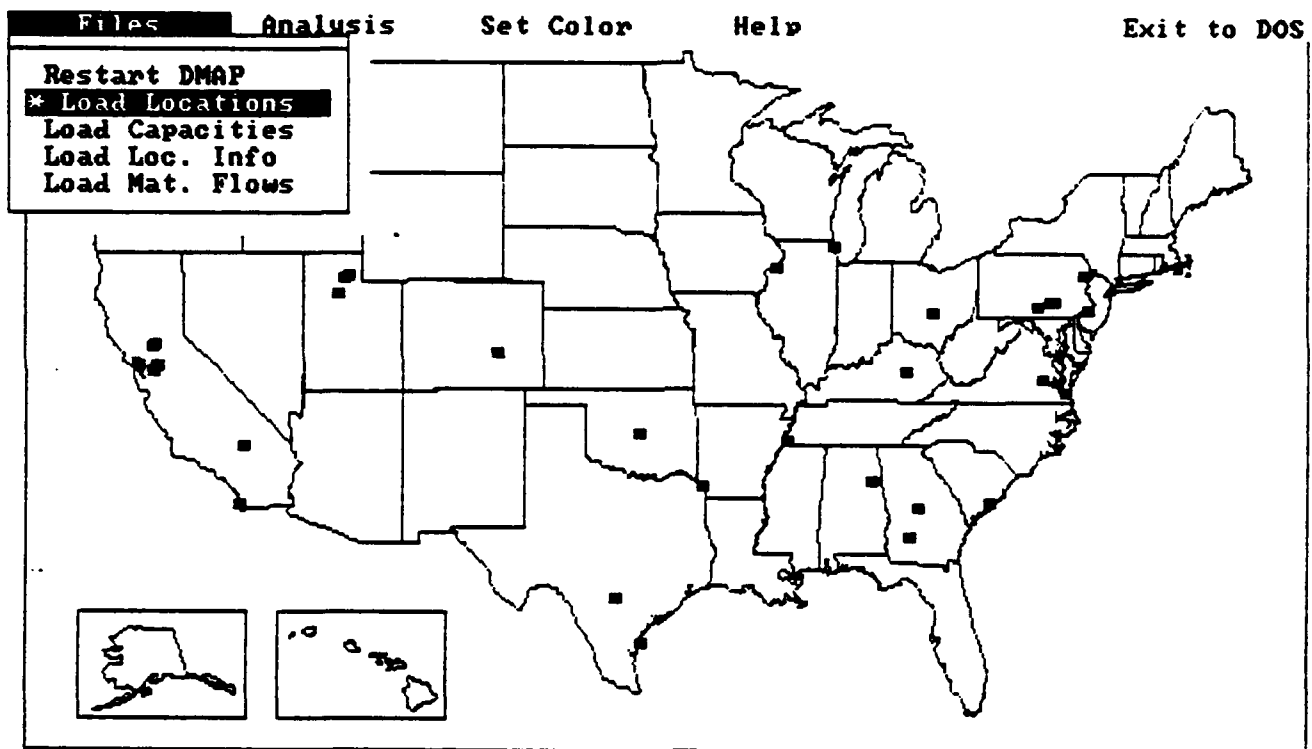
DMAP 1.0

Depot - Macro Analysis - Program (Prototype)

DORO LMR

For this session highlight the file "DEPOT.LOC" and press <Enter>. The following screen will be displayed. The national map is now displayed with the 32 depot locations that were defined in "DEPOT.LOC" and the sub-menu now displays * Load Locations as the highlighted field. This indicates that information has been successfully loaded under this option.

Screen 3-7. Displayed Locations Screen



DMAP 1.0

Depot - Macro Analysis - Program (Prototype)

DORO LMR

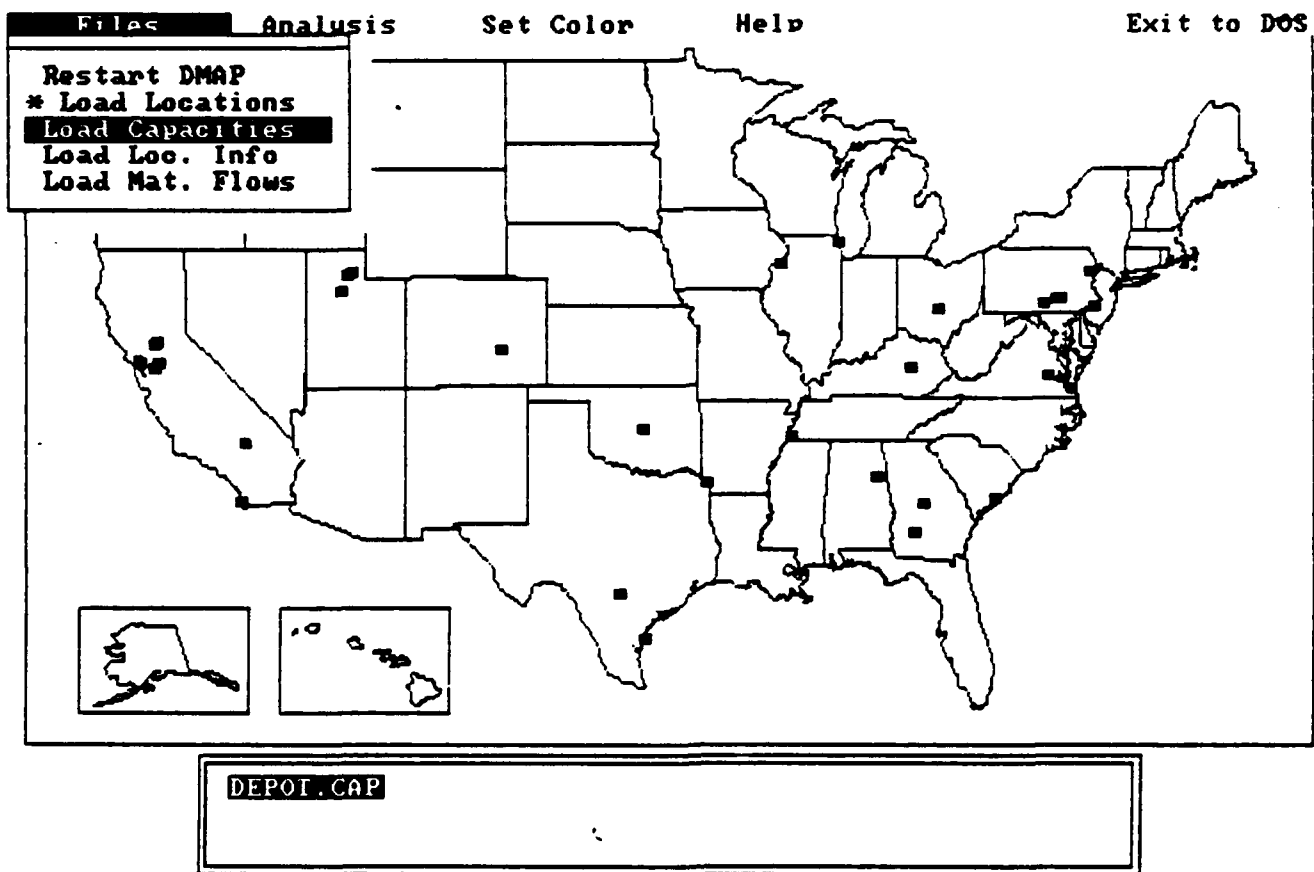
3.2.2

LOAD CAPACITIES

Under the files sub-menu, highlight the **Load Capacities** option. This file will contain workload and storage capacity information about those depots that are displayed on screen. Press the <F1> key for on-line help about this option or see Appendix A for more detailed information about this file.

The process for **Load Capacities** is the same as that used for **Load Locations**. With the **Load Capacities** option highlighted, press <Enter>. Once the path for the desired files is displayed press <Enter> again for a directory listing. Only one capacity file, "DEPOT.CAP" is supplied with the installation diskette. Press <Enter> to select and load this file.

Screen 3-8. Load Capacities Directory Listing



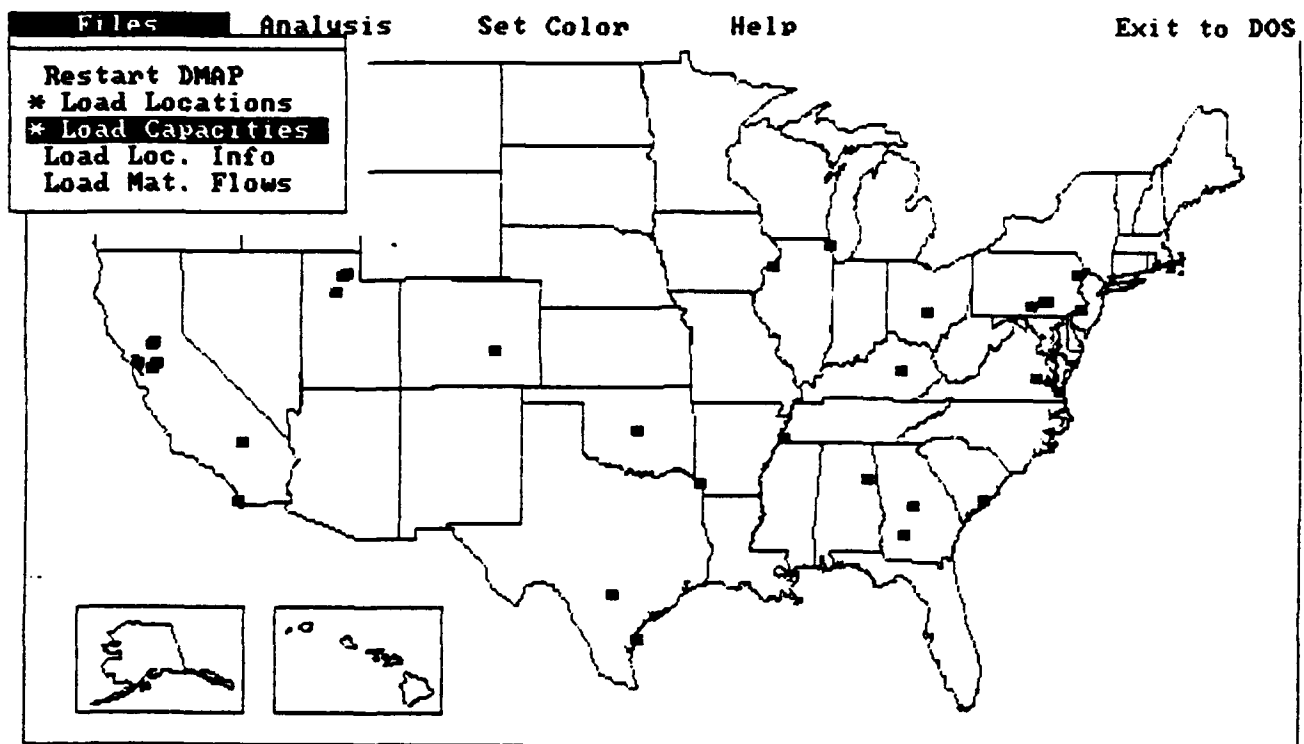
DMAP 1.0

Depot - Macro Analysis - Program (Prototype)

DORO LMR

After successfully loading the capacity file, the sub-menu now displays *** Load Capacities** as the highlighted field. This indicates that information has been successfully loaded under this option.

Screen 3-9. Capacities Successfully Loaded Screen



DMAP 1.0

Depot - Macro Analysis - Program (Prototype)

DORO LMR

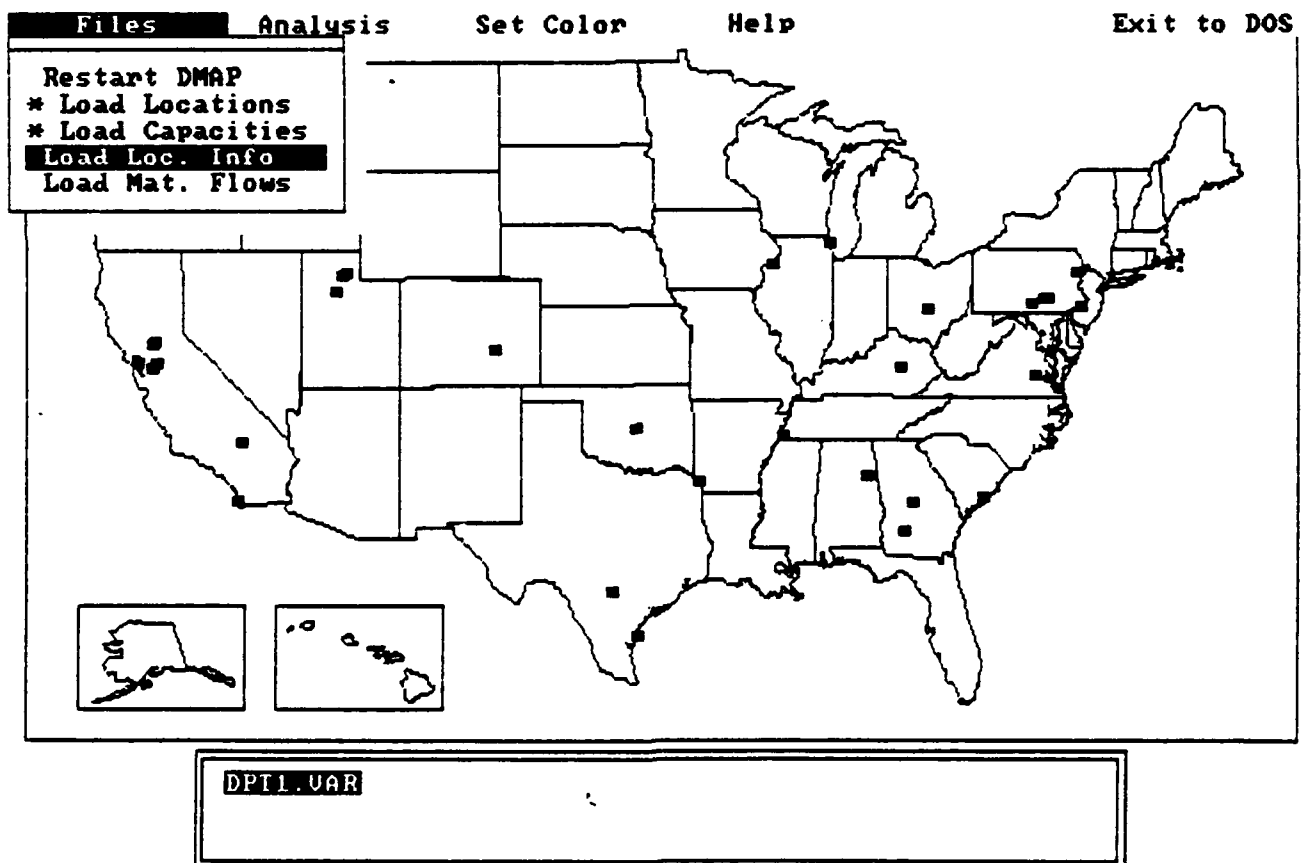
3.2.3

LOAD LOCATION INFORMATION

Under the files sub-menu, highlight the Load Loc. Info option. This file will contain historical workload and stockage data for the depots that are displayed on screen. Press the <F1> key for on-line help about this option or see Appendix A for more detailed information about this file.

The process for Load Loc. Info is the same as that used for Load Locations. With the Load Loc. Info option highlighted, press <Enter>. Once the path for the desired files is displayed press <Enter> again for a directory listing. Only one location information file, "DPT1.VAR" is supplied with the installation diskette. Press <Enter> to select and load this file.

Screen 3-10. Load Location Information Directory Listing



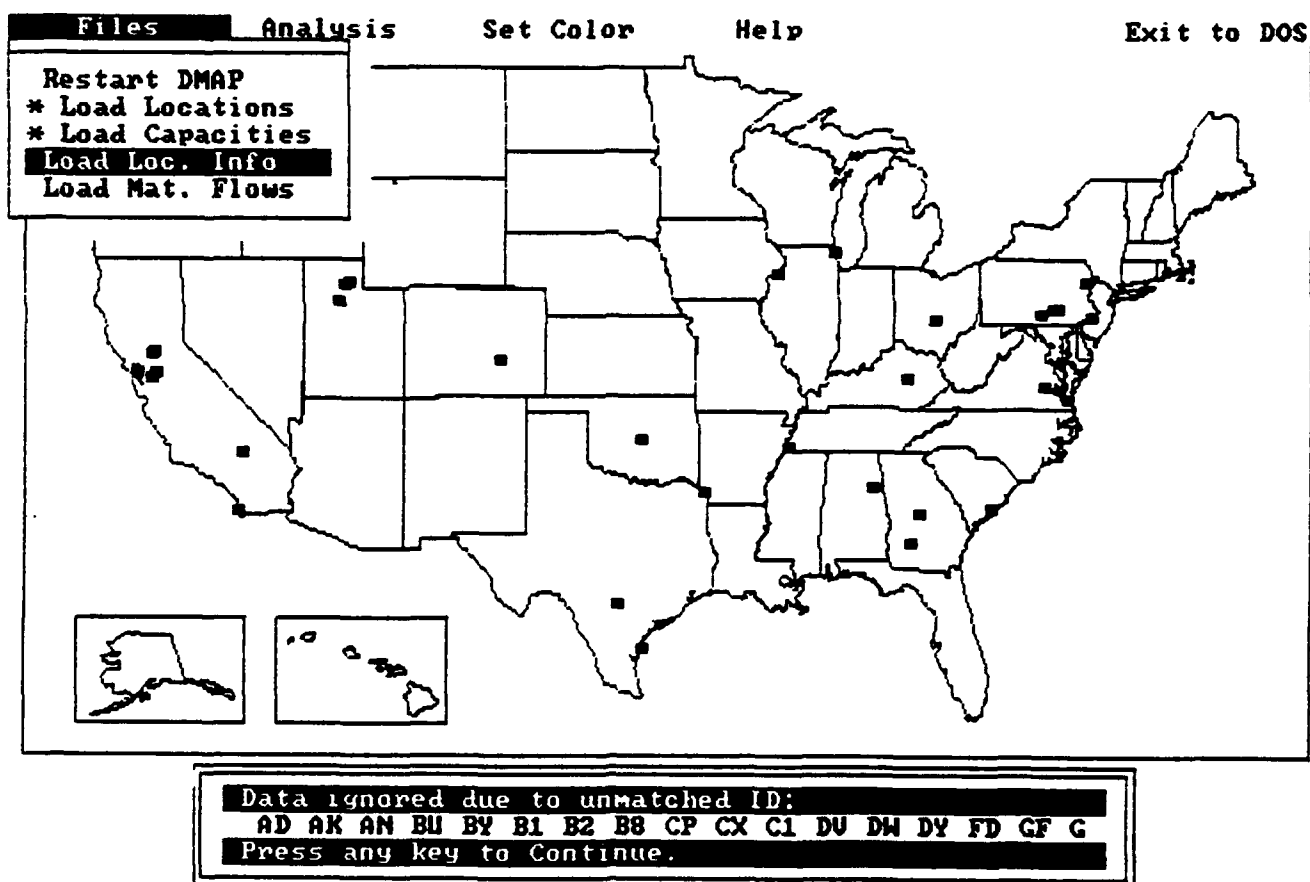
DMAP 1.0

Depot - Macro Analysis - Program (Prototype)

DORO LMR

While loading "DPT1.VAR," DMAP encounters information about locations that were not defined in the location file, "DEPOT.LOC." The following screen lists those two-digit routing identifier codes which did not match against the depot locations previously loaded. These cases often represent special customers such as industrial sites or overseas locations. Only a partial listing may be displayed on screen; however, the log file contains a complete list.

Screen 3-11. Unmatched Locations Listing



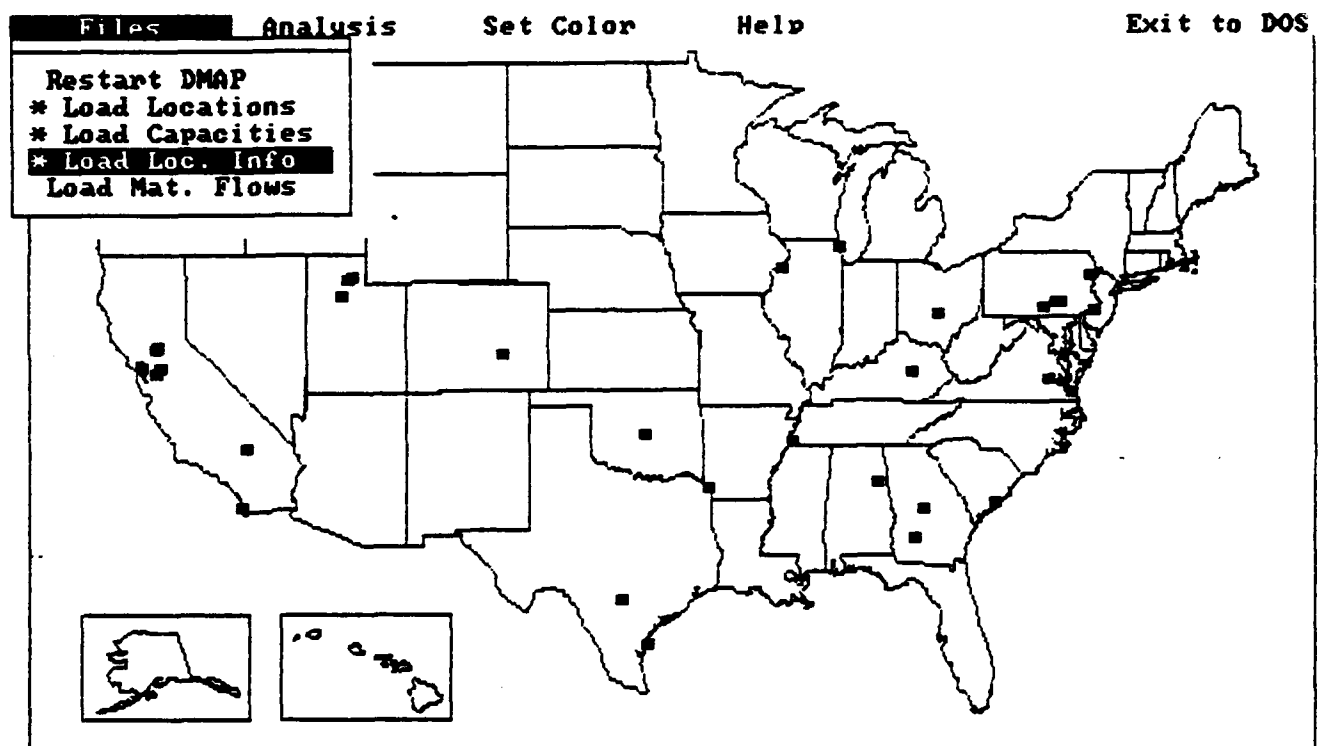
DMAP 1.0

Depot - Macro Analysis - Program (Prototype)

DORO LMR

After pressing <Enter> at the unmatched location listing, the sub-menu now displays * Load Loc. Info as the highlighted field. This indicates that information has been successfully loaded under this option.

Screen 3-12. Location Information Successfully Loaded Screen



DMAP 1.0

Depot - Macro Analysis - Program (Prototype)

DORO LMR

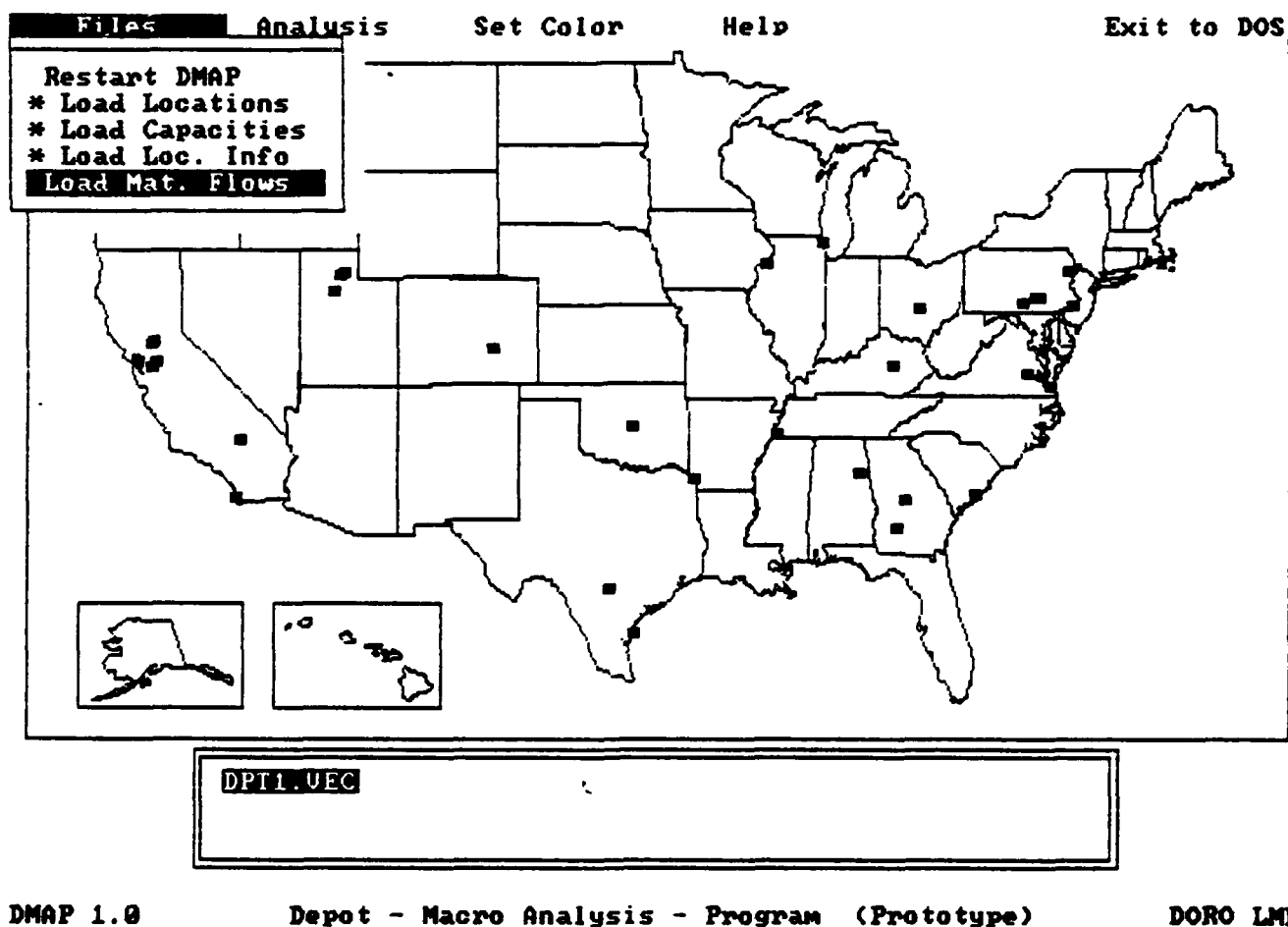
3.2.4

LOAD MATERIEL FLOWS

Under the files sub-menu, highlight the **Load Mat. Flows** option. This file will contain historical distribution and receipt data for the depots that are displayed on screen. Press the <F1> key for on-line help about this option or see Appendix A for more detailed information about this file.

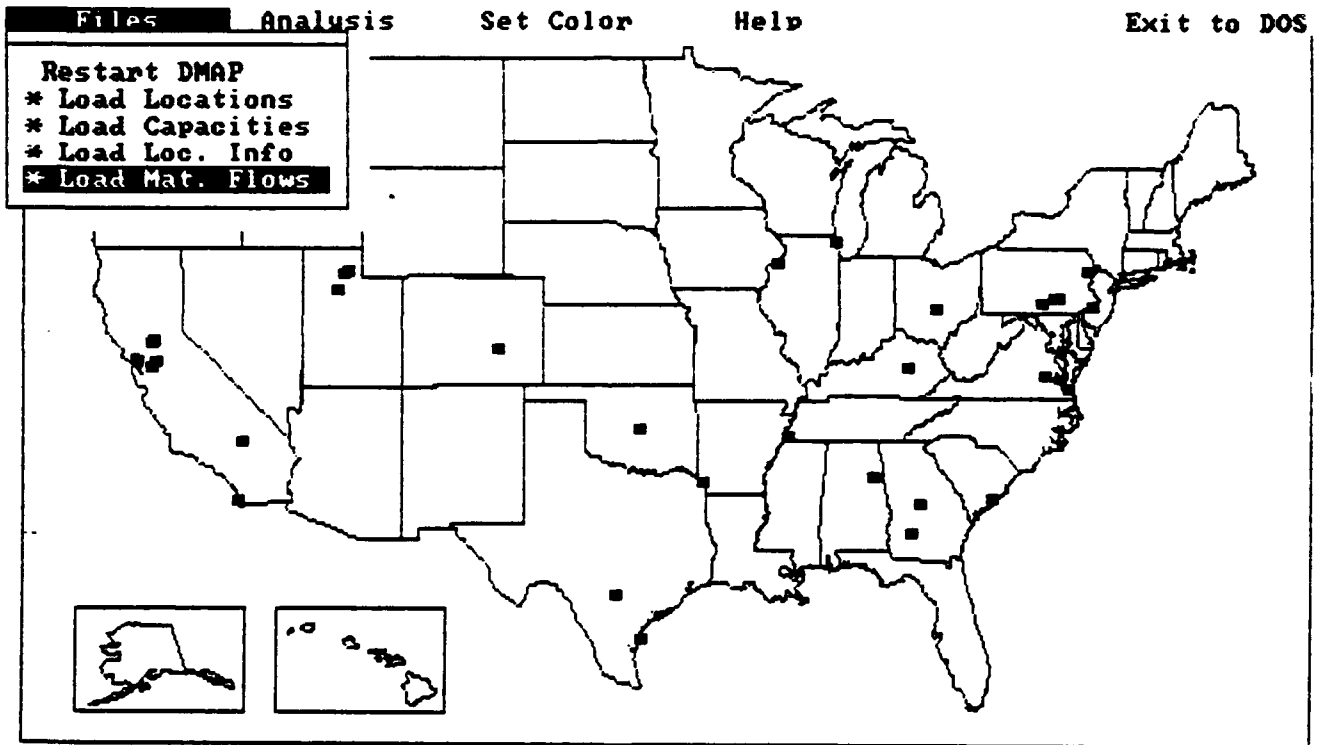
The process for **Load Mat. Flows** is the same as that used for **Load Locations**. With the **Load Mat. Flows** option highlighted, press <Enter>. Once the path for the desired files is displayed press <Enter> again for a directory listing. Only one materiel flows file, "DPT1.VEC" is supplied with the installation diskette. Press <Enter> to select and load this file.

Screen 3-13. Load Materiel Flows Directory Listing



While loading "DPT1.VEC," DMAP computes mileages for each location to each customer or vendor region. This may take a minute or two, but saves time in the analysis phase. After this process is complete, the materiel flow data will have been loaded and the following screen will be displayed. This screen indicates that all necessary data has now been loaded (as evidenced by the * which marks each file selection option) into DMAP and you are now ready for moving on to the analysis portion.

Screen 3-14. Materiel Flows Successfully Loaded Screen



DMAP 1.0

Depot - Macro Analysis - Program (Prototype)

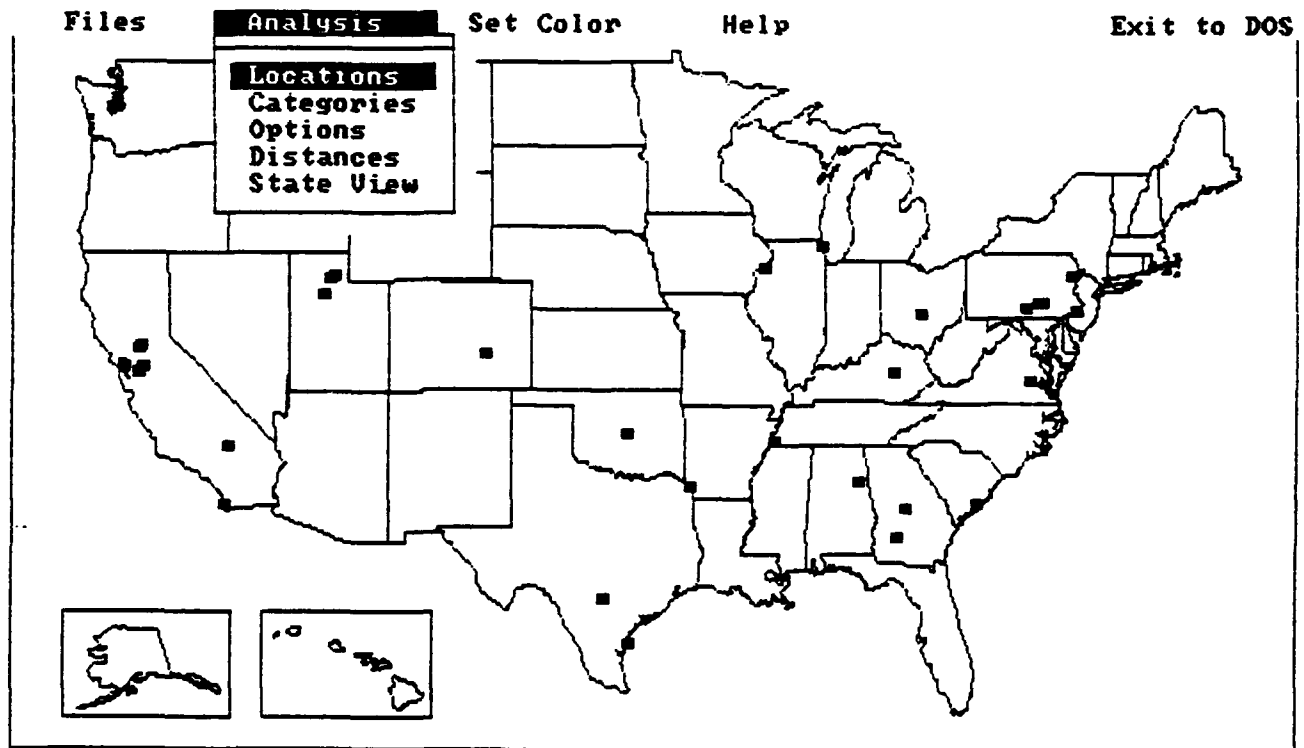
DORO LMR

3.3

DMAP ANALYSIS OPTION

Now that the data files have been loaded, highlight the **Analysis** main menu option. Press <Enter> to activate the **Analysis** sub-menu. The following screen will be displayed which has highlighted **Locations** under the Analysis header.

Screen 3-15. Analysis Sub-Menu Screen



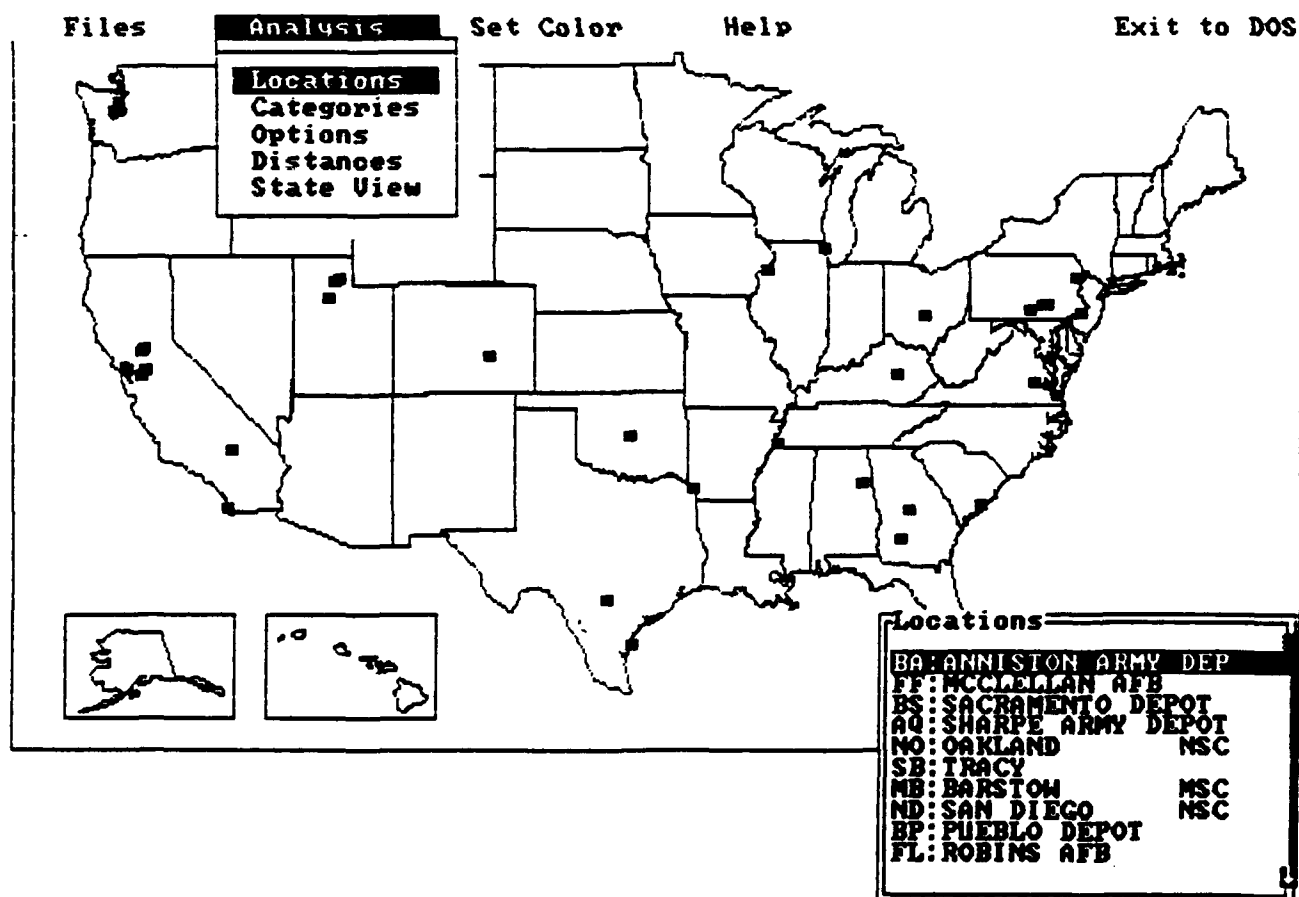
3.3.1

LOCATIONS

The sub-menu option **Locations** gives the user an opportunity to select from one to three depot locations for analysis. If no locations are selected, all of them are selected by default. With **Locations** highlighted, press <Enter>. This will activate a window in the lower right side of the screen which will display locations previously loaded under **Files**. As previously noted, this information includes the first two-digits of the Routing Identifier Code (RIC) for each location.

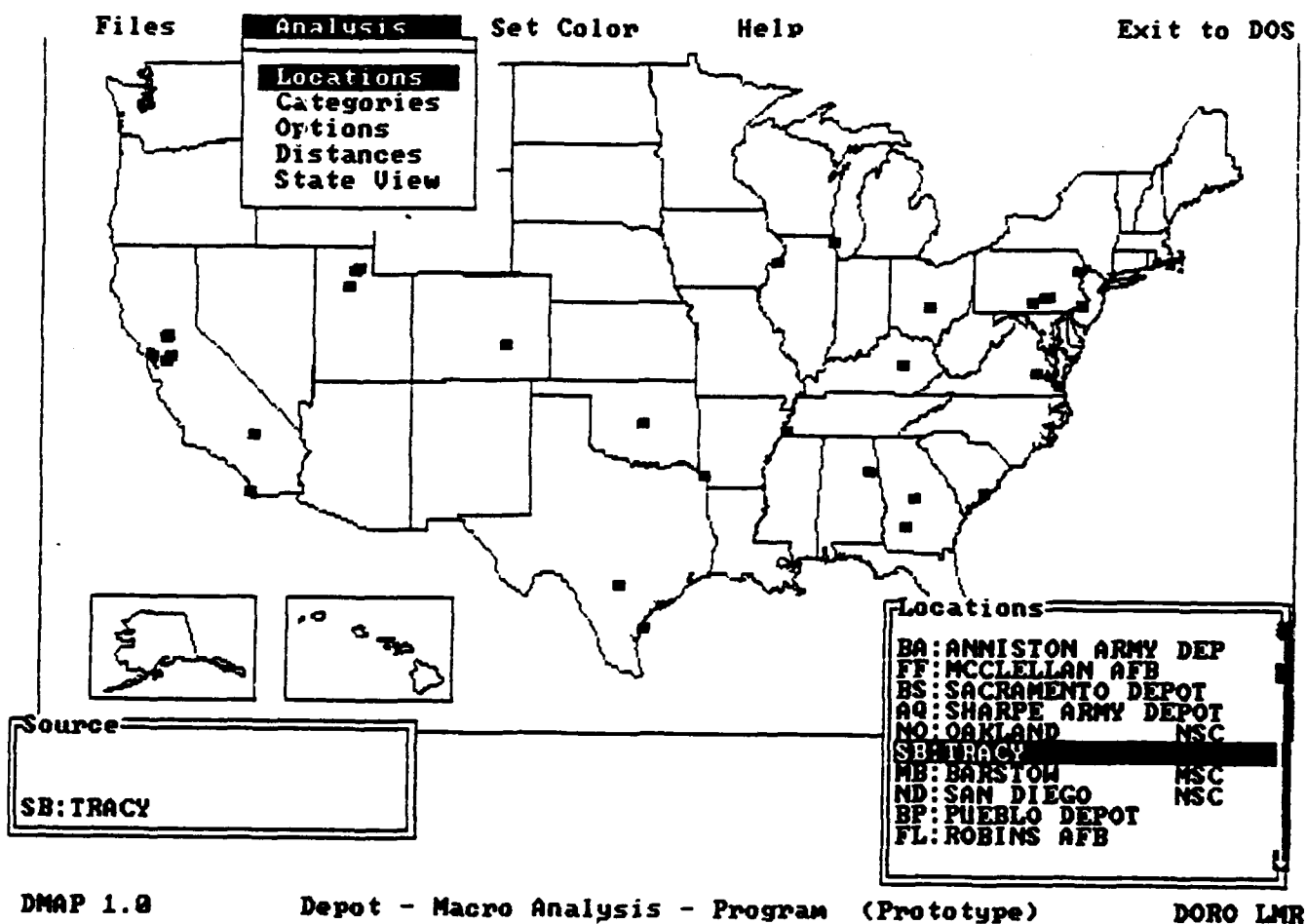
The <Enter> key can be used as a toggle to select and un-select a depot. Pressing the <End> key highlights the last location in the list and <Home> highlights the first. The <PgUp> and <PgDn> scroll up and down through the list of depots. The first digit of the RIC is a "hot" key. For example, repeatedly typing the letter "S" moves the highlight bar to the next location in the list that has a RIC beginning with S, the traditional DLA depots. This permits the user to easily move across Agency facilities (e.g., DLA, Army, Air Force, Navy). If one or more depots have already been selected, the user may type 1, 2, or 3, which correspond to the first, second, or third depot selected, to automatically jump to that depot in the depot selection list for un-selecting.

Screen 3-16. Location Selection List



Now, proceeding with our illustrative example we will select Tracy for analysis. Type S, repeatedly if necessary, until SB: Tracy is highlighted. After pressing <Enter>, another window will have opened. This time the window is on the lower left side of the screen display. Here one will observe that the activated location has popped into the window. Press the <Esc> key to return to the Analysis sub-menu.

Screen 3-17. Tracy Selection Screen



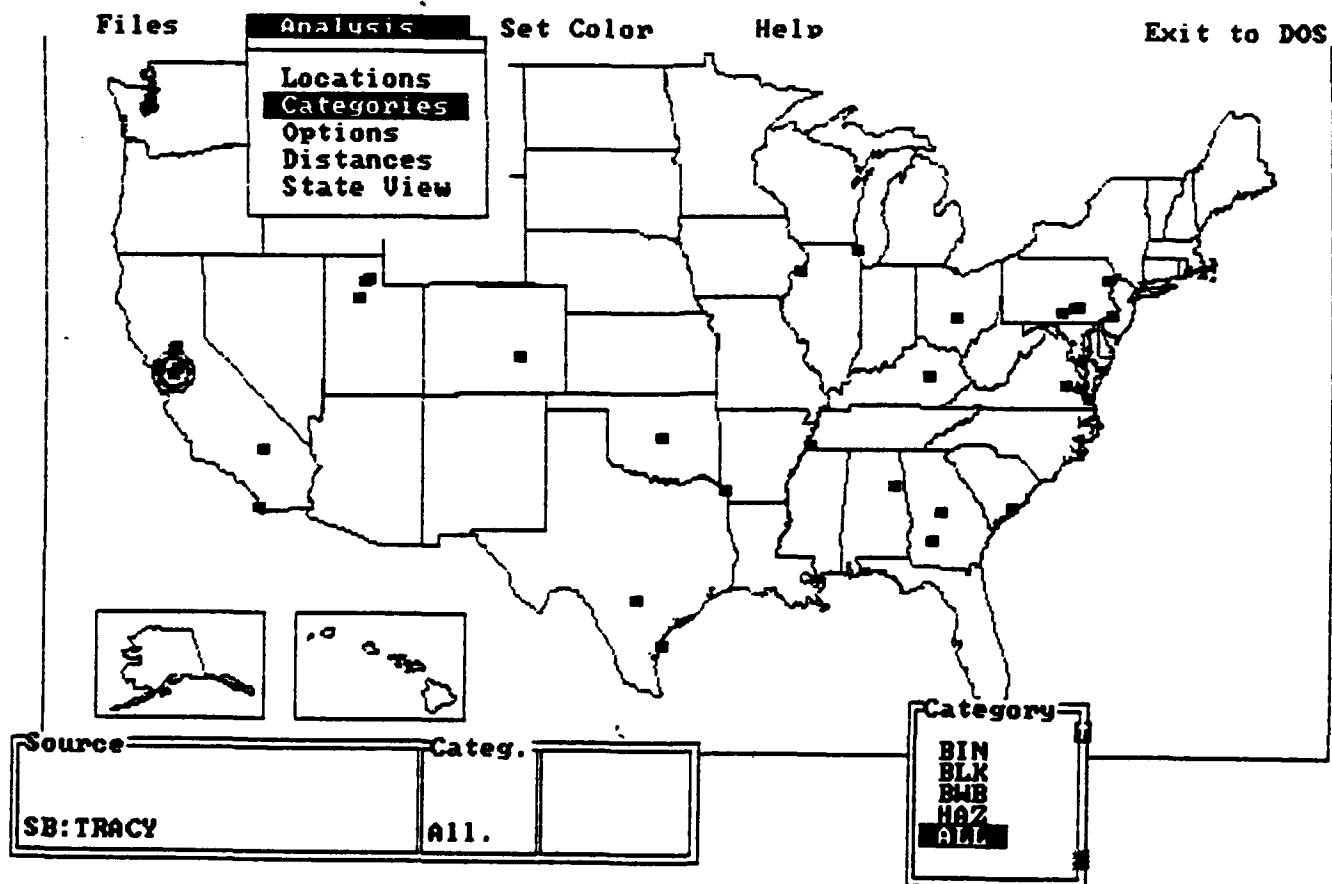
3.3.2

CATEGORIES

Having selected Tracy and hit the Escape key, the window of locations that was in the lower right side of the video display will have disappeared and the lower left side will indicate **SB: TRACY.....ALL**. This indicates that for this location **ALL** categories of stock have been selected. This is a default option which would allow the user to by-pass the **Categories** option under **Analysis** and progress to **Options**. However, we will move more slowly with this example so as to permit the user the opportunity to become more familiar with the DMAP capabilities.

Highlight the sub-menu option **Categories** and press <Enter>. A window will open on the lower right side of the screen. This window will display the various materiel categories which have been loaded for the materiel flows. These item categories are defined in Appendix A. For our example we will move the cursor down until the category **ALL** is highlighted. Press <Enter> to select all categories of items.

Screen 3-18. Category Selection List



3.3.3

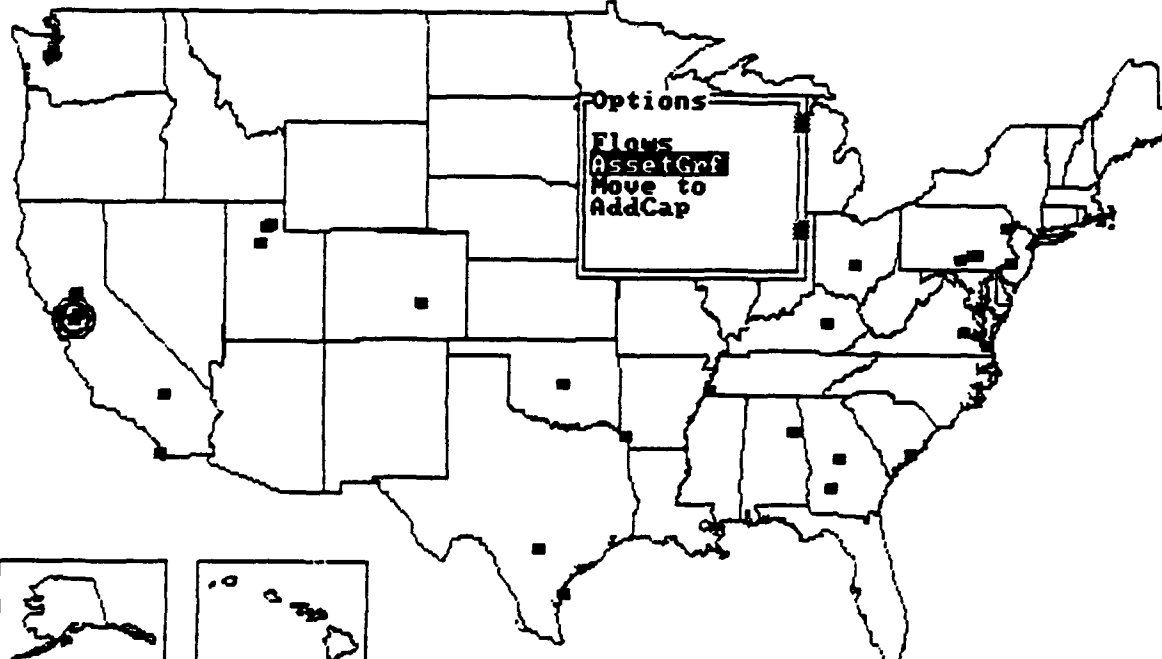
OPTIONS

Given that the user has selected both Locations and Categories, the following screen will be displayed which indicates that Tracy has been selected for evaluating All classes of materiel flows associated with Tracy. For evaluating these materiel flows, a number of options exist. Highlight the sub-menu selection **Options** and press <Enter> to view the various analysis capabilities.

Here we see that one may select from **Flows** (this will allow you to inspect specific materiel flows both on inbound and outbound for the selected depots), **AssetGrf** (which stands for Asset Graphs that will permit you to inspect the amounts of materiel which are presently stored at a site as well as receipt and MRO workloads), **Moveto** (which allows you to move a class of materiel from one site to another and to see what the overall impact is on your strategy), or **AddCap** (this stands for Add Capacity so that you can address space impacts at a given site by either increasing capacity by the use of Military Construction or by Commercial Rental). Here one sees that we have opted for **AssetGrf**.

Screen 3-19. Options Selection List - Asset Graph

Files	Analysis	Set Color	Help	Exit to DOS
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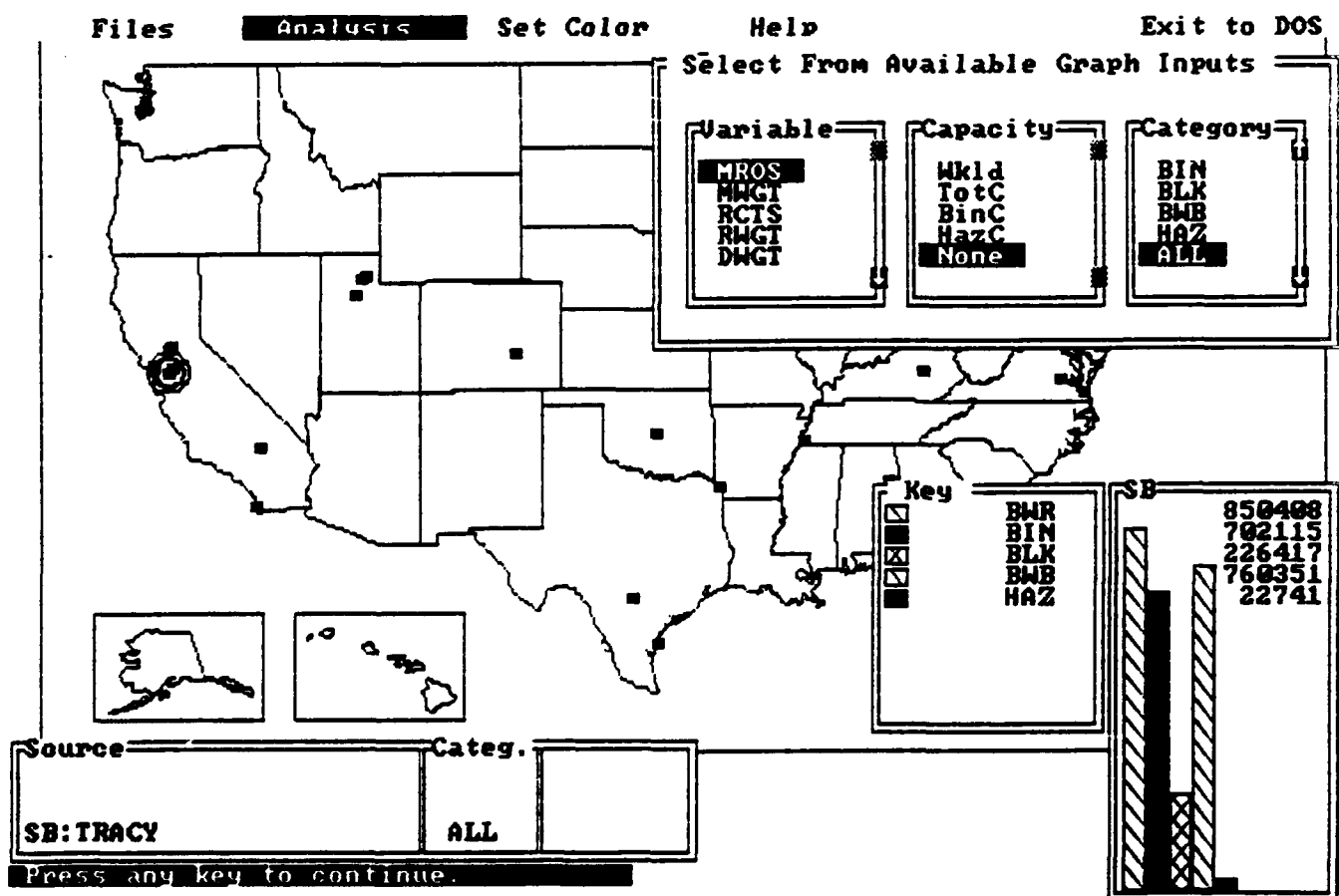


Source	Categ.	
SB: TRACY	ALL	

If the user now hits the Enter key, another sub-menu window will open in the upper right section of the screen. Here one sees that the window has been partitioned into three sections. The first section is labeled as "Variable." This represents the measure of the parameter which will be graphed and in this case we have selected **MROS** which represents Materiel Release Orders; i.e., hence we will be looking at graphs associated with a depot's throughput capability or perhaps we might wish to simply look at work counts. The middle part of this window is labeled as "Capacity" and here we have selected **None** which means that we will just capture the MRO counts going through Tracy (over a one year period for this data). Lastly, we have the particular "Category" which we may wish to select on and here in this document we have elected to stay with **All**.

After making these choices if we hit the Enter key, we will observe the following graph. This displays the MRO counts which Tracy issued across the selected categories. In this case BWR (BIN with Rack backup), BIN (Binnable), BLK (Bulk), BWB (BIN with Bulk backup), and lastly HAZ (Hazardous) are shown and which total to slightly more than two and one-half million MROs. By typing the letter P this information can be saved to the log file.

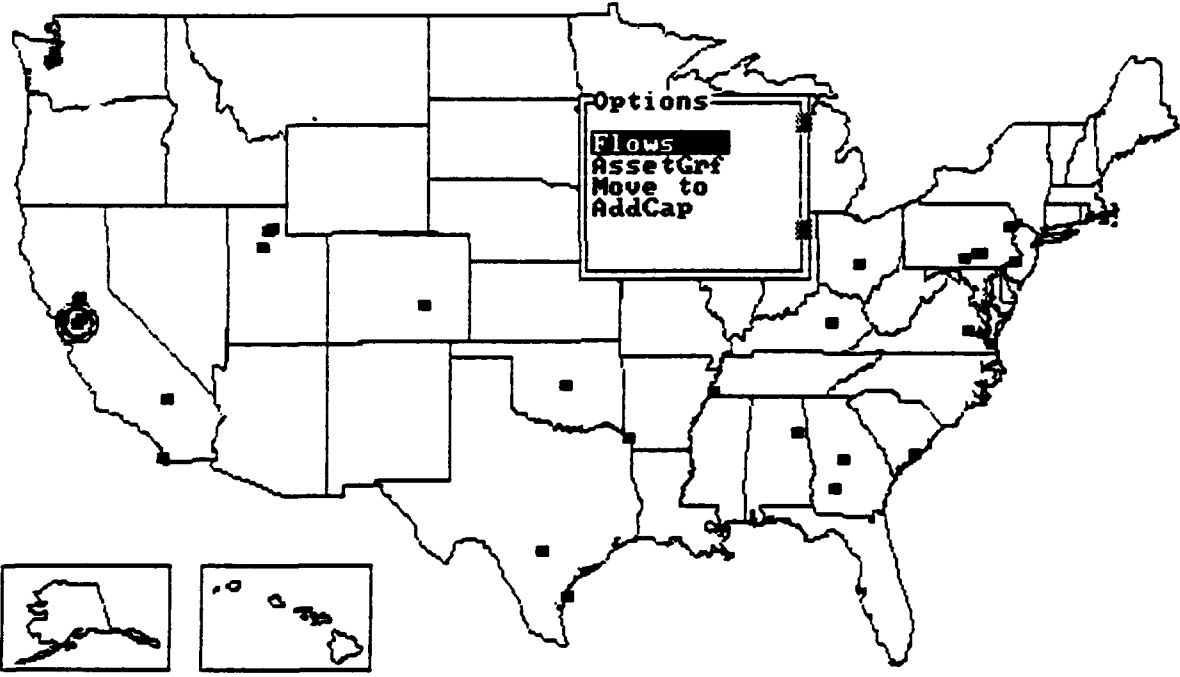
Screen 3-20. Graphical Analysis Option



Returning to the Options sub-menu, if the user desires to look at the various materiel flows which pass through Tracy in order to identify business patterns and to track estimated shipping costs, one should select Flows.

Screen 3-21. Options Selection List - Materiel Flows

Files **Analysis** Set Color Help Exit to DOS



Options
Flows
AssetGrf
Move to
AddCap

Source Categ.

SB:TRACY	ALL	
----------	-----	--

DMAP 1.0

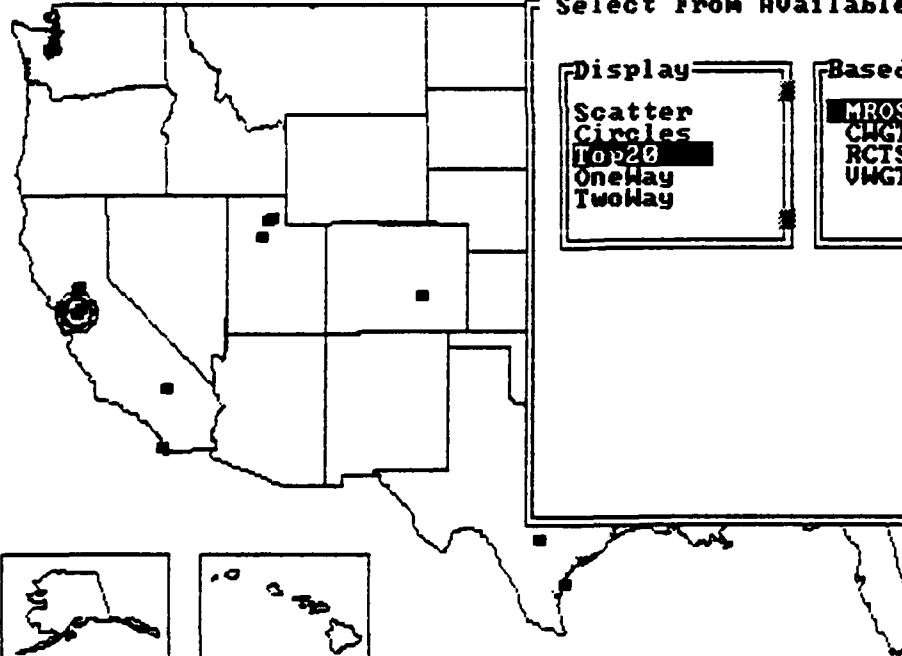
Depot - Macro Analysis - Program (Prototype)

DORO LMR

Having hit <Enter>, a new window will open in the upper right portion of the screen which is entitled "Select From Available Flow Inputs." This will permit you to select from a Display choice (**Scatter** -- this will provide you with a nationwide distribution of your selected materiel flow with each dot color coded to indicate activity level, **Circles** -- this provides you with the same nationwide distribution but instead of using color to indicate activity it will draw different size circles with the larger circles indicating greater activity, **Top20** -- provides the same information as Scatter but only on those leading twenty distribution zones, **OneWay** and **TwoWay** -- provides you with the option of selecting either a single flow variable for centroid analysis or the alternative which represents a bi-directional flow for centroid calculations.

Screen 3-22. Flow Analysis Option - Top 20 Selections

Files	Analysis	Set Color	Help	Exit to DOS
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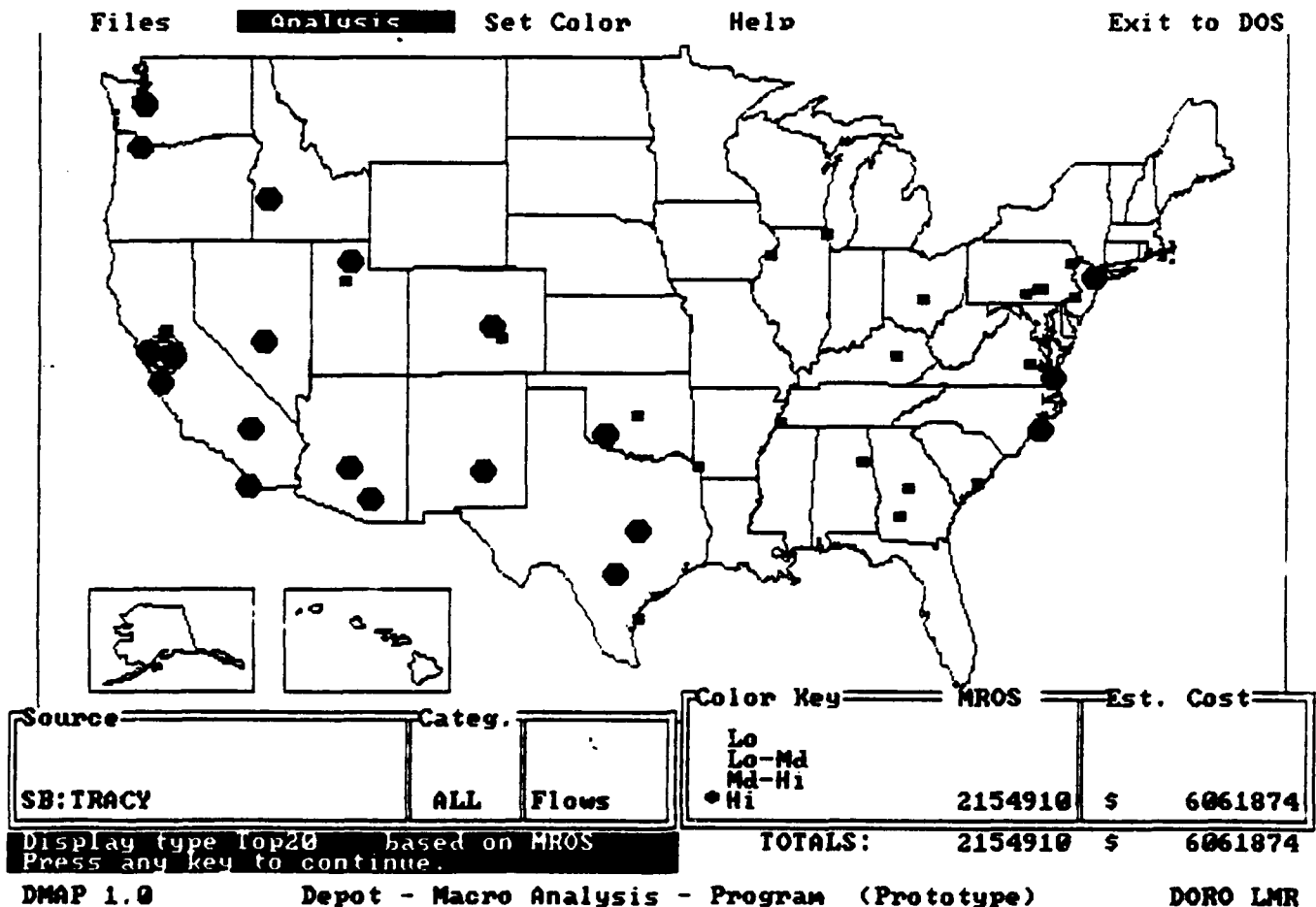
Select From Available Flow Inputs

Display Scatter Circles Top20 OneWay TwoWay	Based on MROS CHGT RCTS UMGT	Var-Cost MROS CHGT RCTS UMGT
---	---	---

Source SB:TRACY	Categ. ALL	
--	---	--

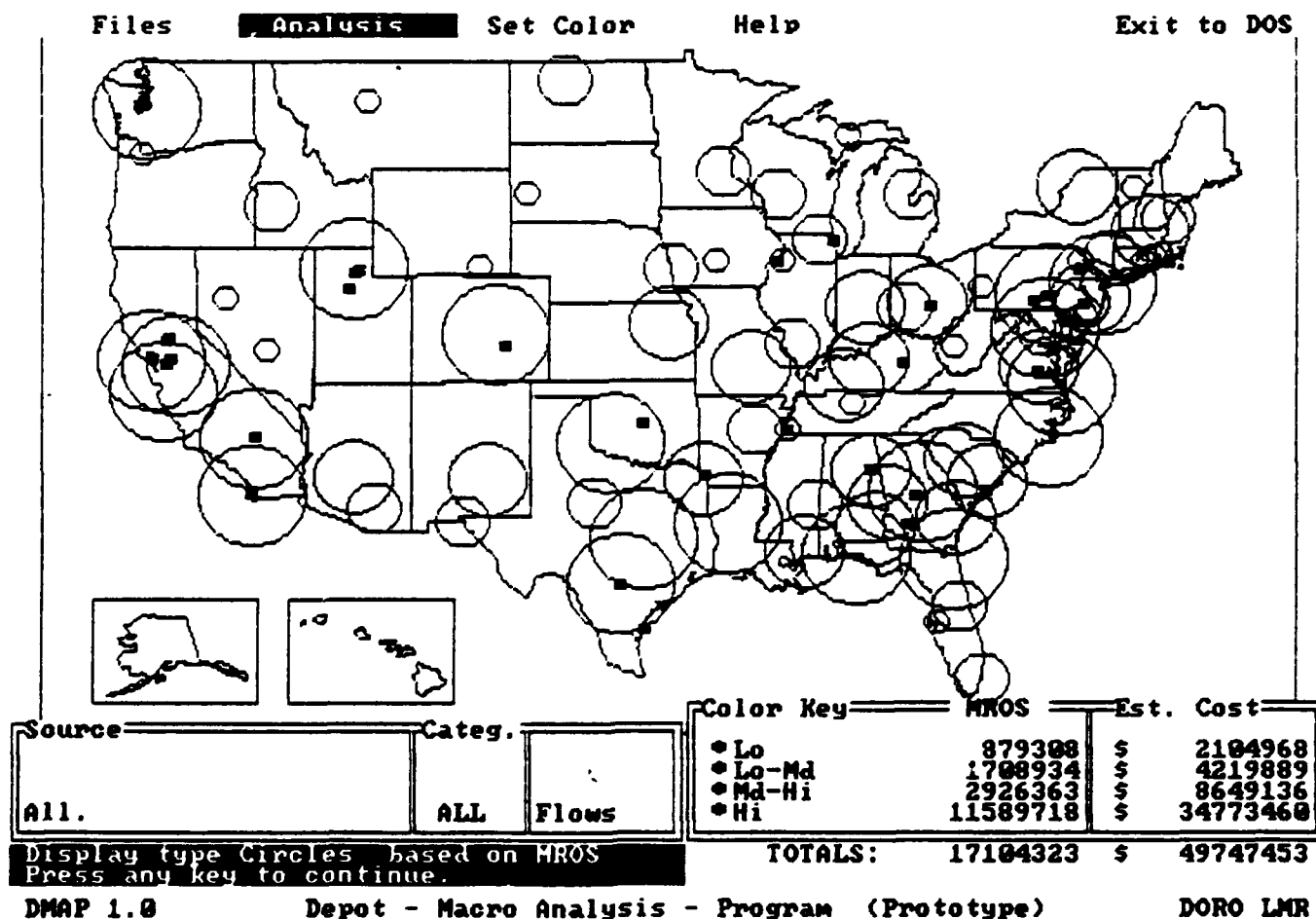
In this particular case, we have opted for Top20. Next we will choose MROS as the variable that will measure the leading 20 distribution zones, or customer zones in terms of MROs, for Tracy. Finally, since we are basing this analysis on MROS, we must use an appropriate variable, a weight-type variable, for estimating the associated transportation costs. In this case, CWGT (MRO hundred weight) is an appropriate variable. If the user has by this time hit <Enter>, the following screen will be displayed. This indicates the leading twenty customer zones nationwide for MRO shipments from Tracy. As indicated, this shows that Tracy shipped a little over two million MROs to the top 20 customer zones at an estimated cost of slightly more than six million dollars. In this example, this represents a one-year snapshot of the primary business flow from Tracy. By typing the letter P this information can be saved to the log file.

Screen 3-23. Flow Analysis Option - Top 20
Primary Customer Zones for Tracy



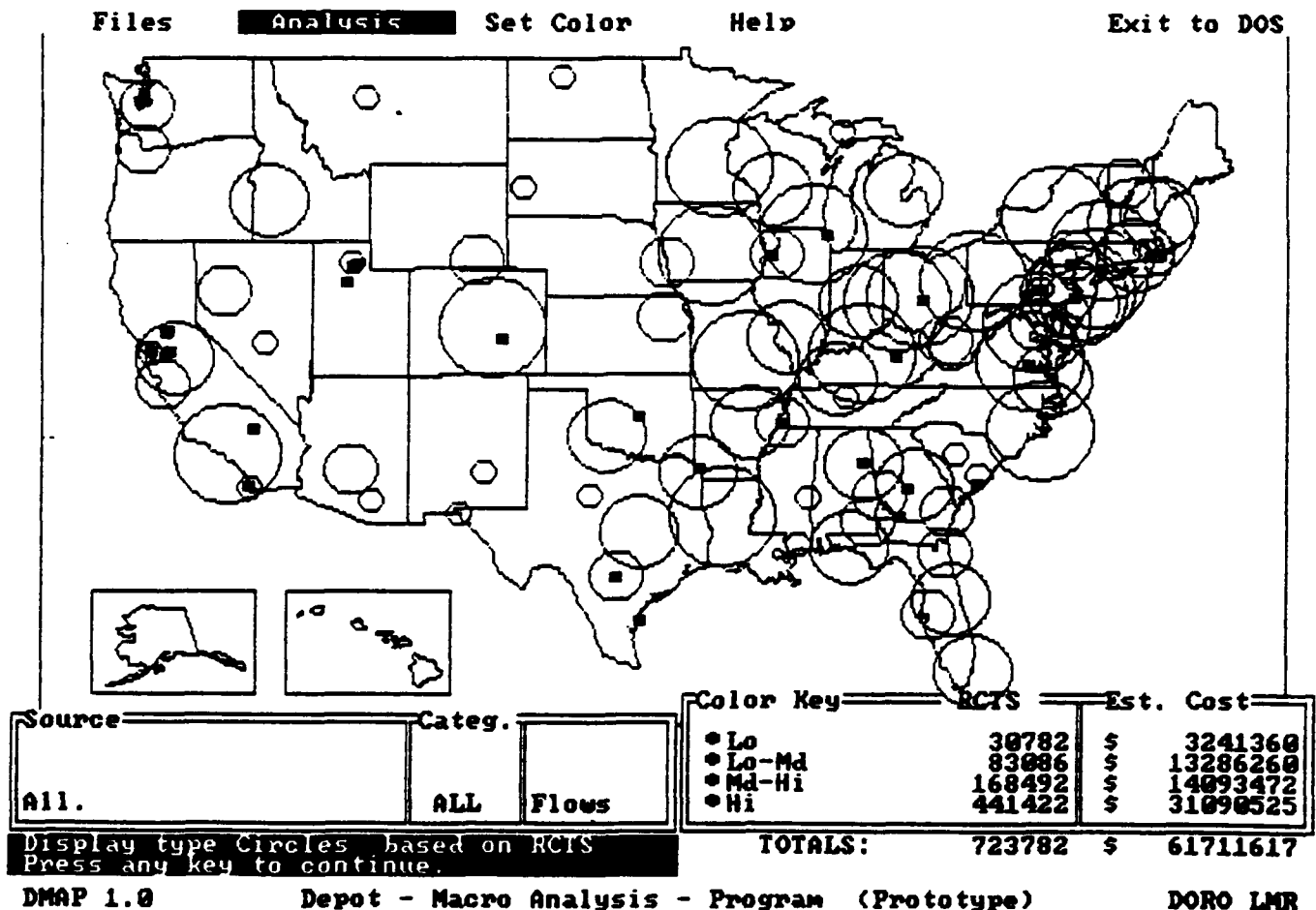
Where as the previous charts have centered on looking at business patterns for Tracy, the user could have just as easily loaded up all locations which for this demonstration data set constitutes thirty-two depots with Fiscal Year (FY) 1991 DLA data (exclusive of fuels and subsistence). If the user had selected this option to review business materiel flows under the **Circles** mode, the following screen would be seen. This captures the **MROS** (approximately seventeen million) for all customer zones and uses the larger circles to indicate those zones having the greatest activity. This chart depicts the so-called **LOGISTICAL CRESCENT** across the United States wherein our heavy demands have been shipped to both coasts and on across the southern sections of our nation.

Screen 3-24. Flow Analysis Option - Circles
The Logistical Cresnet



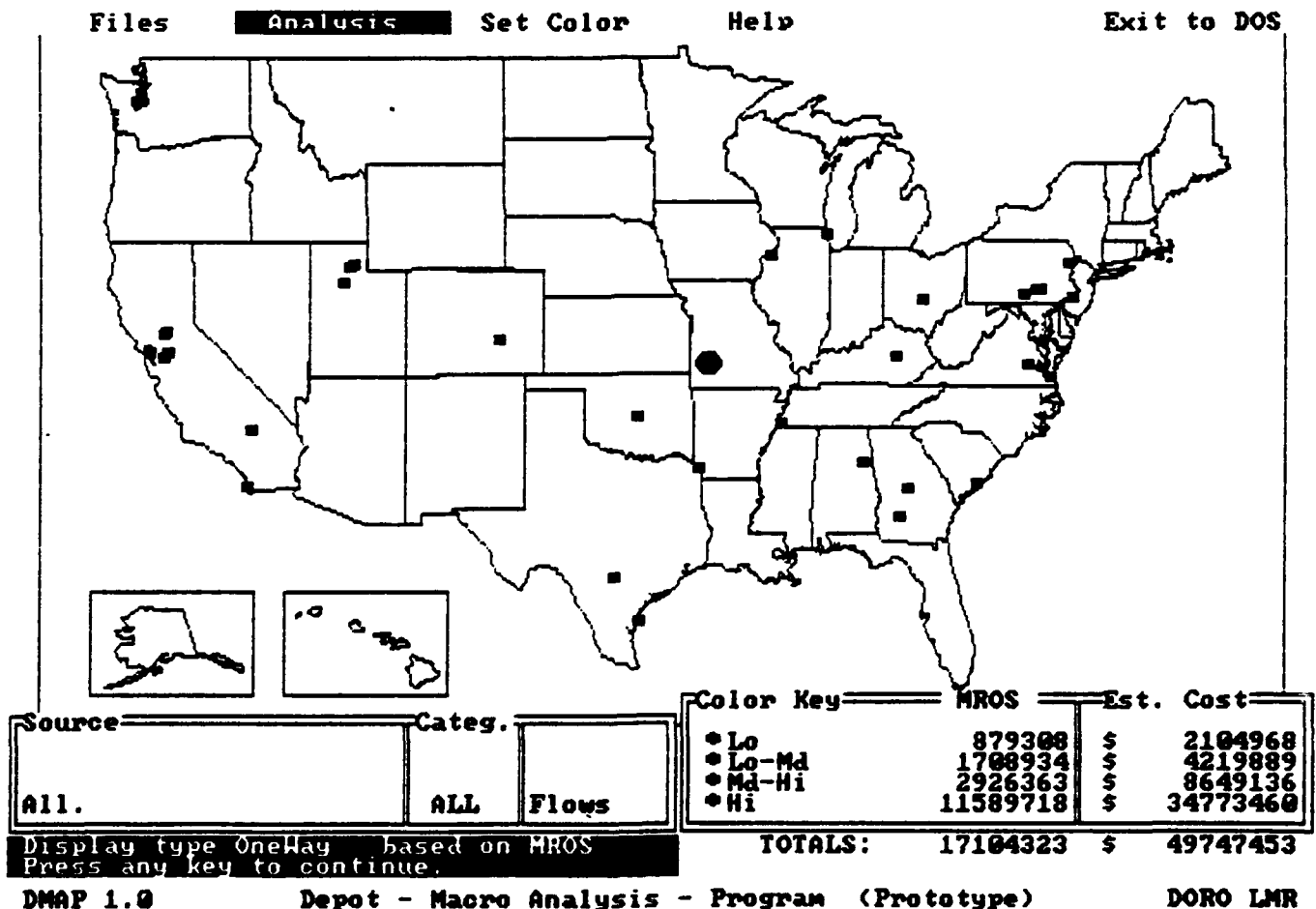
Alternatively, if the user desired to see materiel flows representing the new procurement receipts at the national level, you could select **Circles** display based on **RCTS** (which capture all new procurements) and using **VWGT** (vender shipping weight in hundreds of pounds) for estimating transportation costs. This choice results in the following screen which highlights the fact that the bulk of our vendors are located in the East and upper Mid-West with total new procurement receipts exceeding seven hundred thousand.

Screen 3-25. Flow Analysis Option - Circles
Sources of Supply



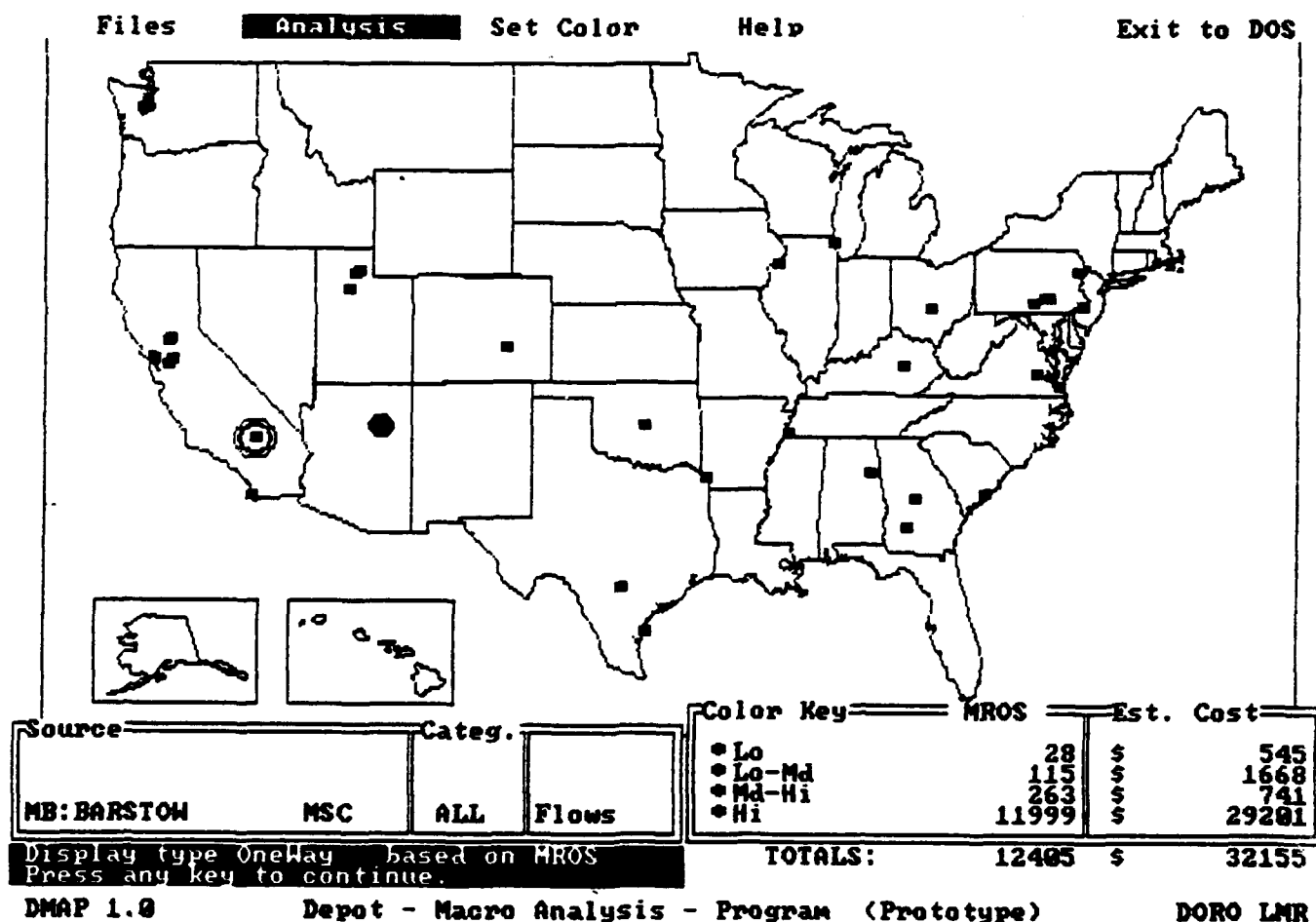
The reader will have noticed that we have mentioned the option associated with determining centroids. This represents a center of mass determination for any selected flow process. Given the data which we are using, this would equate to balancing ton-miles for any selected materiel flow. People have previously said that this type of analysis would result in selecting a "super depot" somewhere in Kansas to balance materiel flows to customer. Well, as it turns out for this data Kansas would not have been a bad guess since the actual centroid for MROS would have been southwestern Missouri.

Screen 3-26. Flow Analysis Option - One Way
Center of Mass Based on All MROS



Another option which we have yet to explore is the **MoveTo** selection. Before we do that, let's return to the **Locations** sub-menu and de-select ALL and select MB: BARSTOW. Now let's do a quick check of the business patterns from Barstow by looking at a centroid for Barstow's MROs. Here we have the following which indicates that Barstow handled a little over twelve thousand MROs for DLA materiel and that this business flow had its center of mass situated in Arizona.

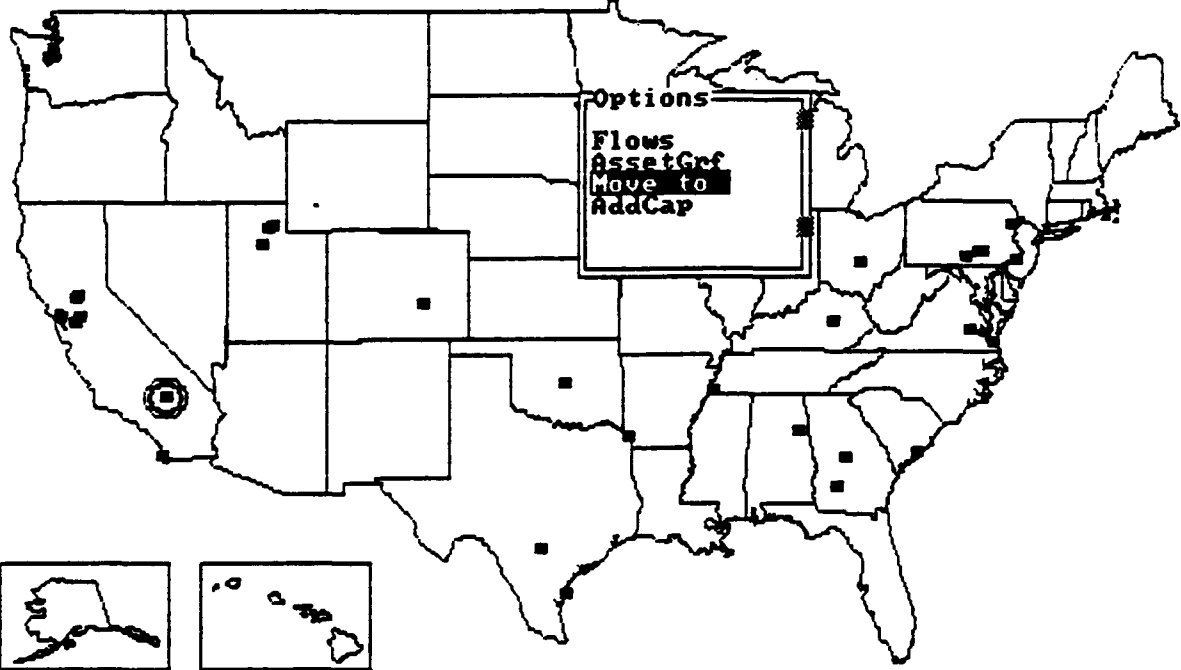
Screen 3-27. Flow Analysis Option - One Way
Center of Mass Based on Barstow's MROs



Continuing with our Barstow example, let's go into **Options** and select the **MoveTo** case. Here we see the following screen.

Screen 3-28. Options Selection List - Move To

Files **Analysis** Set Color Help Exit to DOS



Options
Flows
AssetGef
Move to
AddCap

Source Categ.

MB: BARSTOW	MSC	ALL	
-------------	-----	-----	--

DMAP 1.0

Depot - Macro Analysis - Program (Prototype)

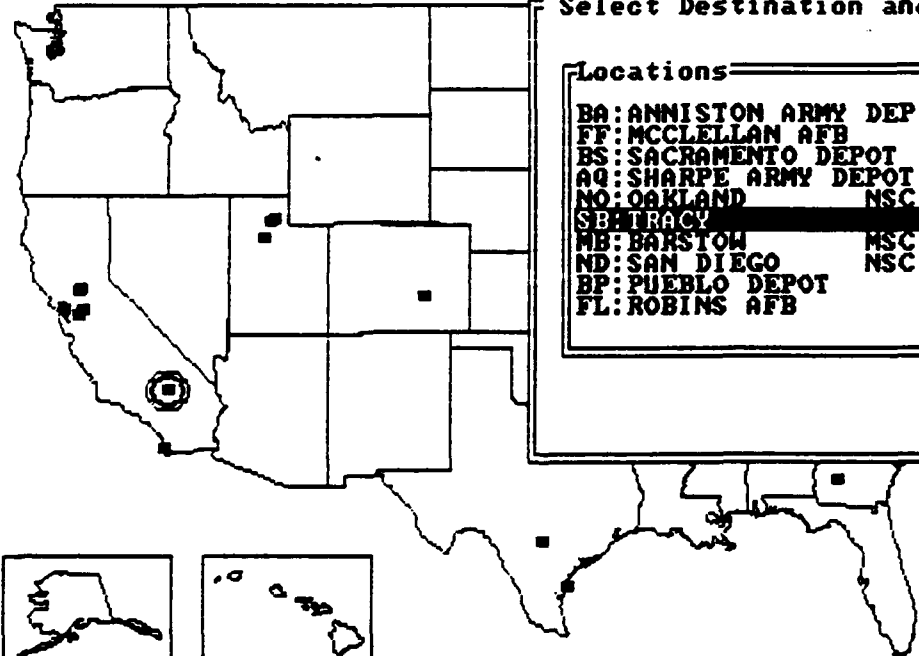
DORO LMR

Having selected the Move to option, the following window will open on the upper right of the screen and is entitled "Select Destination and Cost Inputs." In this case we will select SB: TRACY for where we wish to shift Barstow's DLA component business and we will choose the variable labeled DWGT (which represents depot hundred weight) for estimating the transportation cost of this one-time move.

Screen 3-29. Move To Analysis Option

Files **Analysis** Set Color Help Exit to DOS

Select Destination and Cost Inputs



Locations

BA: ANNISTON ARMY DEP

FF: MCCLELLAN AFB

BS: SACRAMENTO DEPOT

AQ: SHARPE ARMY DEPOT

NO: OAKLAND NSC

SB: TRACY

MB: BARSTOW MSC

ND: SAN DIEGO NSC

BP: PUEBLO DEPOT

FL: ROBINS AFB

Var-Cost

MROS

MMGT

RCTS

RMGT

DWGT

Source

MB: BARSTOW

Categ.

MSC

ALL

DMAP 1.0

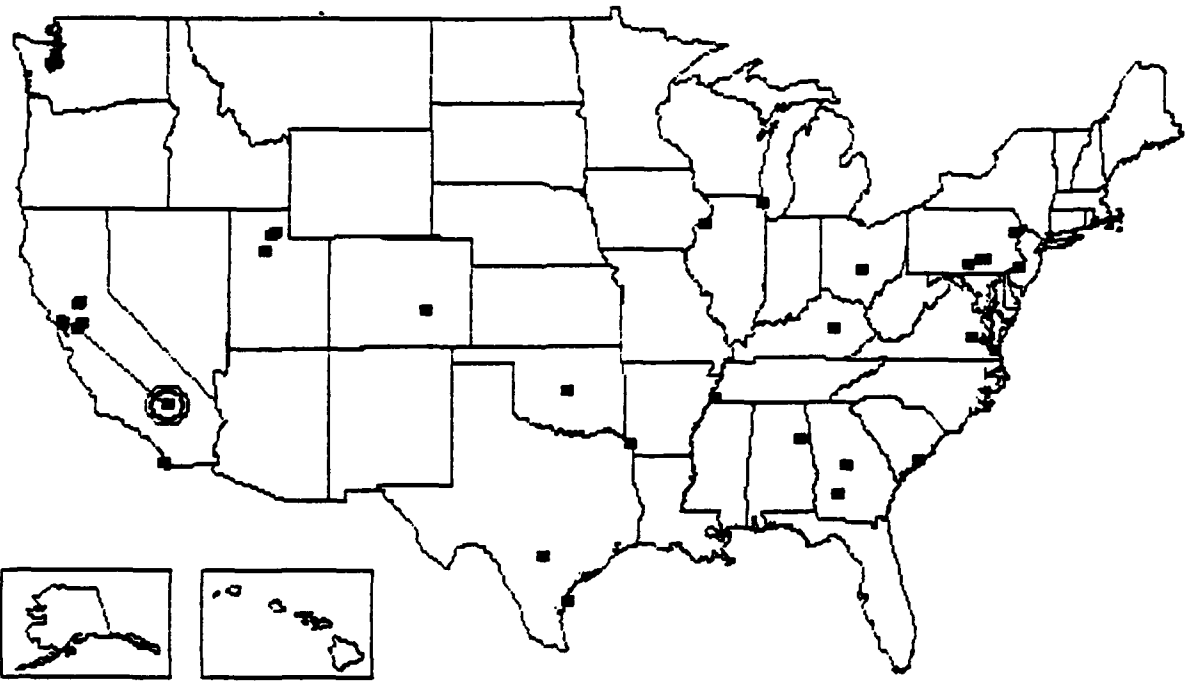
Depot - Macro Analysis - Program (Prototype)

DORO LMR

Having selected these choices and executed them by hitting the Enter key, the following screen will be displayed. This indicates that the DLA materiel within Barstow has been moved by surface rates to Tracy for a cost of slightly more than one hundred and thirty thousand dollars. This represents an estimated cost based on LTL and TL traffic rates. The real benefit of performing this type of analysis is that it permits the user to play off one site with another since not only is the stored materiel transferred but more importantly the entire support mission is transferred to the new site. This allows you to cost out the effect of this decision at a macro level. The information on this screen is automatically captured in the log file.

Screen 3-30. Move To Analysis Option Results

Files	Analysis	Set Color	Help	Exit to DOS
-------	-----------------	-----------	------	-------------



Source	Categ.	Destination	Est. Cost
MB:BARSTOW	MSC	SB:TRACY	\$ 138741

Task complete. Press any key to continue.

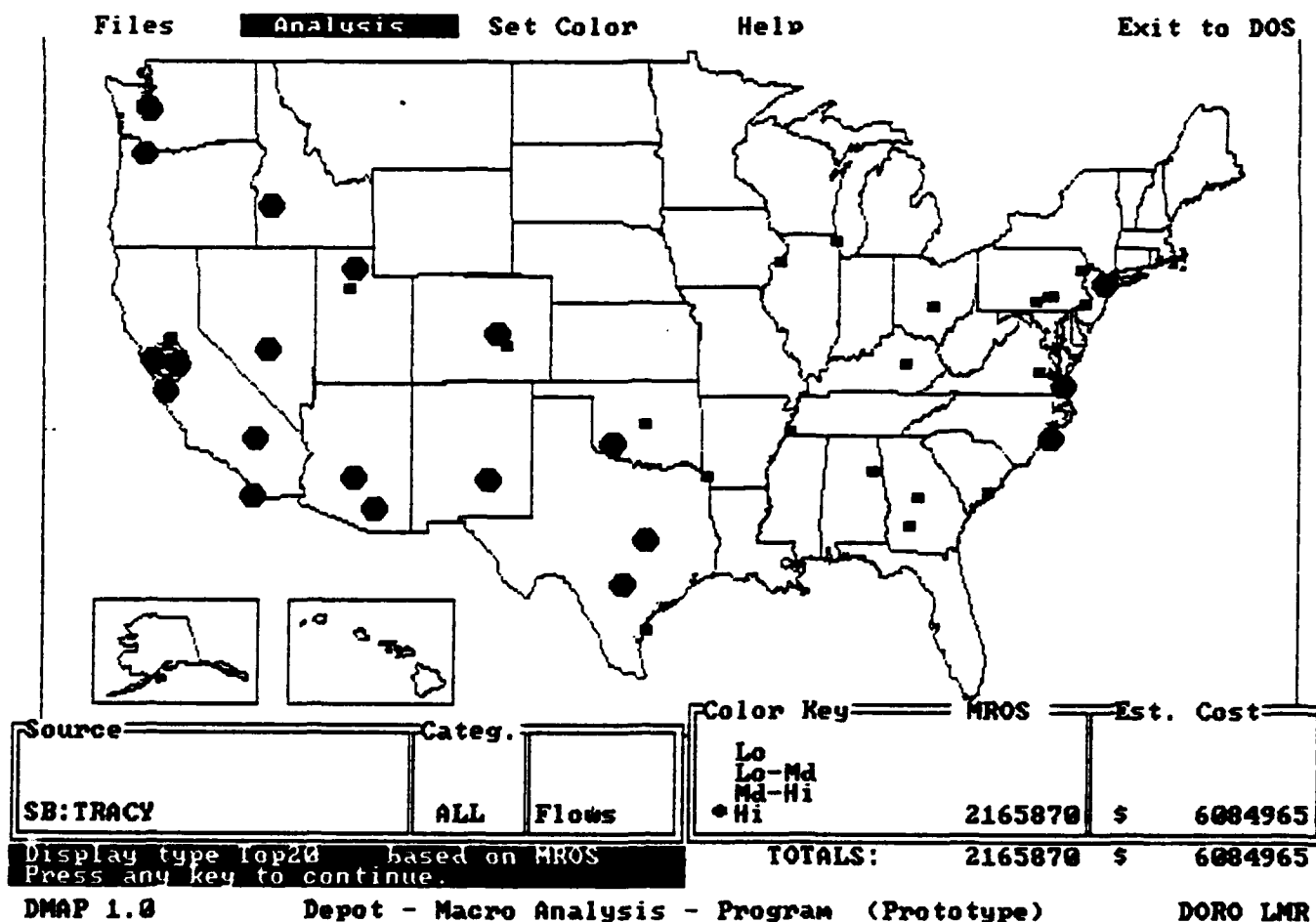
DMAF 1.0

Depot - Macro Analysis - Program (Prototype)

DORO LMR

Consequently, having made the decision to move DLA stock from Barstow and to support that mission from Tracy, we could evaluate the cost of that decision by reassessing business operations and associated costs at Tracy with its augmented mission. The following chart depicts the effects at Tracy along with the costs for the Top 20 customer zones (i.e., this could be contrasted with Screen 3-23 for an initial comparison). Additional comparisons would need to be made between these two sites to see if this was a "good" decision. This completes our initial introduction of DMAP for Analysis.

Screen 3-31. Flow Analysis Option - Top 20
Primary Customer Zones for Tracy After Augmentation

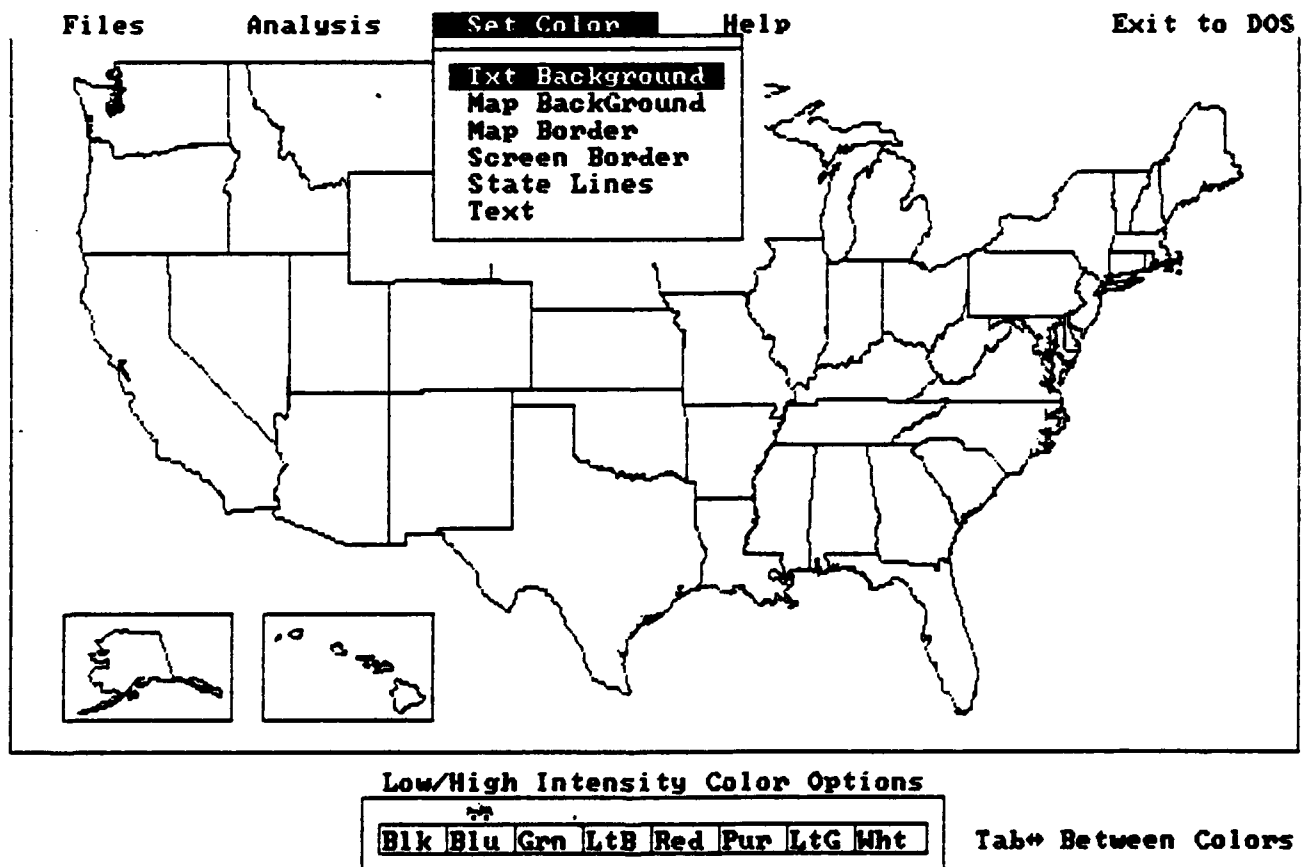


3.4

DMAP SET COLOR OPTION

Now that we have completed our introduction of the analysis section of DMAP, we may proceed to move at the main level menu over to the **Set Color** function. After highlighting **Set Color** and pressing <Enter>, you will see the following sub-menu displayed. For each section you may choose your various color options by using the <Tab> key while being somewhat selective so as not to inadvertently pick colors which would prove to be incompatible for displaying information (e.g., green on green). Within each of the eight color types, you have available two color intensities (i.e., low and high) which may be applied to each of the six color sub-menu topics.

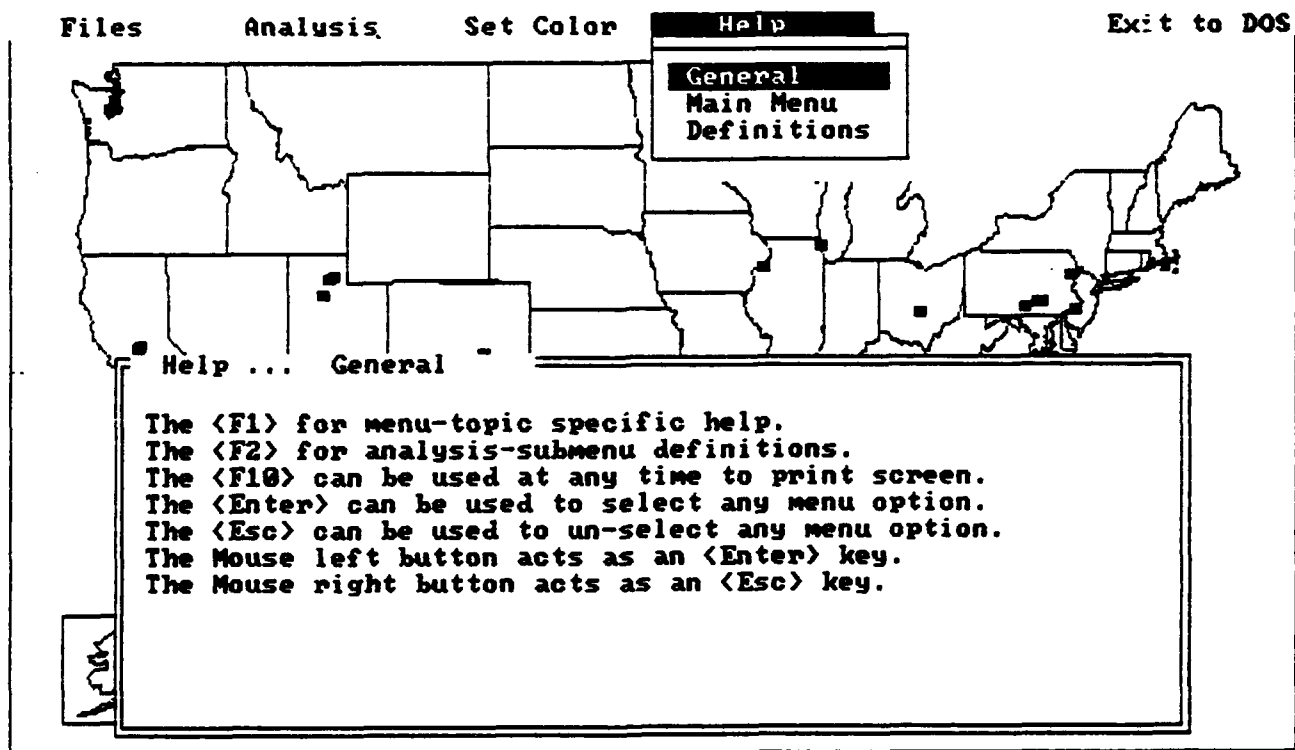
Screen 3-32. Set Color Option



DMAP HELP OPTION

Proceeding on to the **Help** sub-menu, if the user has hit <Enter> the **Help** sub-menu will open. Under the **Help** option there are three sub-menu topics currently available. Selecting the first one, **General**, lists various function keys which may be used as well as how to employ a mouse. Selecting **Main Menu** from **Help**, one will observe descriptions which briefly describe the functions available across each topic. Described under the last **Help** sub-menu are **Definitions**. This **Help** option provides a basic framework for various terms which have been employed under **DMAP**. It has been the intent of the **DMAP** design group to provide a flexible interactive graphical shell model which the user may tailor for specific functional support analysis. In that context, **DMAP**'s definitional terms have intentionally been kept as open as possible. In the following screen, we see the result of selecting **General** from the **Help** sub-menu.

Screen 3-33. Help Option

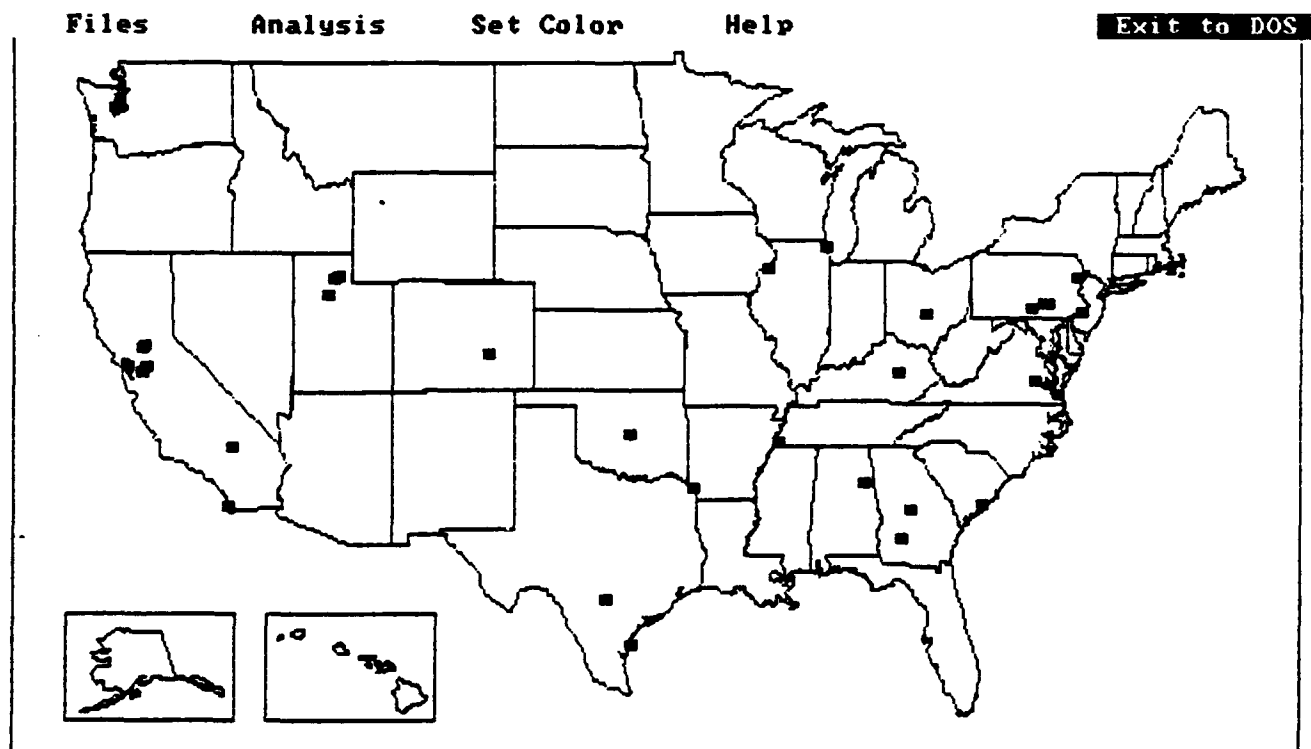


3.6

DMAP EXIT TO DOS OPTION

The final screen to be described by this User's Guide is the following. This is nothing more than the transfer back to the DOS shell of your PC.

Screen 3-34. Exit to DOS Option



DMAP 1.0

Depot - Macro Analysis - Program (Prototype)

DORO LMR

APPENDIX A
USER DATA FILES

APPENDIX A USER DATA FILES

A-1.1 LOCATION FILES

All location files should end with the .LOC extension. The location file supplied on the installation diskette is called "DEPOT.LOC." Ten records from this file are given below.

```
*SC, SC, OH,4976,2389,COLUMBUS
*SM, SM, TN,5404,2107,MEMPHIS DEPOT
*SA, SA, PA,4621,2413,MECHANICSBURG ICP
*SU, SU, UT,6705,2474,DEF DEPOT OGDEN
*SR, SR, VA,4646,2245,RICHMOND DEF SUP
*SB, SB, CA,7290,2262,TRACY
*MA, MA, GA,5045,1896,ALBANY          MSC
*MB, MB, CA,7020,2094,BARSTOW        MSC
*NR, NR, SC,4802,1974,CHARLESTON     NSC
*NG, NG, IL,5270,2538,GREAT LAKES    NTC
```

The first field has two meanings. The asterisk indicates a PDS or a group heading and the two characters following are the name of the PDS or group. The second field is the two digit routing identifier code (RIC) of the depot. The third field is the state abbreviation. This is followed by longitude and latitude, in minutes, and complete location name.

A-1.2 CAPACITY FILES

All capacity files should end with the .CAP extension. The capacity file supplied on the installation diskette is called "DEPOT.CAP." Ten records from this file are given below.

```
          Wkld, TotC, BinC, HazC
SB, 7100000, 55000, 1200, ,TRACY
SR, 3874000, 43900, 1400, 1800,RICHMOND DEF SUP
SC, 2060500, 33600, 600, ,COLUMBUS
SU, 5981520, 41200, 2000, 9200,DEF DEPOT OGDEN
SM, 7358000, 40800, 2000, 3800,MEMPHIS DEPOT
SA, 10600000, 46200, 2000, ,MECHANICSBURG ICP
BS, , 7229, , ,SACRAMENTO DEPOT
FF, , 14615, , ,MCCLELLAN AFB
MB, , 21785, 1000, 1000,BARSTOW          MSC
```

The first record in this file provides the labels that DMAP uses for capacity variables. For example, "Wkld" is a label used in DMAP to denote the workload capacity, "TotC" denotes total cube capacity in thousands of cubic feet, "BinC" denotes binnable storage cube in thousands, and HazC denotes hazardous storage cube in thousands. These variables are used predominately in the ASSETGRF and ADDCAP analysis options in DMAP.

followed by the capacities, if available, for each of the labels. One may realize that this file "reads" as a table of data complete with the appropriate labels.

A-1.3

LOCATION INFORMATION FILES

All location information files should end with the .VAR extension. The location information file supplied on the installation diskette is called "DPT1.VAR." Ten records from this file are given below.

	MROS,	MWGT,	RCTS,	RWGT,	DWGT,	DCUB
SA,BLK,	209117,	1293100,	9732,	1234102,	1316034,	7419
SA,BWB,	842469,	542624,	21235,	521621,	421837,	3253
SA,BWR,	825642,	80101,	26452,	62853,	141965,	605
SA,HAZ,	22906,	16198,	381,	22518,	11987,	41
SB,BIN,	702115,	40214,	48540,	31502,	182558,	799
SB,BLK,	226417,	1179752,	17691,	1263525,	1548621,	8628
SB,BWB,	760351,	499941,	21078,	441510,	505965,	3389
SB,BWR,	850408,	77959,	34820,	65241,	169979,	707
SB,HAZ,	22741,	55173,	739,	137429,	111335,	281
SC,BIN,	938534,	34868,	75349,	25974,	214069,	995

The first record in this file provides the labels that DMAP uses for location information variables. For example, "MROS" is a label used in DMAP to denote the workload counts, "MWGT" denotes total weight of the MROs in hundred weight, "RCTS" denotes the procurement receipt counts, "RWGT" denotes total weight of the receipts in hundred weight, "DWGT" denotes total asset weight in hundred weight, and "DCUB" denotes total asset cube in thousands. These variables are used predominately in the ASSETGRF analysis option in DMAP.

The first field in the second and all subsequent records of this file is the two-digit RIC. This is followed by a label for the category of items. For example, "BLK" refers to bulk items, "BWB" refers to binnables with bulk back-up, "BWR" refers to binnables with rack back-up, "HAZ" refers to hazardous items, and "BIN" refers to true binnables. The item categories are followed by the values for each of the labels. Again, one may realize that this file "reads" as a table of data complete with the appropriate labels.

A-1.4**MATERIEL FLOWS FILES**

All materiel flows files should end with the .VEC extension. The materiel flows file supplied on the installation diskette is called "DPT1.VEC". Ten records from this file are given below.

	MROS,	CWGT,	RCTS,	VWGT
S2,BWB,80,	1,	73,	0,	0
S2,BWR,11,	1,	9,	0,	0
S9,BIN,80,	1,	0,	0,	0
SA,BIN,01,	11276,	174,	327,	113
SA,BIN,02,	4020,	943,	238,	40
SA,BIN,03,	11802,	345,	1055,	524
SA,BIN,04,	3663,	103,	58,	7
SA,BIN,05,	4841,	246,	477,	340
SA,BIN,06,	13184,	8806,	1276,	402

The first record in this file provides the labels that DMAP uses for materiel flow variables. For example, "MROS" is a label used in DMAP to denote the workload counts, "CWGT" denotes total weight of the MROs in hundred weight, "RCTS" denotes the procurement receipt counts, and "VWGT" denotes total weight of the receipts in hundred weight. These variables are used predominately in the **FLOWS** analysis option in DMAP.

The first field in this file is the two-digit RIC. This is followed by a label for the category of items. These categories are defined by the location information file. The item categories are followed by the cluster region number (1-to-80) and by the values for each of the labels. Again, one may realize that this file "reads" as a table of data complete with the appropriate labels.

APPENDIX B
MATH TECHNIQUES

APPENDIX B MATH TECHNIQUES

There are several techniques from mathematics which are employed in the DMAP package. Two of those methodologies will be briefly explained in this appendix for those readers who have an interest. The first topic will cover centroids which are also referred to in DMAP as center of mass calculations. The second subject will deal with distance calculations and how DMAP estimates those while taking into account the curvature of the planet.

B-1.1 CENTROIDS

The use of centroid or center of mass solution techniques are used in a wide class of problems having to do with balancing. To illustrate this concept of balancing, the reader might recall a child's seesaw can be used to balance the weight of children. Hence, if there is a heavy child on one side of the seesaw, this load may be balanced by having several small children sit on the opposite side. In this case, by adding weight to one side of the seesaw, the seesaw is balanced and the pivot or fulcrum of the seesaw represents the centroid or center of mass (assuming that the fulcrum was a fixed point). Alternatively, a seesaw which did not have a fixed or locked pivot point could be brought into a balanced system with a heavy child on one side and a light weight child on the opposite side by simply sliding the seesaw to the point where the loads were balanced. This new pivot point would represent the centroid and it is this latter solution which DMAP solves for when a user requests that materiel flows be looked at as a center of mass from a depot or set of depots.

The specific equations which DMAP employs to solve for the coordinate points of a centroid are based on the formulae used to solve the Euclidean-distance problem. This type of problem is often used as a logical structure for estimating the "best" location at which an organization could establish a new facility (assuming that there are no existing facilities) for balancing costs. This type of problem is also known in the literature as the gravity problem and hence the solution is referred to as the center of mass.

B-1.1.1 FORMULATION OF GRAVITY PROBLEM

The essential gravity problem is the following:

$$\text{minimize}_{x,y} f(x,y) = \sum w_i [(x-a_i)^2 + (y-b_i)^2]$$

The conditions which must be satisfied for a point (x^*, y^*) to minimize this problem is the following:

$$[\delta f(x^*, y^*) / \delta x^* , \delta f(x^*, y^*) / \delta y^*] = (0, 0)$$

If you solve with respect to variables x and y , and set to zero the partial derivatives indicated above, the following solution is obtained:

$$x^* = \Sigma w_i a_i / \Sigma w_i \quad \text{and} \quad y^* = \Sigma w_i b_i / \Sigma w_i$$

The resulting coordinates (x^*, y^*) represent that point in a Euclidean plane which is the center of mass or centroid for the problem which has been selected. It is these last equations which are used in DMAP for solution.

B-1.2 GREAT CIRCLE DISTANCE

In this section we develop the mathematical expressions for computing the Great Circle Distance (GCD) between two points on the surface of the Earth. The GCD, discussed here, represents the shortest distance from one point to another at ground level.

Suppose our objective is to find the GCD from point A to point B, denoted as GCD(AB). Letting the latitude of the North Pole be 0 degrees, rather than the traditional definition of 90 degrees North, one can define point A in the rectangular coordinates:

$$\begin{aligned} x_a &= r \sin(\text{latitude of A}) \cos(\text{longitude of A}), \\ y_a &= r \sin(\text{latitude of A}) \sin(\text{longitude of A}), \\ z_a &= r \cos(\text{latitude of A}). \end{aligned}$$

Here, r represents the radius of the Earth. The Polar diameter of the Earth is given as 7900 miles, while the Equatorial diameter is 7927 miles. For the GCD computation, the radius used represents the average of the two diameters. Hence, $r = (7900 + 7927) / 4$.

The distance formula gives one the length of the chord between points a and b. Chord length represents the straight line distance through the Earth. The squared chord length is given as

$$d^2 = (x_a - x_b)^2 + (y_a - y_b)^2 + (z_a - z_b)^2.$$

Letting C denote the center of the Earth with radius r , the following diagram may be beneficial to our discussion.

First we compute α so that the arc length formula can be used to compute the GCD(AB). Knowing that the sum of the angles in a triangle is 180 degrees, $\alpha = 180 - 2\beta$. In addition, the Law of sines tells us that, $r/\sin(\beta) = d/\sin(\alpha)$. By simplifying these results, $\beta = \arccos(d/2r)$. Finally, $\text{GCD}(AB) = r\pi\alpha/180$, where $\alpha = 180 - 2\arccos(d/2r)$.

B-1.3 USE OF UNDERLYING ROAD NETWORK

DMAP uses a combination of an underlying road network and great circle distances to estimate point to point mileages. The underlying road network used in DMAP consists of known road mileages between 89 cities.

Suppose one wishes to estimate the road mileage between points A and B. Let N_i , $i=1, \dots, 89$, denote the points for which known road distances exist. Now,

- (1) Find point N_a , $0 < a < 90$, such that N_a is closest to point A.
- (2) Find point N_b , $0 < b < 90$, such that N_b is closest to point B.
- (3) Find point N_c , $0 < c < 90$, such that N_c has the smallest squared distance from points A and B. This is the point that is closest to the midpoint of line segment AB.

Note: Here closest or smallest distance refers to the rectangular coordinate system approximation by the lines of longitude and latitude.

Furthermore, define the following ratios:

- (1) $r_1 = \text{GCD}(AN_c) / [\text{GCD}(AN_c) + \text{GCD}(BN_c)]$ as the portion of the line segment AB that will be approximated by the known distance between N_a and N_c , $\text{KNW}(N_a N_c)$. Conversely, $1-r_1$ represents that portion of the line segment AB that will be approximated by the known distance between N_b and N_c , $\text{KNW}(N_b N_c)$.
- (2) $r_2 = \text{GCD}(N_a N_c) / \text{KNW}(N_a N_c)$ as the ratio of the great circle distance to the known road distance between points N_a and N_c .
- (3) $r_3 = \text{GCD}(N_b N_c) / \text{KNW}(N_b N_c)$ as the ratio of the great circle distance to the known road distance between points N_b and N_c .

Finally an estimate for the road mileage between points A and B is given as

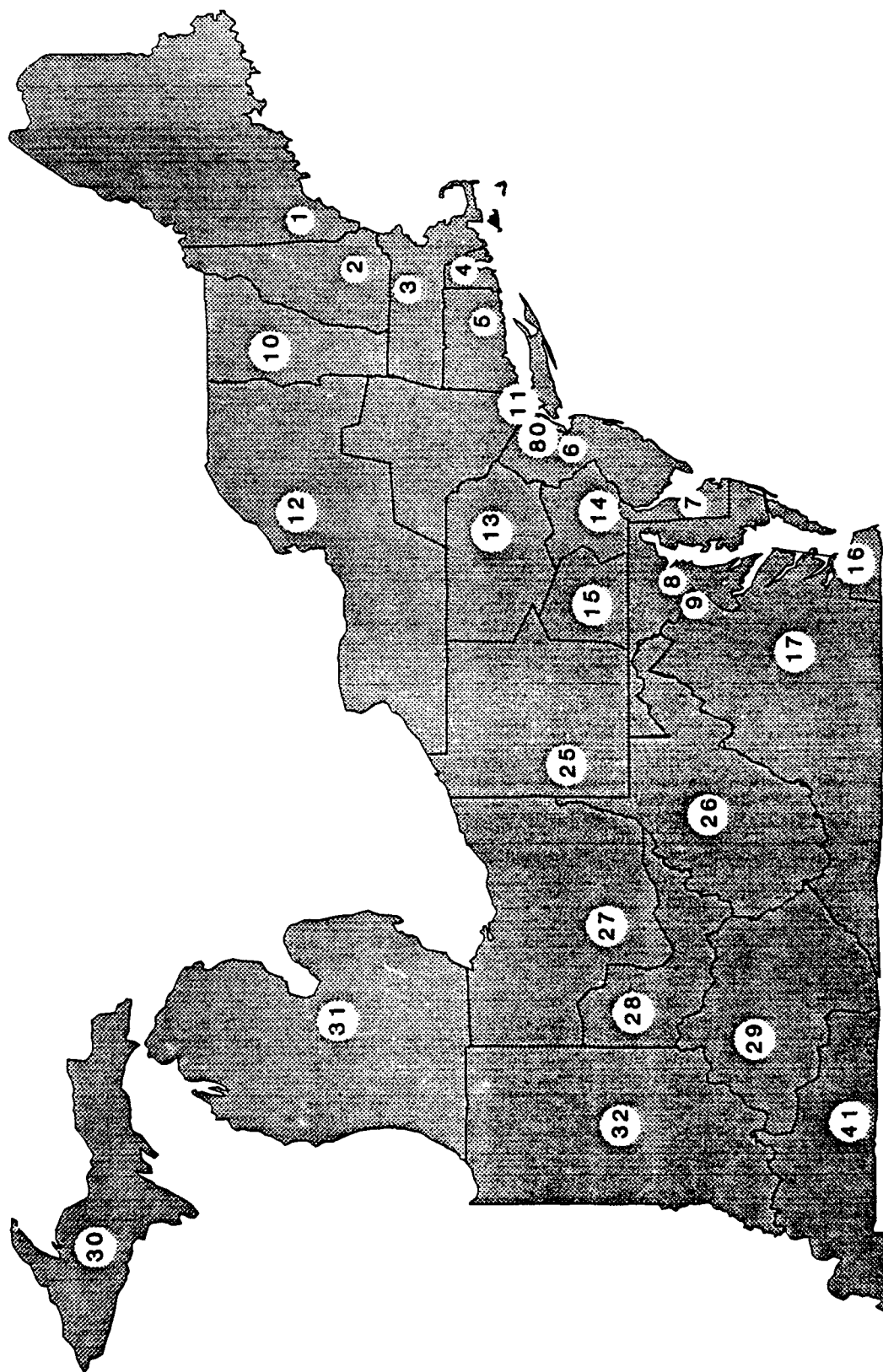
$$\text{mileage}(AB) = r_1 \text{GCD}(AB)/r_2 + (1-r_1) \text{GCD}(AB)/r_3.$$

APPENDIX C
CLUSTER REGIONS

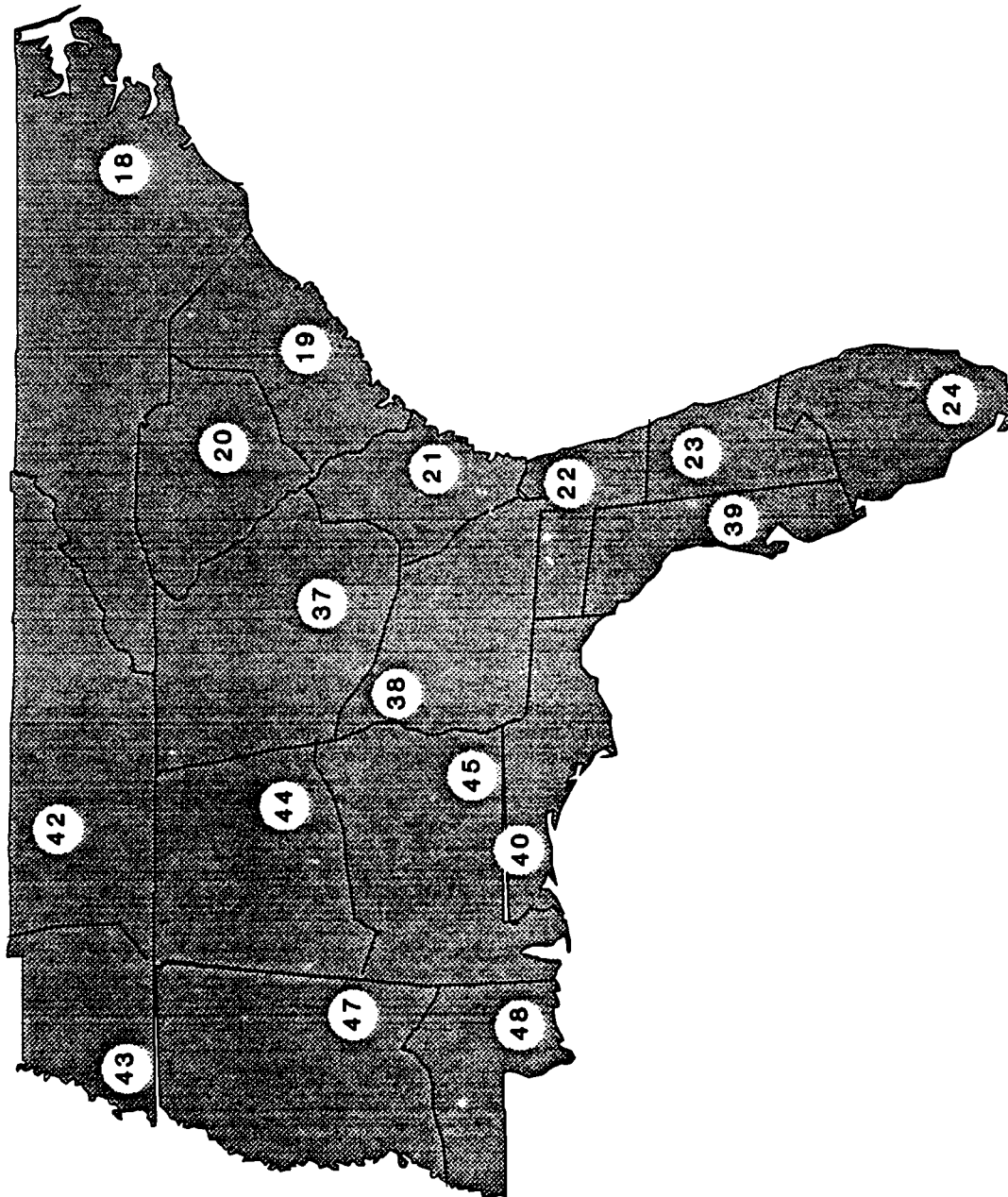
APPENDIX C CLUSTER REGIONS

For plotting customer and vendor activity regions, DMAP uses a set of 80 clusters. Two of these clusters are used for overseas traffic. The Container Consolidation Point (CCP) at Oakland, CA is the cluster for overseas Pacific and the CCP at Bayonne, NJ is for overseas Atlantic. The remaining 78 clusters are illustrated on the CONUS maps contained in this Appendix. Note that these clusters do not represent single points but geographical regions. Most of the clusters have regional borders that are also state borders. In a few cases, e.g. California and Texas, the state may contain multiple cluster regions.

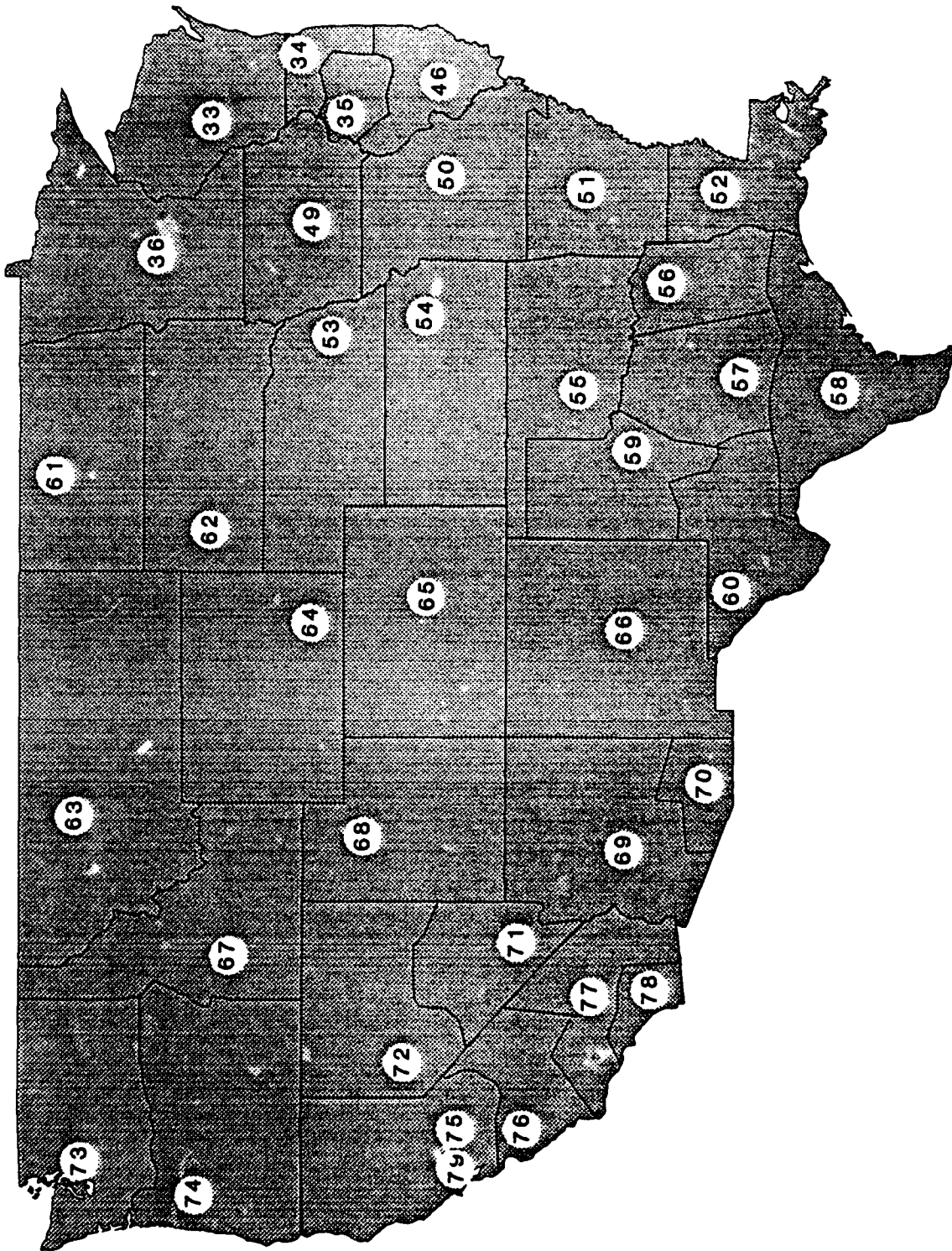
NORTHEASTERN UNITED STATES CLUSTER REGIONS



SOUTHEASTERN UNITED STATES CLUSTER REGIONS



WESTERN UNITED STATES CLUSTER REGIONS



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