Naval Research Laboratory
Stennis Space Center, MS 39529

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AV-8B Map System II: Moving Map Composer (MMC) Version 3.3, Software Users' Manual (Second Edition)

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13. ABSTRACT (*Maximum 200 words*)

This report documents the Moving Map Composer (MMC) software system developed by scientists in NRL Code 7440.1. This is the second edition of the MMC Users' Manual (the first edition is NRL/FR/7441--97-9677) and reflects changes that were implemented for the latest release (version 3.3) of MMC.

The MMC software is resident on the Map-II Station portion of the AV-8B Mission Support System, which NRL designed and configured in support of AV-8B mission planners and pilots in the field. MMC enables users to perform the following functions:

- Design and build Aircraft Optical Disk (AOD) images from user-specified Compressed Aeronautical Chart (CAC) and scanned chart data;
- Include emergency checklists and reconnaissance photographs in an AOD image;
- Write completed AOD images to militarized Write-Once Read-Many AODs;
- Evaluate failed AODs and recover from failed AOD image builds;
- Design and build Mission Planning System Compact Disk Images (MPS-CDIs) from user-specified CAC, scanned chart, and DTED data;
- Write MPS-CDIs to Recordable Compact Disk (CD-R) for mission planning purposes;
- Scan and compress paper charts into a CAC-compatible format (when CAC or Arc Digitized Raster Graphics (ADRG) are not available) and include them in an AOD image or MPS-CDI.
- Print final compositions, CAC images, checklists, and AOD summaries (new function in MMC version 3.3).

The AV-8B Map-II Stations have completely replaced all map data functions and all optical disk image functions that previously were handled by the AV-8B Map, Operator, and Maintenance Stations (MOMS). To date, the AV-8B program has purchased eight NRL-developed Map-II Stations (including two for the Spanish AV-8B and one for the Italian AV-8B), and the F/A-18 program has purchased two.

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1. INTRODUCTION

This report documents the Moving Map Composer (MMC) software system developed by scientists in NRL Code 7440.1. This is the second edition of the MMC Users' Manual (the first edition is Lohrenz et al. 1998); it reflects changes that were implemented for the latest release (version 3.3) of MMC. Appendix A provides a glossary of acronyms and terms.

The MMC software is resident on the Map-II Station portion of the AV-8B Mission Support System, which NRL designed and configured in support of AV-8B mission planners and pilots in the field. MMC enables users to

- design and build Aircraft Optical Disk (AOD) images (AODIs) from user-specified Compressed Aeronautical Chart (CAC) and scanned chart data;
- include emergency checklists and reconnaissance photographs in an AODI;
- write completed AODIs to militarized write-once, read-many (WORM) AODs;
- evaluate failed AODs and recover from failed AODI builds;
- design and build Mission Planning System Compact Disk Images (MPS-CDIs) from user-specified CAC, scanned chart, and Digital Terrain Elevation Data (DTED) data;
- write MPS-CDIs to recordable compact disk (CD-R) for mission planning purposes;
- scan and compress paper charts into a CAC-compatible format (when CAC or Arc Digitized Raster Graphics (ADRG) are not available) and include them in an AODI or MPS-CDI (the CAC format is defined in Lohrenz and Ryan (1990)); and
- print final compositions, CAC images, checklists, and AOD summaries (this is a new function in MMC version 3.3).

The AV-8B Map-II Stations have completely replaced all map data functions and all optical disk image functions that previously were handled by the AV-8B Map, Operator, and Maintenance Stations (MOMS).

Manuscript approved November 14, 1999.

2. SYSTEM CONFIGURATION

2.1 Hardware

Figure 1 illustrates the AV-8B Map-II hardware components and the data flow between each of these components. Figure 2 shows the small computer standard interface (SCSI) and general-purpose interface board (GPIB) connections for the AV-8B Map-II workstation and peripherals. Appendix B defines each of these components in detail, and Appendix C describes how to set up the Map-II hardware.

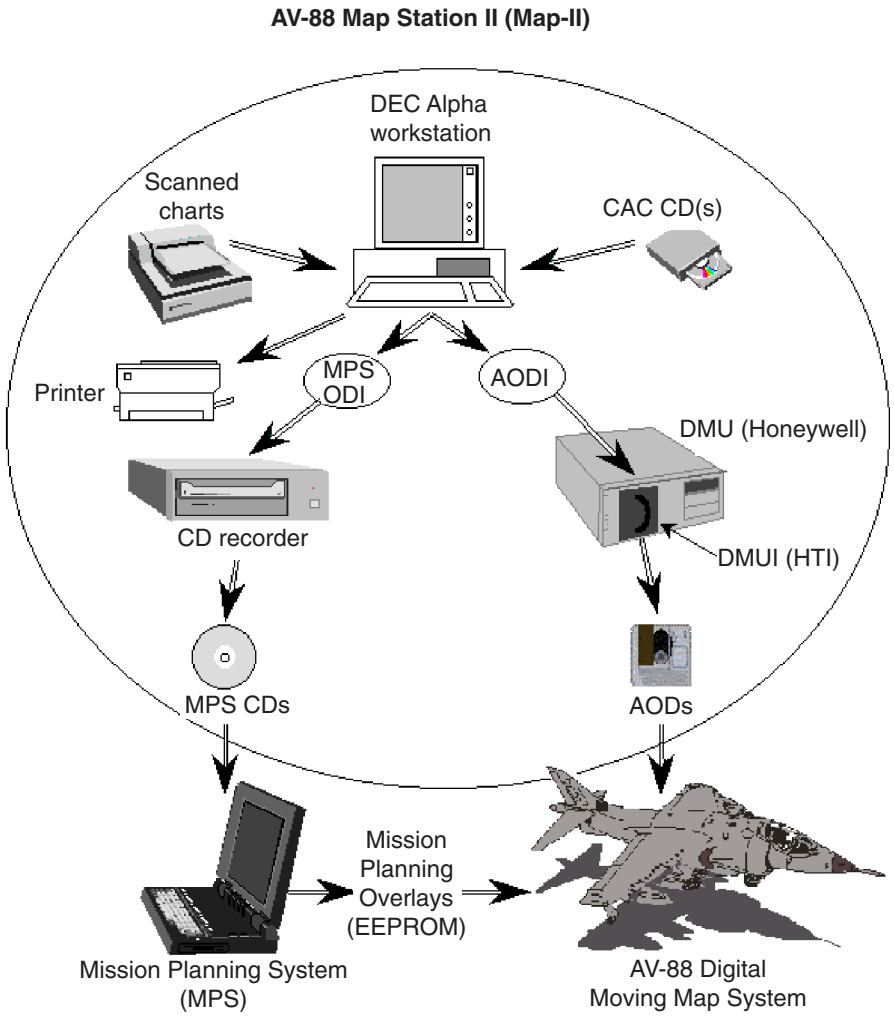


Fig. 1 — AV-8B Map-II hardware components

2.2. Software

Figure 3 is a simplified diagram of the principal MMC software operations: the MMC user inputs up to three primary data sources (CAC, DTED, and scanned charts), from which Mission Planning System (MPS) data and AOD data are processed and archived.

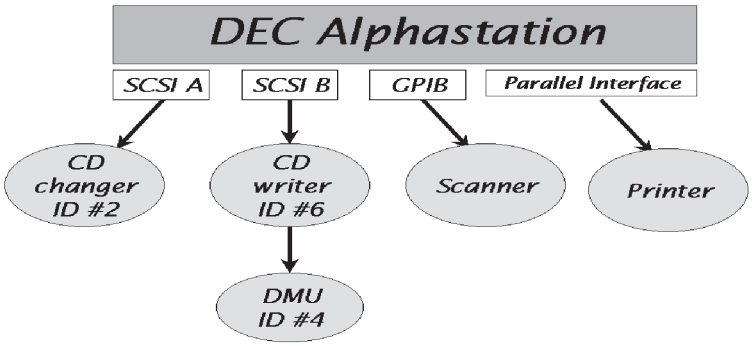


Fig. 2 — AV-8B Map-II SCSI and GRIP connections

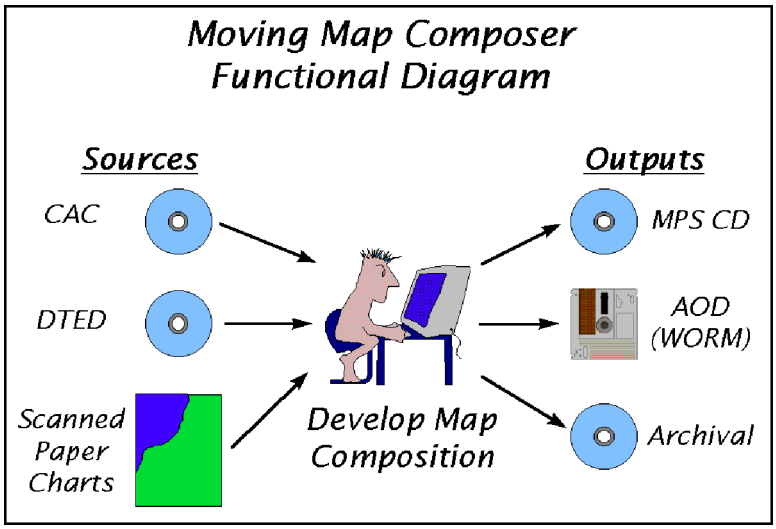


Fig. 3 — Primary MMC software functions

Figures 4 and 5 illustrate how to build an AOD or MPS composition using two different methods (depending on available data). Figure 4 shows how to build a new, user-defined composition from "scratch." Figure 5 shows how to build a new composition from a pre-existing composition (when the user may or may not have all source data available).

The next two sections provide more detailed information on the MMC software. Section 3 describes the MMC graphical user interface (GUI), including the world map workspace, tool bars, and all associated utilities. Section 4 provides step-by-step instructions on how to perform the most common MMC operations. This section was derived from a tutorial that NRL developed for the initial installations of the Map-II workstation in China Lake, California; Rota, Spain; and Aviano, Italy.

3. MMC GRAPHICAL USER INTERFACE

3.1 Starting MMC

To start MMC, log in to the MMC account and type MMC at the $ prompt. After several seconds, the main MMC Window will appear (Fig. 6). Sections 3.2 and 3.3 provide detailed descriptions and illustrations of the various functions and utilities that MMC provides.

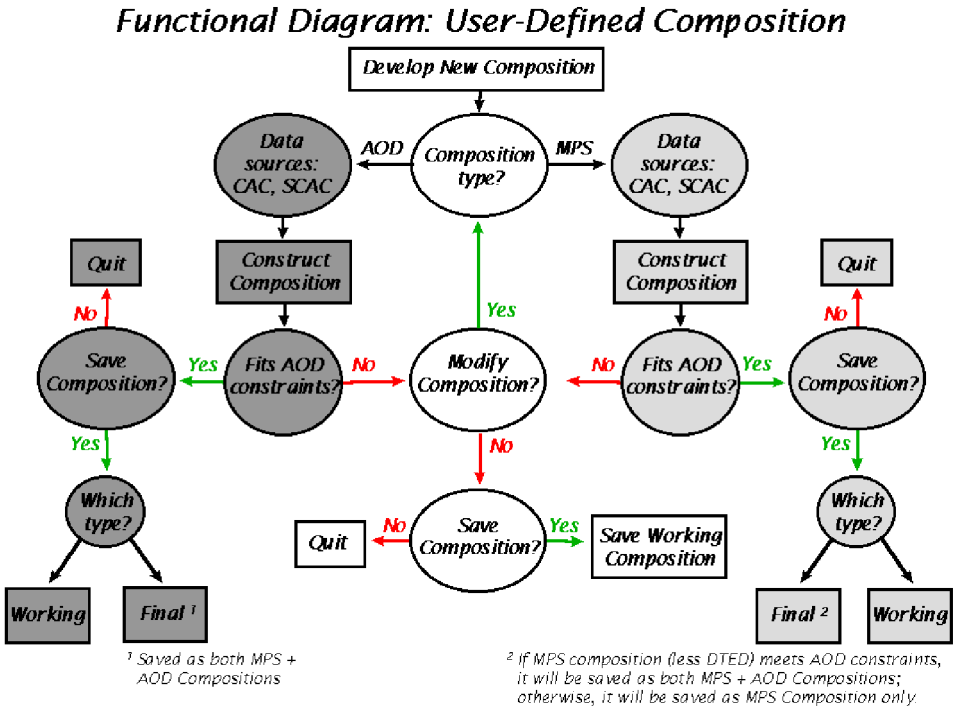


Fig. 4 — Building a user-defined AOD or MPS composition

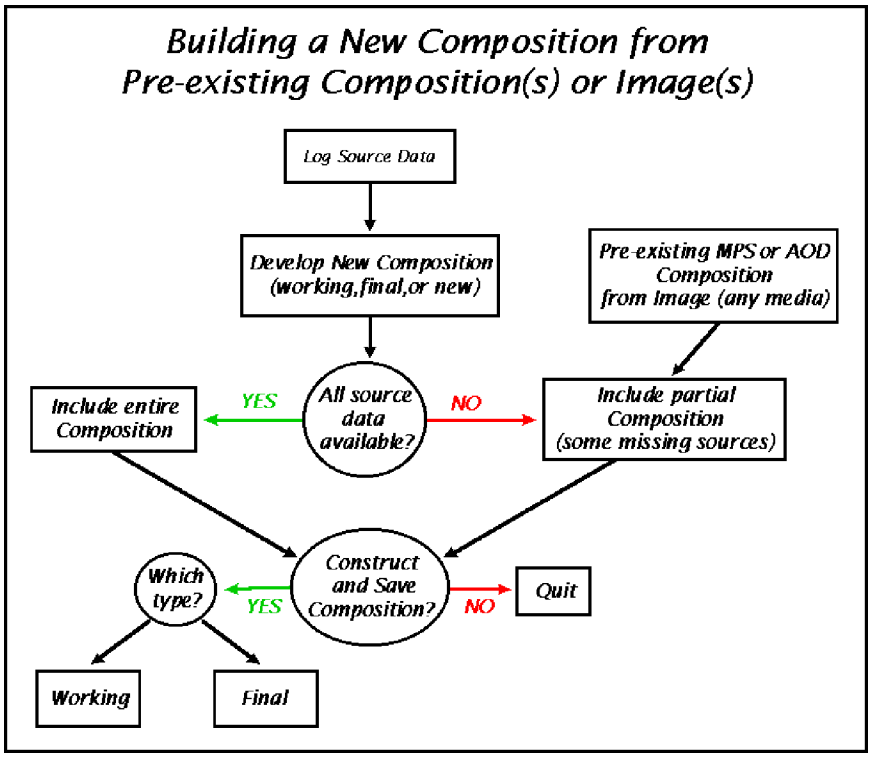


Fig. 5 — Building a new AOD or MPS composition from a pre-existing composition

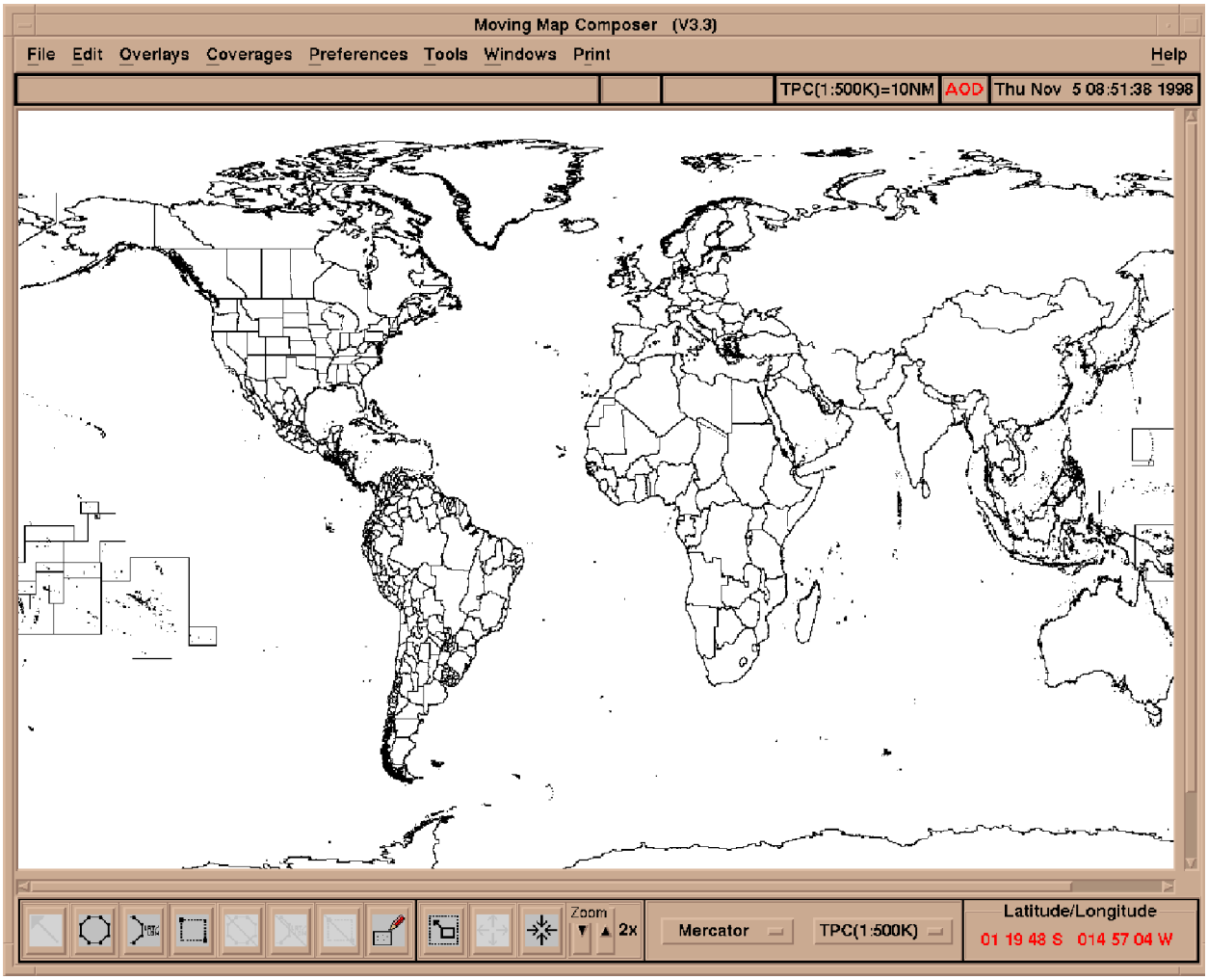


Fig. 6 — Main MMC window

3.2 Toolbars and Workspace Definitions

3.2.1 World Map Workspace

The largest portion of the main MMC Window is a world base map on which to design AODI and MPS-CDI compositions (Fig. 6). To optimize performance (e.g., speed up the graphics), we recommend that the user zoom-in to an area of interest before designing a composition or adding overlays. MMC provides vertical and horizontal scroll bars at the right-hand side and bottom of the base map to allow the user to scroll through the area of interest if the computer screen is not large enough to display it in its entirety.

3.2.2 Title Information

MMC provides six blocks of information in a title bar (Fig. 7) just above the base map:

1. A descriptive title for the AODI or MPS-CDI
2. A unique filename (10 characters or less) for a final composition (this is also used as a volume label when archiving to compact disk (CD)).

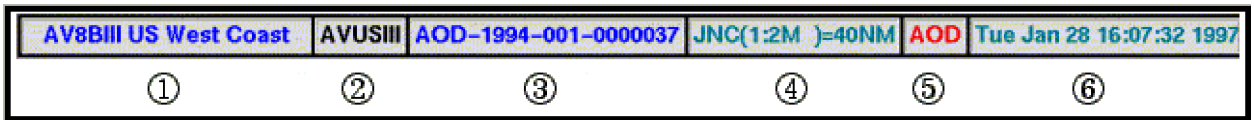


Fig. 7 — MMC title bar

3. A unique library identification (ID) number for the AODI or MPS-CDI. This ID number uses the format *TTT-yyyy-vvv-Mcccccc*, where

   — *TTT* is the image type (AOD or MPS);
   — *yyyy* is the year the image was created;
   — *vvv* is the version number of the image (001 through 999); and
   — *M* is the map station ID: a base-36 number (0-9, A-Z) that identifies the map station that created the original template(s) for this composition. Up to 36 individual map stations can be identified by this ID, of which 11 have been assigned (see Table 1).
   — *cccc* is a composition ID (000001 through 999999) unique for map station M. Two different map stations may create two different compositions with the same composition ID, but the map station IF (M) makes the image library number unique. In this way, a user on one map station is not required to keep track of composition IDs on other map stations. Trenchard et al. (1995) provides the geographic coverages of all archived AOD compositions.

4. The chart series currently in use. To change the series, click on the Chart Series/Map Scale selection box (Section 3.2.6) in the lower-right corner of the **MMC Window**.

5. The type of image currently being created (AOD or MPS).

6. A clock displaying the current date and time. To reset, log in to the SYSTEM account, then type **SET TIME=dd-mmm-yyyy:hh:mm:s.s** at the $ prompt. For example:
   SET TIME=20-JUL-1997:16:31:0.0 will set the clock to July 20, 1997, 4:31 pm. To verify the current date and time, type **SHOW TIME**. The system will print the current date and time. When finished, log out of the SYSTEM account and return to the MMC account.

Table 1 — ID Numbers, System Names, and Locations of Map-II Stations (as of 8/97)

M	System Name	Location
0	VOODOO	NRL, Stennis, MS (old NRL computer; no DMU)
1	MOE	NAWC-AD, China Lake, CA
2	LARRY	MCAS Cherry Point, NC
3	CURLY	NRL, Stennis, MS
4	SHEMP	MCAS Yuma, AZ
5	MAP005	Spain
6	MAP006	Spain
7	MAP007	Italy
8	MAP008	Hughes, Indianapolis, IN
Y	JED	NRL, Stennis, MS (F/A-18-owned)
Z	GRANNY	NRL, Stennis, MS (F/A-18-owned)

3.2.3 Coverage Definition Buttons

The coverage definition buttons (Fig. 8) allow a user to define coverage areas in four ways: (1) using the mouse to pick points and define a polygon; (2) entering a series of latitude/longitude (lat/lon) points to define a polygon; (3) using the mouse to draw a "rubber-band" box around a coverage; and (4) picking individual CAC segments, where one CAC segment is equivalent to 2" × 2" of paper chart (Lohrenz et al. 1993). Note that when a button's icon is light gray, it is not currently available for use.

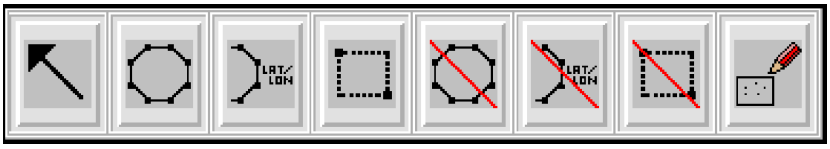


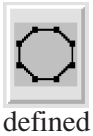
Fig. 8 — Coverage definition buttons

3.2.3.1 Select/Unselect Coverage Area

The *Arrow* button is deactivated until the user has defined at least one area of coverage (Section 3.2.3.2). When ready, click on this button, then click on individual area(s) of coverage to be cut (or copied) and pasted between different chart series. Alternatively, to select or unselect ALL areas of coverage at one time, click on one of the *Edit* menu options: *Select All Coverages* or *Unselect All Coverages*. As a coverage is selected, it turns yellow.

3.2.3.2 Define an Area of Coverage

Use any combination of these three buttons to define an area or areas of map coverage for inclusion in an AODI or MPS CDI template.



The *Polygon Vertices* button defines an irregularly shaped area. Click on this button, then click on a set of points on the world map with the left (first) mouse button. The points will define the vertices of a polygon, which in turn defines the coverage area. To close the polygon and fill the defined area with segments, double-click with the left mouse button.

The *Latitude/Longitude Coordinates* button defines an area bounded by specific latitude and longitude points. When a user clicks on this button, MMC pops up a **Latitude/Longitude Entry Window** (Fig. 9). Enter each geographic coordinate pair (latitude, longitude), indicate whether that coordinate crosses 180° longitude (relative to the previous coordinate), then click on the Next Entry button. As each pair is entered, MMC will list it in the **Latitude/Longitude Entry Window**. The user can edit the entries before accepting the coverage area:

- To delete a record, click on its entry in the list, then click on *Delete*.
- To edit a record, click on its entry in the list, click on Edit, then edit the Latitude, Longitude, and Cross-180 entries in the top half of the window.
- To start over, click on *Clear all coordinates*.
- When all coordinates are listed correctly, click on *Accept Coordinates*. The main **MMC Window** will return, and the defined template will appear on the world map.
- To cancel from the **Latitude/Longitude Entry Window** and not save the points as a template, click on *Cancel*. The main **MMC Window** will return.

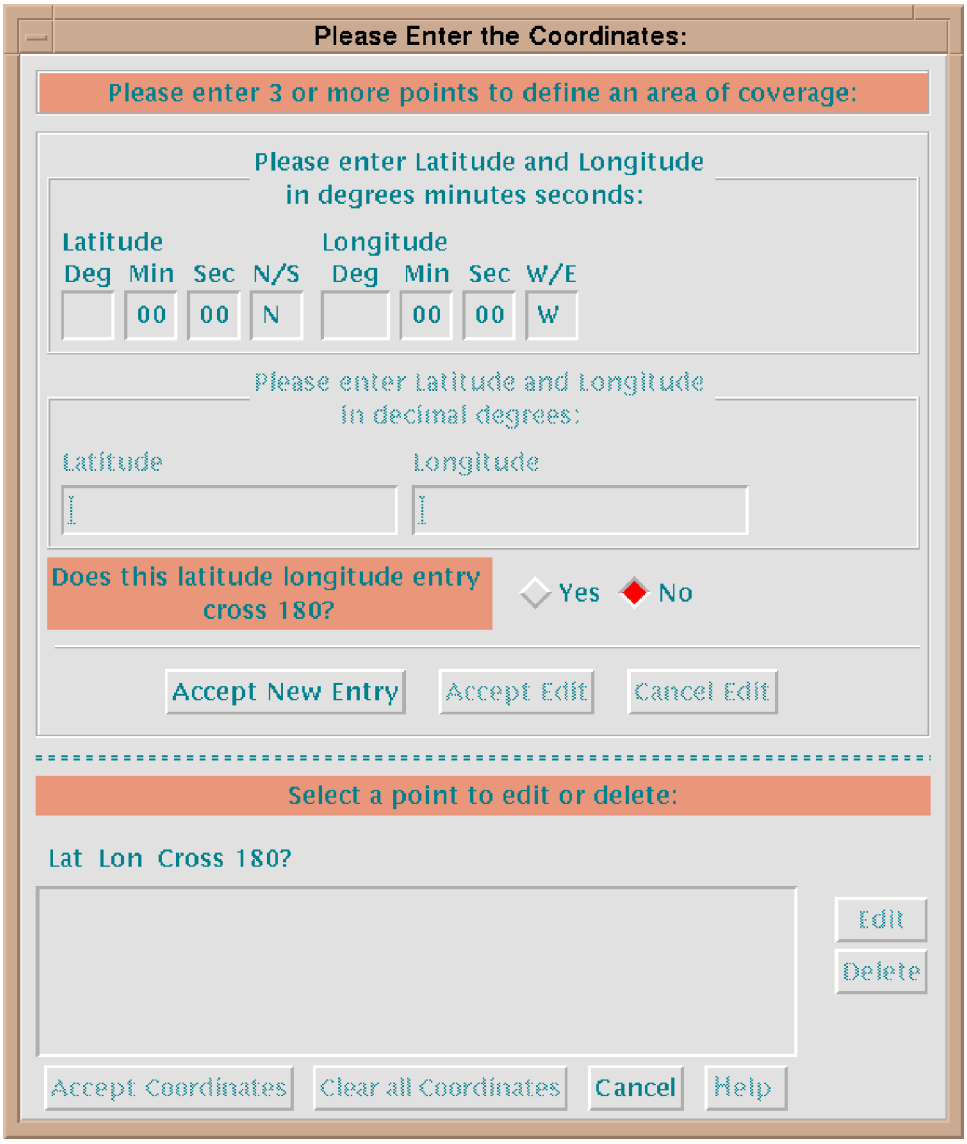
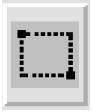


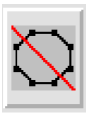
Fig. 9 — Latitude/longitude entry window



The *Stretch-Box* button defines a rectangular area of coverage by a rubber-band box. Click on this button, then click on the upper-left corner of the area to be defined with the left (first) mouse button. Hold the mouse button down and drag the resulting stretch-box to encompass the desired area. Note: the rubber-banding works only from upper-left to lower-right! As long as the mouse button is held down, the stretch-box is adjustable. As soon as the box is satisfactory, release the mouse button. Click once more with the left mouse button to accept the coverage area and fill the box with segments.

3.2.3.3 Erase an Area of Coverage

These buttons are deactivated until the user has defined at least one area of coverage with one or more of the previous three buttons (Section 3.2.3.2). Use any combination of the following three buttons to erase areas of map coverage (i.e., remove coverage from an AODI or MPS CDI template):



The *Erase Coverage by Clicking Polygon Vertices* button erases an irregularly shaped area. Click on this button, then click a set of points on the world map with the left mouse button. The points will define a polygon enclosing the area to be erased. To close the polygon and erase the area, double-click with the left mouse button.

The *Erase Coverage by Latitude/Longitude Coordinates* button erases an area bounded by specific latitude and longitude points. When the user clicks on this button, MMC pops up the **Latitude Longitude Entry Window** (Fig. 9). (Section 3.2.3.2 provides more details.)

The *Erase Coverage by a Stretch-Box* button erases a rectangular area of coverage. Click on this button, then click on the upper-left corner of the area to be erased with the left (first) mouse button. Hold the mouse button down and drag the resulting stretch-box to encompass the desired area. Note: the stretch-box works only from upper-left to lower-right! The stretch box can be adjusted as long as the mouse button is held down. When the box is satisfactory, release the mouse button. Click once more with the left mouse button to erase the enclosed area.

3.2.3.4 Set/Clear Individual Segments

The *Set/Clear* buttons individually select segments to be added to or deleted from a template. This button acts as a toggle to select and deselect individual segments.

3.2.4 Zoom Buttons

The *Zoom* buttons (Fig. 10) allow a user to zoom into (or out from) an area of interest on the MMC base map. Zooming can be done via a "stretch box" or by selecting a zoom factor and then zooming in or out by that factor. Note that when a button's icon is gray, it is not available for use, e.g., the *Zoom-out* button will not be available until the user has zoomed in.

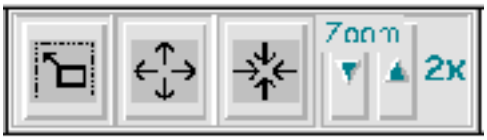
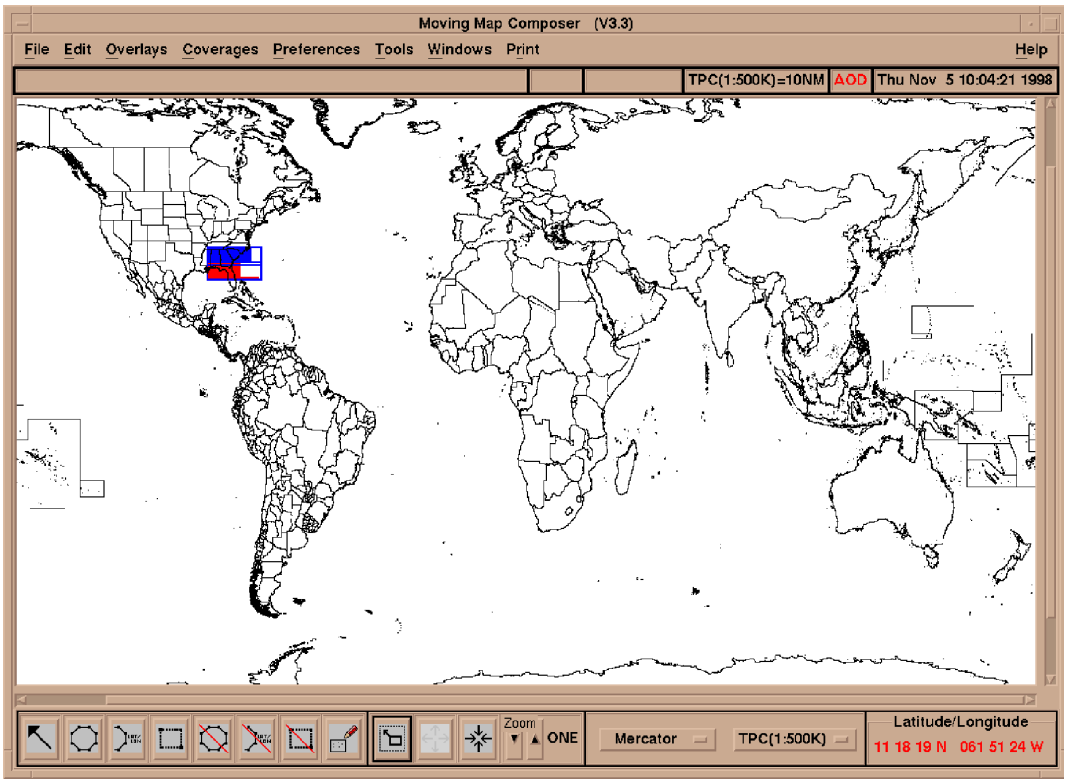


Fig. 10 — *Zoom* buttons

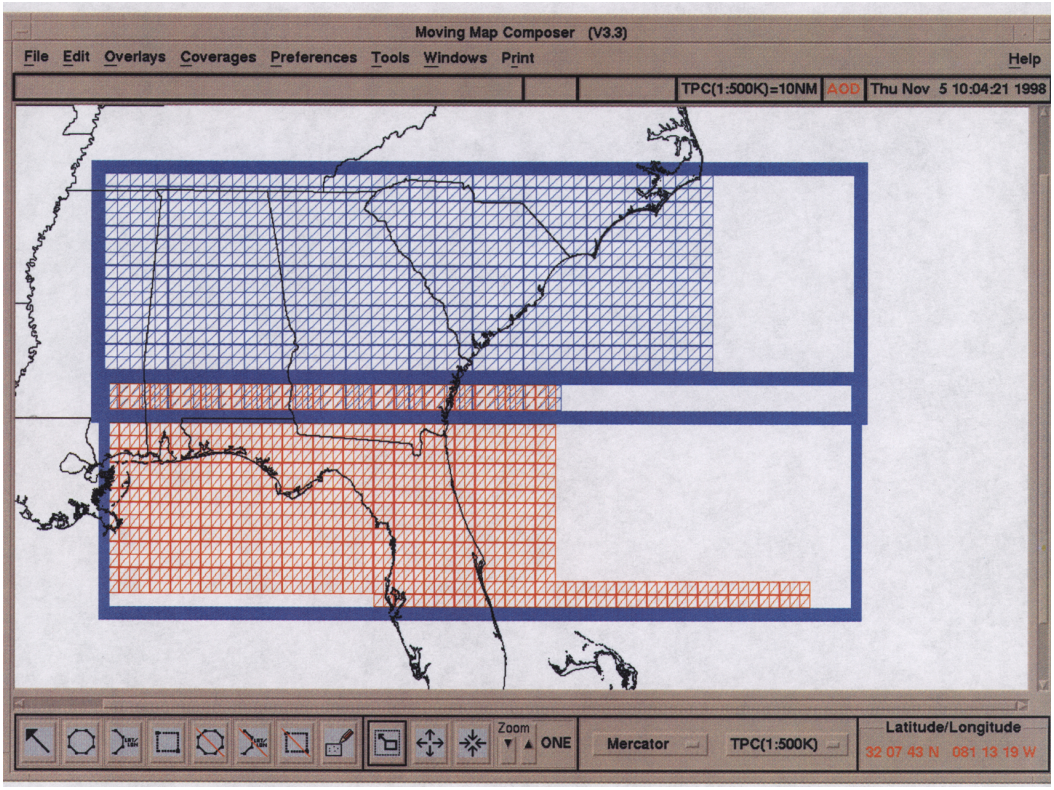
3.2.4.1 Zoom-in with a Stretch-Box

The *Zoom-in with a Stretch-Box* button zooms to an area of interest with a stretch-box. Click on this button, then click on the upper-left corner of the area of interest with the left (first) mouse button. Hold the mouse button down and drag the resulting stretch-box to the lower-right corner of the area of interest.

Note: the stretch-box works only from upper-left to lower-right! As long as the mouse button is held down, the stretch-box can be adjusted. The box maintains a constant aspect ratio identical to that of the display screen. This ensures that the contents of the final stretch-box fit perfectly on the display. When the box is satisfactory, release the mouse button, then click again with the left mouse button to perform the zoom (Fig. 11).



(a)



(b)

Fig. 11 — Zooming in with a stretch-box, (a) before zoom and (b) after zoom

3.2.4.2 Zoom-out by a Specified Zoom Factor

The *Zoom-out from a Point* button zooms out from the MMC base map. Click on this button, adjust the zoom factor (Section 3.2.4.4), then click on the map to zoom out (the map will center on the selected point). Note: you cannot zoom out until you have zoomed in! This button will appear light gray when it is not available.

3.2.4.3 Zoom-in by a Specified Zoom Factor

The *Zoom-in on a Point* button zooms in to the MMC base map. Click on this button, adjust the zoom factor, and then click on the map to zoom in (the map will center on the selected point). This button will turn light gray when the maximum zoom-in range has been reached.

3.2.4.4 Specify the Zoom Factor

Click on the arrows to change the *Zoom factor* (default: 2×). This value dictates how much to zoom-out or in. For example, with the *Zoom factor* set to 8, clicking on the *Zoom-in* button will zoom into the world map by 8:1. The maximum *Zoom factor* is 200.

Two special settings are available below factor 2: PAN and ONE. To pan (i.e., scroll) around the world map, set the *Zoom factor* to PAN, click on either the *Zoom-in* or *Zoom-out* button, then click on the map with the left mouse button. MMC will redraw the map centered on the point selected. For example, clicking on the left edge of the map will scroll to the left. To return to the original, unzoomed, world map, set the *Zoom factor* to ONE, click on either the *Zoom-in* or *Zoom-out* button, then click anywhere on the world map.

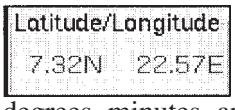
3.2.5 Map Projection Selection Box

Choose a map projection from this drop-down list: *Mercator* [default], *North Polar*, or *South Polar*. Use *North Polar* to work with data in the North Polar Tesselated Spheroid (TS) zone (North Polar segments will be displayed in dark green); use *South Polar* to work with data in the South Polar zone (South Polar segments will be displayed in yellow); and use *Mercator* for all other work. Note: if the user tries to select individual segments in a polar TS zone, but the MMC base map is displayed in *Mercator*, the mouse pointer may appear to be "off" by one or two segments. Switch to the correct *Polar* projection to fix this problem.

3.2.6 Chart Series and Scale Selection Box

Choose a chart series and associated scale from this drop-down list: *JNC (1:2M); ONC (1:1M); TPC (1:500k)* [default]; *JOG (1:250k); TLM-100 (1:100k); TLM-50 (1:50k)*; or *DTED*. Users can define coverages in one series, then switch to another series without losing what they've defined in the first. Users can also cut or copy coverages from one series and paste them into another (see *Edit* menu options *Cut, Copy,* and *Paste* in Section 3.3.2.2).

3.2.7 Cursor Position Box



This information box shows the current geographic position of the cursor on the MMC base map. Position is shown in decimal degrees of latitude and longitude or degrees, minutes, and seconds (depending on which is set in the *Preferences* menu, *View Latitude/Longitude*, Section 3.3.5.3). Use this box to help find areas of interest.

3.3 Top Menu Bar

3.3.1 File

The *File* menu (Fig. 12) lets a user open a composition or image file, save a composition, and exit from MMC.

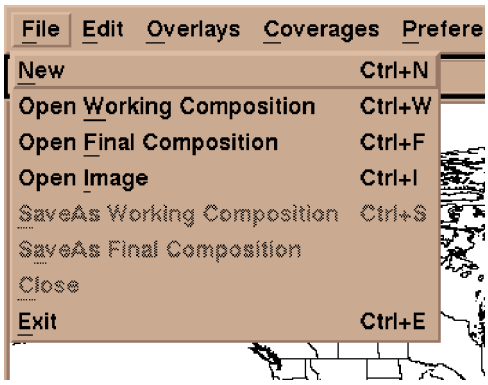


Fig. 12 — *File* menu

3.3.1.1 New (Ctrl+N)

This option opens a new file in preparation for building an AODI or MPS-CDI composition. Only open a new file to build a unique AODI or MPS-ODI. See the *Open* options (below) for alternatives to *New*. If a user was designing a composition and did not save it before selecting *New*, MMC will issue a warning message and the chance to save the work prior to starting a new file.

3.3.1.2 Open Working Composition (Ctrl+W)

This option opens a file containing a composition-in-progress for an AODI or MPS-CDI. Unlike a final composition, a working composition has no library number. In addition, MMC does not place any size restrictions on working files, so the user may build a large "master" composition as a working file, then break it into smaller compositions for final files. When the user selects *Open Working Composition*, MMC displays a list of working compositions from which to choose (Fig. 13). After choosing a composition, MMC returns to the base map and displays the selected composition (Fig. 14). At this point, the user can view the map data defined by the composition or modify the composition.

3.3.1.3 Open Final Composition (Ctrl+F)

This option opens an existing file containing a final AODI or MPS-CDI that has been assigned a library number. When a user selects *Open Final Composition*, MMC provides a list of current final compositions (Fig. 15) from which to choose. After the user chooses one, MMC returns to the base map and displays the selected composition (Fig. 16). At this point, the user can view map data defined by the composition or modify the composition and save it under a new name.

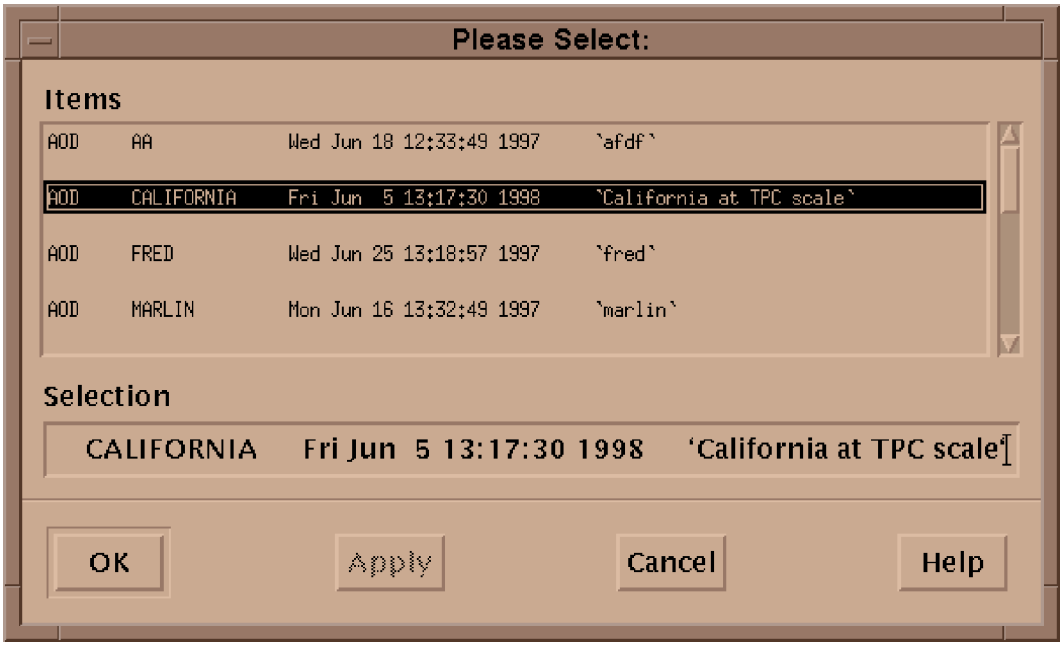


Fig. 13 — Sample list of working compositions

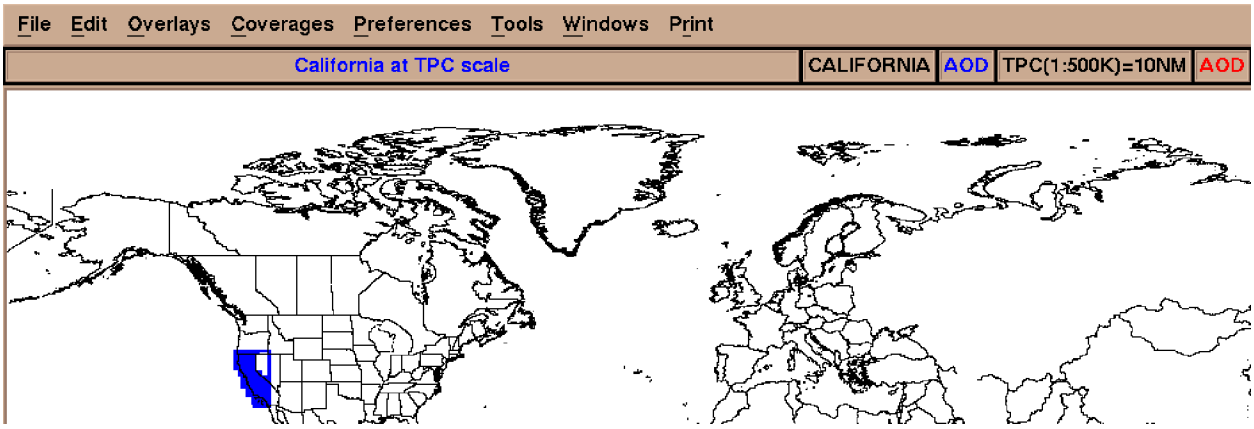


Fig. 14 — Sample working composition displayed on MMC base map

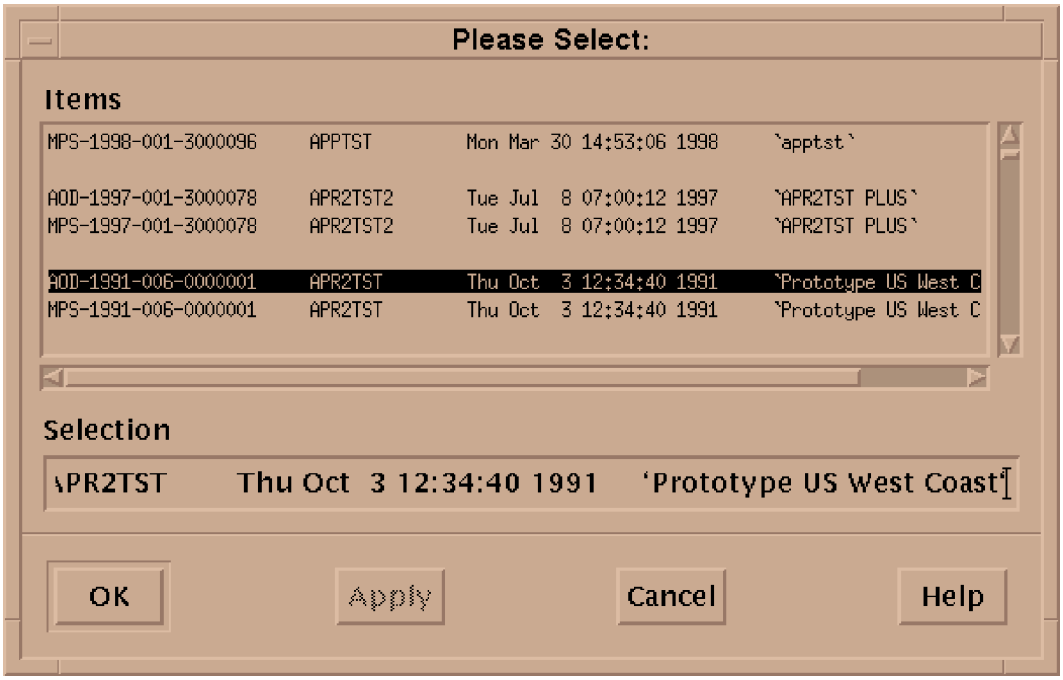


Fig. 15 — Sample list of final compositions

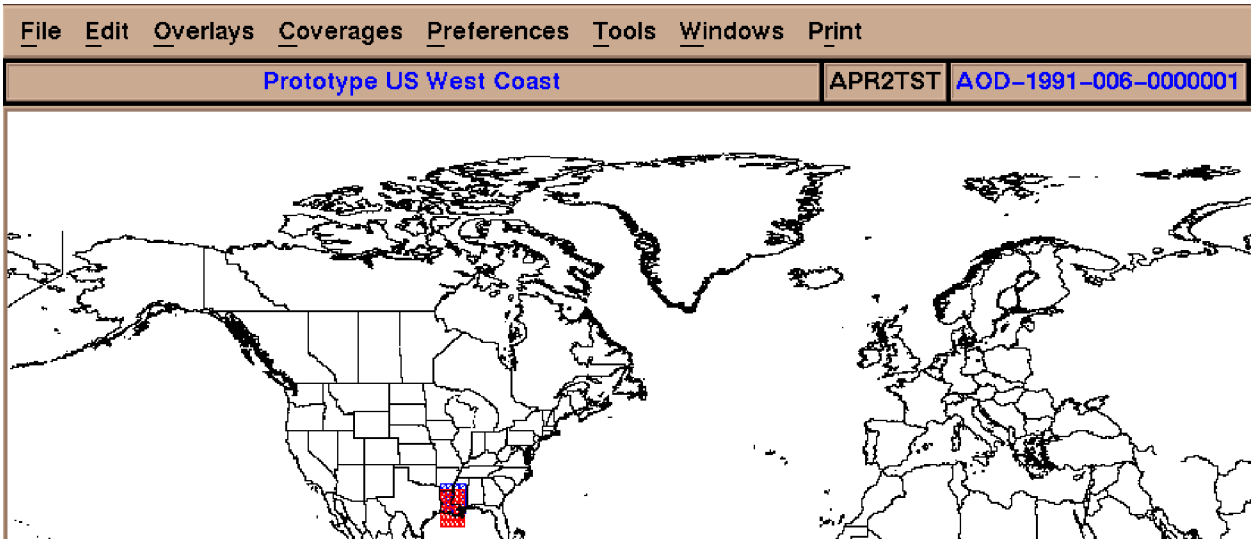


Fig. 16 — Sample final compositions displayed on MMC base map

3.3.1.4 Open Image (Ctrl+I)

This option opens an existing AOD or MPS image, builds a composition based on the image, and loads the composition into MMC for viewing and modification. After the user selects *Open Image*, MMC queries for the image type (AOD or MPS) and device (CD, AOD, hard disk). If the user selects to open the image from CD, MMC will provide a GUI for selecting and mounting the necessary CD in an available drive. See Section 4.1 for more information about mounting CDs in MMC.

3.3.1.5 Save As Working Composition (Ctrl+S)

This option saves the current composition as a working file, with no associated AOD/MPS-ODI library number. MMC does not place any size restrictions on working files, so the user may save a large "master" composition as a working file, then break it into smaller compositions for final files. MMC only keeps one version of each working filename; if the user tries to save a working file with a filename that already exists, MMC will ask if the user wants to overwrite the preexisting working file.

3.3.1.6 Save As Final Composition

This option saves the current composition as a final file, with a unique AOD or MPS-ODI library number. MMC restricts final compositions to the maximum size of the ODI type selected: AODI (260 MB) or MPS-ODI (600 MB). This size restriction is enforced prior to saving the final composition. If the user tries to save a file that is larger than these maximums, MMC will instruct the user to trim some data off of the image first. By default, MMC builds the composition for an MPS-ODI; the user must specify that the composition will also be saved as an AODI file. MMC prompts the user for the final filename and description. Final filenames must be 10 characters or less, and can only contain alphanumerics (e.g., no "_," "-" etc.). Also, if the composition is too big to save to an AOD (i.e., over 260 MB), MMC will issue a warning message. If the user chooses to Fix the composition, MMC will display a message describing which scale(s) contain too much data, then give instructions on how to fix the composition before reattempting the save.

3.3.1.7 Close

This option closes the current composition and refreshes the main **MMC Window**. If the user has made unsaved changes, MMC will issue a warning and provide an opportunity to save the work prior to closing.

3.3.1.8 Exit (Ctrl+E)

This closes the current composition and exits from MMC. If the user has made unsaved changes, MMC will issue a warning and provide an opportunity to save the work prior to closing.

3.3.2 Edit

The *Edit* menu (Fig. 17) provides utilities to select coverages, cut (or copy) and paste coverages between scales, and undo or redo previous actions.

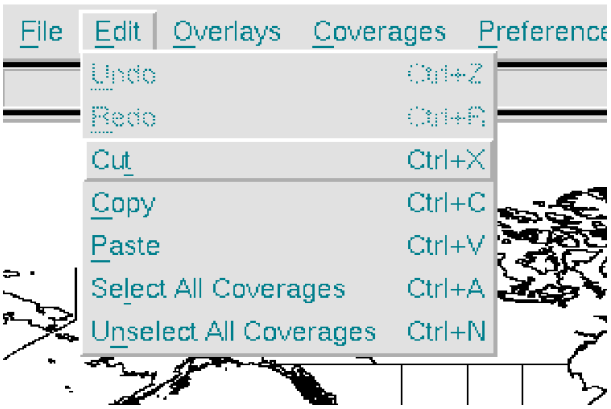


Fig. 17 — *Edit* menu

3.3.2.1 Undo (Ctrl+Z)/Redo (Ctrl+R)

Undo undoes the previous edit action (e.g., *Cut*). *Redo* repeats the previous action.

3.3.2.2 Cut (Ctrl+X)/Copy (Ctrl+C)/Paste (Ctrl+V)

To cut or copy one or more coverages from one scale to another, click on the *Arrow* button (Section 3.2.3.1), then click on each coverage area to be cut or copied (the selected coverages will turn yellow), then choose *Cut* or *Copy*. Alternatively, choose the *Edit* option *Select All Coverages* (described below), then choose *Cut* or *Copy*. Warning: only the most recent *Cut* or *Copy* action stays in memory. If the user *Cut* one coverage, and then *Cut* or *Copy* another before pasting the first, the first coverage will be lost forever!

- *Cut* cuts the selected coverage from the current chart series and temporarily stores it in memory (to be pasted in another series, if desired).
- *Copy* makes a copy of the selected coverage and stores it in memory.
- *Paste* pastes the most recently cut or copied coverage from memory onto the current coverage.

3.3.2.3 Select All Coverages (Ctrl+A)/Unselect All Coverages (Ctrl+N)

Select All Coverages selects all available coverages from the current chart series (all coverages will turn yellow) for cutting or copying and pasting. *Unselect All Coverages* deselects selected coverages at the current map series.

3.3.3 Overlays

The *Overlays* menu (Fig. 18) includes options to refresh the display and overlay shorelines, political boundaries, latitude and longitude grid, user-defined coverage polygons, and available data coverages.

3.3.3.1 Refresh Display

This option redraws the current map information in the MMC Window.

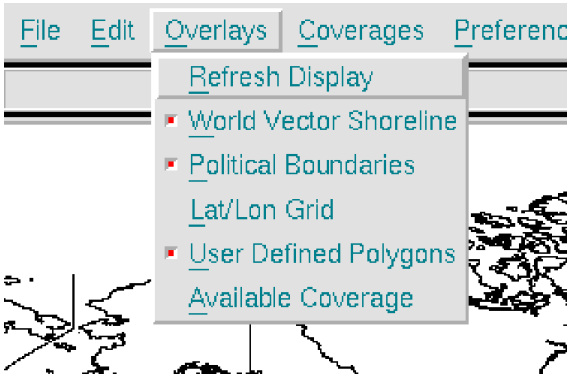


Fig. 18 — *Overlays* menu

3.3.3.2 World Vector Shoreline (WVS)

This is the base map for MMC and a standard product from the National Imagery and Mapping Agency (NIMA 1997). This overlay draws the shorelines of the world and is ON by default (Fig. 19(a)).

3.3.3.3 Political Boundaries

This overlay (ON by default) displays political boundaries between inland countries and states to provide a more robust base map (Fig. 19(a)). Figure 19(b) shows the *WVS* overlay ON and the *Political Boundaries* overlay OFF.

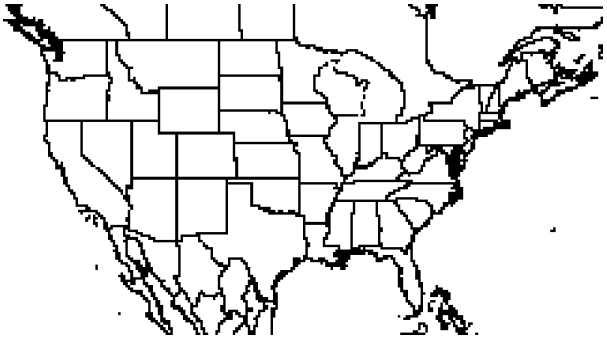


Fig. 19(a) — MMC base map with both WVS and political boundaries overlays ON (default)

Fig. 19(b) — MMC base map with both WVS overlay ON and political boundaries overlays OFF

3.3.3.4 Lat/Lon Grid

This option displays a user-defined grid of latitude and longitude lines (OFF by default: Fig. 19(a)). When the user turns this overlay ON, MMC will prompt for the grid spacing (default is 10° in latitude and longitude). Figure 20 shows the *Lat/Lon Grid* ON with a 20° grid.

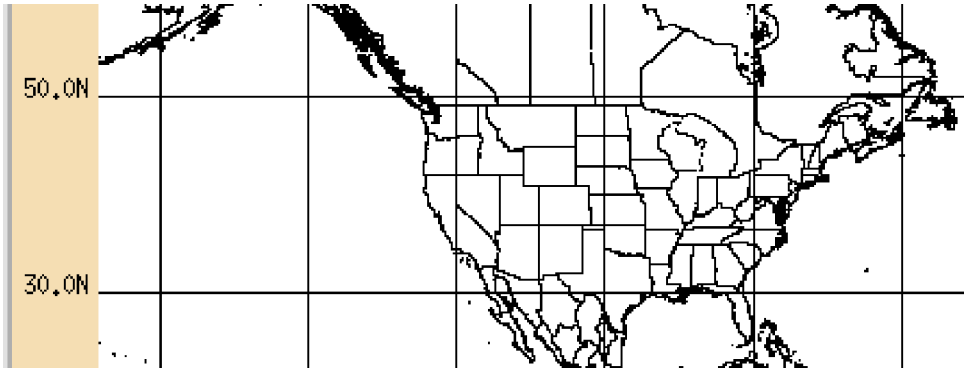
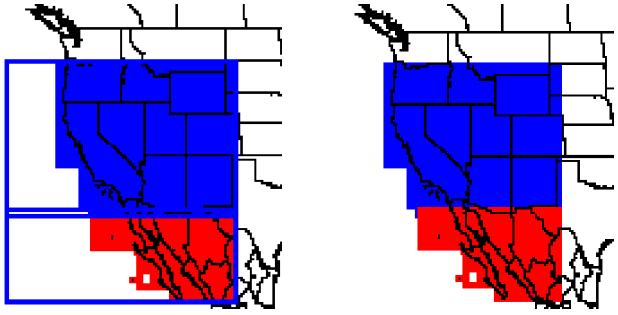


Fig. 20 — MMC base map with lat/lon grid overlay ON

3.3.3.5 User-Defined Polygons

This option outlines each coverage the user defines. These polygons are useful in selecting specific coverages for *Cut* and *Paste* operations. This overlay is ON by default (Fig. 21(a)). When it is OFF (Fig. 21(b)), adjacent coverages are not as easy to distinguish.



(a) (b)

Fig. 21 — MMC base maps with user-defined polygons overlay
(a) ON and (b) OFF

3.3.3.6 Available Coverage

This option displays all logged CAC coverage for the current map scale in light gray (Fig. 22(a)), all scanned chart coverage for the current scale in tan (Fig. 22(b)), and areas that contain **both** CAC and scanned chart data in purple (Fig. 22(c)). This overlay is OFF by default. Note: if the user is designing an MPS image and selects DTED from the *Chart series* selection box (Section 3.2.6), *Available Coverage* will reflect all logged DTED coverage.

3.3.4 Coverages

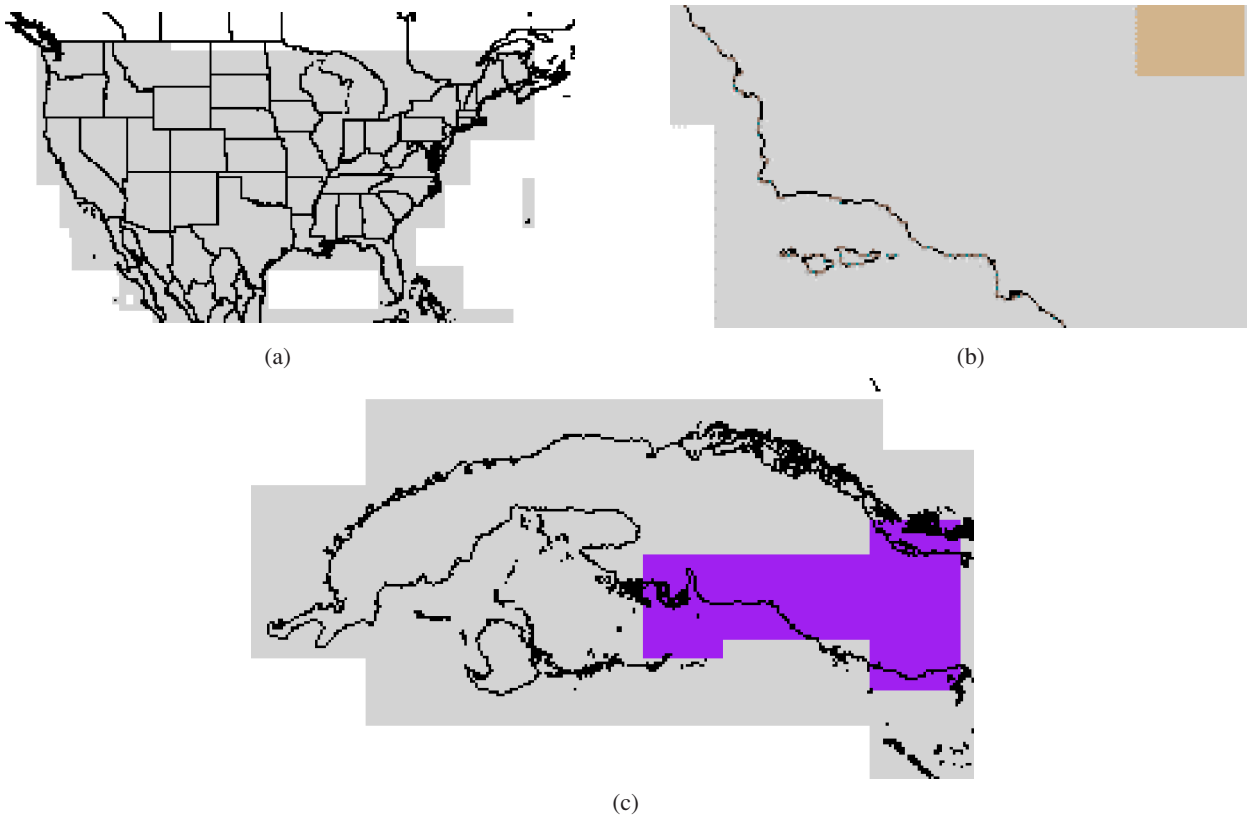
The *Coverages* menu (Fig. 23) provides utilities to include one or more compositions, images, or scanned data sets in a new composition.

3.3.4.1 Include Working Composition

This option retrieves a working composition for either an AODI or MPS-CDI. MMC will present a list of available compositions and prompt for which one to include. A modified working composition may be saved under the same name or a different name. If it is saved under the same name, the original will be deleted.

3.3.4.2 Include Final Composition

This option retrieves a final composition from the hard disk. MMC will present a list of available compositions and prompt for which one to include. Modifications to a final composition may only be saved under a new name.



(a) (b)

(c)

Fig. 22 — Available coverage (of data sources) overlays: (a) CAC only; (b) CAC (gray) abutting scanned charts (tan); (c) CAC (gray) surrounding area with both scanned charts and CAC (purple).

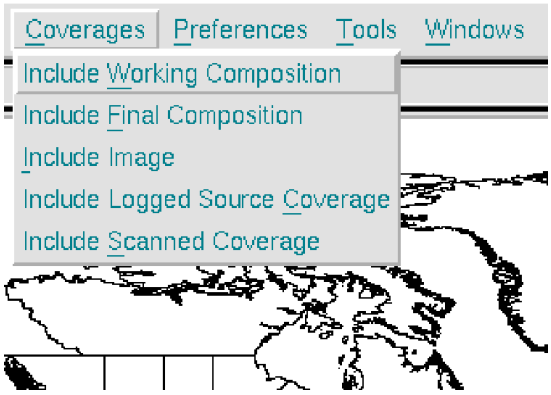


Fig. 23 — *Coverages* menu

3.3.4.3 Include Image

This option dynamically creates a temporary composition from a source image that can then be used to define a new composition (or supplement an existing one). This option will retrieve the composition of either an AOD or MPS image from the hard disk, a CD, or an AOD. If the user selects to open the image from CD, MMC will provide a GUI for mounting the CD in an MMC drive (see Section 4.1). Finally, MMC prompts for the source image filename.

3.3.4.4 Include Logged Source Coverage

This option builds a composition from a source coverage via a menu selection (Fig. 24). Valid source coverages are CAC and DTED CDs that have been logged into MMC. The menu selection box provides four columns of information for each entry: Info File name, CAC library number, date CAC was logged into MMC, and a geographic coverage description. CAC Info Files are named after the library number of their respective CAC CD. Note that some CAC CDs do not have an Info File (the first column lists 000000 instead of an Info File name, and the last column lists "No Info File Located" instead of a descriptive title). CAC CDs without Info Files do not have any geographic description associated with them.

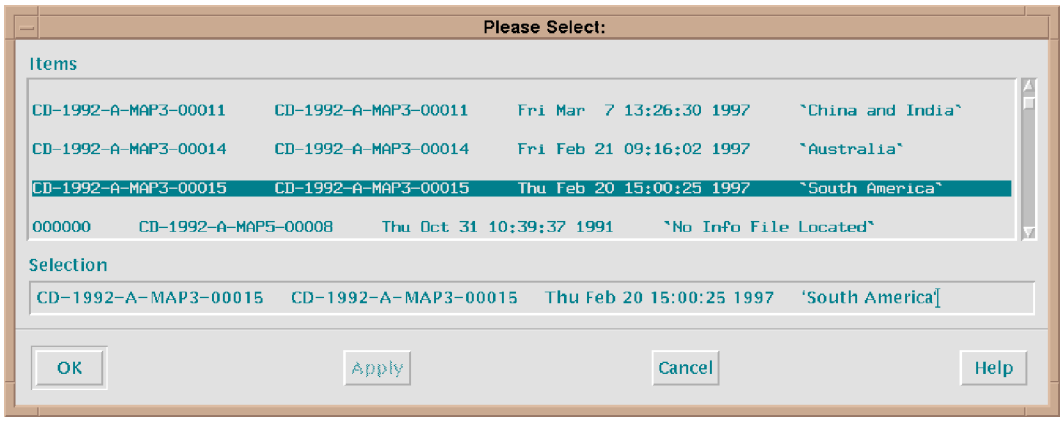


Fig. 24 — Sample list of logged source coverages

3.3.4.5 Include Scanned Coverage

This option builds a composition from scanned chart coverage (i.e., map data that has been scanned within MMC and compressed into CAC segments, then logged and stored on hard disk or CD). The menu selection box provides four columns of information for each entry: Info File name, Scanned Coverage filename, date scanned data was logged into MMC, and a brief description of the geographic coverage of the data.

3.3.5 Preferences

The *Preferences* menu (Fig. 25) allows the user to set certain preferences for the current MMC session, including whether to build an AOD or MPS composition, the primary source from which to view CAC data in the current image (e.g., from CAC CD or from scanned data on the hard disk), and in what format to display latitude and longitude coordinates, and print options.

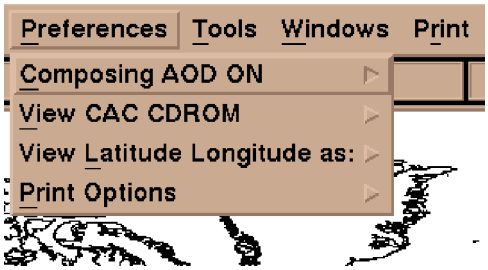


Fig. 25 — *Preferences* menu

3.3.5.1 Compose AOD/Compose MPS

This option sets the type of image to be built. This preference may be changed at any time during the creation of a map theater build. Note that restrictions on AODIs are more stringent than those on MPS images:

- When switched to *Composing AOD ON* (default), MMC will design a composition based on the restrictions of AODIs (e.g., MMC calculates the final image size, number of directories per scale and zone, and number of MBs per directory). Note that MMC does not limit a user from exceeding AOD restrictions (although it will issue warnings) until saving a final composition.

- When switched to *Composing MPS ON* - by clicking on the *Compose MPS* option (Fig. 26) - MMC will compose an image based on the restrictions of MPS images (e.g., image size). DTED data are only available under the *Compose MPS* preference.

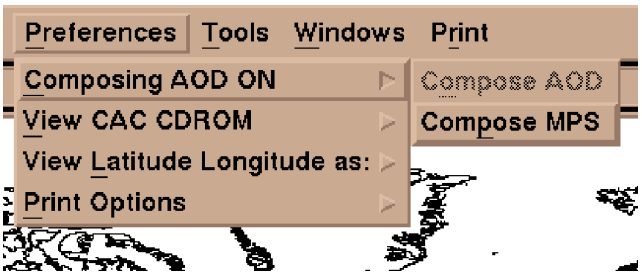


Fig. 26 — Composing preferences

3.3.5.2 View Chart Data Preferences

This option sets the source from which to view chart data (Fig. 27). Chart data may be viewed by selecting a coverage area with the arrow button, positioning the cursor in the area of interest, and pressing the third (right) mouse button. (For more information on viewing chart data in MMC, see Section 4.3.) Chart data will only be displayed for available CAC coverage in the source selected:

- *View CAC CDROM:* sets the preference to view CAC data from a CAC CD (available from NIMA). When this preference is set, and the user clicks (with the third mouse button) on a segment to be viewed, MMC will issue a message telling the user to load the necessary CD. For more information on loading and reading CDs, see Section 4.1.

- *View AOD:* displays CAC data from an AOD mounted in the DMU. This option is not available until the user opens an AODI by clicking on *File*, then *Open Image*. This option is also not available if there is no DMU attached to the system.

- *View MPS Hard Disk:* displays map data from an MPS image stored on the hard disk.

- *View MPS CDROM:* displays map data from an MPS image that has been logged and archived to CD. When this preference is set, and the user clicks on a segment to be viewed, MMC will notify the user to load the necessary CD. For more information on loading, selecting, and reading CDs, see Section 4.1.

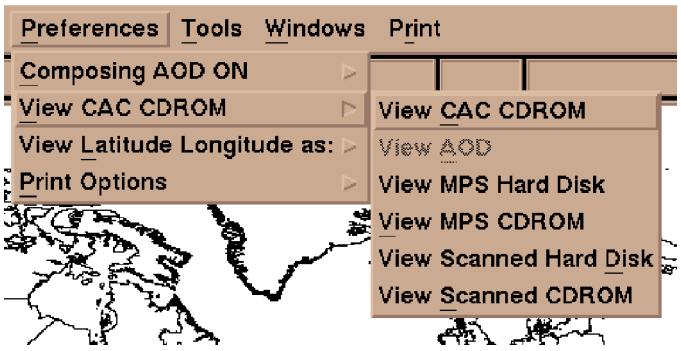


Fig. 27 — View chart data preferences

- *View Scanned Hard Disk:* displays scanned map data stored on the hard disk.

- *View Scanned CDROM:* displays scanned map data that has been logged and archived to CDROM. When this preference is set, and the user clicks on a segment to be viewed, MMC will notify the user to load the necessary CD (see Section 4.1).

3.3.5.3 View Latitude/Longitude Preferences

This option determines how MMC will display latitude and longitude coordinates: decimal degrees [default] or degrees, minutes, and seconds (Fig. 28). Latitude and longitude coordinates are used in the following MMC functions:

- the *Cursor Position* box in the lower-right corner of the main MMC display (Section 3.2.7);

- to define or erase coverages by latitude and longitude; and

- to pick control points after scanning a chart.

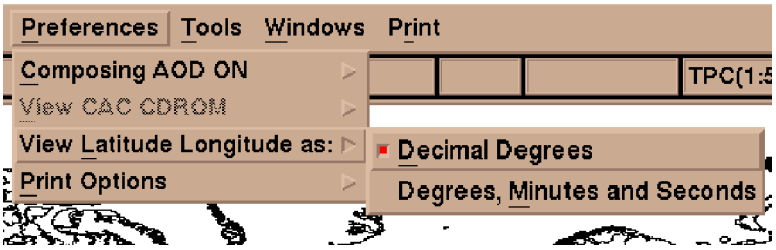


Fig. 28 — View latitude/longitude preferences

3.3.5.4 Print Preferences

This menu provides options for specifying the printer type and resolution (Fig. 29).

- *No Printer:* indicates a printer is not available for use. This is the default setting (upon first installing MMC 3.3).

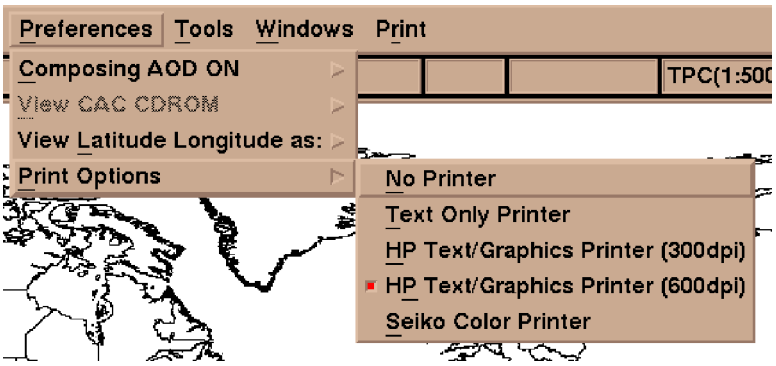


Fig. 29 — Printer preference

- *Text Only Printer:* indicates the available printer can only print text (e.g., the Okidata printer provided with the original MOMS systems).
- *HP Text/Graphics Printer (300 DPI):* indicates the available printer is a Hewlett Packard with 300 dpi resolution.
- *HP Text/Graphics Printer (600 DPI):* indicates the available printer is a Hewlett Packard with 600 dpi resolution.
- *Seiko Color Printer:* indicates the available printer is a color Seiko such as those provided with the original MOMS systems.

3.3.6 Tools

The *Tools* menu (Fig. 30) provides the user with an army of utilities, including logging in new media (including CAC and DTED CDs), checking subdirectory size limits while designing a composition, generating a summary of the current composition, building an AODI to hard disk or AOD, working with checklists and other data frames, scanning paper charts into CAC for use in an AODI or MPS-CDI build, and archiving data (including scanned data, AODIs, MPS-CDIs, and checklists) to CD.

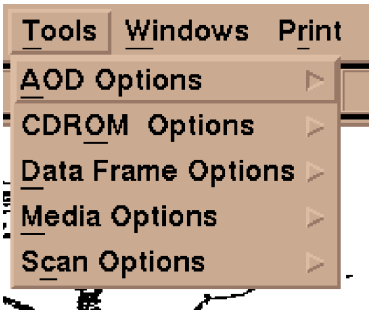
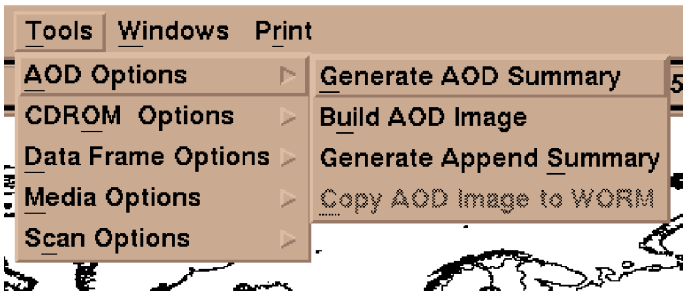


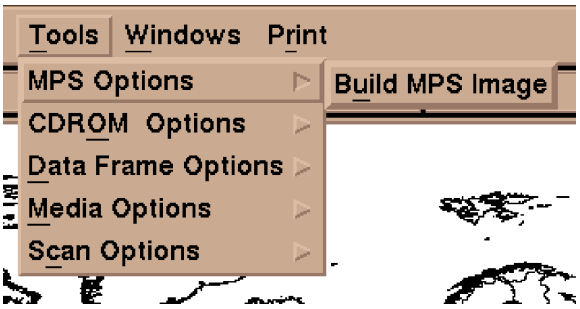
Fig. 30 — *Tools* menu

3.3.6.1 AOD (or MPS) Options

Depending on whether the user is composing an AODI or MPSI (determined in the *Preferences* Menu, Section 3.3.5.1), the first item in the *Tools* menu will be either *AOD Options* or *MPS Options*. As shown in Fig. 31, there are four AOD options: *Generate AOD Summary, Build AOD Image, Generate Append Summary,* and *Copy AOD Image to an AOD*. There is only one MPS option: *Build MPS Image.*



(a)



(b)

Fig. 31 — AOD/MPS options menus (depends on image type set in *Preferences*): (a) *AOD Options* menu, and (b) *MPS Options* menu

3.3.6.1.1 Generate AOD Summary — This option generates a printable summary of a previously built AOD (Fig. 32), including current status, date of summary, number of superdirectories used and remaining on the AOD, AOD size in bytes and number of subdirectories written on the AOD. The summary also includes the names of the workstations used to create and write the AOD, AODI composition and version numbers, and date written. A contents section includes additional subdirectory information, such as map scales and zones. The final coverage section provides the minimum and maximum latitude and longitude values – for each subdirectory – that together define the complete area of coverage.

3.3.6.1.2 Build AODI [or Build MPSI] — This option builds a final image file from the user's AOD or MPS composition. Note: if the user has set the *Compose AOD* preference (Section 3.3.5.1), MMC will automatically build an MPSI first, then the AODI. If the user has set the *Compose MPS* preference, MMC will only build the MPSI. The *Build AOD* [or *MPS*] *Image* option is not available until the user has opened a final composition (Section 3.3.1.3).

```
  SUMMARY:  Previously built ACOD Image

   STATUS:  GOOD  **Correct ACOD Image**

 TIME NOW:  Thu Nov 12 13:30:39 1998

SUPERDIRS
            # USED:   4  (Actual number used in ACOD)
       # REMAINING:  12  (Actual number of superdirectories remaining)

ACOD SIZE:  217.39

# SUBDIRS:   2  (Image subdirectories cannot be modified)

  ACOD ID:
           Created by MMC station:  VOODOO
           Written by MMC station:  JED
               Composition Number:  1
                          Version:  6
                       Written on:  20 Oct 1998


 CONTENTS:  **Subdirectory Information**
            **Note:  Each zone for a given scale can only have a maximum
                     of 3 subdirectories**


            Scale:  JNC (1:2M  )

                    |-------------------------------------------------------|
                    | Zone             Zone     |       Subdirs      | Subdir |
                    | Name             Color    |  ACOD       Total  | Status |
                    |-------------------------------------------------------|
                      Equatorial       Red            1           1     GOOD
                      North Temperate  Blue           1           1     GOOD


COVERAGE:

                                    33 13 37.8 N
                                      (33.2272)
                                       Row 35
                                  ----------------------
                                  |   SubDirectory  1  |
                                  |                    |
                                  |        JNC         |
                 93 47 22.1 W     |     Equatorial     |    089 03 22.8 W
                 ( -93.7895)      |     30 segments    |     ( -89.0563)
               Column   -99       |                    |       Column   -95
                                  |        1 Sectors   |
                                  |                    |
                                  ----------------------
                                    27 41 32.3 N
                                      (27.6923)
                                       Row 30


                                    34 09 0.9 N
                                      (34.1502)
                                       Row 36
                                  ----------------------
                                  |   SubDirectory  2  |
                                  |                    |
                                  |        JNC         |
                 93 33  9.5 W     |  North Temperate   |    088 49 13.5 W
                 ( -93.5526)      |     20 segments    |     ( -88.8204)
               Column   -79       |                    |       Column   -76
                                  |        1 Sectors   |
                                  |                    |
                                  ----------------------
                                    29 32 18.5 N
                                      (29.5385)
                                       Row 32
```

Fig. 32 — Sample AOD summary listing

3.3.6.1.3 Generate Append Summary — This option generates a summary of any existing AOD composition, composition in development, or final AODI (Fig. 32). For each zone, scale, and subdirectory in the composition or image file, *AOD Summary* provides the minimum and maximum latitude and longitude, the number of CAC segments defined, and the number of sectors that would be used if the image were written to an AOD. The summary also gives the total number of bytes in the composition.

3.3.6.1.4 Copy AOD Image to an AOD — This option copies an AODI from the MMC hard disk to an AOD on the DMU. Follow the directions given by MMC for this function. **Recommendation**: label each AOD with the serial numbers of both the DMU and DMUI used to write the AOD. If there have been three write operations made to the AOD (i.e., the original write plus two appends), there should be three sets of DMU and DMUI serial numbers on the label (some may be duplicates).

3.3.6.2 CDROM Options

These options include archiving data to CD and restoring logged sources from CD (Fig. 33).

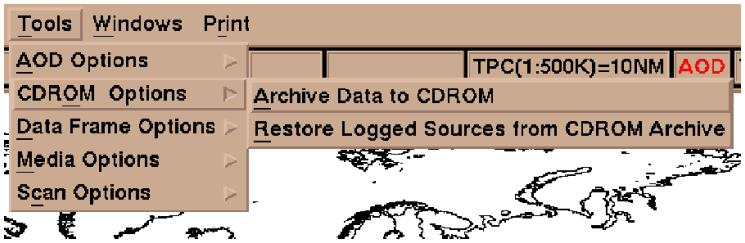


Fig. 33 — CDROM options menu

3.3.6.2.1 Archive Data To CDROM — This option "premasters" a set of data into a CD image and writes the data to a CD. The CD images conform to the International Standards Organization (ISO) 9660 standard for optical disk formats. When a user selects this option, MMC opens the **Archive to CDROM Window** (Fig. 34). Click on *Premaster* and select the data type to be archived*: Scanned CAC Data, Aircraft Optical Data*, *Checklists/Dataframes Data, Mission Planning Data, CDROM,* or *Other Data*. MMC will build an ISO 9660 Image from that data. If the user has built an ISO Image before, MMC will prompt the user to delete that file before building a new one. After premastering the data into an ISO Image, select *Cut* to actually copy the data to a CD. When finished, select *Close* to return to the **MMC Window**. There are six data types that MMC can archive to CD*:*

1) Scanned CAC Data: If the user is archiving scanned data, MMC will pop up a list of valid chart series to be archived (JNC, ONC, TPC, JOG, TLM-100, or TLM-50). Only one series of scanned data may be archived to a single CD, to maintain compatibility with the format and structure of CAC CDs. The only difference between CAC and scanned chart (SCAC) CDs is in the first field of their CD library numbers: tt-yyyy-e-MAPs-fnnnn, where:

tt = type of data: "CD" for CAC, or "SC" for SCAC;
yyyy = year (e.g., 1997);
e = edition (A through Z);
'**MAP**' = the characters "MAP";
s = scale (0 through 6; described in Appendix A3);
f = a unique integer identifying the CD mastering facility (e.g., 0 = 3M);
nnnn = a unique ID number (0000 through 9999).

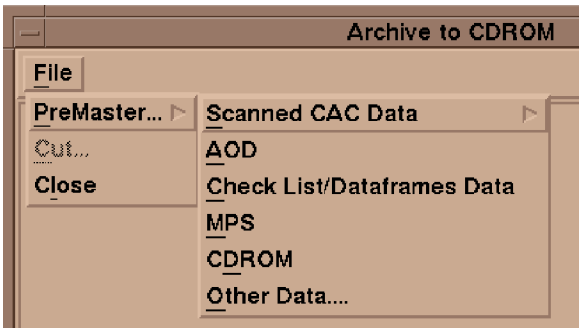


Fig. 34 — Archive to CDROM window

MMC recognizes both CAC and SCAC CDs as valid sources, but the library numbers must be different so that newly logged SCAC CDs will not erroneously replace previously logged CAC CDS, or vice versa. The "CD" vs "SC" at the start of the library number keeps the two data types distinct.

2) Aircraft Optical Data: When archiving AOD data, MMC first checks whether there is a valid AODI on the hard disk. If not, MMC will not allow the user to Premaster. If there **is** a valid AODI, MMC will ask the user to verify the data to be archived. Select *Yes* to proceed (or *Abort* to cancel the operation).

3) Checklist/Dataframes Data: These data archive dataframes (e.g., checklists) to CD. MMC will issue a verification message: select *Yes* to proceed (or *Abort* to cancel).

4) Mission Planning Data: When archiving MPS data, MMC first checks that there is a valid MPS Image on the hard disk. If not, MMC will not allow the user to Premaster. If there **is** a valid MPS Image, MMC will ask the user to verify the data to be archived. Select *Yes* to proceed (or *Abort* to cancel).

5) CDROM: Use this option to make a duplicate copy of any CD. MMC will display a verification message (answer *Yes* to proceed) then the **CD-ROM Site Window**. Load the CD to be copied into the CD changer, then click on the *Start Processing* button at the bottom of the **CD-ROM Site Window**. (See Section 4.1 for more information about loading and selecting CDs in MMC.) MMC will take the user through the necessary steps to Premaster the data.

6) Other Data: Use this option to archive any other data on the MMC system. (It is particularly important to backup the *bitmaps directory* on a regular basis). MMC will display a verification message (select *Yes* to proceed) then a **File Selection Window** to help the user find the directory and file(s) to be included (Fig. 35). After selecting the data files, MMC will guide the user through the necessary steps to Premaster the ISO Image.

3.3.6.2.2 Restore Logged Sources From CDROM Archive — This option restores previously logged sources from CD. When the user selects this option, MMC displays an informational message about restoring data from CD (click on the *Restore* button to proceed). MMC will then display the **CD-ROM Site Window**. After entering the CD to be read, click on the *Start Processing* button at the bottom of the window (see Section 4.1).

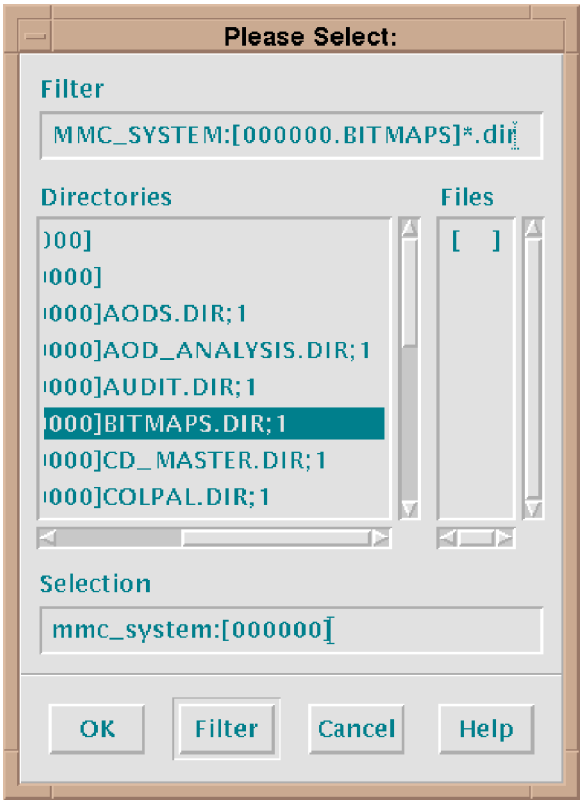


Fig. 35 — File selection window: MMC files to be archived to CD

3.3.6.3 Data Frame Options

These include a checklist editor, a window to view checklists and other data frames, and a utility to copy a checklist to an AOD (Fig. 36).

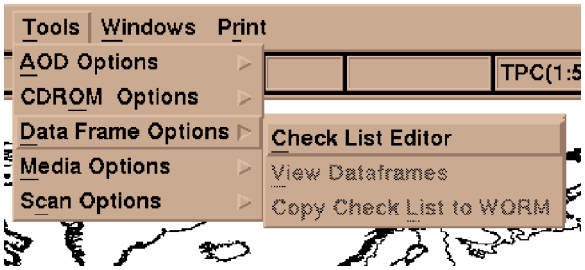


Fig. 36 — Data frame options menu

3.3.6.3.1 Checklist Editor — After selecting this option, MMC will display the **Checklist Editor Window** (Fig. 37) to help the user build and modify AV-8B checklists that can be displayed in the cockpit moving map system. Editor functions include changing text color (*Red*, *Green*, or *Amber*) and font size (*Small*, *Medium*, or *Large*). A future version may support both *Insert* and *Overstrike* edit modes, but currently only *Overstrike* is available.

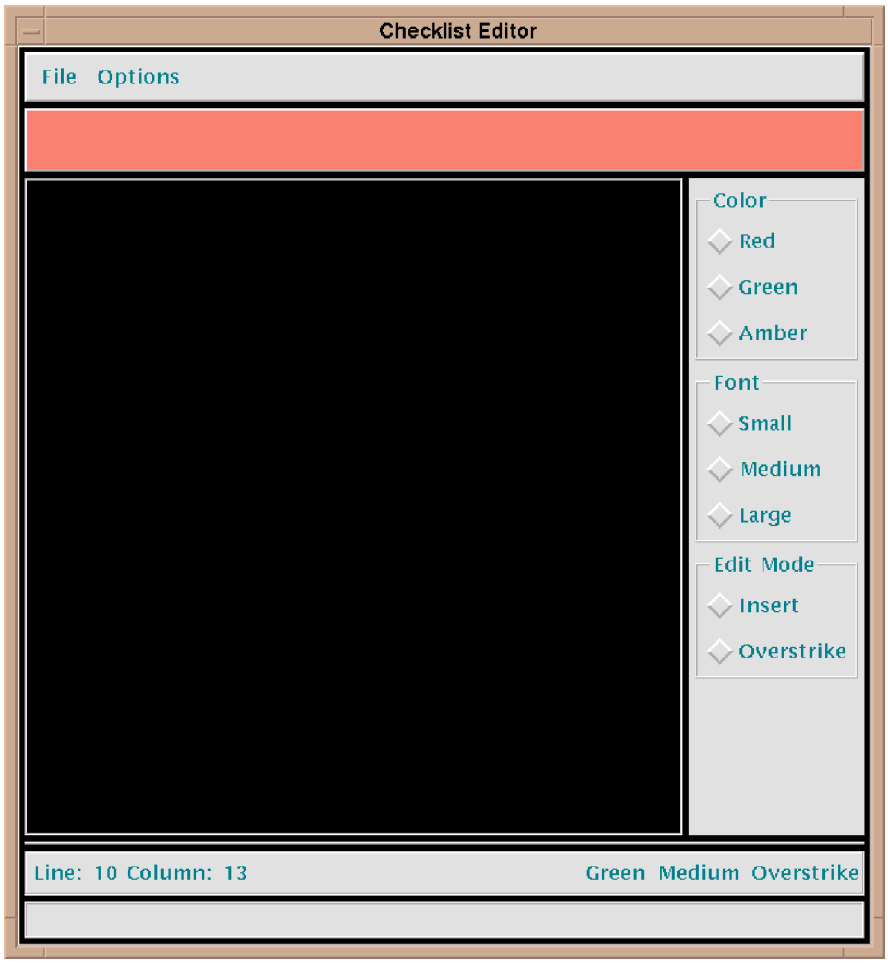


Fig. 37 — Checklist editor window

To start a new checklist page:

- Click on *Select Checklist Set* from the *Options* menu (Fig. 38) in the **Checklist Editor Window**.
- Select *Radar* (the only valid set) from the list (Fig. 39).
- Click on *New* from the *File* menu (Fig. 40) in the **Checklist Editor Window**.
- The new checklist page will be blank, with the exception of the word “MENU” at the bottom; this is on the first page of every category in a checklist set. The cursor will be in the first character position of the first line to be typed on the page (Fig. 41).

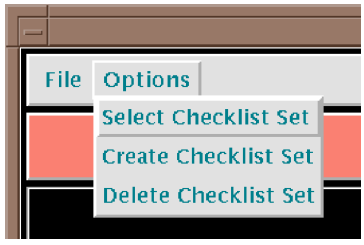


Fig. 38 — Checklist editor:
options menu

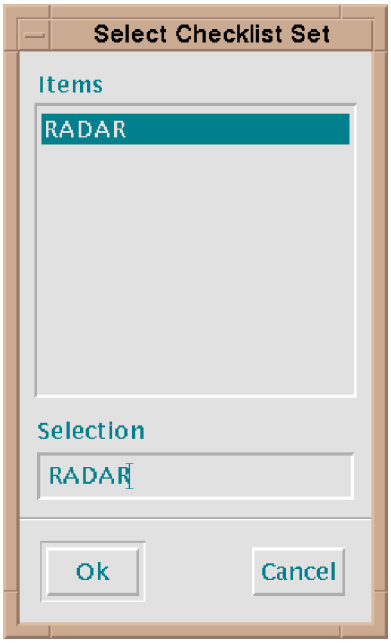


Fig. 39 — List of checklist sets (only radar is valid)

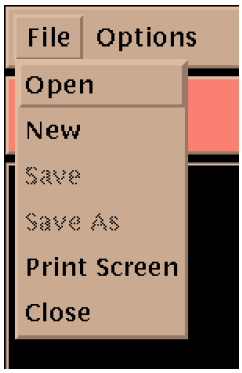


Fig. 40 — Checklist editor: file menu

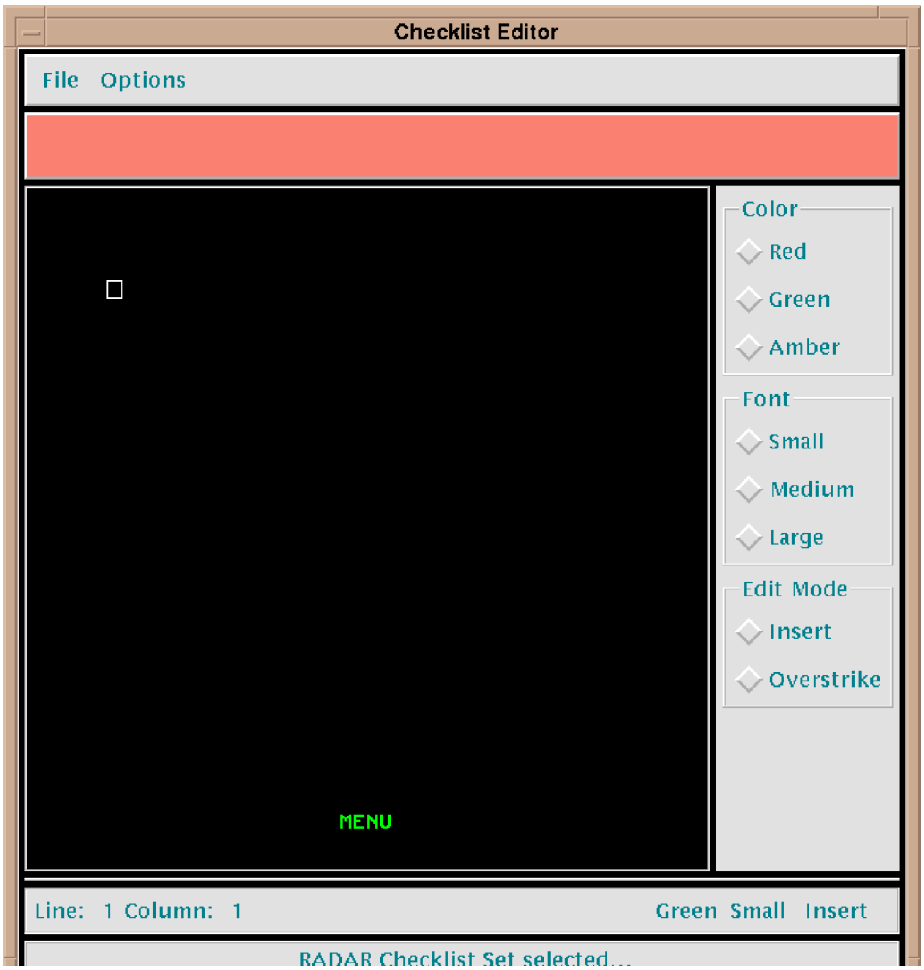


Fig. 41 — New checklist page

To open an existing checklist file:

- Click on *Select Checklist Set* from the *Options* menu (Fig. 38) in the **Checklist Editor Window**.
- Select *Radar* (the only valid set) from the list (Fig. 39).
- Click on *Open* from the *File* menu (Fig. 40) in the **Checklist Editor Window**.
- Enter the desired category and page number in the **Category/Page Selection Window** (Fig. 42).
- The selected checklist will be displayed in the **Checklist Editor Window** (Fig. 43).

Fig. 42 — **Category/Page Selection Window**

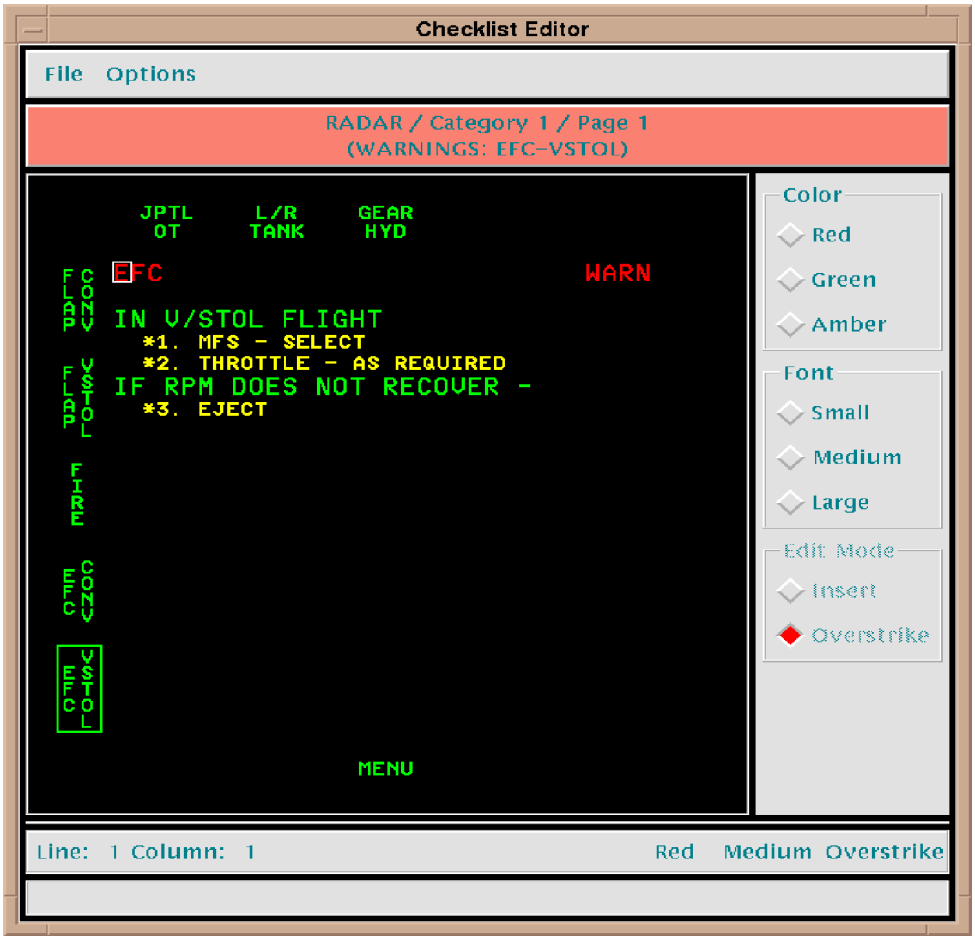
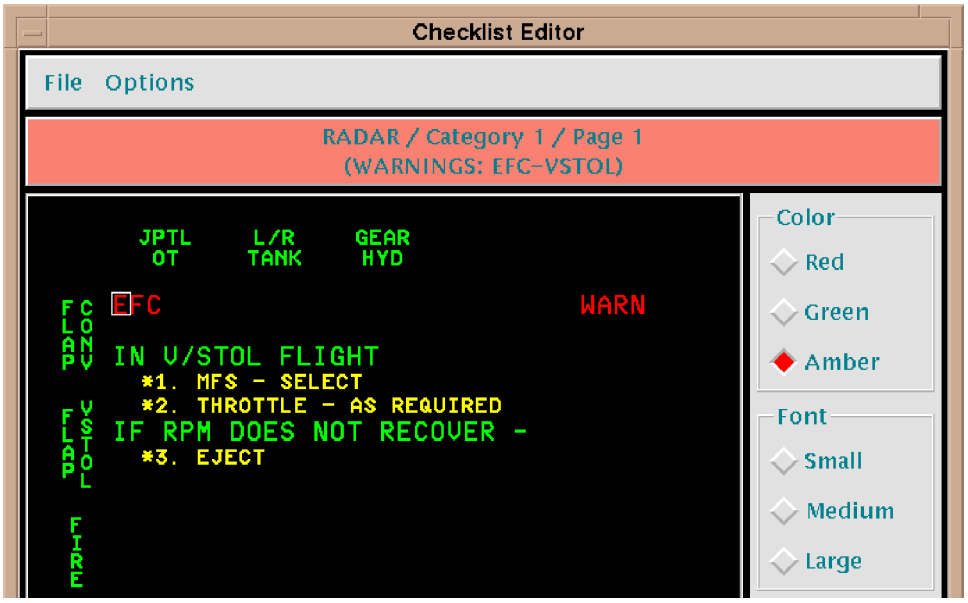


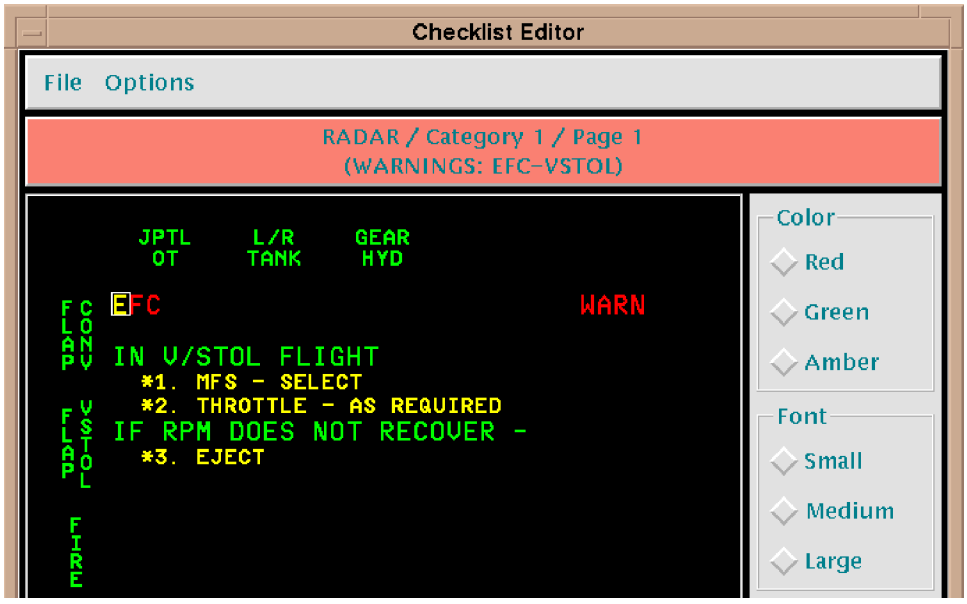
Fig. 43 — Sample **Checklist Editor Window**

To set text color, click on the *Red*, *Green*, or *Amber* button, then click in the text area at the desired starting point, and type. All new text will be in the selected color.

To change text color, first click on the *Red*, *Green*, or *Amber* button, then click on the character to be changed. For example, click on *Amber*, then click on a character to be changed [in Fig. 44, the user changed the selected character from red (Fig. 44(a)) to amber Fig. 44(b))]. Type over any additional characters (immediately following the first) to change them to amber. Any other characters (not immediately following the first) must be changed by clicking again on *Amber*, then clicking on the new character. Future updates to MMC could support more user-friendly color changing.



(a)

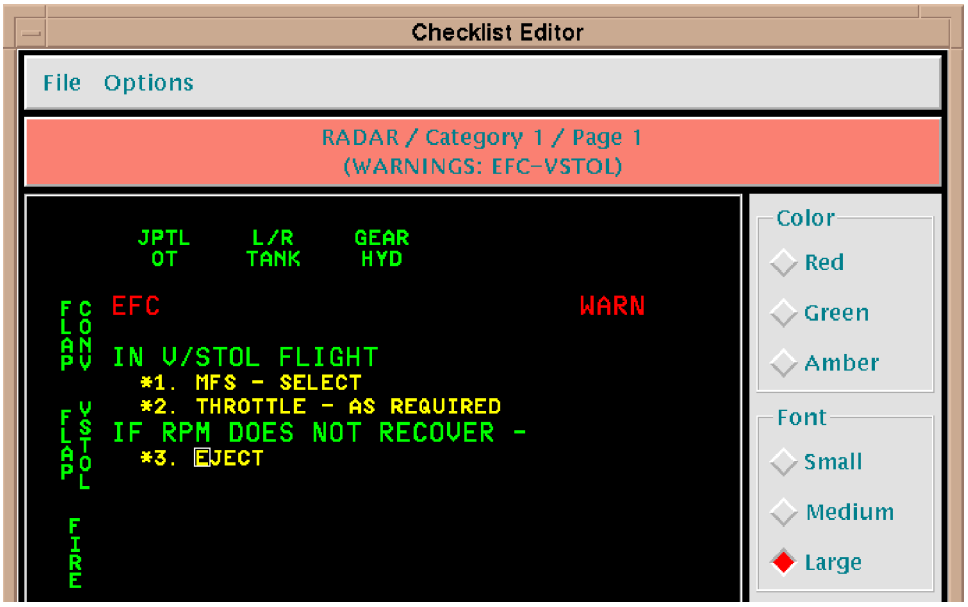


(b)

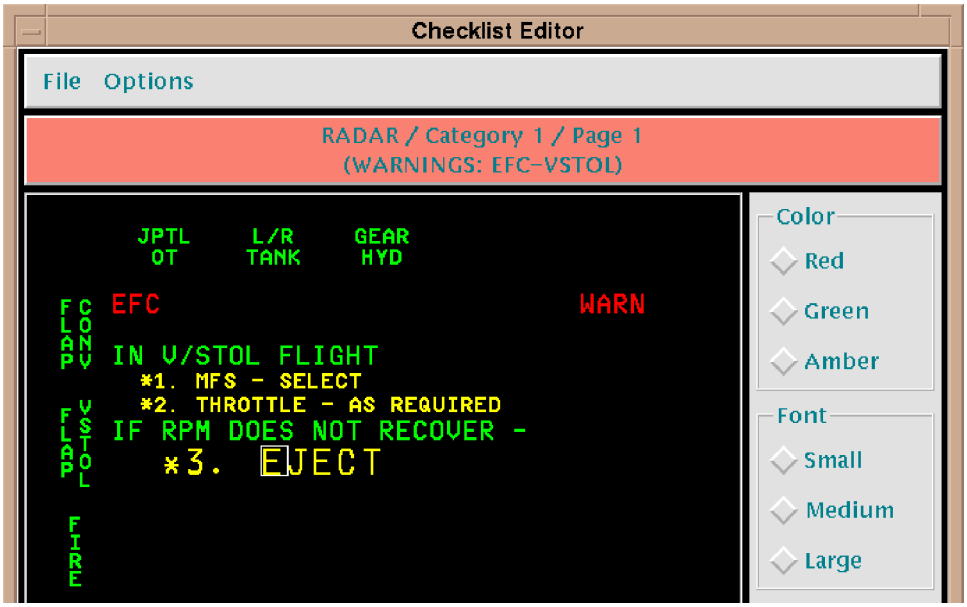
Fig. 44 — Example of changing text color in MMC checklist editor: (a) click on new color (e.g., amber) then (b) click on letter to change (e.g., from red)

To change font size, first click on the *Small*, *Medium*, or *Large* button, then click anywhere in the line to be changed. For example, click on *Large*, then click on a line to be changed [in Fig. 45, the font size of the selected line is changed from small (Fig. 45(a)) to large (Fig. 45(b))]. Font size can only be changed an entire line at a time.

Currently, MMC only supports *Overstrike* mode in the checklist editor. A future update could support *Insert* mode.



(a)



(b)

Fig. 45 — Example of changing font size in MMC checklist editor: (a) click on new size (e.g., large) then (b) click in line to change (e.g., from small)

The checklist editor provides various maintenance functions, including deleting and saving checklists. To delete a checklist set, click on *Delete Checklist Set* under the *Options* menu (Fig. 38) in the **Checklist Editor Window**. Note: *Create Checklist Set* (under *Options*) is not yet available. To save an edited checklist set (and keep the same name), click on *Save* under the *File* menu (Fig. 40) in the **Checklist Editor Window**. To save an edited checklist set with a new name, click on *Save As* under the *File* menu. MMC will prompt the user for the new name. To close an edit session without saving, click on *Close* under the *File* menu. To print a copy of the checklist, click on *Print Screen* under the *File* menu.

3.3.6.3.2 View Dataframes — MMC provides a function to view and print any dataframes (including checklists) in the current AODI. First, open an AODI - containing checklists or other dataframes - by clicking on *File* in the **MMC Window**, then *Open Image* (Section 3.3.1.4). Then click on the *Tools* menu, *Dataframes Options*, *View Dataframes* to start a **Dataframe Viewer Window** listing all dataframes in the current AODI (Fig. 46). To view a dataframe, scroll through the list with the scroll bar (at the right of the list) and double-click (with the left mouse button) on the desired filename. Alternatively, use the arrows at the bottom of the window to scroll through the list, displaying each dataframe in turn (Fig. 47). To print a copy of the dataframe, click on *Print Screen* under the *File* menu. To exit from this window, click on *File*, then *Exit*.

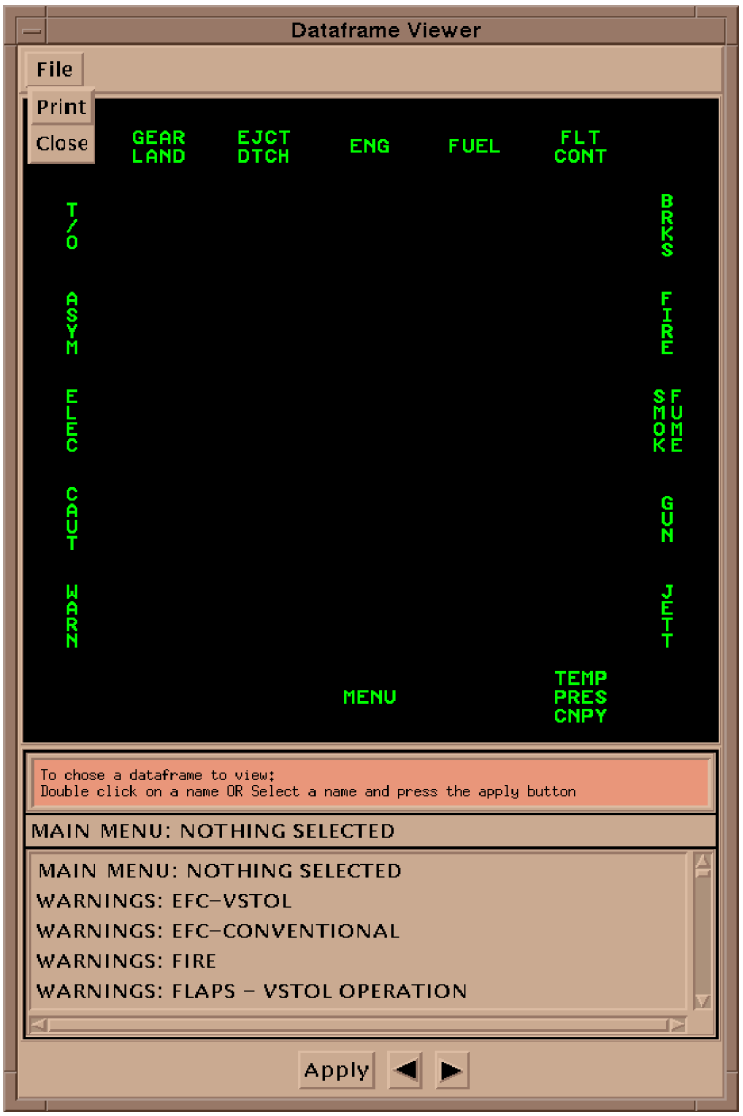


Fig. 46 — **Dataframe Viewer Window**

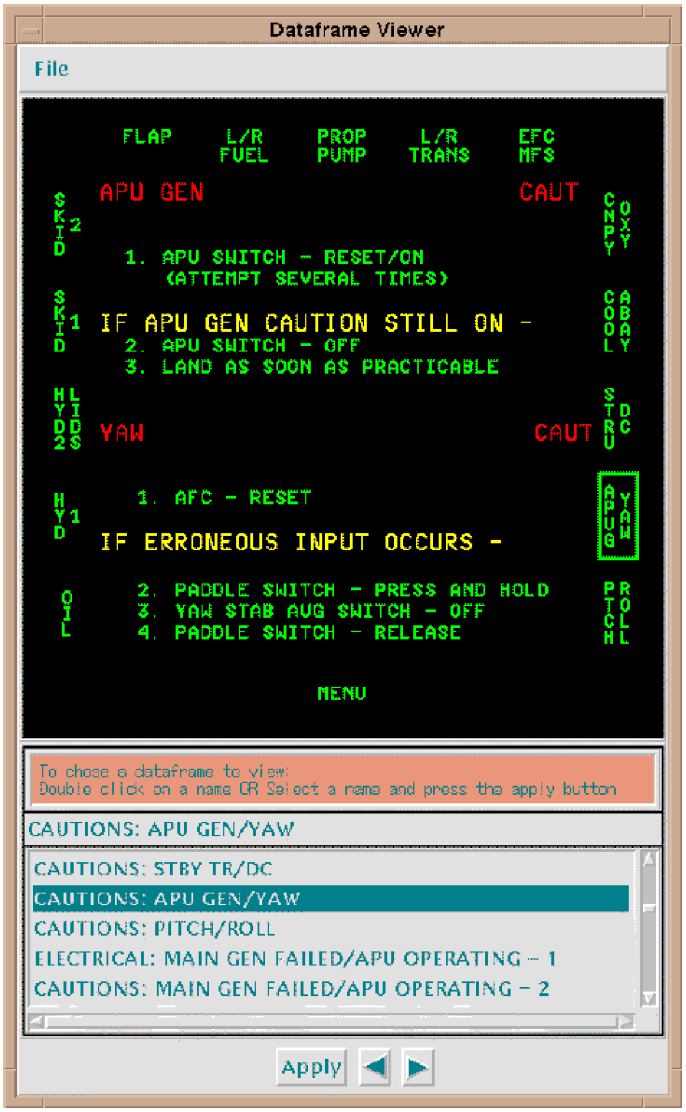


Fig. 47 — Sample dataframe

3.3.6.3.3 Copy Checklist to an AOD — Select this option to copy a checklist to an AOD mounted on the DMU. Follow the directions given by MMC for this function.

3.3.6.4 Media Options

These include logging and unlogging media (e.g., CAC or DTED data from NIMA) in the MMC source databases (Fig. 48).

3.3.6.4.1 Log Media — This option logs new source data (CAC or DTED from NIMA) in the MMC source databases. While logging in a new CAC or DTED CD, MMC will build a bitmap of the source data that will be used to calculate and overlay available coverages (Section 3.3.3.6) and incorporate logged source data (Section 3.3.4.4) into an AODI or MPS-CDI. When the user selects *Log Media*, MMC pops up the **CD-ROM Site Window**. After entering all the CDs to be logged, click on the *Start Processing* button at the bottom of the window (Section 4.1).

Note: **DO NOT** eject any CDs until the "Logging Complete" message is displayed!!

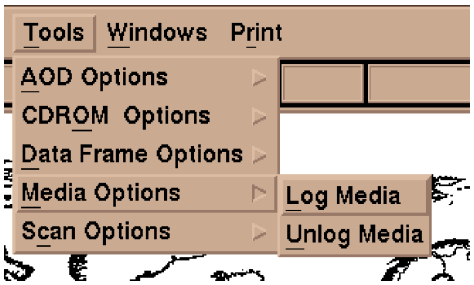


Fig. 48 — Media options

3.3.6.4.2 Unlog Media — Removes references to source data from the MMC log file. This is done if a previously logged source is found to be bad (e.g., an unreadable CD). Note: MMC will store multiple CAC CD versions, but not multiple DTED versions, because NIMA provides unique edition numbers for CAC CDs, but not for DTED CDs. (A future version of MMC may provide a workaround to this problem). Therefore, whenever NIMA issues a new version of a DTED CD, the user must unlog the previously logged version before logging the new one.

3.3.6.5 Scan Options

Scan Options include scanning paper charts into the CAC format (including all phases of compression) and deleting scanned data from MMC (Fig. 49).

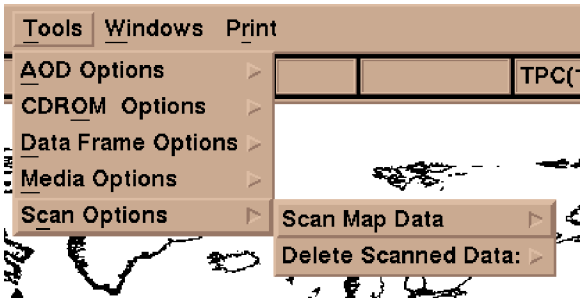


Fig. 49 — Scan options

3.3.6.5.1 Scan Map Data — This option is used to scan paper charts and compress the resulting data into the CAC format to augment existing CAC data. This utility facilitates the inclusion of new and updated charts (not yet available in digital form) to be included in an AODI or MPS Image. The scanning process comprises 10 steps:

1) Select the chart series, projection, and control point format
2) Scan the chart
3) Clip the image (if desired)
4) Identify the chart datum and ellipsoid
5) Enter control points
6) View and accept the control points
7) Process the scanned data
8) Scan another chart (if desired)
9) Quit scanning and finalize data
10) Review scanned data.

These steps are detailed in the following sections.

Step 1: Select the chart series, projection, and control point format.

After clicking on *Scan Options*, choose the chart series to be scanned (Fig. 50). MMC will display a window listing some scanning tips. To proceed, click on the button that says "*Begin with [chart series]*." MMC will display the **Scan Map Data Window**.

From the **Scan Map Data Window**, click on *Preferences*, then *Projection* (Fig. (51). Select *Polar* if the chart is based on a polar or conic projection (i.e., either the latitude or longitude lines are curved); select *Nonpolar* if the chart is based on a rectilinear projection (i.e., both latitude and longitude lines are straight). Click on *Preferences* again, then *Enter Latitude Longitude as:* (Fig. 52). Select a control point format: *Decimal Degrees*; *Degrees, Minutes and Seconds*; or *MGRS* (Military Grid Reference System).

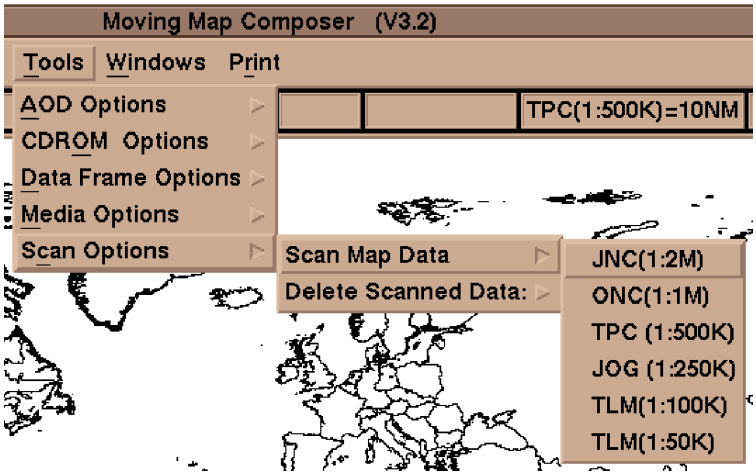


Fig. 50 — Select chart series to scan

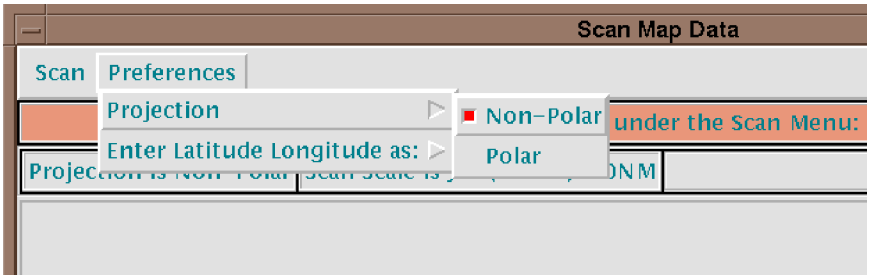


Fig. 51 — Projection preferences for scanning chart data

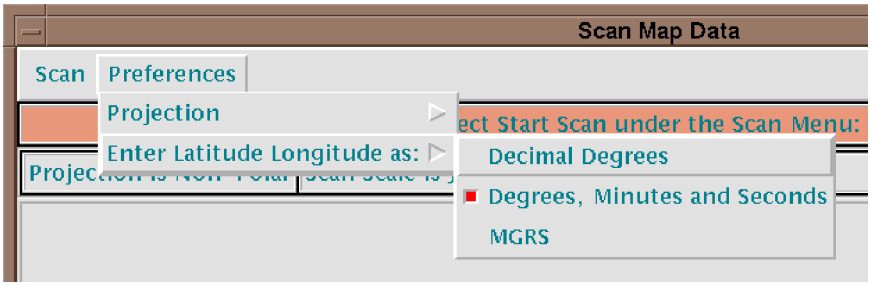


Fig. 52 — Latitude/longitude preferences for selecting control points

Step 2: Scan the chart.

Position the chart on the scanner. Click on *Scan*, then *Start Scan* (Fig. 53). MMC will bring up the **Scan Overview Window** and display the scan as it progresses (Fig. 54). A full scan (i.e., 11" × 16" section of chart) takes about 3 minutes.

At any time during the scan, the user can click on *Cancel* at the bottom of the **Scan Overview Window** (e.g., if the chart is upside-down or sideways, or if the wrong chart is in the scanner). MMC will discard any scanned data from the current scan and let the user start over.

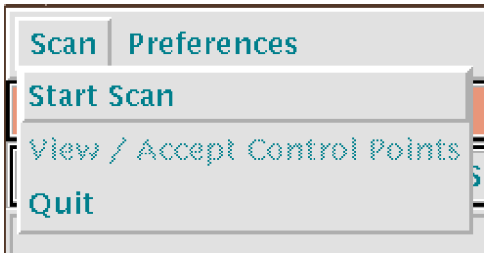


Fig. 53 — Start scan

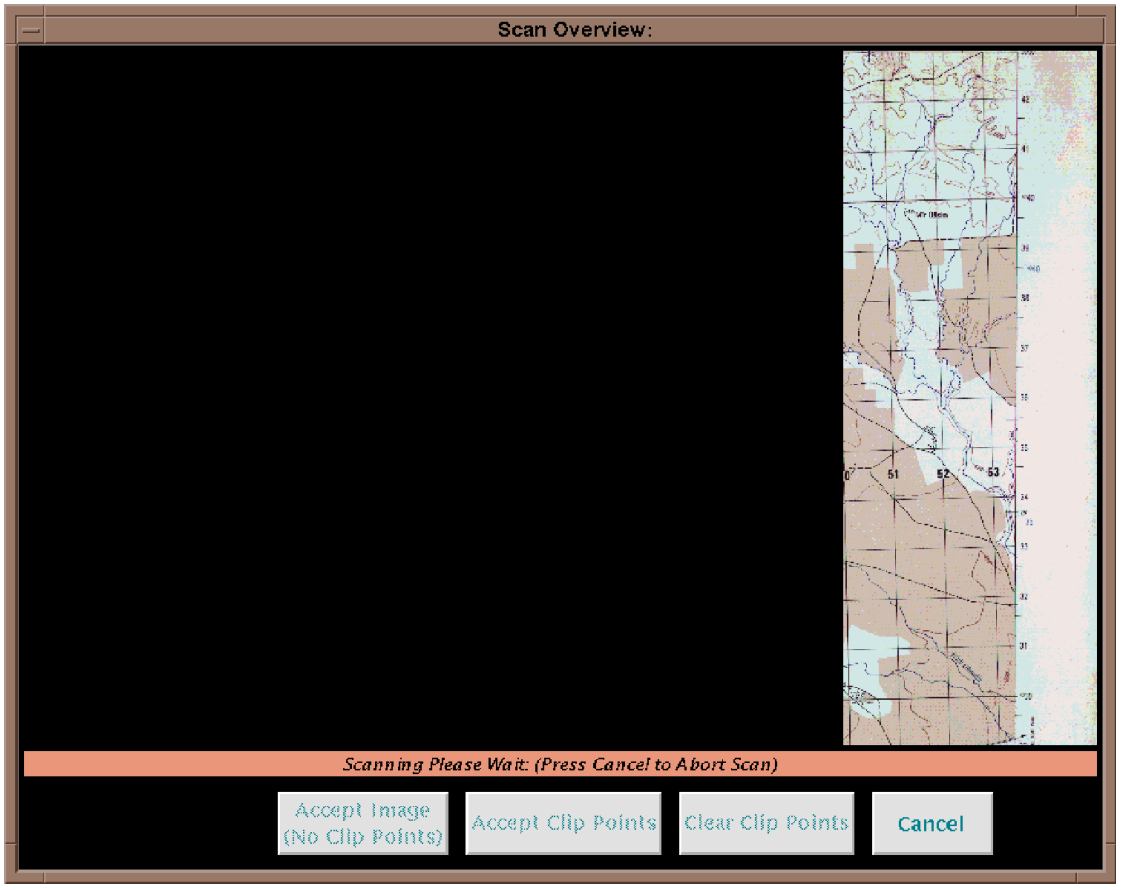


Fig. 54 — **Scan Overview Window** as scan is progressing

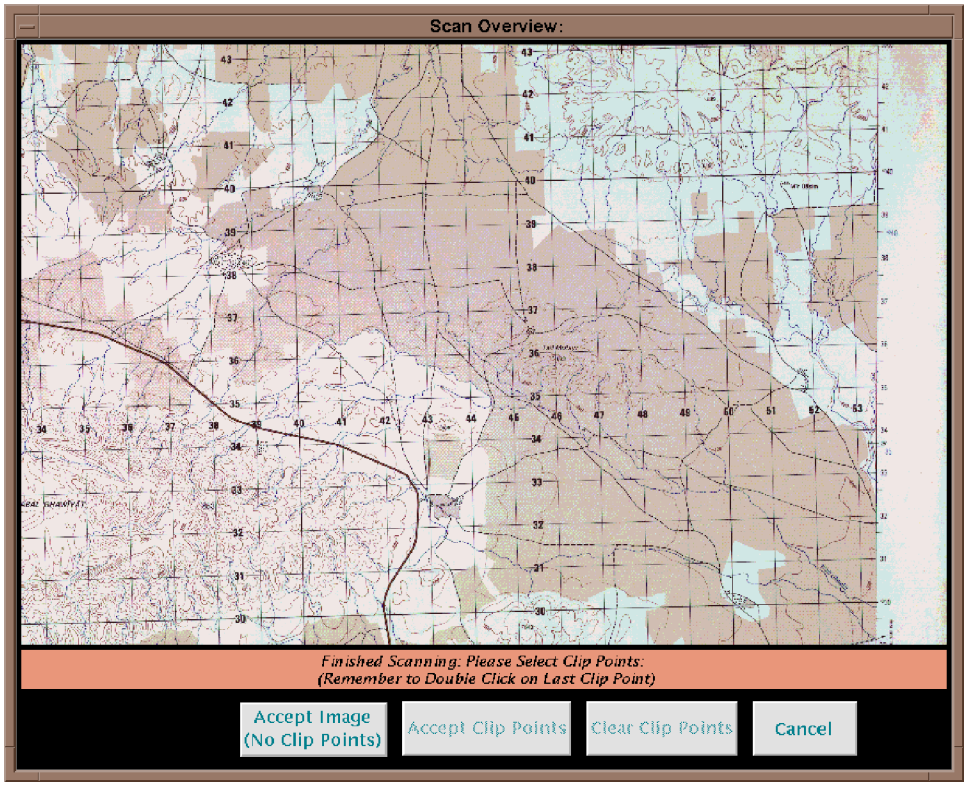


Fig. 55 — **Scan Overview Window** after scan has completed

Step 3: Clip the Scanned Image (if desired).

When the scan is complete, the **Scan Overview Window** will display the entire scan (Fig. 55). Now the user can do one of three things:

a) *Accept the image without clipping*: click on *Accept Image (No Clip Points)* at the bottom of the **Scan Overview Window**;

b) *Cancel and return to MMC*: click on *Cancel* in the **Scan Overview Window**; or

c) *Select clip points to trim the image*: position the cursor over the scanned image in the **Scan Overview Window**, and define a clipping polygon by clicking with the left (first) mouse button. MMC will draw a red line to show the clip region as the user selects each point. On the last clip point, double-click the mouse button to complete the clipping polygon; MMC will redraw the clipped image (Fig. 56). To start over, select the *Clear Clip Points* button at the bottom of the window. When the clip points are acceptable, select the *Accept Clip Points* button. To NOT clip the image, select *Cancel* at any time.

Step 4: Enter Datum/Ellipsoid.

After the user accepts the image (clipped or not), MMC will display a list of datum and ellipsoid combinations (Fig. 57). Select the correct combination for the scanned paper chart (datum and ellipsoid information is usually printed in one of the chart's margins), then click *Ok*. MMC will display a verification message; click on *Use Datum* to proceed. Table 2 lists all the supported data and ellipsoids in MMC.

Fig. 56 — **Scan Overview Window** showing clipped image

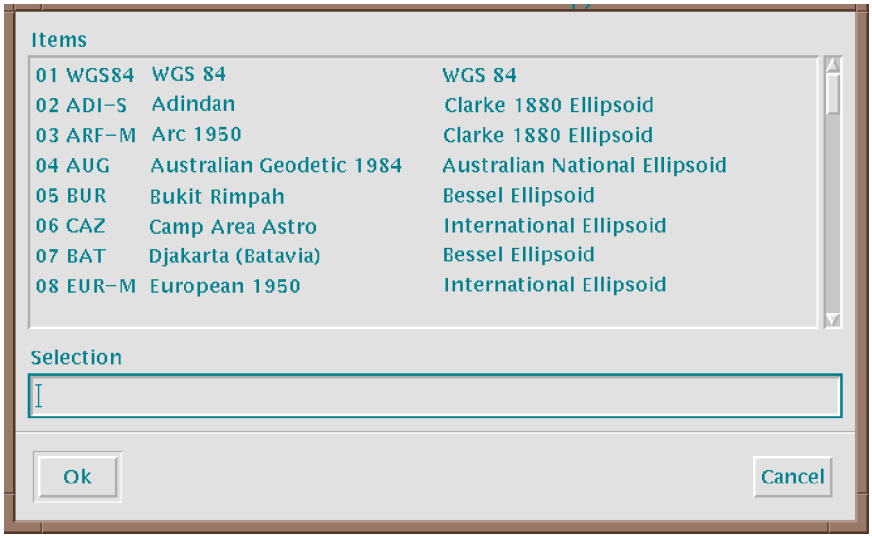


Fig. 57 — Selection list of datums and ellipsoids

Table 2 — List of Datum and Ellipsoid Combinations Supported by MMC

ID	Datum Name	Ellipsoid
1	Adindan	Clarke 1880
2	Arc 1950	Clarke 1880
3	Australian Geodetic 1984	Australian National
4	Bukit Rimpah	Bessel
5	Camp Area Astro	International
6	Djakarta (Batavia)	Bessel
7	European 1950	International
8	Geodetic Datum 1949	International
9	Ghana	WGS 84
10	Guam 1963	Clarke 1866
11	Gunung Segara	Bessel
12	G. Serindung	WGS 84
13	Herat North	International
14	Hjorsey 1955	International
15	Hu-Tzu-Shan	International
16	Indian	Everest
17	Ireland 1965	Modified Airy
18	Kertau 1948 (Malayan revised triangulation)	Modified Everest
19	Liberia 1964	Clark 1880
20	User-entered (*not* supported in MMC)	
21	Luzon	Clarke 1866
22	Merchich	Clarke 1880
23	Montjong Lowe	WGS 84
24	Nigeria (Minna)	Clarke 1880
25	North American 1927 (CONUS)	Clarke 1866
26	North American 1927 (Alaska and Canada)	Clarke 1866
27	Old Hawaiian, Maui	International
28	Old Hawaiian, Oaha	International
29	Old Hawaiian, Kaui	International
30	Ordnance survey of Great Britain (1936)	Airy
31	Qornoq	International
32	Sierra Leone 1960	WGS 84
33	South American (Provisional 1956)	International
34	South American (Corrego Alegre)	International
35	South American (Campo Inchauspe)	International
36	South American (Chua Astro)	International
37	South American (Yacare)	International
38	Tananarive Observatory 1925	International
39	Timbalai	Bessel
40	Tokyo	Bessel
41	Voirol	WGS 84
42	Special datum, Indian Special	Everest
43	Special datum, Luzon Special	Clarke 1866
44	Special datum, Tokyo Special	Bessel
45	Special datum, WGS 84 Special	WGS 84
46	WGS 72	WGS 72
47	WGS 84	WGS 84

Step 5: Enter Control Points.

Enter a set of control points to accurately georeference the image (i.e., reference each pixel to a latitude/longitude coordinate). If control points are not entered correctly, the resulting image could look warped, inverted, or otherwise corrupted (Fig. 58).

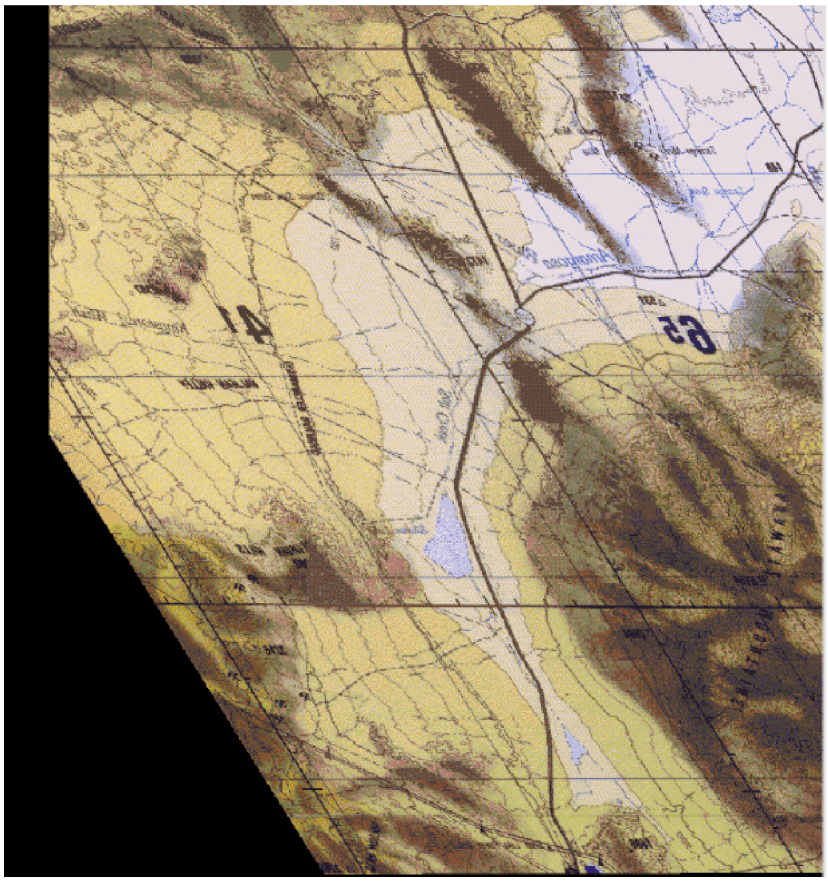


Fig. 58 — Example of scanned chart that was improperly georeferenced

MMC will display the message *Please select first control point*. Click on *OK*. MMC will remove the **Scan Overview Window** and display the scanned image at its full scale (i.e., not zoomed-out) in the **Scan Map Data Window** (Fig. 59). Use the scroll bars at the right and bottom of this window to scroll through the image and find appropriate control points (e.g., intersections of latitude and longitude lines).

To pick a control point:

a) Click with the left (first) mouse button on a point in the scanned image.

b) MMC will display a **Control Point Entry Window** with a zoomed-in view of this point and the surrounding area to let the user pick the point more accurately (Fig. 60). In this window, click on the selected point as accurately as possible (e.g., the intersection of latitude and longitude lines), then enter the latitude and longitude values for this point. To reenter these values, click on *Clear* and reenter them. Note: if MGRS is the preferred control point format (in step 1), enter the control points in MGRS units, as shown in Fig. 60, not latitude and longitude.

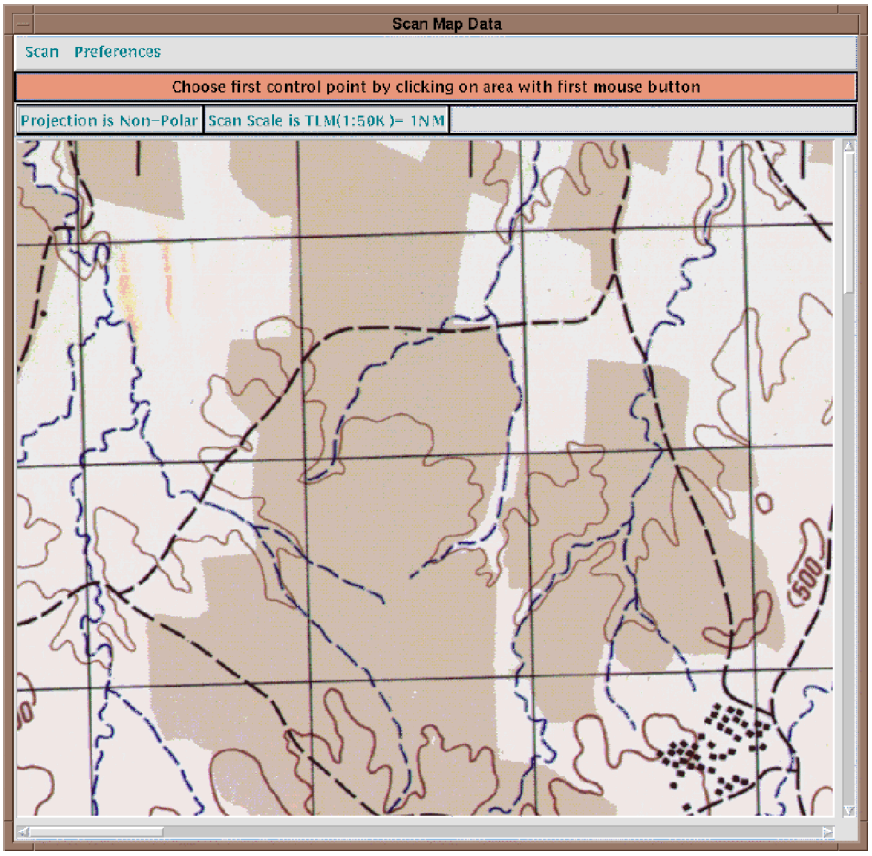


Fig. 59 — **Scan Map Data Window**: full-scale scanned chart (ready for control points)

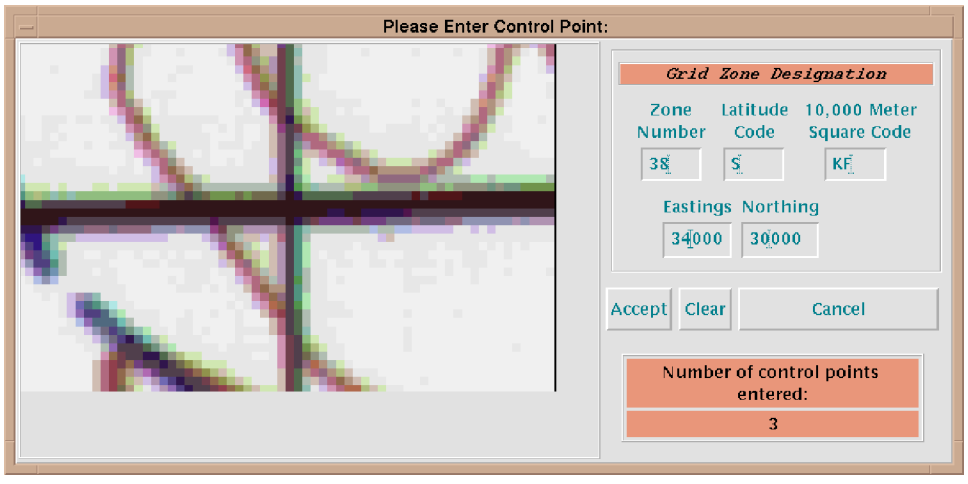


Fig. 60 — **Control Point Entry Window**, including zoomed-in area surrounding the point, plus entry boxes for geographic coordinates (here, in MGRS format)

c) Click on *Accept* when the control point is acceptable. To reselect it, click on *Cancel*, and pick the point again.

Repeat this process for each selected control point. Pick a minimum of three for nonpolar charts (six for polar) and a maximum of 25 control points. Ideally, for nonpolar charts, the user should pick at least the four corner points of the scanned image (or points close to the four corners) to get an accurate georeference. For polar charts, also select several control points within the chart.

Step 6: View and Accept Control Points.

After selecting all necessary control points, click on *Scan*, then *View/Accept Control Points* in the **Scan Map Data Window** (Fig. 61). MMC will display a window listing all the selected control points and allow the user to edit or delete them, if necessary (Fig. 62). When the user is satisfied with the list of control points, click on *Accept Control Points*.

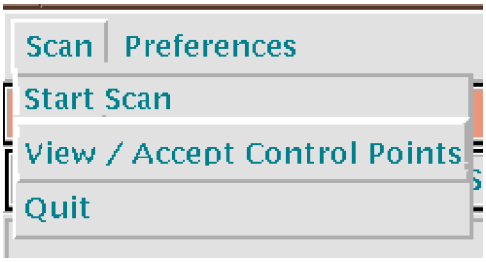


Fig. 61 — **View/Accept Control Points**

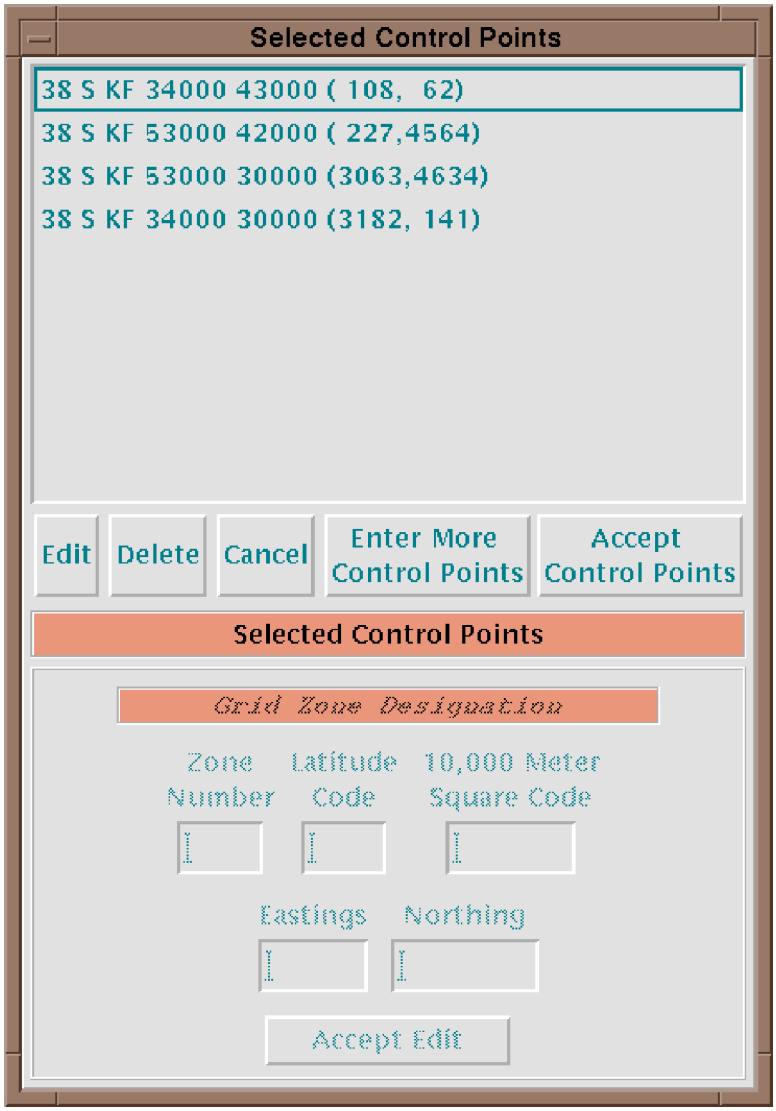


Fig. 62 — List of selected control points

Step 7: Process Scanned Data.

MMC now will transform the control points from the scanned chart's source datum and ellipsoid to WGS-84. After a few seconds, MMC will display the main **MMC Window**, zoomed into the scanned area, with a composition of the scanned image overlaid by a latitude and longitude reference grid. MMC will also display a message asking if the scanned coverage area is in the right area (Fig. 63), i.e., is it in the right location and of the right size and shape? The user may have to move this message to the side if it obscures the template.

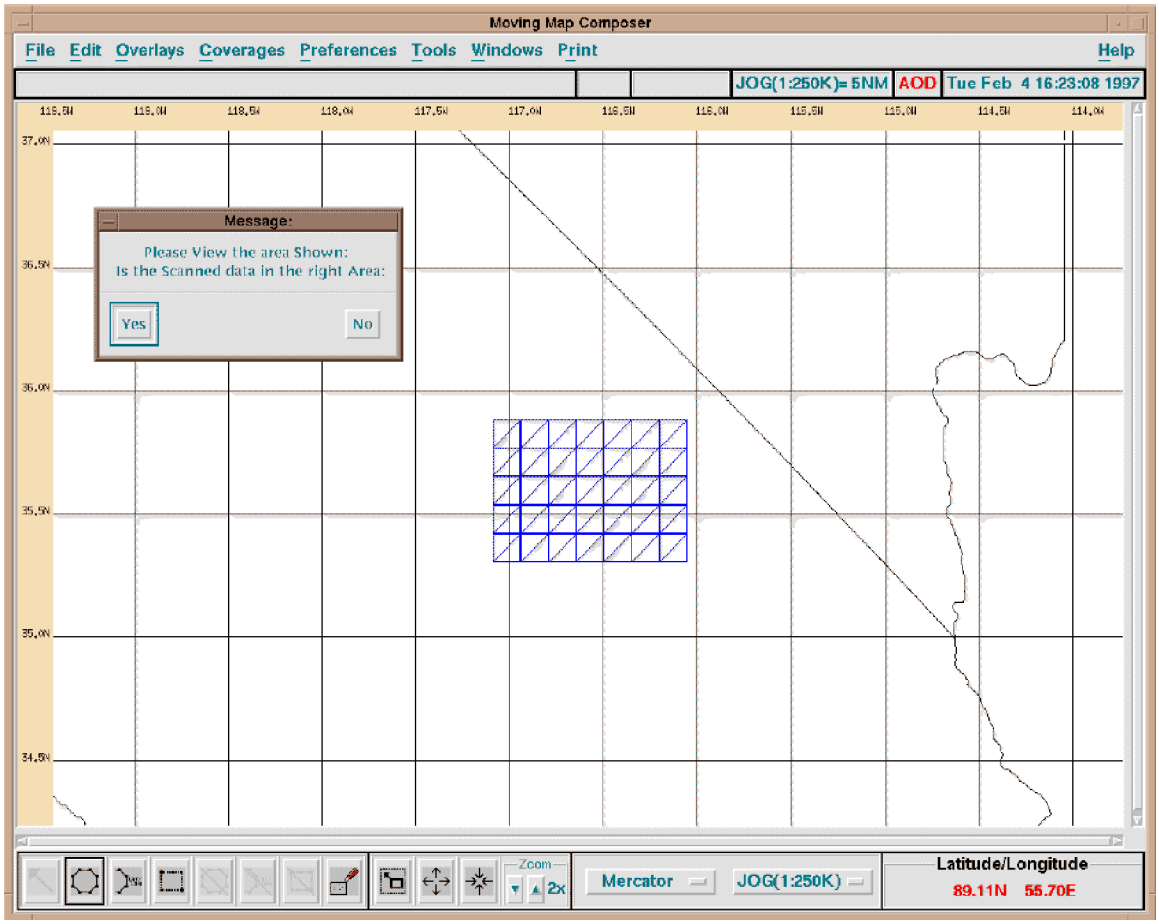


Fig. 63 — Composition of newly scanned chart data and verification that it is correct

Note: if the image was clipped, MMC will have clipped it to the nearest TS segment boundary, to keep the entire segment intact. Therefore, the template boundaries may not exactly match the user-entered clip bounds (the template may be slightly larger).

If the template does not look right, click *No* to the message. MMC will let the user edit the list of control points again or start the scan over.

If the template looks good, click *Yes*. MMC will return to the **Scan Map Data Window**, process the data, and display a meter of the percent completed (Fig. 64). Note: the data will be subsampled into TS segments, but not color-compressed yet.

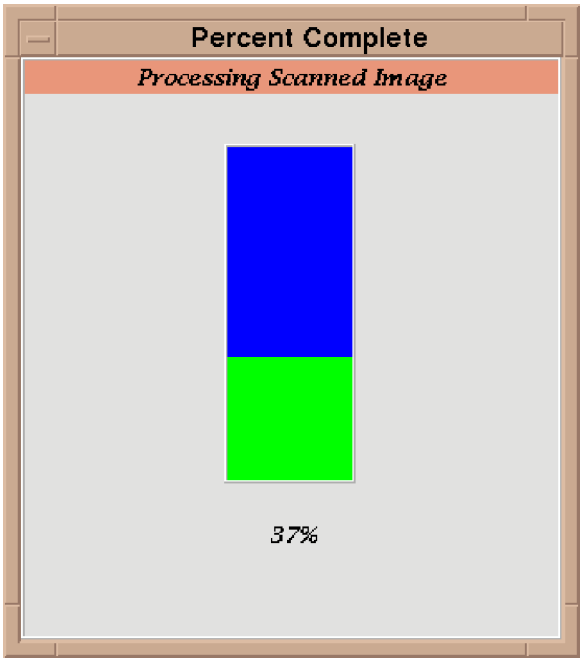


Fig. 64 — Meter showing the percent complete while processing scanned chart data

Step 8: Scan Another Chart (if desired).

When the processing has completed, the message at the top of the **Scan Map Data Window** will tell the user to scan another chart or quit. To scan another chart of the same scale (or an adjacent section of the same chart), reposition the chart on the scanner and repeat the steps to scan, starting with *Start Scan* (step 2). To scan another chart of a different scale, quit this scan session first (i.e., continue with steps 9 and 10), then start a new scanning session (with step 1) for the new scale.

Step 9: Quit Scanning and Finalize Data.

If there are no more charts to scan in this scale, select *Quit*. *Quit* can be used at any time to stop scanning and return to the main **MMC Window**.

If the user has just finished scanning a chart and selects *Quit*, MMC will display a message saying there is scanned data to be finalized. At this point, either click on *Finalize Scanned Data* to compress it now, or *Do this later* to postpone compression for another time.

When the user selects *Finalize Scanned Data*, MMC will color-compress all the scanned data into "Scanned CAC" (SCAC) files and display a meter showing the percent completed (Fig. 64). **Wait** until processing has finished before trying to do anything else in MMC!

Note: if MMC dies (e.g., due to a power failure) while compressing scanned data, simply restart MMC and click on *Tools*, *Scan Options*, *Scan Map Data*. Choose the chart series of the scanned data that was being compressed. MMC will bring up the **Scanning Tips Window** (click on *Begin with [chart series]*), then the **Scan Map Data Window**. Click on *Scan*, then *Quit*, and then continue with *Finalize Scanned Data* as previously described.

When processing has completed, MMC will display a message saying that scanned data have been added or removed at the current scale. Click *Acknowledge*. MMC will return to the main **MMC Window.**

.

Step 10: Review Scanned Data.

After returning to the main **MMC Window**, the user can review the data just scanned by first defining an area of coverage that includes that scanned data. Next, click on *Preferences*, then the *View CAC Data* option list, then *View Scanned Hard Disk* (Section 3.3.5.2). Finally, click with the right (third) mouse button on the area to be reviewed. Figure 65 depicts three adjacent scanned charts being reviewed (see Section 4.3 for more information on reviewing chart data in MMC).

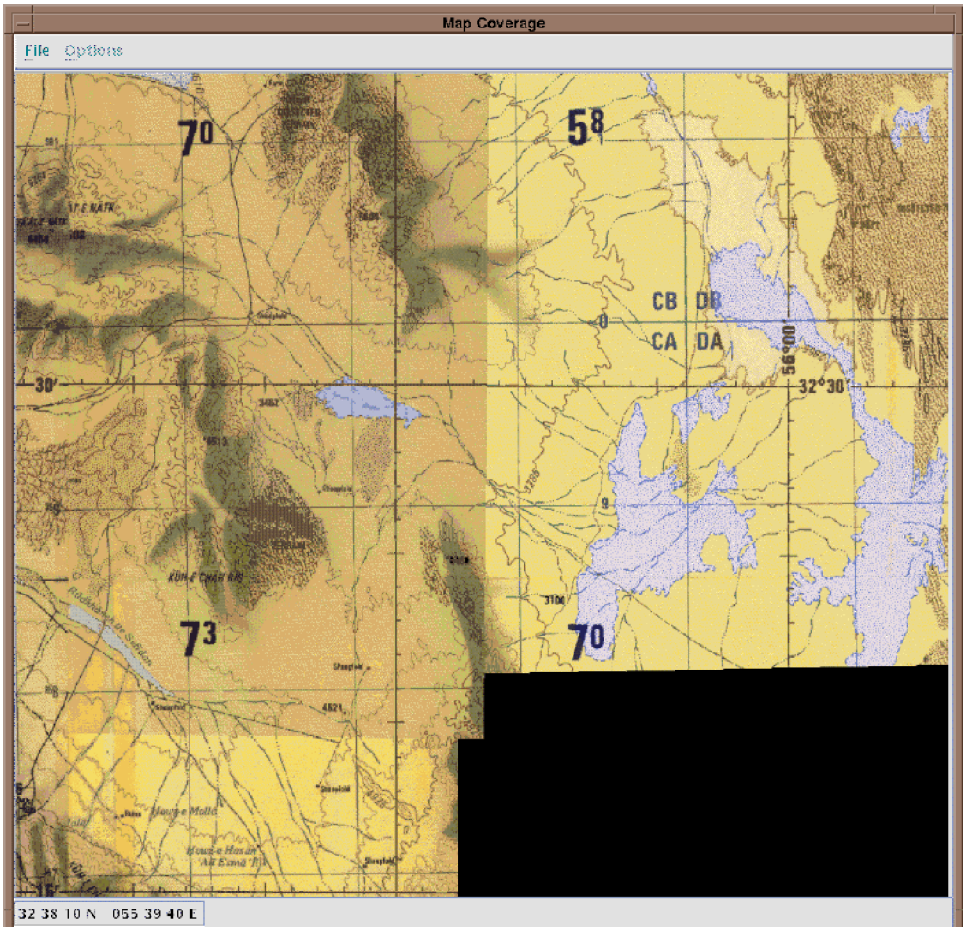


Fig. 65 — Reviewing scanned chart data: three adjacent scanned charts

3.3.6.5.2 Delete Scanned Data—This should **only** be done if the scanned data have been archived to CD (Section 3.3.6.2.1) or if the data are no longer required.

There are three ways to delete scanned data: (1) delete all the scanned data from the hard disk for a specified scale; (2) delete a defined area of scanned data from the hard disk (at one or more scales); or (3) delete scanned data from the hard disk while reviewing the scanned image (which is done prior to archival).

1) To delete all scanned data (at a given scale) from the hard disk, click on *Tools*, *Scan Options*, *Delete Scanned Data*, *For Scale*, then the scale to delete (Fig. 66). MMC will request verification; click on *Continue* to proceed or *Abort* to cancel. If these scanned data have not been archived to CD, MMC will display a warning; click on *Delete anyway* to proceed or *Abort* to cancel. MMC will display a meter to show the percent of scanned data deleted until it has finished.

2) To delete a defined coverage of scanned data (at one or more scales), first use the MMC define coverage buttons (Section 3.2.3) to outline the area(s) to be deleted (individual segments or entire areas). Then click on *Tools*, *Scan Options*, *Delete Scanned Data*, and *For the Defined Coverage* (Fig. 67). MMC will display a verification message; click on *Continue* to proceed or *Abort* to cancel.

3) The third method of deleting scanned data is while the user is reviewing it. This method is not part of *Tools*, *Scan Options*, *Delete Scanned Data*, but it is an easy way to selectively delete scanned data on the hard disk prior to archiving it to CD or including it in a composition. In particular, this is probably the best way to delete "partial segments" around the edge of a scanned area in preparation for seamlessly merging the scanned data with surrounding CAC data. Partial segments are not completely filled with chart data (i.e., they are partially black), so if they are inadvertently used as part of a final composition, partial segments would introduce gaps into the image.

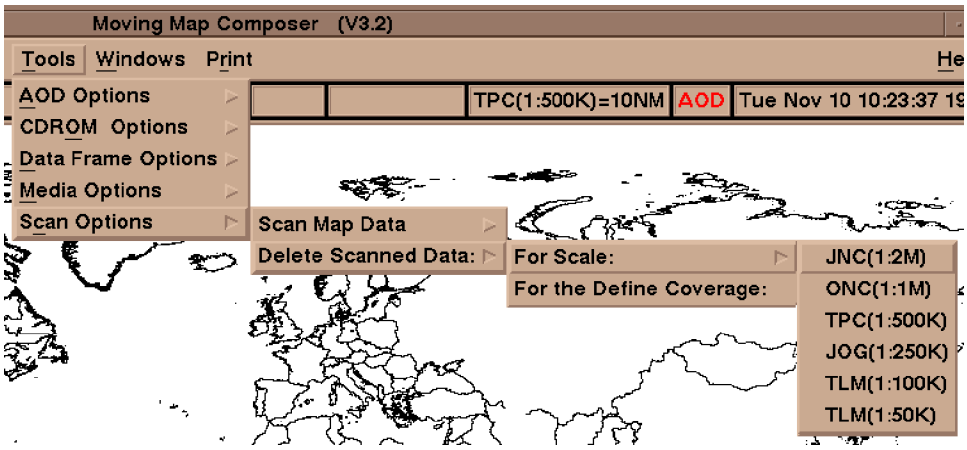


Fig. 66 — Delete all scanned data (for a given scale) from the MMC hard disk

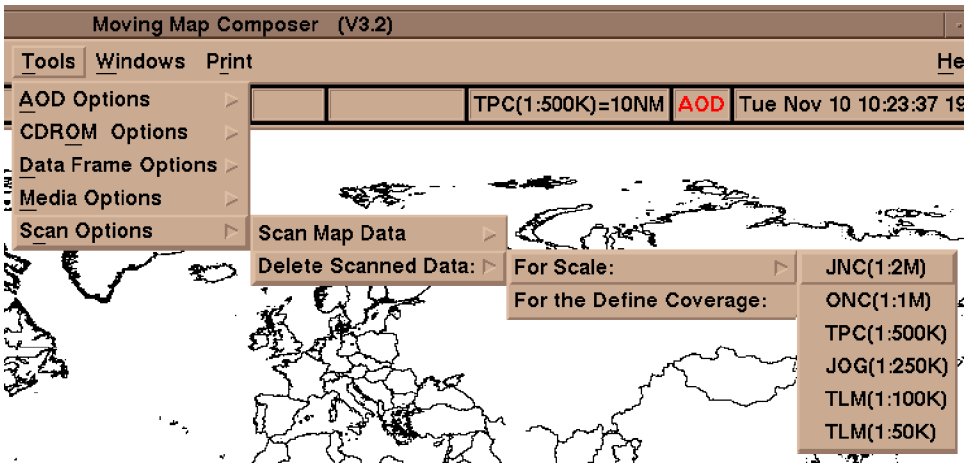


Fig. 67 — Delete a defined coverage of scanned data (at one or more scales)

To delete or edit the scanned data this way, the user must be reviewing it. Display the composition(s) of the scanned data to be edited by clicking on *Coverages*, *Include Scanned Coverage*, then select the coverage(s) to be included (Section 3.3.4.5). Note: only scanned data stored on the hard disk can be edited, not archived data on CD. Zoom-in to the area of interest, then review the data by clicking on the area with the right (third) mouse button. MMC will display the scanned data in a **View Data Window**. Next, pan around the data (using the left (first) mouse button), and find the area to be deleted. For more information on viewing data in MMC, see Section 4.3.

Next, delete a single TS segment by clicking on a point inside the segment with the middle (second) mouse button. MMC will issue a message: "Are you sure you want to permanently DELETE the segment you click on?" Click on *Cancel* (default) to return to the **View Data Window** without deleting, or click on *DELETE* to delete the segment just selected. Note: MMC does not currently display segment boundaries (a future release could do this). To delete partial segments around the edge of the scanned image, click very close to the edge of the image (with the middle mouse button), then select *DELETE*. MMC will redisplay the image with the deleted segment removed, so from then on, the user can visualize how large a segment is and where adjacent segments are located.

3.3.7 Windows

The *Windows* menu (Fig. 68) executes various MMC utilities in pop-up windows, including Composition Data Size, Scanned Data Size, Data Sources, AOD/MPS Area Status, and History.

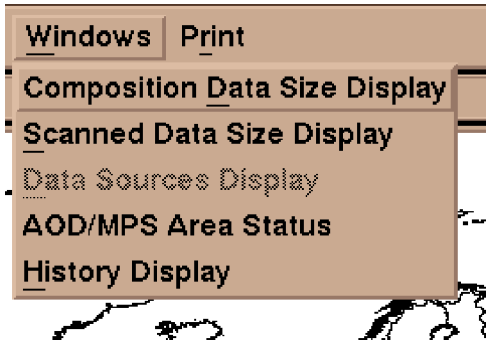


Fig. 68 — *Windows* menu

3.3.7.1 Composition Data Size Display

This display monitors how much disk space is used for each scale of chart data in a composition (Fig. 69). If one or more scales has too much data (calculated by the number of AOD sectors permitted per scale), the graph will turn red for that scale (Fig. 70(a)). If the size of the composition (for all the scales combined) is greater than 260 MB - i.e., too large to fit on an AOD - then the "Total" graphs will turn red. This can happen even if each individual scale of data is within the size limits of an AOD (Fig. 70(b)).

3.3.7.2 Scanned Data Size Display

This display monitors how much scanned data (per scale) is stored on the hard disk (Fig. 71). If a scale exceeds 600 MB, the graph will turn red for that scale, indicating that it's time to archive that scale of scanned data to CDROM.

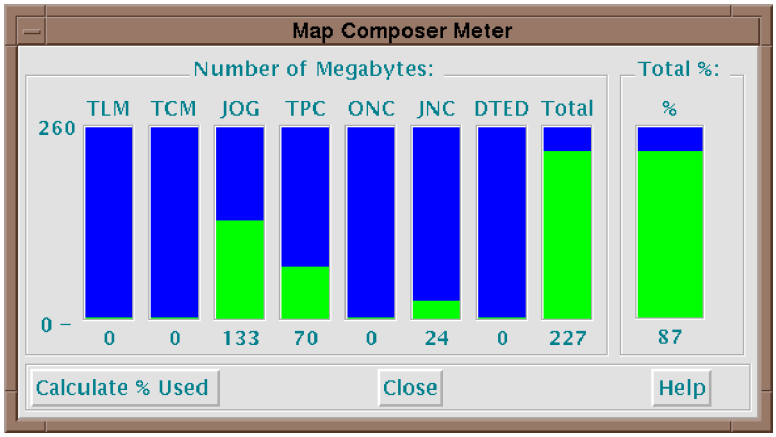
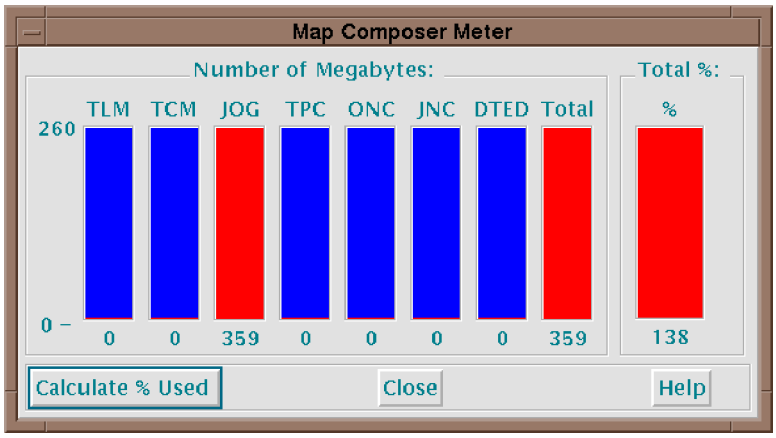
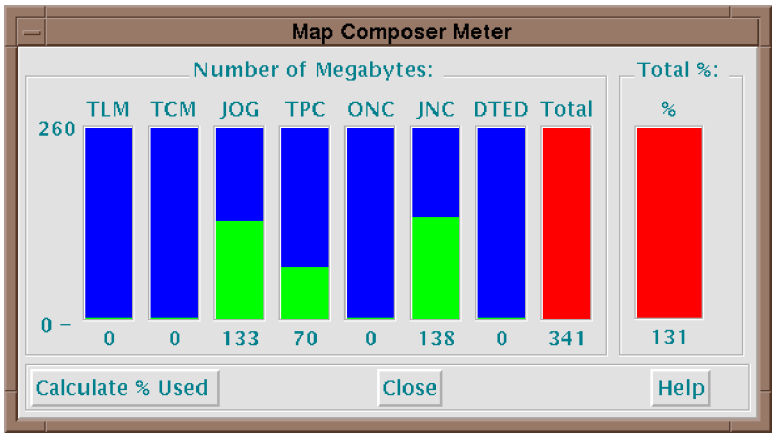


Fig. 69 — Composition size with limits



(a)



(b)

Fig. 70 —Composition data size exceeds AOD limit: (a) JOG scale exceeds 260 MB; (b) individual JOG, TPC, and JNC scales are within 260 MB, but total exceeds 260 MB.

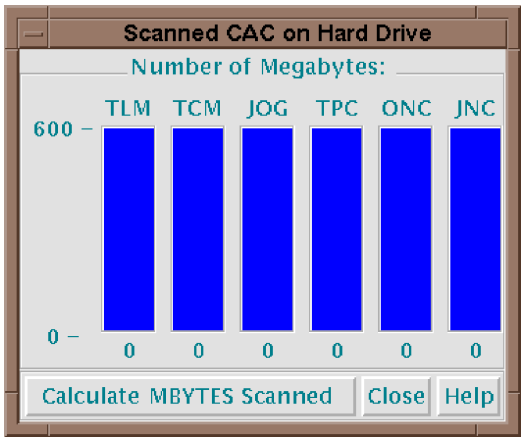


Fig. 71 — Scanned data size display

3.3.7.3 Data Sources Display

This display lists all logged data sources for the current composition, including DTED (for MPS compositions only), CAC, and scanned chart data (Fig. 72). As the user defines new coverages, this display will reflect any new logged sources that are applicable.

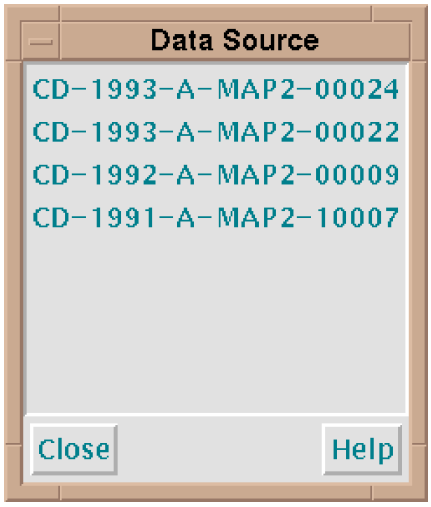


Fig. 72 — Data sources display

3.3.7.4 AOD/MPS Area Status

This display lists all AODIs and MPS Images currently stored on the MMC hard disk (Fig. 73). The list includes the descriptive title, library number, and build status for each image. Click on *Acknowledge* to erase this display and return to the main **MMC Window**.

3.3.7.5 History Display

This displays the MMC log file, which includes all errors, warnings, and other messages issued by MMC. To print this log file, go to the MMC *Print* menu and click on *Print MMC Log File* (Section 3.3.8.3).

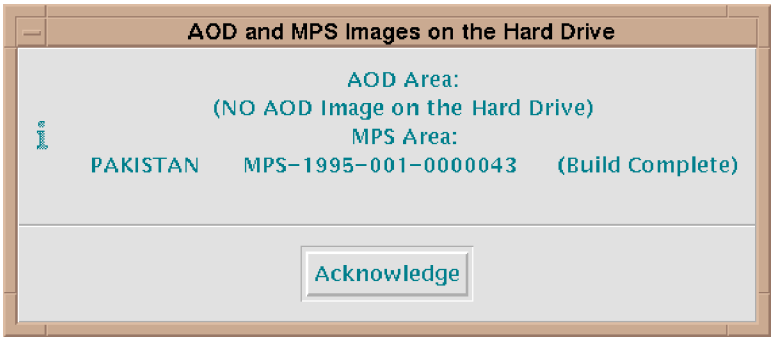


Fig. 73 — AOD/MPS area status

3.3.8 Print

The *Print* menu (Fig. 74) provides three options: print the entire screen, print AOD audit files, and print the MMC log file.

3.3.8.1 Print Screen

This option prints the contents of the entire screen. Must have a graphics printer (i.e., *HP-300*, *HP-600* or *Seiko printer*) connected and set via *Print Preferences* (Section 3.3.5.4) under the *Preferences* menu.

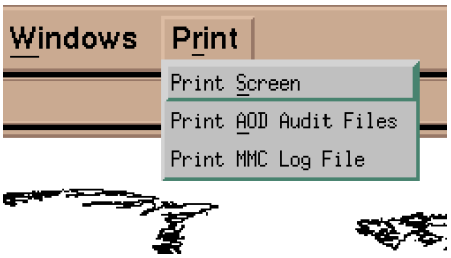


Fig. 74 — **Print** menu

3.3.8.2 Print AOD Audit Files

This option prints the AOD Audit Files, which are created during AOD builds. After clicking on this option, MMC will prompt the user for AOD serial number and side. Only the audit file for that AOD and side will be printed. Must have a text printer (i.e., *Text-Only Printer*, *HP-300*, or *HP-600*) connected and set via *Print Preferences*.

3.3.8.3 Print MMC Log File

This option prints the MMC log file. The user is advised to view this log file first—via the *History Display* (Section 3.3.7.5) under *Windows*—before printing. After printing, MMC will automatically purge the log file (i.e., clear all contents).

4. COMMON MMC OPERATIONS

4.1 Loading and Selecting CDs in MMC

MMC uses the CD changer for a variety of operations, including archiving scanned data, viewing chart data, etc. The procedure for loading and selecting a CD is the same regardless of the application:

1) Load the required CD(s) in one of the six slots of the CD changer or in the internal CD drive. For certain functions (e.g., viewing CAC data from CD), MMC will specify which CD to load.

2) MMC will pop up the **CD-ROM Site Window** (Fig. 75) listing all seven CD slots, including six in the CD changer (CDROM1 through CDROM6) and the Alpha's internal CD drive (CDROM7).

Fig. 75 — **CD-ROM Site Window**

3) Click (with left mouse button) on the CD device number(s) to be selected (1 through 7). As the user selects a device number, MMC will enter it in the list (Fig. 76).

4) Select *Scan Readers* (in the lower-left corner of the window); MMC will list the titles of the CDs on the selected readers (Fig. 77).

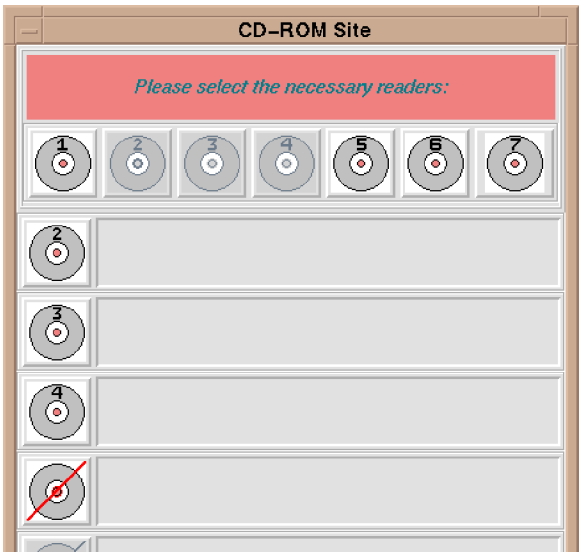


Fig. 76 — **CD-ROM Site Window**: three CD readers selected (#2, 3, 4)

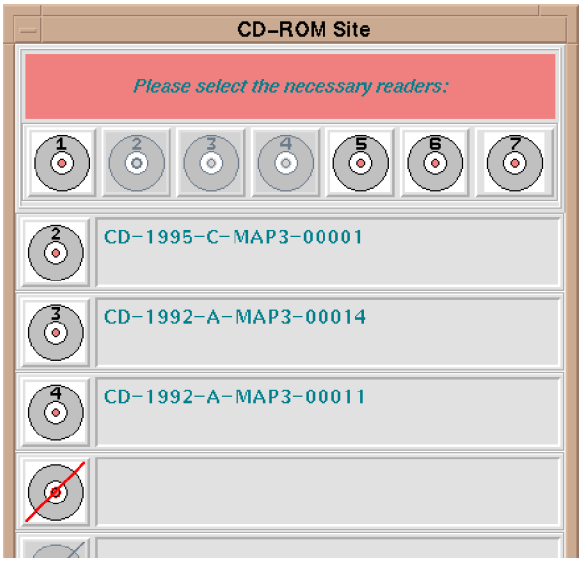


Fig. 77 — **CD-ROM Site Window**: titles listed for selected CD readers

5) If any of the listed CDs is not required, click (with middle mouse button) and drag that CD's number from the list to the Trash Can at the bottom of the window. Any CDs that were listed below the deleted CD will be bumped up to fill in the list (Fig. 78).

6) The user can rearrange the order of the CDs in the list, if necessary. For example, when listing source CDs to be used in building an AODI, the order will dictate priority: the CD listed first gets top priority. This allows the user to properly overlap CAC sources with different edition numbers, since more recent data should get higher priority than older data. To reorder the CD list, click (with middle mouse button) and drag the desired CD number to its new location (Fig. 79).

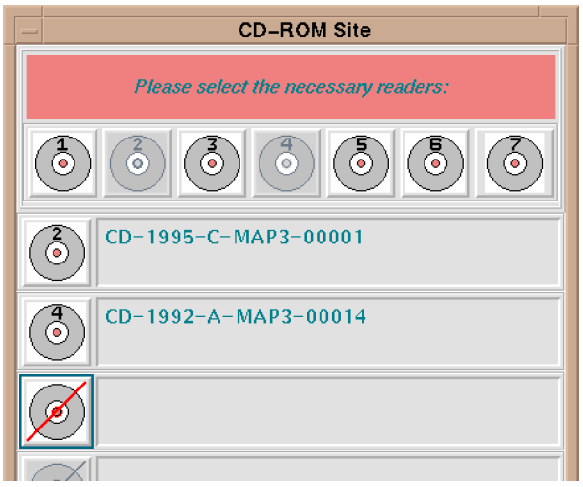


Fig. 78 — **CD-ROM Site Window**: deleted one CD reader from the list (#3)

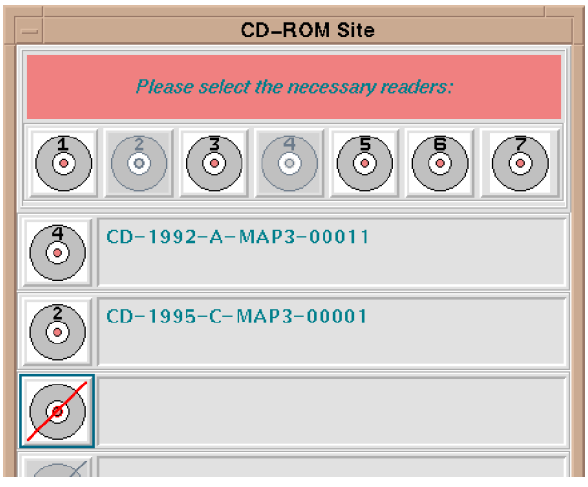


Fig. 79 — **CD-ROM Site Window**: switched priority of CD readers #2 and #4

7) When all required CDs are listed in the appropriate priority order, select *Start Processing* (at the bottom of the window).

8) Alternatively, select *Clear Readers* to start the process over, or *Cancel* to cancel the operation and return to MMC.

4.2 Logging CAC, Scanned CAC, and DTED CDs

Prior to building any AOD or MPS compositions, the user must first log all the necessary NIMA data sources. As a standard practice, NRL recommends that the user log-in every available data source as it is received from NIMA. Figure 80 is a data-flow diagram that illustrates how to log data sources, at various stages of MMC processing.

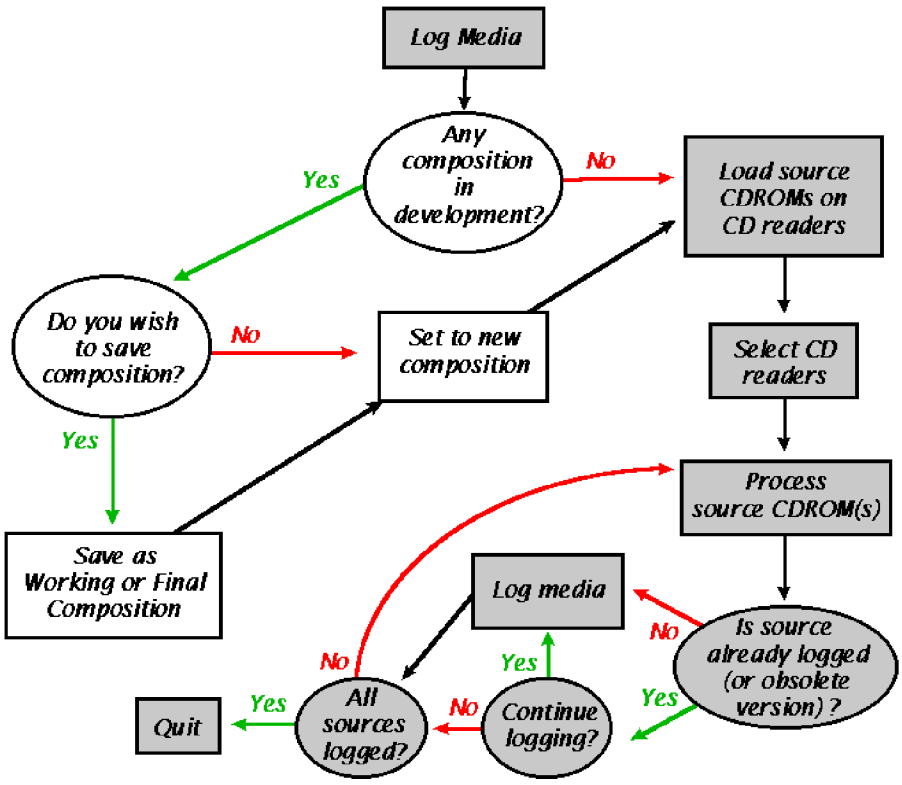


Fig. 80 — Logging data sources: complete before building any compositions

To log source data, perform the following steps:

- Insert the required CD(s) in empty slots of the CD changer caddy, then load the caddy in the CD changer. Note: load each CD face down in a caddy tray.

- Click on *Tools*, then *Media Options*, then *Log Media*.

- MMC will pop up the **CD-ROM Site Window** (Fig. 75). Currently, MMC will only allow a user to log in one CD at a time, so select the first CD reader containing a CD to be logged, click on *Scan*

Readers, then *Start Processing*. MMC may prompt for a descriptive title for each CD (e.g., "Continental US at TPC scale"). Logging one CD takes about 1 minute.

- After the first CD is logged, repeat the process for the second CD.
- For more information about loading and selecting CDs in MMC, refer to Section 4.1.

4.3 Viewing Chart Data

4.3.1 Viewing Chart Data from a Programmed AOD

This section lists the steps for viewing chart data from a previously programmed AOD.

1. Mount an AOD containing chart data in the DMU.
2. Turn off the DMU (use the power switch on front).
3. Load an AOD containing chart data in the DMU.
4. Turn the DMU back on.
5. Wait 30 seconds after loading the AOD in the DMU before continuing.
6. Load the AODI into MMC: In MMC, click on *File*, then *Open Image*. Follow the directions to open an AODI from the DMU and display the composition in the **MMC Window** (Fig. 16).
7. Zoom into an area of interest with the *Zoom-in with a Stretch-Box* button (Section 3.2.4.1).
8. Set the *View [data source]* option in *Preferences* to *View AOD* (Section 3.3.5.2).
9. View the chart data in the image:
   - Click on an area of interest with the right (third) mouse button. MMC will pop up a **View Data Window** displaying chart data centered on the selected point.
   - To scroll around the image, position the cursor at the edge of the **View Data Window** and click with the left mouse button. For example, to scroll up, position the cursor at the top edge of the window and click. (When switching TS zones, there will be a pause while the new color palette loads).
   - From the **Map Coverage Window** (which displays the chart data), click on *File*, then *Close* to return to MMC.
   - In MMC, click on *Windows*, then *Composition Data Size Display* to show which other map scales (and how much data) are included in this image (Section 3.3.7.1).
   - Switch to one of the other scales of data (e.g., JOG or JNC) by clicking on the *Chart Series*/*Map Scale* box in the lower-right corner of the MMC display (Section 3.2.6).
   - View the new scale of CAC data in the image; scroll around this new image.

4.3.2 Viewing Chart Data from a CAC CD

This section lists the steps for viewing chart data from a source CAC CD.

1. Log the desired CAC CD into MMC, if not already done (Section 4.2).

2. Set *View [data source]* option in *Preferences* to *View CAC CDROM* (Section 3.3.5.2).

3. Define an area to be viewed using the coverage definition buttons (Section 3.2.3).

4. Click inside the coverage area with the right (third) mouse button.

5. MMC will prompt the user to load the appropriate CAC CD (Fig. 81) into the CD changer caddy (Section 4.1).

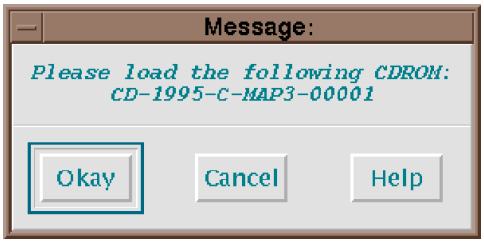


Fig. 81 — MMC prompt to load CAC CD

6. After selecting the CAC CD in the **CD-ROM Site Window** (Fig. 75), click on *Scan Readers*, then *Start Processing*. MMC will display the CAC data, centered on the selected point (step 4, above).

7. To scroll around the image, position the cursor at the edge of the **View Data Window** and click with the left mouse button. For example, to scroll up, position the cursor at the top edge of the **View Data Window** and click. (When switching TS zones, there will be a pause while the new color palette loads).

8. From the **Map Coverage Window** (which displays the CAC data), click on *File*, then *Close* to return to MMC.

4.4 Designing, Building, and Archiving a New AODI and MPS-CDI

This section itemizes how to design, build, and archive a new AODI and MPS-CDI. To use this as a tutorial, use the sample data sources provided to design the sample composition described. All tutorial samples are given in { }.

1. Log in any data sources { two CAC CDs of TPC (1:500k) series: CD-1995-C-MAP3-10001 and CD-1996-B-MAP3-2003 } needed to build the images (see Section 4.2).

2. Display all available coverages:

   - Click on *File*, then *New*. The default chart series is TPC.

   - Zoom into an area of interest {Hawaii and SW California} (Section 3.2.4.1).

- Click on *Overlays*, then *Available Coverage*.
- MMC will display the coverage of all data that has been logged, to date, at the selected scale.

3. Design a composition {Hawaii and China Lake, CA, in the TPC series}:
   - Use the coverage definition buttons (Section 3.2.3) to define two areas of coverage {"Big Island" of Hawaii and China Lake, California, areas}.
   - MMC will display each coverage area as a template comprised of colored boxes; the color reflects the TS zone of the data, and the boxes represent TS segments. See Appendix A for more information about TS.
   - Use the *Composition Data Size Display* (Section 3.3.7.1) to monitor how much space has been used, and keep the composition within the limits of an AOD.
4. Save the composition:
   - Click on *File*, then *Save As Final Composition*.
   - Enter a filename and description when prompted.
5. Reopen the same composition. (As a security measure, MMC requires that the user open a final composition and not modify it prior to building the AODI):
   - Click on *File*, then *Open Final Composition*.
   - Scroll through the list and select the **AOD** composition (not the MPS composition) just created. MMC will display the templates on the world map.
6. Build the AOD and MPS images (MMC automatically builds both):
   - Click on *Tools*, then *AOD Options*, then *Build AOD Image*.
   - MMC will pop up a **Data Sources Window** (Fig. 72) listing which data sources are needed {CD-1995-C-MAP3-10001 and CD-1996-B-MAP3-2003}.
   - MMC will also pop-up the **CD-ROM Site Window** (Fig. 75).
   - Load the necessary CAC CDs in the CD changer. From the **CD-ROM Site Window**, select all drives with the required CDs. Click on *Scan Readers*, then *Start Processing* (Section 4.1). MMC will now build the AOD and MPS images.
   - Wait until MMC says the image build is complete { 2 minutes } before continuing with the next step.
7. Open the AODI and review it:
   - Click on *File*, then *Open Image*. Follow the directions to open the new AODI file from the hard disk.
   - View the CAC data in the AODI by clicking on an area of interest with the right (third) mouse button (Section 4.3).

8. Archive the AODI to CD:

   - Click on *Tools*, *CDROM Options*, *Archive Data to CDROM* (Section 3.3.6.2.1).
   - The **Archive to CDROM Window** will open. From this window, click on *File*, then *PreMaster…*, then *AOD*.
   - Wait until MMC finishes Premastering before continuing **{** 2 minutes **}**.
   - Insert a blank CD face-up in the CD caddy, then load the caddy in the CD writer. Wait until the CD writer's green **Disc** light is ON (not blinking) before continuing.
   - Click on *File* (still in the **Archive to CDROM Window**) then *Cut*.
   - Wait until the CD writer has finished writing to the CD before continuing! Important: even after MMC says the write is finished, wait until the CD writer's **Read** (green) and **Write** (red) lights stop blinking! (There is no other way for the CD writer to "tell" MMC that the write is finished). The green **Disc** and **4x** lights will stay on.
   - Select *Close* from the **Archive to CDROM Window** to return to the **MMC Window**.
   - Again, be sure the CD writer's **Read** and **Write** lights have stopped blinking, then eject the CD from the CD writer.
   - Label the CD with an indelible pen. Include the date, AODI library ID, a descriptive title, and a volume label.

9. Review the archived AODI from CD:

   - Load the AODI CD in the CD changer caddy (Section 4.1).
   - In the main **MMC Window**, click on *File*, then *Open Image* (*Ctrl-I*). Follow the directions to open the AODI file from CD.
   - View the CAC data in the AODI by clicking on an area of interest with the right (third) mouse button (Section 4.3).

10. Open the MPS image and review it:

    - Click on *File*, then *Open Image* (*Ctrl-I*). Follow the directions to open the MPS image file from the hard disk.
    - View the CAC data in the MPS image by clicking on an area of interest with the right (third) mouse button (Section 4.3).

11. Archive the MPS image to CD: repeat step 8, substituting *MPS* for *AOD* in the *Premaster…* selection.

12. Review the archived MPS Image from CD: repeat step 9, substituting *MPS* for *AOD* in *Open Image* selection.

4.5 Adding Data to an Existing Composition

This section describes how to add a new scale of CAC data to an existing composition. To use this as a tutorial, use the sample instructions given in **{ }** to add new data to the composition designed in Section 4.4.

1. Choose a new scale and geographic area for the data to be added **{** JOG **}**.

2. Log any new data sources required **{** CD-1996-B-MAP2-20007: Western US at JOG Scale **}** - see Section 4.1. Zoom-in on an area to show previously logged data sources.

3. Display all available coverages (Section 4.4, step 2). If necessary, zoom into an area of interest (Section 3.2.4.1).

4. Open the final composition to be modified:

   - In MMC, click on *File*, then *Open Final Composition* (*Ctrl-F*).

   - Scroll through the list of available compositions and select the desired AOD composition **{** the composition built in Section 4.4, step 4 **}**. MMC will display the templates for that composition on the world map.

5. Define additional template(s) for the new scale:

   - Tip: copy existing template(s) from one scale **{** TPC **}** to a new scale **{** JOG **}**:

     — Click on *Edit*, *Select All*. The templates will turn yellow.
     — Click on *Edit*, then *Copy* (*Ctrl-C*).
     — Change scales by clicking on the *Chart Series*/*Map Scale* selection box in the lower-right corner of the **MMC Window** and selecting the new scale **{** JOG **}**. MMC will clear the world map of all current templates in preparation for defining templates in this new scale.
     — Click on *Edit*, then *Paste* (*Ctrl-V*). MMC will paste the previously selected templates into the new scale. Note that the size of the segment boxes will be different than they were in the previous scale, since segment size is scale-dependent. Also note that the new template will only include those segments that have been logged to date.

   - If desired, modify these templates in the new scale, by using one of the coverage definition buttons (Section 3.2.3).

   - As in Section 4.4, use the *Composition Data Size Display* (Section 3.3.7.1) under *Windows* to monitor how much space has been used, and keep the composition within the limits of an AOD.

6. Review the CAC data at the new **{** JOG **}** scale by clicking on the area of interest with the right (third) mouse button. From the **CD-ROM Site Window**, select the CD reader containing the new CAC CD **{** CD-1996-B-MAP2-20007 **}**, then click on *Scan Readers*, then *Start Processing*.

7. Save this work: click on *File*, then *Save As Final Composition*. **{** Give this composition a different name from the one used in Section 4.4, step 4.**}**

8. Reopen the new composition, build an AODI and MPS-CDI, review these images, and archive either or both to CD, as described in Section 4.4 (steps 5 through 12).

4.6 Copying an AODI to an AOD

This section summarizes the procedure for copying an AODI to an AOD. To use this as a tutorial, use the sample instructions in **{ }**.

1. Place an AOD in the DMU (see Section 4.3.1, step 1).

2. Reopen the AODI: in MMC, click on *File*, then *Open Image*. Follow the directions to open an Aircraft Optical Image from hard disk.

3. Click on *Tools*, then *AOD Options*, then *Copy AOD Image to WORM*.*

4. A verification message will appear: click *Yes*.

5. As the image is copied to the AOD, a meter will show its progression until completion.

6. After the copy is complete, view the image from the AOD (Section 4.3.1).

4.7 Checklists

4.7.1 Viewing Existing Checklists from an AOD

Related Section: 3.3.6.3 (*Data Frame Options* under the *Tools* menu).

1. Mount an AOD containing checklists in the DMU:

   - Turn off the DMU (use the power switch on front).
   - Load an AOD containing chart data in the DMU.
   - Turn the DMU back on.
   - Wait 30 seconds after loading the AOD in the DMU before continuing.

2. In MMC, click on *File*, then *Open Image*. Follow the directions to open an AODI from the DMU.

3. View checklist data: click on *Tools*, *Data Frame Options*, then *View Dataframes*. It will take MMC several seconds to display the **Dataframe Viewer Window** (Fig. 46). When it does, scroll through the available checklists for this AOD (Fig. 47).

4.7.2 Editing Checklists on the Hard Drive

MMC only permits editing of checklists on the Map-II hard drive — not on an AOD. In MMC, click on *Tools*, then *Data Frame Options*, then *Checklist Editor*. MMC will display the **Checklist Editor Window** (Fig. 37), which allows the user to edit the text, text color, and font size of selected checklist pages. Refer to Section 3.3.6.3 (*Data Frame Options* under the *Tools* menu) for detailed instructions on how to edit checklists.

*Write Once, Read Many

4.7.3 Copy a Checklist to an AOD

1. Place an AOD containing an image in the DMU (see Section 4.3.1, step 1).

2. In MMC, click on *File*, then *Open Image* to open an AODI. An AODI must exist on an AOD before checklists can be written to it.

3. Select *AOD* as the image type to open, then select *DMU* as the device.

4. After the AODI is loaded, click on the *Tools* menu, then *Data Frame Options*, then *Copy Checklist to WORM*. Follow the directions given by MMC to copy a checklist set from the MMC hard disk to the AOD.

4.8 Scanning a Chart and Archiving the Data to CD

1. *Scan a chart*: follow the instructions given in Section 3.3.6.5 to scan a chart into MMC, clip the image, georeference the scanned chart data using user-specified control points, transform the data to the WGS-84 datum, scan adjacent charts (if desired), compress the data into the CAC format, and review the final scanned CAC ("SCAC") image.

2. *Archive the SCAC data to CD*: follow the instructions given in Section 3.3.6.2 to archive scanned data to CD.

3. *Log-in the SCAC CDROM*: follow the instructions given in Section 4.2 to log a SCAC CD into MMC.

4. *Review the archived SCAC data from CDROM*:

   - Click on *Preferences*, then be sure the *View [Data source]* item in that menu is *View Scanned CDROM*. If not, click on the *View [Data source]* item and choose *View Scanned CDROM* from the drop-down list (see Section 3.3.5.2).

   - Follow the instructions in Section 4.3.2 (*Viewing Chart Data from a CAC CD*), steps 3 through 8, substituting "SCAC" for "CAC" in each step.

5. *Delete scanned data from the MMC hard disk*: once the user is satisfied that the data on the new SCAC CD are satisfactory, he or she can delete the scanned data from the hard disk. Refer to Section 3.3.6.5 (*Delete Scanned Data*) for detailed instructions on each of the three ways to delete scanned data: by scale, by defined coverage area, or while reviewing the scanned data.

4.9 Building an MPS CD with DTED, CAC, and Scanned CAC (SCAC) Data

This section summarizes the procedure for building an MPS CD using DTED and Scanned CAC (SCAC) data. To use this section as a tutorial, use the samples given in { }.

1. Display the existing DTED coverage overlay:

   - Click on *File*, then *New*.

   - Click on *Preferences*, then *Composing AOD ON*, then *Compose MPS*.

- Switch the data series to DTED using the *Chart Series/Map Scale* button in the lower-right corner of the main **MMC Window**.

- Zoom into the area of interest **{** Hawaii and SW California **}** using the *Zoom-in on a Stretch-Box* button.

- Click on *Overlays*, then *Available Coverage*.

- MMC will display the coverage of all existing, logged DTED CDs in the area of interest.

2. If necessary, log in any additional DTED CD(s) required **{** TCD DTED140 **}**, as described in Section 4.2.

3. Design compositions **{** Hawaii and China Lake **}** using SCAC, CAC, and DTED data:

   - Define DTED area(s) of coverage using the coverage definition buttons in the lower-left corner of the main **MMC Window** (Section 3.2.3.2).

   - MMC will display the defined DTED area(s) in colored boxes, where the color reflects the TS zone of the data, and each box represents a TS segment (see Appendix A for more information on TS zones and segments).

   - Switch the data series to a new series **{** JOG **}** using the *Chart Series/Map Scale* button in the lower-right corner of the main **MMC Window**.

   - Click on *Overlays*, then *Available Coverage*. Available map data **{** all JOG data that are logged in, to date **}** will be displayed: CAC data in gray, scanned data in tan, and a combination of CAC and scanned data in purple.

   - Define map area(s) of coverage using the coverage definition buttons in the lower-left corner of the main **MMC Window** (Section 3.2.3.2).

   - To be sure that the composition is not getting too large, click on *Windows*, then *Composition Data Size Display* to see a dynamic meter showing how much space has been used, and whether the image has exceeded the limit for this scale of data. Note: to keep a tutorial short, try to keep each data coverage around 5 to 10 MB in the meter; if either DTED or JOG is larger than 10 MB, trim the coverage using one of the *Erase Coverage* buttons at the bottom of the **MMC Window**.

4. Save this work: click on *File*, then *Save As Final Composition*.

5. Reopen this composition. (As a security measure, MMC requires that users open a final composition and don't modify it prior to building the MPS-CDI.)

   - Click on *File*, then *Open Final Composition*.

   - Scroll through the list of available compositions and select the MPS composition just created. MMC will display the composition on the world map.

6. Build the MPS image:

   - Click on *Tools*, then *MPS Options*, then *Build MPS Image*.

- MMC will pop up a **Data Sources Window** listing which data sources (e.g., CAC CDs) are needed.
- MMC will also pop up the **CD-ROM Site Window**.
- Insert all the necessary CAC, SCAC, and DTED CDs (listed in the **Data Sources Window**) in the CD changer caddy, then load the caddy into the CD changer. Click on *Scan Readers*, check that the correct CDs are loaded, then click on *Start Processing*. MMC will now build the MPS image. (For more information on loading and selecting CDs in MMC, see Section 4.1.)

7. Wait until MMC completes the MPS image build before continuing to the next step.
8. Open the MPS image and review it:
   - Click on *File*, then *Open Image* (*Ctrl-I*). Follow the directions to open the MPS image file from the hard disk.
   - Click on *Preferences*, then on the *View [Data sources]* drop-down list. Select *View MPS Hard Disk*.
   - View the CAC data in the MPS image by clicking on an area of interest with the right (third) mouse button. (See Section 4.2 for more information on viewing data.)
9. Archive the MPS image to CD:
   - Click on *Tools*, then *CDROM Options*, then *Archive Data to CDROM*.
   - The **Archive to CDROM Window** will open. From this window, click on *File*, then *PreMaster*, then *MPS*. See Section 3.3.6.2 for more information on archiving MPS data to CD.
10. Review the archived MPS Image from CD:
    - Insert the MPS CD in an empty slot in the CD changer caddy, then load the caddy in the CD changer.
    - In the main **MMC Window**, click on *File*, then *Open Image* (*Ctrl-I*). Follow the directions to open the MPS image file from CD.
    - View the CAC data in the MPS image by clicking on an area of interest with the right (third) mouse button. (See Section 4.2 for more information on viewing chart data.)

4.10 Building an MPS Image from an AODI on an AOD

This section specifies how to build an MPS Image from an AODI on an AOD.

1. Mount an AOD containing chart data in the DMU (Section 4.3.1, step 1).
2. Open the AODI and extract the composition:
   - In MMC: click on *File*, then *New*.
   - Click on *Coverages*, then *Include Image*. Follow the directions to open an AODI from the DMU.

- Save the composition from the AOD to the MMC hard disk: click on *File*, then *Save As Final Composition*. Enter filename and description of the final composition.

- Note: If **all** the sources have been logged in for this composition, MMC will let the user save it. If not, those that are not available will be removed from the composition and displayed; click on *File*, and *Save As Final Composition* again.

- Reopen this composition (as a security measure, MMC requires that users open a final composition and not modify it prior to building the MPS): click on *File*, then *Open Final Composition*. Scroll through the list of available compositions and select the **MPS** composition (not the AOD composition) just created. MMC will display the composition on the world map.

3. Build the MPS image:

   - Click on *Tools*, then *MPS Options*, then *Build MPS Image*.

   - MMC will pop up a **Data Sources Window** (Fig. 72) listing which data sources (e.g., CAC CDs) are needed.

   - MMC will also pop up the **CD-ROM Site Window** (Fig. 75):

     — Insert all necessary CAC, SCAC, and DTED CDs (listed in the **Data Sources Window**) in the CD changer caddy, then load the caddy into the CD changer.

     — From the **CD-ROM Site Window**, select all the CD drives that contain the necessary CDs for this operation. See Section 4.1 for more information about selecting and mounting CDs for use in MMC.

     — Click on *Scan Readers*, check that the correct CDs are loaded, then click on *Start Processing*.

   - MC will now start building the MPS image. MMC will ask if the user wants to delete the previous MPS Image from disk. Answer *Yes* - there can only be one image resident on the hard disk at a time. MMC will delete the old image from hard disk, then build the new image.

   - Wait until MMC completes the MPS Image build before continuing to the next step.

4. Open the MPS image and review it: refer to Section 4.4, step 10.

5. Archive the MPS image to CD: refer to Section 4.4, step 11.

6. Review the archived MPS Image from CD: refer to Section 4.4, step 12.

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Appendix A
GLOSSARY OF ACRONYMS AND TERMS

A1. PROCESSING TERMS

Composition (or template)

A composition is a user-defined geographic coverage area (or set of areas) saved as a series of bitmaps (Fig. A1). A composition includes a bitmap for each contiguous geographic area, within each Tessellated Spheroid (TS) zone, and at each map scale required to build the user's AODI or MPS image. Each "bit" in the composition's bitmap(s) represents a single TS segment of CAC data (and/or DTED, if the user is designing an MPS image).

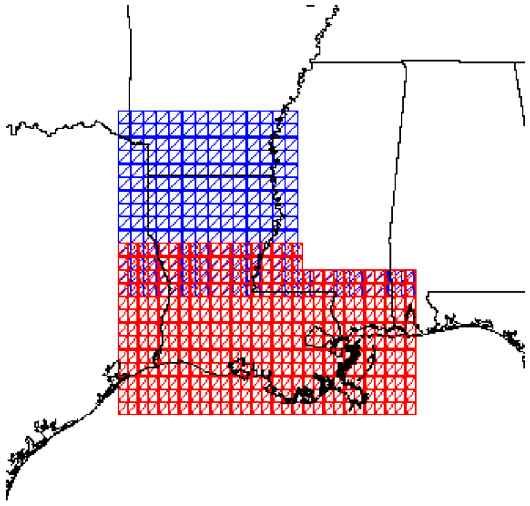

Fig. A1 — Sample MMC composition

Image

An image is the actual data set (including CAC data, scanned map data, DTED, or some combination of these) to be copied to an AOD or MPS-CD. MMC constructs an image from a composition's bitmaps. Figure A2 illustrates a sample image, comprised of CAC data.

A2. DATA TYPES

ADRG

ARC (equal-Arc-second Raster Chart) Digitized Raster Graphics (ADRG) is a standard, digital, raster chart product produced and distributed on CD-ROM by NIMA. To produce ADRG, paper charts are scanned

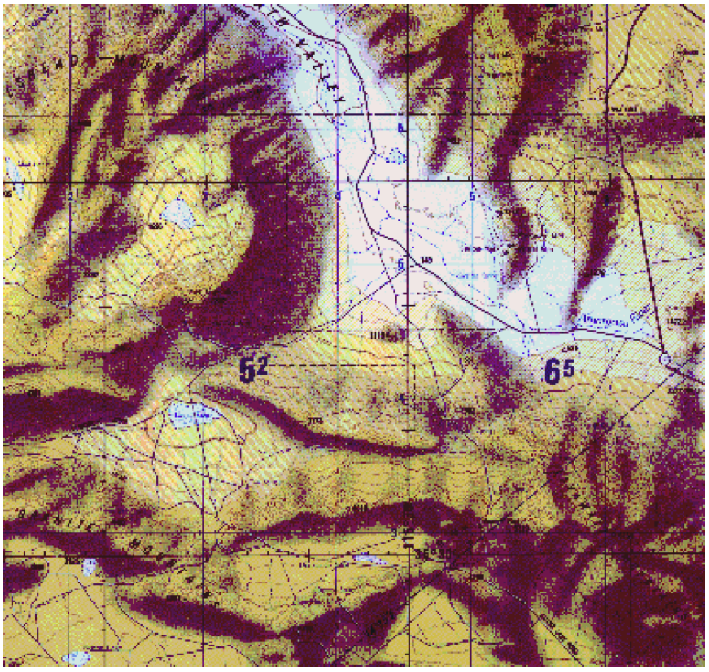

Fig. A2 — Sample image (chart data)

and transformed into the ARC system frame of reference. Data collected from a single chart/chart series and scale are maintained as a worldwide, seamless database in which each pixel is represented by a 24-bit RGB (red, green, and blue) color value and exists at a distinct geographic location. All ADRG data have been adjusted to the World Geodetic System 1984 (WGS 84) horizontal datum. ADRG is the source data for both CAC and CADRG. For more details, refer to NIMA's *Digitizing the Future* report or web-site (NIMA 1997).

Compressed Aeronautical Chart (CAC)

The CAC database is a compressed (48:1) form of ADRG. CAC originally was produced by NRL and now is produced and distributed on CD-ROM by NIMA. CAC is the base map for current AV-8B and F/A-18 moving map displays (future systems—e.g., TAMMAC—will use CADRG instead). CAC is organized into TS segments, as described in the TS definition (below).

To produce CAC, NIMA converts ADRG digital map images from the ARC system frame of reference into the TS projection using a neighborhood averaging function, which effectively reduces the resolution of the data from 256 pixels per inch (ppi) to 128 ppi for compatibility with current aircraft moving map displays. The averaged data values are then color-compressed from 24 bits per pixel (full-color data) to 8 bits per pixel according to a predefined color palette. The data are also spatially compressed, a process that replaces every nonoverlapping group of 2 pixels × 2 pixels in the data set with a 1-byte codeword and creates a unique codebook for every 2" × 2" segment of data. The final data compression ratio for CAC is 48:1 over ADRG. Since most ADRG CD-ROMs are not filled to capacity, while most CAC CD-ROMs are filled, there may be over 65 ADRG CD-ROMs compressed onto a single CAC CD-ROM. See Lohrenz and Ryan (1990) for more details.

Compressed ADRG (CADRG)

Produced and distributed on CD-ROM by NIMA, CADRG was designed to be a jointly coordinated compression of ADRG to be used in any application requiring rapid display of a map image or manipulation

of the image of a map in raster form. CADRG achieves a nominal compression of 55:1 over ADRG, excluding supplemental data such as color palettes and codebooks. CADRG is processed similarly to CAC, except that CADRG has a data density of 169 pixels per inch (CAC is 128 ppi) and CADRG maintains the ARC coordinate system of ADRG (CAC uses the TS projection system). CADRG will replace CAC as the standard raster chart data to be used in the TAMMAC cockpit moving map systems. For more details, refer to NIMA's *Digitizing the Future* report or web-site (NIMA 1997).

Digital Terrain Elevation Data (DTED)

DTED is a uniform matrix of terrain elevation values that provides basic quantitative data for systems that require terrain elevation, slope, and/or gross surface roughness information. DTED is produced and distributed on CD-ROM by NIMA. DTED is available at two different resolutions:

- Level 1: Content is comparable to the contour information represented on a 1:250,000 scale chart. Latitudinal post spacing is 3 arc seconds (about 100 m); longitudinal post spacing varies by latitude (see Table A1).

- Level 2: Content is comparable to the contour information represented on a 1:50,000 scale chart. Latitudinal post spacing is 1 arc second (about 30 m); longitudinal post spacing varies by latitude (see Table A1).

For more information about DTED, refer to NIMA's *Digitizing the Future* publication or web-site (NIMA, 1997).

Table A1 — DTED Longitudinal Post Spacing
(Level 1 vs Level 2)

Zone	Lat Bounds	Post Spacing (arc sec)	
		Level 1	Level 2
I	0° - 50° N/S	3	1
II	50° - 70° N/S	6	2
III	70° - 75° N/S	9	3
IV	75° - 80° N/S	12	4
V	80° - 90° N/S	18	6

Tessellated Spheroid (TS)

TS is the projection system used to store CAC data. TS was developed by Honeywell, Inc. as a structure for seamlessly storing and displaying global chart data on a cockpit moving map display. TS stores CAC data in rectilinear segments, where one segment is characterized as follows:

- 2" × 2" section of scanned paper chart;
- 256 pixels × 256 pixels of raster data;
- a single file on the CAC distribution CD;
- smallest piece of data in MMC (drawn as a square bisected by a diagonal line).

TS organizes these segments into five geographic zones, as listed in Table A2. There is an overlap between zones (*not* reflected in Table A2), such that two rows of segments from each zone extends into the adjacent zone. This minimizes display "jumping" if a pilot is flying along a zone boundary. The amount of overlap in degrees of latitude is scale-dependent (since the size of a segment depends on the scale). For more information about the TS projection system, refer to Lohrenz et al. (1993).

Table A2— TS Geographic Zones

Zone ID	Zone Name	N Latitude Bound	S Latitude Bound
0	North Polar	90.00 deg N	51.69 deg N
1	North Temperate	51.69 deg N	31.38 deg N
2	Equatorial	31.38 deg N	31.38 deg S
3	South Temperate	31.38 deg S	51.69 deg S
4	South Polar	51.69 deg S	90.00 deg S

World Vector Shoreline (WVS)

WVS is the basemap for defining coverages for AODIs and MPS-CDIs on the Map-II workstation. WVS is a standard NIMA digital product consisting of the shorelines, international boundaries, and country names of the world. The uncompressed version of WVS averages 12 data points per nautical mile (nmi), approximately equivalent to the data density of a scanned 1:250,000 scale map. WVS conforms to the World Geodetic System 1984 (WGS 84) datum. Compressed and thinned versions of WVS are also available from NIMA. For more details, refer to NIMA's *Digitizing the Future* (NIMA, 1997).

A3. CHART SERIES, SCALES, AND DISPLAY RANGES

Chart series and geographic scale typically refer to paper chart products: a Joint Operations Graphic (JOG) chart series is produced at a scale of 1:250,000, which means that 1" on the chart represents 250,000" on the ground. For aeronautical charts, larger scales (e.g., 1:50,000 and 1:100,000) provide more detailed map information for low altitude flying or approach and landing operations. Smaller scales (e.g., 1:2,000,000 and 1:5,000,000) are used for faster flying at high altitudes (e.g., cross-country flights).

The term map scale is not always appropriate for digital map products, since the actual scale may become distorted by zooming or subsampling the data. For digital charts, it may be more useful to refer to display range: e.g., the number of nautical miles from the top to the bottom of the screen on which the digital chart is displayed.

Table A3 is a list of the common aeronautical chart series, along with their geographic scales and normal (pre-zoom) display ranges. The table also indicates, for each chart series, if it is supported by current moving map displays and if it will be supported under the new TAMMAC systems.

Table A3 – Common Aeronautical Chart Series, Scales, and Display Ranges

Chart Series	Scale[1]	Display Range (nmi)[2]		In Current System?	In TAMMAC System?
		AV-8B	F/A-18		
Global Navigation Chart (GNC)	1:5 M	200	160	No	Yes
Jet Navigation Chart (JNC)	1:2 M	100	80	Yes	Yes
Operational Navigation Chart (ONC)	1:1 M	50	40	[3]	Yes
Tactical Pilotage Chart (TPC)	1:500 k	25	20	Yes	Yes
Joint Operational Graphics (JOG)	1:250 k	13	10	Yes	Yes
Topographic Line Map-100 (TLM-100)	1:100 k	5	4	Yes	Yes
Topographic Line Map-50 (TLM-50)	1:50 k	3	2	No	Yes

[1]For map scales, M = million, k = thousand
[2]AV-8B and F/A-18 use the same display but calculate range differently (Trenchard et al. 1995)
[3]The ONC series is not supported in current systems; instead, pilots can zoom into the JNC chart by 2:1 to simulate an ONC display range.

A4. AGENCIES AND COMPANIES

Defense Mapping Agency (DMA)

DMA has been reorganized and renamed to the National Imagery and Mapping Agency (NIMA). See description, below.

Honeywell

As subcontractor to McDonnell Douglas, Honeywell manufactured and distributed most of the hardware components for the AV-8B and F/A-18 cockpit moving map systems, including the DMU used by both the Map Station and the cockpit map computer. Honeywell also developed the TS projection system and CAC database format, specifications, and original compression software, which were later transitioned to NRL. NRL made significant modifications to the CAC compression software before transitioning it to NIMA in September 1995.

Horizons Technology, Inc. (HTI)

HTI is the original manufacturer and distributor of the MOMS system. HTI is located in San Diego, California.

Naval Air Warfare Center (NAWC)

NAWC Weapons Division, China Lake, California, retrofitted the MOMS software with Pentium PC platforms to develop the Mission Planning System-II (MPS-II) and Maintenance Data System-II (MDS-II)

for the AV-8B Muxbus Data System. NAWC tasked NRL to develop the Map-II workstation for AV-8B. The following are key NAWC personnel in this effort:

- Project Team Leader: Diana Lemon
- Project Engineers: Luie Trudy and Jean Carlton

National Imagery and Mapping Agency (NIMA)

NIMA—formerly the Defense Mapping Agency (DMA)—produces and distributes the standard cartographic databases that support the cockpit moving map, Map-II, MPS-II, and MDS-II systems, including CAC, DTED, and WVS.

Naval Research Laboratory (NRL)

The NRL Mapping Sciences Section (Code 7440.1) developed the Map-II workstation and Moving Map Composer (MMC) software for the AV-8B Muxbus Data System. NRL Code 7440.1 is located at the Stennis Space Center, Mississippi, which is on the Gulf of Mexico approximately 70 miles northeast of New Orleans, Louisiana. The following are key NRL personnel in this effort:

- Project Team Leader: Maura Lohrenz
- Project Engineers: Marlin Gendron, Michelle Mehaffey, Stephanie Myrick, Michael Trenchard, and Perry Wischow

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Trenchard, M.E., M.C. Lohrenz, M.L. Gendron, and J.M. Mehaffey (1995). "Geographic Coverage Plots for F/A-18 and AV-8B Aircraft Optical Disks, Third Edition." NRL/MR/7441--95-7683, Naval Research Laboratory, Stennis Space Center, MS.

Appendix B

AV-8B MAP-II COMPONENTS

ALPHASTATION

The Central Processing Unit (CPU) for the AV-8B Map-II is an Alphastation 255/233 (manufactured by Digital Equipment Corporation) with the following configuration:

- 64 MB of parity memory
- 4.3 GB of disk space
- 1 high-resolution 17" color monitor
- 1 VMS-style keyboard
- 1.44-MB floppy diskette drive (SCSI)
- PCI to SCSI host bus adapter

At the time of the initial Map-II purchase (FY96), each of these Alphastations cost about $14,500 (GSA price) and came with a 1-year warranty.

AOD

An Aircraft Optical Disk (AOD) is a militarized Write-Once, Read-Many (WORM) Optical Disk that NRLSSC procures from Honeywell (part number 8509831) for $1,230 each under contract #N00014-93-C-6016. A Japanese company developed specialized glass with a proprietary coating to be used for these AODs. However, this company stopped production of the glass components in 1993. Honeywell purchased a large quantity of glass to continue producing AODs for NAVAIR as a "last-time buy" agreement.

An AOD is two-sided and contains up to 260 MB of data per side. Current aircraft moving-map systems can only access one side of the AOD at a time; the aircraft must land before the pilot can flip the AOD to access the other side. The data are stored in the form of an AOD Image (AODI).

Data cannot be deleted or overwritten on an AOD, but old data can be "skipped" (i.e., ignored), and new data can be added to an AOD in the form of a new AODI. Up to 16 AODIs can be written to — and accessed from — an AOD, if the total space used by these images does not exceed 260 MB.

AODI

An Aircraft Optical Disk Image (AODI) is an exact replica of the information to be written to an AOD. Depending on a user's choice, MMC will write an AODI to a file on the Alpha disk, archive it to recordable Compact Disk (CD-R), or copy it to an AOD via the DMU.

CD Changer

The Compact Disk (CD) Changer installed on the Map-II holds up to six CDs at one time, although the workstation can only access one at a time; i.e., the CD changer is treated as a single device. (For more

information about using the CD changer on the Map-II workstation, see Section 4.1 "Loading and Selecting CDs in MMC"). The CD changer supports quad-speed reads from CD-ROM and CD-R. The systems were purchased from Acersoft Corporation for approximately $2,000 each in FY96.

CD Recorder

The CD Recorder installed on the Map-II is a Yamaha CD Studio with quad-speed Kodak PCD225 CD writer (part no. 120135), purchased from BTG, Inc. The price in FY96 was $10,475, although that price has since dropped (reference: NAWC, Indianapolis). MMC uses an NRL-developed CD-R Graphical User Interface (GUI) to archive various information to CD (e.g., MPS-CDIs, AODIs, and scanned map data).

Digital Video Map Set

The AV-8B Digital Video Map Set comprises a Digital Map Computer, Color Display, and Digital Memory Unit (DMU). Together, these components provide an in-flight, near-real-time, digital moving map capability to the AV-8B.

The moving map system is supported by the ground-based AV-8B Mission Support Systems (MSS): the Maintenance Data System-II (MDS-II), Mission Planning System-II (MPS-II), and the Map-II workstation. The MDS-II extracts aircraft maintenance information that is written in-flight to a reserved portion of the DSU memory. The MPS-II System allows a mission planner to design mission overlays (e.g., threats, routes, and targets) to be loaded in the aircraft's Mission Computer via the DSU. The Map-II workstation allows an operator to define, tailor, and build map theaters for a given area of operations. These map theaters are also loaded in the aircraft's Digital Map Computer, via an AOD.

The Digital Map Computer and Display Computer combine the map data (built on the Map-II) with the mission data (built on the MPS-II) and display the resulting image on a 4.5" × 4.5" color monitor in the aircraft. Once the mission is completed, the MPS-II operator can erase the DSU and reprogram it with new mission data without altering the base map on the AOD.

DMU and DMUI

The Digital Memory Unit (DMU) was used in the original MOMS system and is now used in the Map-II workstation. The DMU (Honeywell part #8509830-002) is used exclusively for writing militarized AODs. The DMU communicates with the Alphastation via a DMU Interface (DMUI, HTI part number DMUI-01), which translates between the Honeywell DMU's fiber optic protocol and the computer's SCSI-I protocol. NRLSSC developed the OpenVMS-based driver on the Alphastation to communicate with the DMU via the DMUI.

MOMS

The Map, Operator, and Maintenance Stations (MOMS) were developed by HTI to support map, mission planning, and maintenance operations. The MOMS were used to define map coverages at various scales and copy selected map data to an AOD, define necessary mission overlays and copy those to a DSU, etc. All of the AV-8B MOMS functions have been replaced by the AV-8B Muxbus Data System (AMDS-II): the Map-II workstation and Moving Map Composer (MMC) software replaces the MOMS' Map Station, the MPS-II replaces the MOMS' Operator System, and the MDS-II replaces the MOMS' Maintenance System.

MPS

The Mission Planning System II (MPS-II) was developed by NAWC Weapons Division, China Lake, California, to replace the mission planning portion of the Horizons Technology, Inc. (HTI) MOMS. The MPS-II is based on a portable notebook computer with a 120 MHz Pentium processor.

MPS-CD

The Mission Planning System Compact Disk (MPS-CD) stores up to 650 MB of map data in the form of an MPS-CDI. The MPS CD is the sole link between the Map-II and MPS-II systems.

MPS-CDI

The Mission Planning System Compact Disk Image (MPS-CDI) contains CAC data, sometimes supplemented with DTED, of an area of interest for mission planning purposes. An MPS operator uses the MPS CDI map coverage to design and position mission overlays such as threats, routes, targets, and waypoints, which are then stored on a DSU and installed in the aircraft, along with the AOD (which stores the map coverage).

Scanner

The Map-II workstation uses the original flatbed Howtek "Scanmaster" scanner that was procured for the MOMS in FY90. This scanner can scan at 300, 200, 150, 100, and 75 dpi (dots per inch). The Map-II will implement only the 300 dpi (highest resolution) scan. To integrate this scanner in the Map-II, a General Purpose Interface Board (GPIB) board was procured from National Instruments ($495 each), and a software driver was procured from EQUIcon Software ($575 each).

MMC scans paper charts and processes them into the CAC format, to be included in AODIs and MPS-CDIs as required, to supplement existing CAC data. Scanned data should be used if there are no CAC data available for the area of interest, or if there are more recent paper charts that have not yet been distributed as CAC by the National Imagery and Mapping Agency (NIMA).

Appendix C
SETTING UP THE MAP-II WORKSTATION

The following procedure details how to set up the Map-II workstation and connect all the peripherals:

1) Unpack all equipment from the boxes.

2) Arrange equipment in workspace:

- Set DMUI on table.
- Place CD writer on top of DMUI.
- Place Alpha CPU on top of CD writer.
- Place CD changer on top of the CPU.
- Place monitor, keyboard, and mouse next to stack of equipment.
- Place scanner on a table with enough clearance for the moving scan bed.

3) Plug peripherals into the back of the CPU:

- Monitor: Plug the monitor's video cable into the video port on the CPU (in the upper-right corner of the back of the CPU box: pictures of a monitor and sunglasses label this port).

- Keyboard/Mouse: Plug the keyboard and mouse into their respective ports on the CPU (in the lower-center: pictures of a keyboard and a mouse label these ports).

- Scanner: Plug the scanner cable into the GPIB port on the CPU box (in the right-center — the port is labeled GPIB).

- CD changer: Plug one of the Centronix - High Density SCSI cables into the internal SCSI port on the CPU box (SCSI A, located next to the keyboard and mouse connections). Plug the other end of the cable into the CD changer's SCSI port (use the port on the right, above the power plug, on the CD changer). Plug a SCSI terminator into the other CD changer SCSI port.

- CD writer: Plug the other Centronix - High Density SCSI cable into the external SCSI port on the CPU box (SCSI B, located between the monitor and the scanner connections). Plug the other end of this cable into the CD writer SCSI port labeled "host" (the right-most SCSI port, when viewing the CD writer from the back).

- DMUI: Plug the Centronix - Centronix cable into the other SCSI port on the CD writer. Plug the other end of this cable into either of the DMUI SCSI ports. Plug a SCSI terminator into the remaining DMUI SCSI port.

4) Power:

- Plug power cords into each peripheral (scanner, DMUI, CD writer, CD changer, CPU, and monitor) then plug into unplugged power strip.

- Check that all equipment is turned OFF at their individual power switches BEFORE plugging in power strip.

- Plug in and turn on power strip.

- Turn on the peripherals in the following order:

  1) DMUI (power switch on the back, then on the front of the box).
  2) CD writer, CD changer, scanner, and monitor.
  3) Map station CPU.

5) Check device configuration and boot Map Station:

- Wait until the map station's >>> prompt is displayed.

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- Check that the CD writer's red HDD light is off. If it is on, press the RESET button on the front of the CD writer (which will turn off the light), then, at the >>> prompt on the Map Station monitor, type ***INIT***.

- When the >>> prompt returns on the Map Station monitor, wait 5 to 10 seconds, then type ***SHOW DEVICE***. The Map Station should display a listing similar to that shown in Table C1.

Table C1 — AV-8B Map-II Device Listing at Boot Prompt

Device ID	Device Name	Description (not listed)
DKA0	RZ26F	System disk
DKA100	RZ29B	MMC disk
DKA200	Pioneer CD-ROM DRM-624X	CD changer device MMC1
DKA201	Pioneer CD-ROM DRM-624X	CD changer device MMC2
DKA202	Pioneer CD-ROM DRM-624X	CD changer device MMC3
DKA203	Pioneer CD-ROM DRM-624X	CD changer device MMC4
DKA204	Pioneer CD-ROM DRM-624X	CD changer device MMC5
DKA205	Pioneer CD-ROM DRM-624X	CD changer device MMC6
DKA400	RRD45	Internal CD device MMC7
DKB401	Toshiba CD-ROM Drive:XM	CD Writer drive
DVA0		Internal floppy disk drive
MKB400		CD Studio device
EWA0		Ethernet (e.g., 00-00-F8-22-64-OD)
PKA0	SCSI Bus ID 7	Internal SCSI Bus - A
PKB0	SCSI Bus ID7	Internal SCSI Bus - B

- If this listing is incomplete or inaccurate: turn off the CPU, then turn off the power strip, then turn the power strip back on, and turn the CPU back on. Repeat the CD writer checks (and RESET if necessary), >>>***INIT*** and >>>***SHOW DEVICE*** commands. If the device listing is still inaccurate, repeat this power cycle one or two more times, then call Bob Murray at Hughes, Indianapolis, Indiana.

- When the device listing is correct, type ***B*** (for boot) at the >>> prompt. It will take about 3 minutes to completely boot up the system.

6) Login:

Username: ***MMC***

Password: ***8675309***