Moving Map Composer — Personal Computer (MMCPC) Version 1.0 Training Manual Developed for the Finnish Air Force

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14. ABSTRACT

This document is the training manual for the Naval Research Laboratory (NRL) Moving Map Composer - Personal Computer (MMCPC) System, Version 1.0, developed for the Finnish Air Force (FiAF). Training was conducted in August 2005, immediately following the Acceptance Test Procedures (ATP) in Halli, Finland, at Patria Aviation.

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MOVING MAP COMPOSER – PERSONAL COMPUTER (MMCPC) VERSION 1.0 TRAINING MANUAL DEVELOPED FOR THE FINNISH AIR FORCE

1. INTRODUCTION

This document is the training manual for the Naval Research Laboratory (NRL) Moving Map Composer – Personal Computer (MMCPC) System Version 1.0, developed for the Finnish Air Force (FiAF). Training was conducted in August 2005, immediately following the Acceptance Test Procedures (ATP) in Halli, Finland, at Patria Aviation.

Figure 1 illustrates the data flow between MMCPC, mission planning systems, and the Naval Air Systems Command (NAVAIR) Tactical Aircraft Moving-Map Capabilities (TAMMAC) system installed on FiAF F/A-18 aircraft. MMCPC 1.0 performs the following functions for the FiAF:

- Process FiAF source Georeferenced Tagged Image File Format (geotiff) data into a Compressed Arc Digitized Raster Graphics (CADRG) compatible format that can be read and displayed by TAMMAC;

- Process FiAF or National Geospatial-Intelligence Agency (NGA) source Digital Terrain and Elevation Data (DTED) into a TAMMAC-compatible Re-gridded DTED format (RDTED);

- Define and save regions of interest for mission and theater map data loads;

- Populate these regions of interest with data from user-specified FiAF geotiff files (converted to CADRG-like files via MMCPC), NGA CADRG data, FiAF and NGA RDTED data, and NGA Controlled Image Base (CIB) data;

- Import and convert non-georeferenced images into TAMMAC-compatible data frames;

- Build Mission Planning and Map Theater data loads from CADRG, RDTED, CIB, and data frames that can be read and displayed by the TAMMAC system;

- Write completed TAMMAC map theater data loads to PC cards for aircraft loading.

MMCPC is installed on a FiAF-owned PC (Dell Dimension 8400) configured with the following hardware and software:

- Windows XP Professional Operating System

- 3.4 GHz Pentium 4 Processor

- 1 GB RAM (memory)

- 17-in. flat panel display

- Amtron Technology IDE interface 16-bit PCMCIA (Personal Computer Memory Card International Association) PC card reader / writer

- 16X DVD +/-RW (DVD reader / writer)

- 160 GB hard disk (RAID configuration) – dual redundancy

This system's repair tag code is 6M3TQ61, which may be referenced for a complete system configuration on the Dell website (www.dell.com).

Table 1 lists the source data required for training, most of which NRL provided during the ATP.

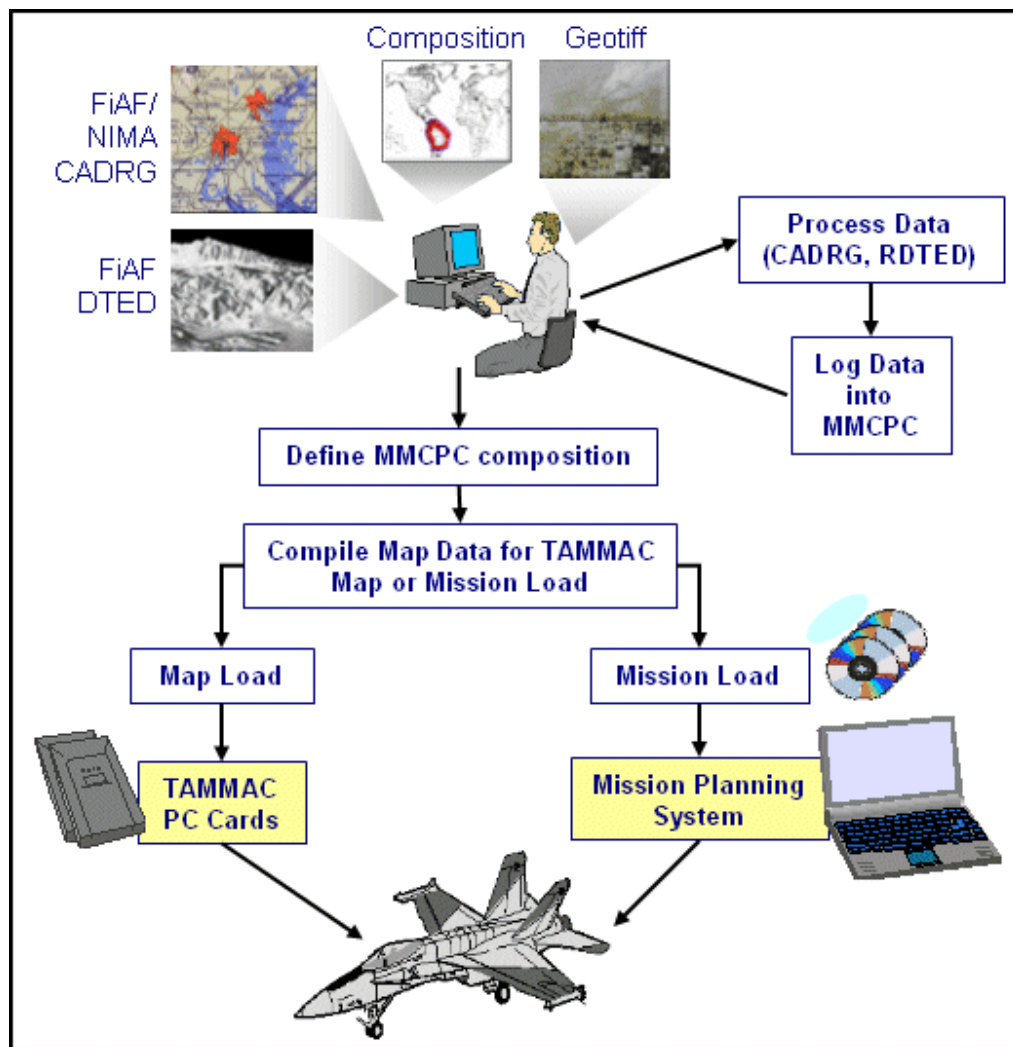A definition of all acronyms used in this document is provided in Appendix A.

Fig. 1 — Data flow between MMCPC, Mission Planning, and TAMMAC systems

Table 1 — Source Data Required for MMCPC Training

Label	Description
FiAF DTED	Finnish DTED Level 1 (~100m post spacing). Release date: May 18, 2004
NGA DTED #1	NGA DTED Level 1 (59-69 N latitude)
NGA DTED #2	NGA CADRG Level 1 (66-70 N latitude)
NGA CADRG 1:2M	NGA CADRG at 1:5M, 1:2M. Item number: GNCJNCN, edition 9
NGA CADRG 1:500k #1	NGA CADRG at 1:1M, 1:500k. Item number: ONCTPC05, edition 8
NGA CADRG 1:500k #2	NGA CADRG at 1:1M, 1:500k. Item number: ONCTPC01, edition 7
NGA CADRG 1:250k	NGA CADRG at 1:250k. Item number: SPFIJOGAZ, edition 1
NGA CIB 5m	NGA CIB at 5m. Item number: NP3500, edition: 1
FiAF GTIF	Finnish geotiff source files at 1:2M with a custom color palette

2.   MMCPC LOGIN AND STANDALONE SYSTEM PROCEDURES

2.1 Overview

These training instructions assume the MMCPC system is assembled and ATP is successfully completed. This section describes the login procedure, explains how to restore the MMCPC software to its original state without reinstalling, and lists useful standalone system procedures.

2.2 Login Procedure

The only account configured for this computer is the MMCPC account, which provides full administrator privileges. Log in to the MMCPC account as follows:

a. Enter the following username and password:
   Username: **MMCPC**
   Password: **FIAFMAP**

b. Check the device configuration:
   Right click on the *My Computer* icon located on the desktop. Verify that the DVD/CD drive is displayed as drive E: and the PC card drive is displayed as drive F:

2.3 Reset Program

The standalone program RESET.EXE is provided to restore the MMCPC software to its original configuration by deleting all logged sources, compositions, processed map data, and data frames (located in the default directory) and reinitializing the processed unique identifiers (PUID). Run RESET from the MMCPC root directory (C:\MMCPC). A DOS window will be displayed instructing the user to click any key to continue. Click *Enter* to close the DOS window and reinitialize the MMCPC system.

2.4 Standalone System Programs

The MMCPC root directory contains several other standalone programs that are not used in training, but are listed here for informational purposes. These programs must be run from a DOS emulation

window, which can be accessed by clicking on **Start** > **All Programs** > **Accessories** > **Command prompt**. A brief synopsis of each program, with input parameters, is provided below.

2.4.1 *RPF_DUMP.EXE*

Description   Provides a screen dump of the contents of a Raster Product Format (RPF) file, such as CADRG, CIB or RDTED.

Usage   RPF_DUMP **type d path**

Parameters   **type**: CADRG, CIB, RDTED
               d: N = dump NITF header
                          R = dump RPF header
                          P = dump color Palette
                          C = dump Coverage
                          D = decompress Data
               path: directory path and filename of framefile

Example   RPF_DUMP CADRG P D:\rpf\ctlm50\ct50z03\03BN6023.TL3

2.4.2 *ARC_EXTRACT_TIF.EXE*

Description   Extracts the Theater Identification File (TIF.DAT) from a TAMMAC map theater archive file (ARC.DAT).

Usage   ARC_EXTRACT_TIF **path**

Parameters   **path**: directory path and filename of ARC.DAT

Example   ARC_EXTRACT_TIF C:\mmcpc\TAMMAC\theater\test\ARC.DAT

2.4.3 *DUMP_CIF.EXE*

Description   Provides a screen dump of the Card Information File (CIF.DAT) written to a TAMMAC map theater or mission load.

Usage   DUMP_CIF **path**

Parameters   **path**: directory path and filename of CIF.DAT

Example   DUMP_CIF C:\mmcpc\TAMMAC\theater\test\CIF.DAT

2.4.4 *DUMP_DIR.EXE*

Description   Provides a screen dump of the directory file that is created for a TAMMAC map theater or mission load.

Usage   DUMP_ DIR **path**

Parameters   **path**: directory path and filename of DIR.DAT

Example   DUMP_DIR C:\mmcpc\TAMMAC\theater\test\DIR.DAT

2.4.5 *DUMP_ TIF.EXE*

Description   Performs a screen dump of the Theater Information file that is created for a TAMMAC map theater or mission load. For a theater map, the TIF.DAT first must be extracted from the ARC.DAT.

Usage   DUMP_ TIF **path**

Parameters   **path**: directory path and filename of TIF.DAT

<u>Example</u>   DUMP_TIF C:\mmcpc\TAMMAC\theater\test\TIF.DAT

3.   MAP DATA PROCESSING

3.1   Overview

A primary function of MMCPC is to process Finnish source map data into file formats that can be read by the TAMMAC digital map system.   MMCPC performs the following map data processing operations, depending on which input data is required: NGA DTED into RDTED, FiAF DTED into RDTED, geotiff into CADRG, and image files into TAMMAC data frame files.

CADRG processing (from geotiff) is the slowest of these operations, because CADRG processing requires compression, which is the most computationally intensive function in MMCPC.   Note that the volume label and directory structure for geotiff files are defined in Appendix B.   **MMCPC will not process FiAF map data that does not conform to the map data and directory structure formats listed in Appendix B.**

Processed map data is written to a default location provided by MMCPC unless the user specifies another directory to store the map data.   In either case, once data has been processed and finalized, the map data resides on the hard disk until it is unlogged. If the processed map is archived to CD or moved to another directory, it must be re-logged into MMCPC.

A default set of color palettes used in the processing of FiAF geotiff to CADRG is derived from NGA source data.   This color palette set is used to process FiAF source geotiff data <u>only</u> if no custom color palettes are provided with the geotiff.   There is no need to maintain the default color palettes to use NGA CADRG in combination with processed FiAF CADRG. NRL recommends that FiAF operators use their own custom color palettes for processing geotiff files into CADRG to improve color accuracy.   The user may process multiple data sets with different color palettes without making the previous map data obsolete. The file structure of custom color palette files must conform to that specified in Appendix C for MMCPC to properly install and use custom color palettes.

MMCPC will process source image files into TAMMAC-compatible data frames.   The source image files provided by the user must be 768x768 pixels in size.   Source images of any other size will not be processed.   The user defines the source and destination directories, which can be either the default directories provided by MMCPC or user-specified directories.

The source data CDs listed in Table 1 are required for the following procedures.

3.2   Start the MMCPC Program

a. Double-click on the MMCPC icon on the desktop.

3.3   Process NGA DTED Data into RDTED

a. Insert the CD-ROM labeled *DTED 1 of Finland (N59-N65, E19-E31)* in the CD drive.

b. In MMCPC, click **Process**, then **RDTED** (or use the shortcut **Ctrl+D**).

c. A window will appear prompting the user to select source and destination directories for processing. Use the **Browse** button at the top of this window to navigate to the CD drive (E:/). Verify a checkmark is displayed next to **Found Valid Source Data**.

d. Use the default destination directory for the processing RDTED (C:\mmcpc\data\RDTD).   Click **Open**. Wait a few moments while MMCPC reads the DTED data from the CD.

e. An RDTED processing window will be displayed. Note the listing of source DTED files under the 150m and 750m tabs. The same DTED files are used to create both resolutions (150m and 750m) of RDTED. Click **View Coverage** to show the approximate RDTED coverage to result from processing this DTED source.

f. Zoom into the area of interest by clicking with the right mouse button, selecting **Zoom by Stretch Box** in the menu and using the mouse (with the left button depressed) to zoom.

g. Click **View Text** to return to the previous view. Since you will be appending more NGA DTED data to this data set, unclick **Finalize Automatically**.

h. Click **Process** to begin processing the NGA DTED into TAMMAC-ready RDTED files, which will take approximately 3 minutes.

i. When a message is displayed stating the RDTED processing has completed, click **OK**.

j. The newly processed RDTED data is not yet ready to use in MMCPC, because **Finalize Automatically** was unchecked and MMCPC is awaiting more source data to complete RDTED processing. Remove the DTED CD from the CD drive.

k. Insert the CD-ROM labeled *DTED 1 of Finland (N66-N70, E20-E30)* in the CD drive.

l. Again, click **Process**, then **RDTED** (or **Ctrl+D**).

m. This time, a window is displayed stating RDTED data exists that has not been finalized. Click **Append**.

n. A window appears prompting the user to select source and destination directories for processing. Use the **Browse** button at the top of this window to navigate to the CD drive (E:/).   Verify a checkmark is displayed next to **Found Valid Source Data**.

o. Since this is an append operation, the destination directory is fixed and cannot be modified. Click **Open**.

p. An RDTED processing window will be displayed (as in step e). Click **View Coverage** to show the approximate RDTED coverage to result from processing this DTED source.

q. Click **View Text** to return to the previous view. This is the last set of DTED data to be processed for this data set, so verify that **Finalize Automatically** is checked. Enter the **User Given Name** of NGA DTED.

r. Click **Process** to begin processing the NGA DTED into TAMMAC-ready RDTED files, which will take approximately 2 minutes.

s. When a message states RDTED processing has completed, click **OK**. This RDTED data set is now complete. Remove the DTED CD from the CD drive. The processed RDTED data will be verified in the Map Composition Development section of this manual. Note that the MMCPC-assigned ID for this data set is **RDTDFIAF0001_A**.

3.4 Process FiAF DTED into RDTED

a. Insert the CD-ROM labeled FiAF DTED level 1 (May 18, 2004 Release) in the CD drive

b. Repeat steps b-f from above (the same as processing NGA DTED into RDTED).

c. Click **View Text** to return to the previous view. Since this is the only DTED data for this data set, verify that **Finalize Automatically** is checked. Enter the **User Given Name** of FiAF DTED.

d. Click **Process** to begin processing the FiAF DTED into TAMMAC-ready RDTED files, which will take approximately 18 minutes.

e. When a message states the RDTED processing has completed, click **OK**. This RDTED data set is now complete. Remove the DTED CD from the CD drive. The processed RDTED data will be verified in the Map Composition Development section of this manual. Note that the MMCPC-assigned ID for this data set is **RDTDFIAF0002_A**.

3.5 Process FiAF GEOTIFF into CADRG

a. Insert the CD-ROM labeled *FiAF source geotiff - 1:2M* in the CD drive. This CD-ROM contains geotiff files with custom color palettes for each map scale.

b. In MMCPC, click **Process**, then **CADRG** (or use the shortcut **Ctrl+G**).

c. A window will appear prompting the user to select source and destination directories for processing. Use the **Browse** button at the top of this window to navigate to the CD drive (E:/). Verify a checkmark is displayed next to **Found Valid Source Data**.

d. Use the default destination directory for processing CADRG (C:\mmcpc\data\CDRG). Click **Open**. Wait a few moments MMCPC reads the FiAF geotiff data from the CD.

e. Since the CD contains custom color palettes, a message will inform the user that a new color palette was detected for the appropriate map scale (in this case, 1:2M) and warn about possible repercussions of installing new color palettes. Click **Continue**.

f. A CADRG Processing window will be displayed. Note the listing under each map scale tab that contains geotiff files. In CADRG processing, each geotiff file is processed only for the scale at which it is associated. Click **View Coverage** to show the approximate CADRG coverage to result from processing these FiAF geotiff source files.

g. Click **View Text** to return to the previous view. Since this is the only FiAF geotiff source CD for this data set, verify that **Finalize Automatically** is checked. Enter the **User Given Name** of FiAF CADRG.

h. Click **Process** to begin processing the FiAF geotiff files into TAMMAC-ready CADRG-like files. This is a CPU-intensive process due to spatial and color compression techniques that must be used to create CADRG files.

i. When a message states CADRG processing has completed, click **OK**. This CADRG data set is now complete. Remove the FiAF geotiff source CD from the CD drive. The processed CADRG data will be verified in the Map Composition Development section of this manual. Note that the MMCPC-assigned ID for this data set is **CDRGFIAF0001_A**.

j. Quickly verify that all map data in this section have been logged and properly processed:

   1. From the MMCPC main window, click **Compose**, then **Include Coverage**, then **Logged Source**.

   2. Verify that the logged source listing includes all sources that have been logged and processed during this session.

   3. Double-click on **RDTDFIAF0001_A**. Set **MMCPC Data Type** to **RDTED** and set **MMCPC scale** to **150m**, then move the cursor to the processed coverage area. Right click, select **View RPF Data**, and verify that the RDTED coverage is correct.

   4. Repeat steps 1-2, and then double-click on **CDRGFIAF0001_A**. Set **MMCPC Data Type** to **CADRG** and **MMCPC scale** to **1:2M**. Right click, select **View RPF Data**, and verify that the CADRG coverage is correct.

   5. Close the View RPF Data window. From the MMCPC main window, click **File**, then **New**. Click **No** when prompted to save the current composition.

3.6 Process Data Frames

a. A set of images was installed with MMCPC for the ATP. From the MMCPC main window, click **Process**, then **Dataframe** to display the Dataframe Viewer window.

b. In the Dataframe Viewer window, click **File**, then **Open Image File**. A set of four image files are listed in the default directory (C:\MMCPC\IMPORT). You will process only three of the four images. Double-click on the first image filename (AUSTIN.GIF). Verify that the data frame image is displayed in the Viewer window.

c. From the Viewer window, click **File**, then **Save As Dataframe**. In the Save As window, save the data frame as AUSTIN.HDF, a TAMMAC-ready data frame file.

d. Repeat steps b-c for the DREVIL.GIF and STOOGIES.GIF files. Save the image files as EVIL.HDF and STOG.HDF, respectively.

e. Verify that the data frames were properly saved by opening each one in the viewer. From the viewer menu, click **File**, then **Open Image File**. Browse to the directory C:\MMCPC\data\dataframes. Double-click on a saved data frame and verify it is correct in the Viewer window.

f. From the Dataframe Viewer menu, click **File**, then **Exit**.

4. LOGGING MAP DATA

4.1 Overview

Any original NGA map data (CADRG, CIB, or RDTED) to be used in MMCPC must first be logged into the system. Logging map data consists of creating a bitmap representation of the data, storing it in a protected MMCPC directory, and notifying MMCPC that the data is available for composition development and map theater/mission builds for use with TAMMAC. In the map data processing procedures described in Section 3, these logging functions were performed automatically.

The user may also unlog map data from MMCPC using the **UNLOG** function. Unlogging will remove the bitmap representation of the map data from MMCPC. The user may unlog any map data – including processed map data – residing on hard disk. In the case of processed map data, the actual map files also will be deleted from the system. **It is very important to recognize that unlogging processed map data will permanently remove that data from the system. UNLOG** should be used to eliminate obsolete data from the system. For example, if FiAF CADRG data is replaced by newer map data, both sets will reside on MMCPC until a user unlogs the older data. Unlogging map data will render "locked" compositions obsolete. This aspect is discussed in greater detail in Section 5 of this manual.

4.2 Log NGA Map Data

a. Insert the CD-ROM labeled *GNCJNCN (NSN# 7644014004622)* in the CD drive.

b. In MMCPC, click **LOG**, then **LOG SOURCE** (or use the shortcut **Ctrl+L**).

c. Use the **Browse** button at the top of the pop-up window to navigate to the CD drive (E:/), then click **OK**.

d. Verify that a checkmark appears next to **Found Valid Source Data** and the label name of the source is shown.

e. Click **LOG**. Verify that the logging process completed successfully. Click **OK**.

f. Repeat steps a-e for each of the following NGA CADRG CDs:
   - *ONCTPC01 (NSN# 7644014496348)*

- *ONCTPC05 (NSN# 7644014391906)*
- *JOG-A (expurgated) (Item# SPFIJOGAZ)*
- *CIB (NSN# 7644014540544)*

g. This completes the logging process for all NGA source data to be used (without any pre-processing) by MMCPC during this training session.

5.   MAP COMPOSITION DEVELOPMENT

5.1   Overview

Map compositions, like logged data sources, are bitmaps. However, unlike logged data sources, map composition bitmaps are designed by the user. Logged sources must exist wherever the user wishes to define map coverage for a composition before the composition can be built.

Map compositions may exist in three states: unlocked, locked, and obsolete. All newly created compositions are unlocked. An unlocked composition is a user-defined bitmap representation for a region of interest (ROI) where logged sources exist. However, the composition is not "locked" to any particular logged map source. This is a key point, since logged sources may overlap one another. An unlocked composition is, therefore, based on any applicable logged map coverage but not any particular source. For example, in Section 3 (Map Data Processing), NGA and FiAF DTED data are processed into RDTED data sets RDTDFIAF0001_A and RDTDFIAF0002_A. The geographic coverage of RDTDFIAF0002_A (Northern Europe / Scandinavia) completely overlaps the coverage of RDTDFIAF0001_A (Finland only). So, an unlocked composition that includes RDTED coverage of Finland may use either source for a map build. In an unlocked state, the composition only indicates that coverage exists (in this case, from two possible sources).

Once a composition has successfully built a TAMMAC theater or mission load, the composition becomes "locked" (i.e., the map sources are now locked to the composition). This establishes a record of the exact map sources used to create a particular map load. Continuing with the example above, the composition containing RDTED coverage of Finland is used to build a theater map. MMCPC will display to the user the available sources that are needed to construct the theater map for this composition (RDTDFIAF0001_A and RDTDFIAF0002_A). The user may arrange the order of sources for a build to force MMCPC to use the sources from top (highest priority) to bottom (lowest priority). If RDTDFIAF0002_A is ordered for highest priority, the other source will not be used at all, since RDTDFIAF0002_A completely overlaps RDTDFIAF0001_A. Once the build completes successfully, the composition is locked to its source (here, RDTDFIAF0002_A). If the user wishes to again create a theater map build from this composition, the user will no longer be prompted to set the order of sources, since the composition is now locked to RDTDFIAF0002_A.

When a map source that was used for a locked composition is unlogged from MMCPC, the composition becomes obsolete. Any associated "locked" compositions created using the obsolete map source also become obsolete. Continuing with the example above, if the source RDTDFIAF0002_A was unlogged from MMCPC, the composition would become obsolete. This will be demonstrated later in this training.

5.2   Define Composition Using a Variety of Methods

a. Show all available map coverage by clicking **View** from the main menu, then check on **Available Coverage**. Using the MMCPC **Data Type** and **Scale** pull-down windows, click through each data type and map scale selection. Note that the color of the map coverages is green, indicating coverage is available but not part of the current composition (map segments are displayed red in compositions).

b. From the MMCPC main menu, click **Compose**, then **Include Coverage**, then **Logged Source**.

c. A window should be displayed listing the logged sources available for composition development. Verify there are one CIB source, four NGA CADRG sources, one FiAF CADRG source, and two RDTED sources.

d. Double-click the CIB source, verify that CIB map coverage in central Finland is displayed. This demonstrates the method to create a composition by including a logged source.

e. Use the **Zoom Stretchbox** to zoom into the Scandinavian region. Once the button has been depressed, the cursor should change from an arrow to a cross (+). Depress the left mouse button at the upper left hand corner and drag to the lower right-hand corner of the desired zoom box.

f. Click the **Zoom Stretchbox** again to return the cursor to an arrow.

g. Change the data type to **CADRG** and the scale to **1:250k**. Green map segments should be displayed for the entire country of Finland. Use the **Define Coverage by Stretchbox** tool to select the lower half of Finland. Depress the button to activate the function, hold down the left mouse button from the upper left-hand corner and drag to the lower right-hand corner of the desired coverage. A purple box should be displayed showing the extents of the stretchbox, and the color of the map segments within the box should now be red (indicating these map segments are part of the current composition).

h. Change the scale to **1:2M**. Use the **Define Coverage by Polygon** tool to select the territorial boundaries of Finland. Depress the button to activate the function then, starting at the bottom, left-click on a location just below Helsinki. A purple dot should appear. Continue to left-click on points just outside the boundaries of Finland. Line segments will be displayed for each point clicked. After clicking around the boundaries of Finland, double-click to close the polygon. The map segments in the polygon should be red.

i. Use the **Erase Coverage by Stretchbox** tool to remove the coverage at the 1:2M scale for the northern half of Finland. Depress the button to activate the function, hold down the left mouse button from the upper left-hand corner and drag to the lower right-hand corner of the desired coverage. A purple box should be displayed showing the extents of the stretchbox and the color of the map segments within the box should now be green (indicating these map segments no longer part of the current composition).

j. Change data type to **RDTED** and map scale to **150m**. If necessary, use the **Zoom Out** tool to see all available RDTED coverage. Use the **Define Coverage by Lat-Lon** tool to select the southern half of Finland. A window will appear allowing the user to enter a set of latitude / longitude points. Enter latitude **60** (degrees) and longitude **20** (degrees) **30** (minutes). Click **Add LAT/LON**. Add three additional latitude and longitude pairs: (64, 20 30), (64, 31 20), and (60, 31 20), then click **OK**. A box should be displayed showing the extents of the latitudes and longitudes entered and the color of the map segments within the box should turn from green (available) to red (composition). Note that the **Define Coverage** toolbar is inactive at the **750m** scale. However, the actions taken at the **150m** scale for RDTED are automatically applied to the **750m** scale.

k. Next, associate the data frames that were created earlier with this composition. From the main window, click **Compose**, then **Associate DF**.

l. A **Select Dataframes** window will be displayed. Since we stored the data frames in their default location (C:\MMCPC\data\dataframes), the three data frames created in section 3.6 should

be listed. Select all three data frames by placing the cursor below and to the right of the last data frame, and then depress the right mouse button and drag to the upper left data frame. Click **Open** to associate the data frames.

m. From the MMCPC main window, click **File**, and then **Save** (or **Ctrl+S**). Enter the composition name as **TRAINING1**. The composition will be saved as an unlocked composition. Click **OK**.

n. From the main window, click **File**, then **Close**. Verify the composition has been closed.

o. From the main window, click **File**, then **Open** (or **Ctrl+O**). Note that **TRAINING1** is an unlocked composition. Double-click on **TRAINING1**. Verify that all map data included in the composition was properly saved.

p. For each data type, right-click over a red segment and select **View RPF Data** to verify the data. You may be prompted to enter the appropriate CD if the data is not on hard disk:

  ▪ Data type: **CIB**, Scale: **5m**.

  ▪ Data type: **CADRG**, Scale: **1:250k**.

  ▪ Data type: **CADRG**, Scale: **1:2M**.

  ▪ Data type: **RDTED**, Scale: **150m**.

  ▪ Data type: **RDTED**, Scale: **750m**.

q. From the main window, click **COMPOSE**, then **VERIFY COMPOSITION**. Click the radial button for **Theater**. Verify the current composition is a valid theater map for TAMMAC, and verify the number of map cards needed. The maximum size of a theater map is slightly less than 3 GB (each theater card is 1 GB capacity, with 3 cards maximum).

r. Again, from the main window, click **COMPOSE**, then **VERIFY COMPOSITION**. Click the radial button for **Mission**. Verify the current composition is *not* valid for a mission build. Current mission card capacity is slightly less than 256 MB and only 1 mission is allowed.

s. Verify that the data frames have been properly associated with this composition by right-clicking on the composition toolbar. A window will be displayed showing the active toolbars. Toggle on the **Associated Dataframes** toolbar. A pull-down menu will be displayed showing each data frame associated with the current composition.

t. Once verified, click **File**, then **Close**.

u. This completes the training to create map compositions in MMCPC.

6. MAP THEATER BUILD

6.1 Overview

This section describes how a composition can be used to create a theater map build. As stated in the previous section, a theater map has a maximum capacity of 3 GB (capacity is actually slightly less than 3 GB, due to vendor-reserved space on the disk). Each theater map PC card has a capacity of approximately 1 GB.

A mission map has a maximum capacity of 256 MB (not withstanding vendor reserved disk space). Only a single mission card may be loaded into TAMMAC, so the mission PC card size is 256 MB. Both PC card capacity sizes are read from a configuration file in MMCPC and could be modified in the future to change the capacity sizes.

Theater and mission map builds are composed of the actual map data files stored in the proper structure for the selected type (theater vs. mission) with all required TAMMAC-specific files included as part of the build. MMCPC writes all theater and mission builds to hard disk in the directory

*C:\mmcpc\TAMMAC\theater***map_build**   or   *C:\mmcpc\TAMMAC\mission***map_build**   where   the subdirectory **map_build** takes the name of the map build and contains all the files to be loaded for TAMMAC. A separate function copies theater map files to PC cards. All mission builds are retained on hard disk for utilization by the Mission Planning System (MPS). MMCPC does not create all files needed for a valid mission build. This function was outside the scope of MMCPC v1.0 development.

6.2   Build a TAMMAC Theater Map

a. From the MMCPC main menu, click **Build**, then **Build Map**. A **Build Map** window should be displayed.

b. Click the **Theater** radial button on the build window to indicate that this map build will be a TAMMAC Theater Build. Click the **Browse** button to view the available compositions. Double-click the composition **TRAINING1**. Click **OK**.

c. The **Build Map** window will close and the **Data Sources** window will be displayed showing all possible map sources for the selected composition.

NOTE: Map data sources may have overlapping coverage. The **Data Sources** window provides up and down arrows enabling the user to prioritize the data sources that will be used to construct the map build. The order of precedence may be important when newer map data overlaps older data or when the user needs to prioritize data based on the provider (e.g., use FiAF data before NGA data).

d. Move the **RDTDFIAF0002_A** source above the **RDTDFIAF0001_A** source. Click **OK**.

e. Since data frames are associated with this composition, another window will be displayed showing the list of data frames. As in the list of data sources, the order of precedence for data frames may be changed via up and down arrows to determine the order in which they will be displayed in the aircraft (top is first).   Click **OK** to accept the default order.

f. The build process will begin. For sources on CD, MMCPC will instruct the user to insert the source disk in the CD reader and click **OK** to continue. When the **Build Finished** window is displayed, click **OK**.

g. The status of the **TRAINING1** composition is now locked. From the main window, click **File**, and then **Open** to verify. Make sure the file filter is set to show all composition types. Click **CANCEL**.

6.3   Write TAMMAC Theater Load to PC Card

a. From the MMCPC main window, click **Build**, then **Write Theater Map**.

b. A window will be displayed instructing the user to enter the serial number of the first PC card. Select a map card, type the serial number in the window provided, insert the card into the PC card drive, and click **OK**.

c. Click **OK** when the write has completed. Eject the card from the PC card drive and mark this card as **TRAINING1**. Note that MMCPC will automatically erase any previous map data that existed on the card prior to writing the new map theater.

d. Take PC card **TRAINING1** to the TAMMAC system in the Scientific and Technical Information Center (STIC) facility for verification. Note the following during review:

▪ View and verify the accuracy of CADRG map data at 80 nmi, 40 nmi, and 5 nmi scales. The 80 nmi and 40 nmi CADRG is from the FiAF source (same map data zoomed) while the 5 nmi CADRG data is from the NGA source.

- View and verify the accuracy of RDTED data at the 80 nmi, 40 nmi, 20 nmi, and 10 nmi scales. Note this is RDTED data taken from FiAF source. The FiAF source DTED is much better quality than NGA DTED.

- View and verify the accuracy of CIB map data at the 5m scale.

  NOTE: The F-18 operational flight program (OFP) only supports the display of three CADRG scales: 1:250k, 1:500k, and 1:2M.

7.   DEMONSTRATE OBSOLESENCE

7.1   Overview

As discussed before, it is the user's responsibility to unlog obsolete map data from MMCPC. In the following procedure, we assume the RDTED data RDTDFIAF0002_A is now obsolete. This procedure will show 1) the status of the composition has changed and 2) a theater map can no longer be constructed from that composition. The user will then create a composition based on the obsolete composition and construct another theater map build.

7.2   Unlog Source Data and Rebuild Map

a. From the MMCPC main menu, click **Log**, then **Unlog Source**. A window will be displayed showing all currently logged sources. Double-click the source **RDTDFIAF0002_A**. A notice will be displayed asking if the user really wants to unlog this data. Click **Yes**. The source has been un-logged.

b. Verify that the source has been un-logged by repeating step (a) to display the window of logged sources. Note that the source **RDTDFIAF0002_A** is no longer listed.

c. Since the un-logged source was used in the map build of the composition **TRAINING1**, the composition's status should now be **Obsolete**. From the main window, click **File**, and then **Open** to verify. Make sure the file filter is set to show all composition types.

d. In this case, since the un-logged RDTED data used in this composition was completely overlapped by another RDTED source, the composition **TRAINING1** will still show all of the RDTED coverage. This would not be the case if there were no overlap coverage (i.e., no coverage for RDTED would have been displayed).

   NOTE: MMCPC will not prohibit the user from attempting to build an obsolete composition. However, in most cases, this will fail. It is the user's responsibility to insure that an obsolete composition is not used for a map build.

e. Click **File**, then **Save As**. Enter the composition name **TRAINING2**. Note that the new composition **TRAINING2** has been saved as an unlocked composition.

f. Build a map theater using **TRAINING2** by following the procedure in section 6. Note that the list of required sources does not include **RDTDFIAF0002_A**. Only **RDTDFIAF0001_A** is listed as an RDTED source.

g. This completes the training to demonstrate the impacts of un-logging source data that has become obsolete.

8.   ACKNOWLEDGMENTS

Appendix A

ACRONYMS

ASCII	American Standard Code for Information Exchange
ATP	Acceptance Test Procedures
CADRG	Compressed Arc Digitized Raster Graphics
CIB	Controlled Image Base
CD-R	Compact Disk – Recordable
DF	Data Frame
DTED	Digital Terrain Elevation Data
FiAF	Finnish Air Force
GB	Gigabyte
GEOTIFF, GTIF	Geo-referenced Tagged Image Format
IDE	Integrated Drive Electronics
MMCPC	Moving Map Composer – Personal Computer
MPS	Mission Planning System
NAVAIR	Naval Air Systems Command
NGA	National Geo-Intelligence Agency
NRL	Naval Research Laboratory
NSN	National Stock Number
OFP	Operational Flight Program
PCMCIA	Personal Computer Memory Card International Association
RAID	Redundant Array of Inexpensive Disks
RAM	Random Access Memory
RDTED	Re-gridded Digital Terrain Elevation Data
ROI	Region of Interest
STIC	Scientific and Technical Information Center
TAMMAC	Tactical Aircraft Moving-Map Capability

Appendix B

SOURCE MAP DATA AND DIRECTORY STRUCTURE FORMAT

B1. INTRODUCTION

Appendix B provides detailed information on the data format and directory structure of the Finnish source map data to be processed by MMCPC version 1.0. In addition to the Finnish-specific map data that MMCPC 1.0 supports (defined below), MMCPC is also designed to read the following data types and associated directory structure:

- Compressed Arc Digitized Raster Graphics (CADRG): *Military Specification for the Compressed ARC Digitized Raster Graphics, MIL-C-89038, October 1994*.

- Controlled Image Base (CIB): *Performance Specification for Controlled Image Base, MIL-PRF-89041, May 1995*.

- Digital Terrain Elevation Data (DTED): *Performance Specification for Digital Terrain Elevation Data, MIL-PRF-89020A, April 1996*.

The following sections consist of Finnish-specific data types that are processed and supported in MMCPC to produce TAMMAC theater and mission data loads per Appendix G of the document referenced below:

- *Performance Specification for the TAMMAC Digital Map System*, PS 74-870260 revision D, March 2001.

B2. FIAF GEOTIFF FILE FORMAT AND DIRECTORY STRUCTURE

MMCPC 1.0 supports files that conform to the geotiff format specification version 1.8.1 (see http://www.remotesensing.org/geotifff/spec/geotifffhome.html for a complete definition). MMCPC has tested sample Finnish geotiff map data and will support both Model Transformation Tag and Model Pixel Scale / Model Tiepoint Tag geocoding. However, due to cost constraints, MMCPC cannot extensively test all possible geocoding and geokey combinations, but has successfully tested Finnish implementations used to date. For MMCPC to identify and process source media, all FiAF geotiff CD-ROMs *must* have a volume identification of **FAF_GTIF**. Otherwise, MMCPC will *not* process the map data. The geotiff producer is responsible for providing the CD-ROM volume identification.

A FiAF geotiff CD-ROM may contain any number of geotiff files for *multiple* map scales and one optional custom color palette file (discussed in Appendix C) for each map scale that contains geotiff files. All geotiff files must contain a *TIF* suffix (e.g., *ABCDEFGH.TIF*) and all files must conform to the directory structure shown in Fig. B1.

The Finnish MMCPC 1.0 system is initially installed with a default set of CADRG color palettes extracted from NGA source. For any map scale directories containing source geotiff files that do not contain a custom color palette, the default CADRG palette for that map scale will be used to process the source geotiff into CADRG. Once a custom color palette has been installed for a given map scale, that custom color palette becomes the default for that map scale.
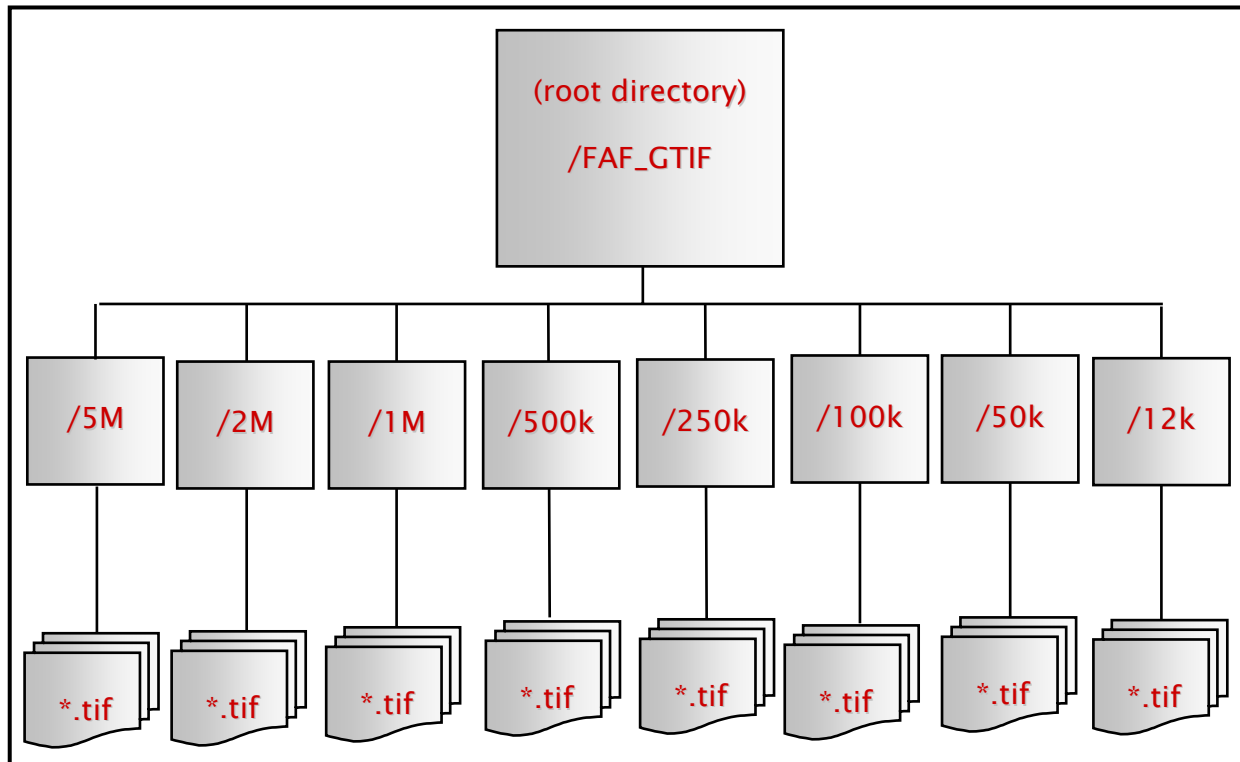
Fig. B1 — FiAF source geotiff directory structure

B3. FIAF DTED FORMAT

The FiAF DTED files must conform to the structure defined in Section 3.14 of MIL-PRF-89020A, *Performance Specification Digital Terrain Elevation Data* (April 1996).

MMCPC 1.0 will support *only* DTED level 1. DTED level 1 post (elevation) spacing is defined in Section 3.9 of the DTED military specification.

The directory structure *and* file naming convention of FiAF DTED must conform to the format defined in Section 3.14.2 of the DTED military specification, *with the exception* that FiAF DTED is not required to have a gazetteer, a DMED file, text files, or the GAZETTE or TEXT directories.
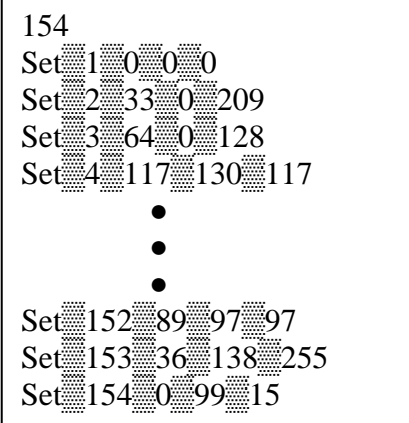
Appendix C

FIAF CUSTOM COLOR PALETTE FORMAT

C1. INTRODUCTION

Appendix C provides the format for installing custom color palettes for use by MMCPC when processing source FiAF geotiff files into CADRG-like files compatible with the TAMMAC Digital Map System. The color palette is an ASCII file containing a maximum of 216 colors as shown in Fig. C1. Color palettes are used by MMCPC to transform source geotiff files from 24-bit color to 8-bit color (i.e. color compression). MMCPC is installed with a default set of 8 color palettes (one per supported map scale: 1:5M, 1:2M, 1:1M, 1:500k, 1:250k, 1:100k, 1:50k, and 1:12.5k) derived from NGA source CADRG. A custom color palette is installed in MMCPC during data processing of FiAF geotiff into CADRG. A custom color palette must reside in the appropriate scale directory (Fig. A1) with the set of geotiff files that will be processed.   Only one color palette is allowed per scale and it must be named **PALETTE.TXT**. Once processing begins, the custom color palette will replace the default color palette for that particular map scale. The custom color palette becomes the new default palette for that scale and will then be used to color compress the source geotiff files at that scale into CADRG files.   A **PALETTE.TXT** file may exist in each map scale directory that contains geotiff files. Custom color palettes that provide good representations of the true colors of the source data are recommended to reduce the impact of color loss during processing.

C2. FIAF COLOR PALETTE FORMAT

   MMCPC requires that a custom color palette file (**PALETTE.TXT**) follow a very specific format as shown in Fig. C1. The first line of the color palette file must contain the number of colors that will follow. The *maximum* number of colors is 216. If the actual number of colors does not match the number listed in the first line, the file will be considered incorrect and the map data will not be processed. After the first line, each successive line must contain the text: "Set x" where "x" is the numeric identifier of the color (e.g., "Set 216"). These numbers should be consecutive. Please note that the "S" in "Set" must be capitalized. Following the text, the red, green, and blue values (valid values 0 to 255) for the color follows with each value delimited by a single space. In the following figure, each space is shown as "▨" for clarity only.

```
154
Set 1   0   0   0
Set 2   33  0   209
Set 3   64  0   128
Set 4   117 130 117
              •
              •
              •
Set 152 89  97  97
Set 153 36  138 255
Set 154 0   99  15
```

Fig. C1 — FiAF custom color palette
format; this sample palette has 154 colors
(216 is the maximum number of colors).