Experimental Internet Environment
Software Development
(5-34474)

Final Technical Report for Period
14 June 1996 through 31 March 1997
September 1998

Prepared by:
Gary A. Maddux
Research Institute
The University of Alabama in Huntsville
Huntsville, Alabama 35899

Prepared for:
Marshall Space Flight Center
Huntsville, AL 35898
**REPORT DOCUMENTATION PAGE**

<table>
<thead>
<tr>
<th>1a. REPORT SECURITY CLASSIFICATION</th>
<th>15. RESTRICTIVE MARKINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unclassified</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2a. SECURITY CLASSIFICATION AUTHORITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>UAH Research Institute</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2b. DECLASSIFICATION DOWNGRADING SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. DISTRIBUTION/AVAILABILITY OF REPORT</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. PERFORMING ORGANIZATION REPORT NUMBER(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSFC, AL 35899</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. MONITORING ORGANIZATION REPORT NUMBER(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6a. NAME OF PERFORMING ORGANIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>UAH Research Institute</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6b. OFFICE SYMBOL (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA / MSFC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7a. NAME OF MONITORING ORGANIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7b. ADDRESS (City, State and ZIP Code)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huntsville, AL 35899</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8a. NAME OF FUNDING/SPONSORING ORGANIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA / MSFC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8b. OFFICE SYMBOL (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA / MSFC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSFC, AL 35899</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>10. SOURCE OF FUNDING NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Element No.</td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**11. TITLE (Include Security Classification)**

**EXPERIMENTAL INTERNET ENVIRONMENT SOFTWARE DEVELOPMENT**

**12. PERSONAL AUTHORS**

**13a. TYPE OF REPORT**

FINAL

**13b. TIME COVERED**

14 JUN 96 - 31 MAR 97

**14. DATE OF REPORT**

01 SEP 97

**15. PAGE COUNT**

2

**16. SUPPLEMENTARY NOTATION**

**17. COSATI CODES**

FIELD | GROUP | SUBGROUP |
------|-------|----------|

**18. SUBJECT TERMS**

VIRTUAL RESEARCH CENTER

INTERNET

**19. ABSTRACT**

This report documents efforts performed under contract NAS8-38609 Delivery Order 169.

**20. DISTRIBUTION/AVAILABILITY OF ABSTRACT**

UNCLASSIFIED/UNLIMITED

**21. ABSTRACT SECURITY CLASSIFICATION**

C

**22a. NAME OF RESPONSIBLE INDIVIDUAL**

R. Newby

**22b. TELEPHONE** (Include Area Code)

514-544-3855

DD Form 1473, JUN 86

Previous editions are obsolete.
3.0 Activities

The activities undertaken during this task emphasized moving the VRC from technical feasibility to a working resource by which NASA scientists and engineers could use the WWW to collaborate on specific experiments. In order to meet this objective, successful completion of the subtasks listed in the statement of work was required.

As a member of the VRC team, UAH was able to satisfactorily address all three requirements. A data archiving system was completed that allowed experiment collaborators to check documentation in and out as required. By building this shared library, scientists and engineers now have the ability to work in a more collaborative environment, a requirement of the complex science typified by NASA researchers.

The further development of the graphical user interface (GUI) and Internet security was addressed by the UAH team. The principal GUI for the VRC was enhanced to provide a more user friendly and intuitive approach to the VRC participant. The security issues, including encryption and password authentication, were a substantial effort within this task.

All software and documentation for the VRC task have been delivered under separate cover.

4.0 Conclusion and Recommendations

During the period allocated by the delivery order, members of the UAH Research Institute Systems Management and Production Lab, with the cooperation of representatives from NASA, designed, developed and implemented enhancements to the VRC. These enhancements addressed the archival, graphical interface and security subsystems of the VRC. Upon completion of these features, a number of NASA experiments were included within the VRC, and access was granted to those scientists and engineers who were developing those experiments.

It is recommended that the VRC continue to be developed and enhanced. With a system based on the Internet technology, it is imperative that the system be continually maintained and updated. As the Internet evolves to provide the world with more and more functionality, the VRC can provide ever-greater service to the NASA scientific community.
PREFACE

This technical report was prepared by the staff of the Research Institute, The University of Alabama in Huntsville. The purpose of this report is to provide documentation of the work performed and results obtained under Delivery Order 169 of NASA Contract No. NAS8-38609. Mr. Keith Crowe and Mr. Gary Maddux were the principal investigators. Ms. Jennifer Demirjian provided technical support.

The views, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as an official NASA position, policy, or decision unless so designated by other official documentation.

Except as provided by the Contract Data Requirements List DD Form 1423, hereof, the distribution of any contract report in any state of development or completion is prohibited without the approval of the Contracting Officer.

Prepared for: Marshall Space Flight Center
Huntsville, AL 35898

I have reviewed this report, dated 12 Sept 98, and the report contains no classified information.

[Signature]
Principal Investigator
TABLE OF CONTENTS

1.0 INTRODUCTION................................................................. 1
2.0 STATEMENT OF WORK ............................................... 1
3.0 ACTIVITIES ............................................................... 2
4.0 CONCLUSIONS AND RECOMMENDATIONS ............... 2
1.0 Introduction

Geographically distributed project teams need an Internet based collaborative work environment or "Intranet." The Virtual Research Center (VRC) is an experimental Intranet server that combines several services such as desktop conferencing, file archives, on-line publishing, and security. Using the World Wide Web (WWW) as a shared space paradigm, the Graphical User Interface (GUI) presents users with images of a lunar colony. Each project has a wing of the colony and each wing has a conference room, library, laboratory, and mail station.

In FY95, the VRC development team proved the feasibility of this shared space concept by building a prototype using a Netscape commerce server and several public domain programs. Successful demonstrations of the prototype resulted in approval for a second phase. Phase 2, documented by this report, will produce a seamlessly integrated environment by introducing new technologies such as Java and Adobe Web Links to replace less efficient interface software.

2.0 Statement of Work

The statement of work, as outlined in delivery order 169, was as follows:

UAH shall perform the following specific activities:

Experimental Internet Based Multi-Media Archive. Geographically distributed teams require tools for archiving project related documentation and media. This archive tool provides a graphical user interface for checking documents into and out of a remote file server. Presently, a prototype archiving system exists but the process for checking in and out documentation is only partially automated. In addition to on-line text documents, this archiving system shall provide links to a variety of audio and visual material.

Experimental WWW User Interface. This task will apply HTML, Java, and Adobe Acrobat Web Links and develop an experimental GUI. The GUI will provide geographically distributed design teams access to a variety of collaborative computing utilities, multi-media presentations, and operating system scripts. Objectives of this experiment include comparing different techniques and technologies for client/server multi-application integration.

Application of Encryption Technology in an Internet Testbed. Security is a major concern of teams comprising representatives from industry. This experiment will apply encryption technology to an Internet based collaborative work environment. UAH shall install an encryption system and develop a multi-level approach to security in an Internet based collaborative computing environment.


*************** ARTICLES ***************


Research Administration
REPORT FORM

1. Author(s): Gary A. Maddux
2. Principal Investigator: Gary A. Maddux
3. Report Title: Experimental Internet Environment Software Development
4. Contract Title: Experimental Internet Environment Software Development
5. Agency (Name, Address, Contact): NASA, MSFC
6. Agency Contract Number: NAS8-38609, Delivery Order 169
7. Date of Report: September 1998
8. School/Organization: Research Institute
9. Department Report Number:
10. Subject Area;
a. Virtual research center
b. Internet
c. 1.
   2.
   3.
11. May this report be released to the public? YES
    YES NO
    Comments:
### DISTRIBUTION/AVAILABILITY SUMMARY

<table>
<thead>
<tr>
<th>Distribution Code</th>
<th>Distribution Statement</th>
<th>Distribution Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Approved for public release; distribution is unlimited</td>
<td>N/A</td>
</tr>
<tr>
<td>B</td>
<td>Distribution limited to US Government agencies only; Reason; Date; Other requests must be referred to (Controlling Office)</td>
<td>Foreign Info, Proprietary Info, Test and Evaluation, Contractor Performance Evaluation, Export Limitations, Administrative/Operational Use, Software Documentation, Specific Authority</td>
</tr>
<tr>
<td>C</td>
<td>Distribution limited to US Government agencies and their contractors; (Reason; Date); Other requests must be referred to (Controlling Office)</td>
<td>Critical Technology, Administrative/Operational Use, Specific Authority</td>
</tr>
<tr>
<td>D</td>
<td>Distribution limited to DoD and DoD contractors only; Reason; Date; Other requests must be referred to (Controlling Office)</td>
<td>Premature Dissemination, Software Documentation, Critical Technology, Specific Authority</td>
</tr>
<tr>
<td>E</td>
<td>Distribution limited to DoD only; Reason; Date; Other requests must be referred to (Controlling Office)</td>
<td>Software Documentation, Foreign Info, Premature Dissemination, Critical Technology, Specific Authority</td>
</tr>
<tr>
<td>F</td>
<td>Distribution; Further dissemination only as directed by (Controlling DoD office and date) or higher DoD authority</td>
<td>N/A</td>
</tr>
</tbody>
</table>

1 This statement may be used only on unclassified documents that have been cleared for public release by competent authority in accordance with DoD 5230.9.

2 In addition to the distribution statement, the following notices may be used on all documents assigned Distribution Statement B, C, D, E, or F.

**Warning**

INFORMATION SUBJECT TO EXPORT CONTROL LAWS

This document may contain information subject to the International Traffic in Arms Regulation (ITAR) or the Export Administration Regulation (EAR) of 1979 which may not be exported, released, or disclosed to foreign nationals inside or outside the United States without first obtaining an export license. A violation of the ITAR or EAR may be subject to a penalty of up to 10 years imprisonment and a fine of $100,000 under 22 U.S.C. 2778 or Section 2410 of the Export Administration Act of 1979. Include this notice with any reproduced portion of this document.

**DESTRUCTION NOTICE**

For classified documents, follow the procedures in DoD 5200.1-R, Chapter IX, or DoD 5220.22-M, "Industrial Security Manual," paragraph 19. For unclassified documents, destroy by any method which precludes reconstruction of this document.
REQUEST FOR TECHNICAL PUBLICATIONS SERVICES

PART I

Title of Document: EXPERIMENTAL INTERNET ENVIRONMENT SOFTWARE

Author(s)/POC: GARY MADDUX

Phone: 876-0828

Type of Document (check):
- Technical Report ( )
- Special Report ( )
- Management Brief ( )
- Other ( )

Security Classification: Unclassified

DA Project No.

AMCMS Code No.

Distribution Code (See reverse side for definition of codes):
- A ( )
- B ( )
- C ( )
- D ( )
- E ( )
- F ( )

This manuscript can ( ) or cannot ( ) be contracted for editing and final preparation. If cannot, give reason: ________________________________

The contents of this draft manuscript have been reviewed and approved for technical accuracy and security classification. If classified, the security classification markings on the manuscript accurately reflect the classification of the information contained herein, as specified in: ________________________________

Remarks: ________________________________

Director/Chief: ____________________________

Date: ____________________________

Organization: ______________________________

PART II

To be completed when document is returned to originator for final review:

Report No. ____________________________ Date of Report ____________________________

The reproducible manuscript is approved for printing and distributing:

Director/Chief: ____________________________

Date: ____________________________

AMCSM-AD FORM 192 JAN 86 REPLACES DLEM-8 FORM 192 WHICH MAY BE USED