

REPORT DOCUMENTATION PAGE

*Form Approved
OMB No. 0704-0188*

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE (DD-MM-YYYY) 10-26-2000	2. REPORT TYPE CONFERENCE PROCEEDINGS	3. DATES COVERED (From - To)
---	--	------------------------------

4. TITLE AND SUBTITLE THE DESIGN AND DEVELOPMENT OF AN INTERNET-BASED GRAPHICAL USER INTERFACE USING A COMMERCIAL DESIGN TOOL AND JAVA	5a. CONTRACT NUMBER
	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S) Stephanie A. Myrick, Marlin L. Gendron, Maura C. Lohrenz, and Stephanie S. Edwards	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Research Laboratory Marine Geosciences Division Stennis Space Center, MS 39529	8. PERFORMING ORGANIZATION REPORT NUMBER NRL/PP/7440-00-1010
--	---

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) NAVAIR	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution is unlimited

13. SUPPLEMENTARY NOTES

20010102 018

14. ABSTRACT
This paper describes the design and development of an Internet-hosted Graphical User Interface (GUI) to plan digital aeronautical chart coverages for cockpit moving-map displays by U.S. military aircraft mission planners, requirements officers, and aircrew. The GUI is a component of the Moving-Map Composer (MMC) software that has been developed by the Naval Research Laboratory at the Stennis Space Center (NRLSSC). MMC performs a wide variety of naval mission planning systems and in-flight moving-map displays.

15. SUBJECT TERMS
graphic user interface, moving-map displays, aircraft optical disks, X-designer and X-library

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified		1	Stephanie A. Myrick 19b. TELEPHONE NUMBER (Include area code) 228-688-5499

THE DESIGN AND DEVELOPMENT OF AN INTERNET-BASED GRAPHICAL USER INTERFACE USING A COMMERCIAL DESIGN TOOL AND JAVA

Stephanie A. Myrick, Marlin L. Gendron, Maura C. Lohrenz, and Stephanie S. Edwards¹

Abstract. This paper describes the design and development of an Internet-hosted Graphical User Interface (GUI) to plan digital aeronautical chart coverages for cockpit moving-map displays by U.S. military aircraft mission planners, requirements officers, and aircrew. The GUI is a component of the Moving-Map Composer (MMC) software that has been developed by the Naval Research Laboratory at the Stennis Space Center (NRLSSC). MMC performs a wide variety of aeronautical chart planning functions, including the design and construction of chart images from user-specified data for use in naval mission planning systems and in-flight moving-map displays.

1. Introduction. X-Designer is a commercial GUI design tool (offered by Imperial Software Technology) that produces source code for the GUI designs created. X-Designer originally was used to produce an X Windows-based version of MMC and has proven to be an excellent tool for generating X Library (Xlib) and OSF/Motif source code. MMC is comprised of C functions and X-Designer generated code and is implemented as a standalone system on a Compaq Alpha workstation running OpenVMS. The main MMC GUI is shown in figure 1. A new version of MMC (due to be released in early 2001) will also run on a PC platform running Linux. Peripheral devices for performing optical disk operations are included as part of the system hardware configuration.

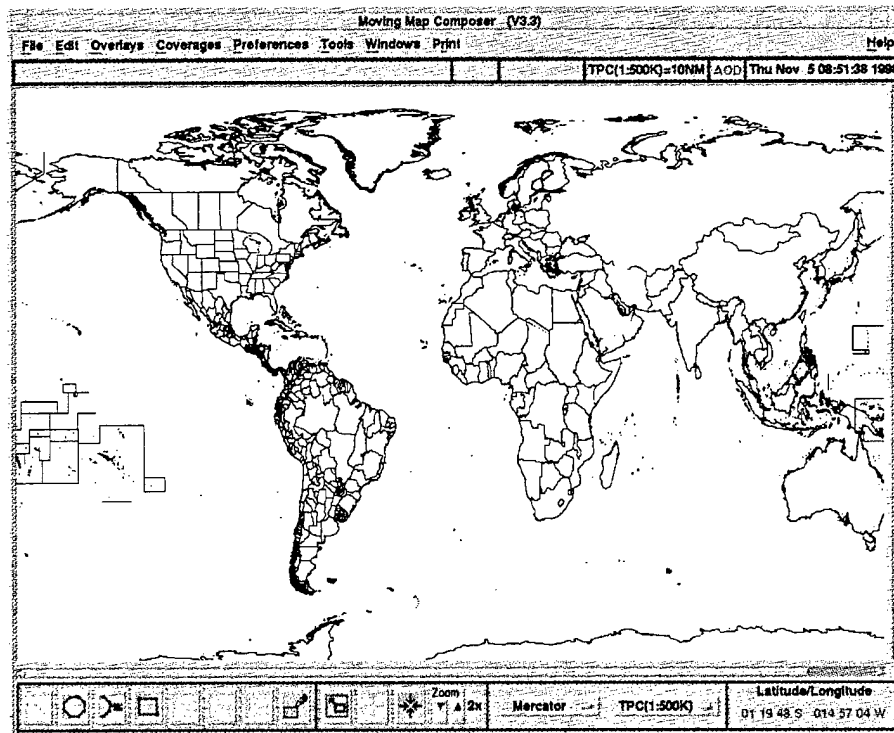


Figure 1. Main MMC GUI

Since its inception, MMC has undergone numerous software revisions to provide increased support to the fleet and, as a result, now is in greater demand. However, MMC is only available to those who have access to an Alpha workstation and the requisite peripheral devices, which are expensive to maintain and nearly obsolete in terms of CPU speed, memory, disk storage, etc. While the Linux

¹ Naval Research Laboratory, Code 7440.1, Stennis Space Center, MS 39529

PC version of MMC will help to alleviate obsolescence problems, many pilots and mission planners do not have access to these platforms, either. Therefore, NRLSSC scientists are starting to redesign MMC into a web-based system that would provide structural and platform independence. There are two principle benefits of this redesign: (1) As a web-based system, MMC will be accessible to a substantially greater number of users, primarily pilots and mission planners; (2) As a portable system, MMC no longer will be tied to any one hardware platform and will benefit from newer, faster hardware and peripherals as they become available.

2. Discussion. Software implementations using X-Windows, Java and C programming languages will meet these needs. NRLSSC scientists are utilizing the most recent version of X-Designer (v5.5) - which generates Java code - to generate the GUI portion of MMC in Java and OSF/Motif. Two companion papers being presented at this symposium address (1) the design and implementation of the Java Server portion of this MMC redesign, and (2) the design of Java-based moving-map simulations, on-line surveys and databases to solicit evaluations of future moving-map displays from pilots and mission planners stationed around the world.

The decision to continue utilizing X-Designer for software development was primarily based on product licensing and extensive familiarity with its use. Production costs were reduced since the license was current and scientists had previous experience with its use as a development tool. X-Designer also enabled GUI design and implementation to progress in a consistent manner by maintaining the design's "look and feel", maintaining the independence of lower level code, and streamlining individual programming styles. With personnel changes that are inherent in multi-year programs, it is essential to maintain control and consistency with programming techniques. The following sections address the primary issues that are being during this transition to a web-based system: Section 2.1 covers design modification issues associated with using X-Designer for Java source code generation, and Section 2.2 covers MMC enhancements for web use.

2.1 Design Modifications. Modifications (e.g., additional buttons or windows) are quickly and easily made. Once a design is created or modified, the *Generation* feature of X-Designer is used to generate Java source code (including individual files for callback routines). These files are compiled, along with other existing low-level C functions, to create an executable application that is MMC (figure 2).

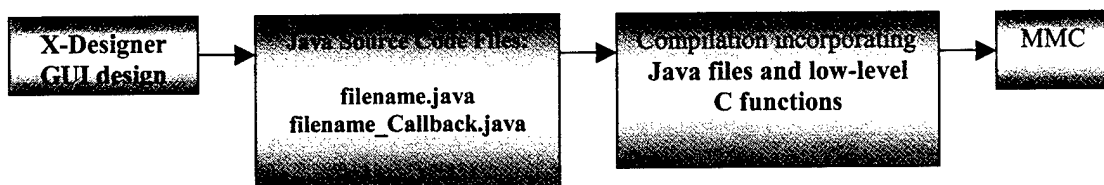


Figure 2. The transformation steps of a GUI design from its creation to its final form as an executable Java application.

To date, the only significant problem encountered generating Java source code (instead of X-windows) has been associated with the X-Designer Layout Manager and attachments. Specifically, some of the GUI component (i.e., widget) placement and size specifications have been set erroneously in the Java source code and required manual correction (figure 3). All manual corrections are documented within the source code. This problem appears to be limited to Java source code generation since the same design appears correct when implemented in X-Window source code. This may be one disadvantage of using X-Designer instead of other development tools that have been designed exclusively for generating Java source code.

However, these errors are easily corrected through modifications to the *FormLayoutConstraint* definitions and do not appear to be substantial impediments to the completion of this project.

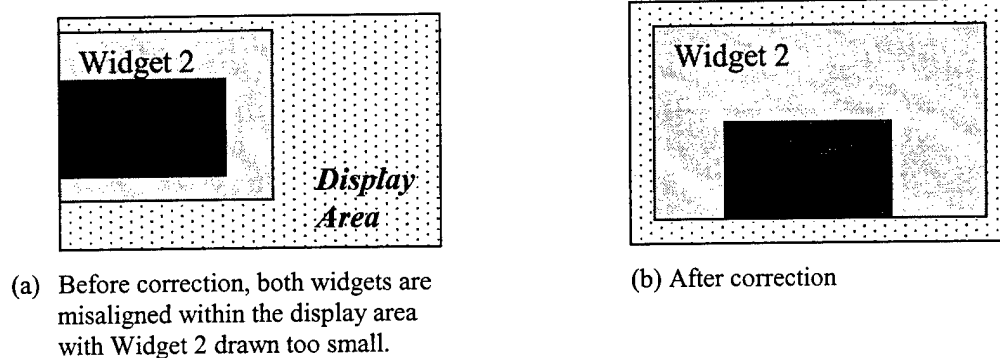


Figure 3. Widget placement and size attachments.

2.2 Development for Web use. MMC has been enhanced to serve in a client/server architecture on the Internet. The existing low-level C language code is robust and well tested. Therefore, in order to minimize software modifications and avoid introducing new bugs, only a few key changes are being made. These modifications primarily include file naming conventions, and file location operations. As an application, MMC now generates individual queries that belong to a set of ASCII-based query language commands that are being developed as part of this project. These commands are understood by both client and server and serve as their logical link (figure 4).

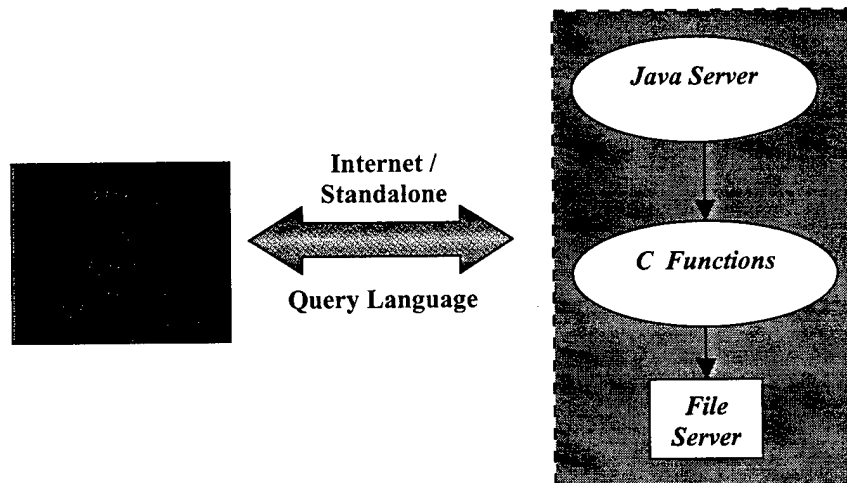


Figure 4. The Internet-based MMC GUI client application and its Java server.

For example, using the File Menu option to open a final composition (figure 5), generates the following query which is subsequently interpreted by the Java server:

```
build file[type=ascii] template[location=hd, name=all]
```

Queries are incorporated as part of the individual callback routines used within MMC. The appropriate C functions are then invoked to complete the tasks identified in the query. In the above example, a file selection menu is provided to obtain the name of a final composition and once opened, is available for use. With MMC available on the Internet, pilots and mission planners can design map

mission-specific compositions from their respective workplaces and maintain a library of chart coverages that are available for future use or may be modified as needed for other missions. With system hardware upgrades being transparent, these users will be able to rely on MMC, as a state of the art resource for their map display needs.

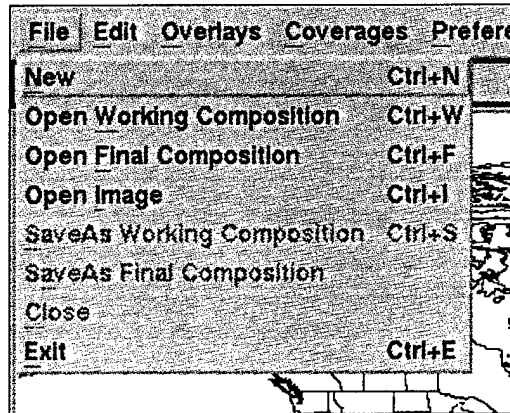


Figure 5. MMC File menu option

3. Summary. NRLSSC scientists have begun to redesign MMC into a web-based system that will provide structural and platform independence. As a web-based system, MMC will be accessible to a substantially greater number of users, primarily pilots and mission planners. As a portable system, MMC no longer will be tied to any one hardware platform and will benefit from newer, faster hardware and peripherals as they become available. X-Designer is being used in this effort since production costs can be reduced (due to the existence of current license agreements and in-house experience with its use as a development tool). X-Designer also offers the advantages of enabling GUI design and implementation to progress in a consistent manner by maintaining the design's "look and feel", maintaining the independence of lower level code, and streamlining individual programming styles. Primary issues that are being addressed during this transition to a web-based system include design modifications associated with using X-Designer for Java source code generation, and MMC enhancements for web use.

4. Acknowledgements. The Naval Air Systems Command funds this work in support of their AV-8B and F/A-18 aircraft programs.

REFERENCES

- [1] L.C. Lohrenz, et.al., AV-8B Map System II: Moving Map Composer (MMC) Version 3.3, Software User's Manual, 2nd Edition, NRL/FR/7440-00-9938, June 30,2000.
- [2] M. L. Gendron, P. B. Wischow, M.E. Trenchard, M.C. Lohrenz, L.M. Riedlinger, and M.J. Mehaffey, *Moving Map Composer*, Naval Research Laboratory, Patent Pending, Case No. 76,358,1-29, 1997.
- [3] *X-Designer User's Guide*, Imperial Software Technology Limited, December 1999.
- [4] M. L. Gendron, S. S. Edwards, S.A.Myrick, M. Lohrenz, and M.E. Trenchard *The Design and Development of an Internet-based Graphical User Interface Using a Commercial Design Tool in Java*, Publication pending in the Proceedings of the Southern Conference on, Computing Hattiesburg, Mississippi, October 26-28, 2000.

PUBLICATION OR PRESENTATION RELEASE REQUEST

SSC-137-00

NRLINST 5600.2

1. REFERENCES AND ENCLOSURES	2. TYPE OF PUBLICATION OR PRESENTATION	3. ADMINISTRATIVE INFORMATION
Ref: (a) NRL Instruction 5600.2 (b) NRL Instruction 5510.40D Encl: (1) Two copies of subject paper (or abstract)	<input type="checkbox"/> Abstract only, published <input type="checkbox"/> Abstract only, not published <input type="checkbox"/> Book <input type="checkbox"/> Book Chapter <input type="checkbox"/> Conference Proceedings (refereed) <input checked="" type="checkbox"/> Conference Proceedings (not refereed) <input type="checkbox"/> Invited speaker <input type="checkbox"/> Multimedia report <input type="checkbox"/> Journal article (refereed) <input type="checkbox"/> Journal article (not refereed) <input type="checkbox"/> Oral Presentation, published <input type="checkbox"/> Oral Presentation, not published <input type="checkbox"/> Other, explain	STRN <u>NRLPP/7440-00-1010</u> Route Sheet No. _____ Job Order No. _____ Classification <u>X</u> U _____ C _____ Sponsor <u>NAVAIR</u> approval obtained _____ yes _____ no

4. AUTHOR

Title of Paper or Presentation
THE DESIGN AN DEVELOPMENT OF AN INTERNET-BASED GRAPHICAL USER INTERFACE USING A COMMERCIAL DESIGN TOOL AND JAVA.

Author(s) Name(s) (First, Mi, Last), Code, Affiliation if not NRL
STEPHANIE A. MYRICK, (Code 7440.1), MARLIN L. GENDRON (Code 7440.1), MAURA C. LOHRENZ (Code 7440.1) and STEPHANIE S. EDWARDS (Code 7440.1)

It is intended to offer this paper to the SOUTHERN CONFERENCE ON COMPUTING
 (Name of Conference)

THE UNIVERSITY OF SOUTHERN MISSISSIPPI, OCTOBER 26-28, 2000, HATTIESBURG, MISSISSIPPI
 (Date, Place and Classification of Conference)

and/or for publication in _____
 (Name and Classification of Publication) (Name of Publisher)

After presentation or publication, pertinent publication/presentation data will be entered in the publications data base, in accordance with reference (a).

It is the opinion of the author that the subject paper (is _____) (is not X) classified, in accordance with reference (b). This paper does not violate any disclosure of trade secrets or suggestions of outside individuals or concerns which have been communicated to the Laboratory in confidence. This paper (does _____) (does not X) contain any militarily critical technology. This subject paper (has _____) (has never X) been incorporated in an official NRL Report.

STEPHANIE A. MYRICK, NRL Code 7440.1
 Name and Code (Principal Author) *Stephanie A. Myrick*
 (Signature)

5. ROUTING/APPROVAL

CODE	SIGNATURE	DATE	COMMENTS
Author(s) Myrick	<i>Stephanie A. Myrick</i>	10-26-00	
Section Head Lohrenz			
Branch Head Harris	<i>White/Harris</i>	10/26/00	
Division Head Acting 7400 Valent Eppert	<i>Philip J. Valent</i>	10/26/00	1. Release of this paper is approved. 2. To the best knowledge of this Division, the subject matter of this paper has (has never <u>X</u>) been classified.
Security, Code 1022X 7031	<i>David K. Conroy</i>	10/31/00	1. Paper or abstract was released. 2. A copy is filed in this office. SSC137-00
Office of Counsel, Code 30222 1008.2	<i>David J. Conroy</i>	11/17/00	
ADOR/Director NCST			
Public Affairs (Unclassified/ Unlimited Only), Code 1230 7030.4	<i>Betty Robinson</i>	11/1/00	add PE# to ack 10/20
Division, Code			
Author, Code 7440.1			

6. DISTRIBUTION STATEMENTS (Author to check appropriate statement and fill in reason as required)

A - Approved for public release, distribution is unlimited.

B - Distribution authorized to U.S. Government agencies only (check reason below):

- | | | |
|---|--|--|
| <input type="checkbox"/> Foreign Government Information | <input type="checkbox"/> Contractor Performance Evaluation | <input type="checkbox"/> Critical Technology |
| <input type="checkbox"/> Proprietary Information | <input type="checkbox"/> Administrative/Operational Use | <input type="checkbox"/> Premature Dissemination |
| <input type="checkbox"/> Test and Evaluation | <input type="checkbox"/> Software Documentation | <input type="checkbox"/> Cite "Specific Authority" _____ |

Date statement applied _____

(Identification of valid)

Other requests for this document shall be referred to _____
(Insert Controlling DOD)

C - Distribution authorized to U.S. Government agencies and their contractors (check reason below):

- | | | |
|---|---|--|
| <input type="checkbox"/> Foreign Government Information | <input type="checkbox"/> Software Documentation | <input type="checkbox"/> Cite "Specific Authority" _____ |
| <input type="checkbox"/> Administrative/Operational Use | <input type="checkbox"/> Critical Technology | |

Date statement applied _____

(Identification of valid)

Other requests for this document shall be referred to _____
(Insert Controlling DOD)

D - Distribution authorized to DOD and DOD contractors only (check reason below):

- | | | |
|---|---|--|
| <input type="checkbox"/> Foreign Government Information | <input type="checkbox"/> Critical Technology | <input type="checkbox"/> Cite "Specific Authority" _____ |
| <input type="checkbox"/> Software Documentation | <input type="checkbox"/> Administrative/Operational Use | |

Date statement applied _____

(Identification of valid)

Other requests for this document shall be referred to _____
(Insert Controlling DOD)

E - Distribution authorized to DOD components only (check reason below):

- | | | | |
|---|--|--|--|
| <input type="checkbox"/> Proprietary Information | <input type="checkbox"/> Premature Dissemination | <input type="checkbox"/> Critical Technology | <input type="checkbox"/> Direct Military Support |
| <input type="checkbox"/> Foreign Government Information | <input type="checkbox"/> Software Documentation | <input type="checkbox"/> Test and Evaluation | <input type="checkbox"/> Cite "Specific Authority" _____ |
| <input type="checkbox"/> Administrative/Operational Use | <input type="checkbox"/> Contractor Performance Evaluation | | |

Date statement applied _____

(Identification of valid)

Other requests for this document shall be referred to _____
(Insert Controlling DOD)

F - Further dissemination only as directed by _____
(Insert Controlling DOD)

Date statement applied _____ or higher DOD authority _____

X - Distribution authorized to U.S. Government agencies and private individuals or enterprises eligible to obtain export-controlled technical data in accordance with regulations implementing 10 U.S.C. 140c.

Date statement applied _____

Other requests for this document shall be referred to _____
(Insert Controlling DOD)

*For NRL publications, this is usually the Commanding Officer, Naval Research Laboratory, Washington, DC 20375-5320

7. OTHER LIMITATION

- Classification only NOFORN DTIC exempt (explain) _____

@ 31 Dec 00
Classification Review
(Initial/Date)

Substantive changes made in this document after approval by Classification Review and Public Release invalidate these reviews. Therefore, if any substantive changes are made by the author, Technical Information, or anyone else, the document must be returned for another Classification Review and Public Release.

8. INSTRUCTIONS

Author completes and submits this form with the manuscript via line channels to the division head for review and approval according to the routing in section 4.

- NRL Reports.....Submit the diskette (if available), manuscript, typed double-spaced, complete with tables, illustrations, references, draft SF 298, and proposed distribution list.
- NRL Memorandum Reports.....Submit a copy of the original, typed manuscript complete with tables, illustrations, references, draft SF 298, and proposed distribution list.
- NRL Publications or other books, brochures, pamphlets,.....Handled on a per case basis by Site Technical Information Office. proceedings, or any other printed publications.