



COMMANDER,
NAVAL METEOROLOGY AND OCEANOGRAPHY COMMAND (CNMOC)
NAVAL OCEANOGRAPHIC OFFICE
(NAVOCEANO)

And

OPEN SOURCE SOFTWARE INSTITUTE

**COOPERATIVE RESEARCH
AND DEVELOPMENT AGREEMENT
(NCRADA -01-008)**

EXECUTIVE SUMMARY

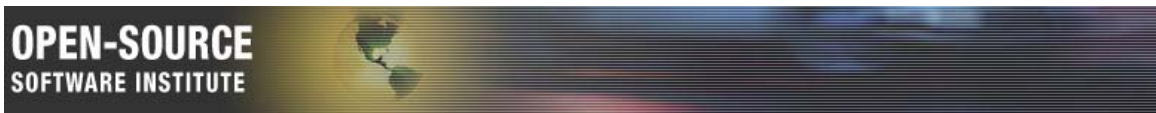
AUGUST 13, 2003

OSSI Technical Team Lead by:

[Olliance Consulting Group](#)

OSSI Project Sponsors:





NCRADA-01-008
Executive Summary
Public release

**Naval Oceanographic Office
and
Open Source Software Institute, Inc.
Cooperative Research and Development Agreement
(NCRADA -01-008)**

EXECUTIVE SUMMARY

August 13, 2003

Introduction

Open-source software has achieved widespread use in both industry and government, and its use is expected to continue to grow. This summary of a study of open-source software use and potential in the U.S. Navy shows why.

Background

The [U.S. Naval Oceanographic Office](#) (NAVOCEANO, hereafter NAVO) possesses leading-edge technical and science skills for the application of Information Technology (IT) to the processing of oceanographic data over multiple scientific domains. NAVO produces numerous information products supporting U.S. Navy operations, the Department of Defense, and various national and international customers. These NAVO capabilities are critical to developing and maintaining the highest quality oceanographic products for the Navy fleet. In addition, NAVO maintains an extensive library of state-of-the-art scientific application software.

Recently, NAVO collaborated with the [Open Source Software Institute](#) (OSSSI) to assess the existing and potential future use of open-source software within NAVO. The Open Source Software Institute (www.oss-institute.org) is a non-profit organization that promotes the development and implementation of Open Source software solutions within government and academia.

The Commander, Naval Meteorology and Oceanography Command (COMNAVMETOCOM, hereafter CNMOC) and OSSSI executed a Cooperative Research And Development Agreement (NCRADA-01-008) to perform this study. The goal of this CRADA was to assess the current use of open-source software at NAVO and to identify additional opportunities for further implementation of open-source software within NAVO's computing environment. Open-source software is characterized by the availability of user-readable and modifiable computer source code. A number of open-source software licenses exist in a continuum of legal rights and obligations ranging from the Berkeley Software Distribution (BSD) license, which permits, but does not

require, providing source code, to the General Public License (GPL), which mandates source code availability for all users.

NAVO

NAVO is headquartered at NASA’s Stennis Space Center in Mississippi. It has several field offices in the U.S. and overseas and operates a fleet of six oceanographic survey ships. NAVO employs about one thousand Navy personnel, civilian Navy employees, and contractors. NAVO’s information technology infrastructure includes both classified and unclassified networks as well as a variety of processing platforms from desktop workstations to supercomputers.

In general, all NAVO divisions operate similarly. Data is collected from the field (e.g., remote sensor, ship, satellite, etc.), processed for quality assurance and normalization, archived, processed for deliverable production, and finally a report or other output is generated to present the data. This general processing flow is illustrated in Fig. 1 below.

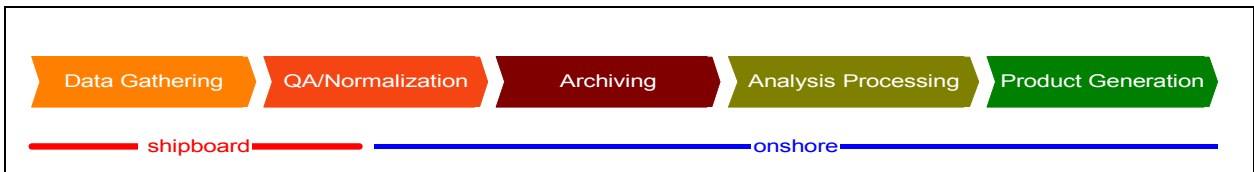


Fig. 1 – NAVO processing flow

The deployed legacy Integrated Survey System (ISS60) shipboard data collection platform runs on PA-RISC systems operating under HPUX. These systems are currently being transitioned to industry standard x86 platforms running Linux. An independent shipboard system, Unified SONAR Image Processing System (UNISIPS), is also currently being migrated from SGI IRIX workstations to x86 notebook systems running this in-house application as ported to Linux.

Onshore data processing systems use a wide range of hardware platforms, from desktop x86 PCs and various Unix workstations through midrange servers from Sun, HP, and SGI up to Cray and IBM supercomputers in one-of-four DoD Major Shared Resource Center (MSRC) located at NAVO headquarters. Extensive data storage facilities support archival and processing of large scientific data sets within NAVO.

Findings and Recommendations

There is already extensive use of open-source within NAVO’s existing computing infrastructure. Open-source was initially adopted on a limited basis without a formal policy directive or strategy for implementing open-source. This assessment identified key successes in the ISS60, UNISIPS, Network Attached Storage Servers and QA/Monitoring

workstation migrations to open-source, as well as key lessons of these deployments in migration, training, reliability, security, and financial areas.

Open-source is used in several mission critical areas, most notably as the principal shipboard data-gathering platform, as combined data storage and computational systems, and as a generic acoustic imaging platform. The costs, financial metrics, and net savings projected for two of the open-source platforms selected as case studies are:

Existing Open Source	Cost	IRR	ROI	Net Savings
ISS60 Systems	\$40,678	900%	833%	\$338,797
UNISIPS Systems	\$119,322	749%	721%	\$860,096
Totals	\$160,000	787%	749%	\$1,198,893

The net savings are in hard dollars. Financial returns (IRR and ROI) were calculated on an immediate one-year basis using the U.S. Treasury 5-year real discount rate of 1.9%.

Software costs were excluded. These financial metrics would have been higher if they had been factored in. On the other hand, this evaluation did not include labor costs of software porting, since contract labor costs were invariant.

Additionally, as legacy systems reach end-of-life, they are increasingly being replaced with open-source solutions. This trend, coupled with growing interest and enthusiasm for open-source in most departments, along with open-source's increasing maturity and suitability in enterprise environments, indicate it is likely that substantial portions of NAVO's computing infrastructure will use open-source operating systems and applications in the future. The study team worked with NAVO to identify future open-source opportunities, based on the following considerations:

1. Current Platform - What proprietary systems hardware, operating system, and applications software?
2. Value Contribution - What mission value does this particular process add? How does it add value?
3. Application Suitability - Is the application UNIX based? Is the source code of the application available?
4. Potential ROI - Does the process reside on a high-cost platform? Are expensive upgrades anticipated?
5. Enabling Factors - Are the users familiar with open-source platforms?
6. Additional Benefits - Do standard hardware and open-source software have other advantages or benefits?
7. Policy Barriers - Are there any "showstopper" policy or security requirements that apply to the system?

This study identified three potential open-source insertion points within NAVO’s onshore processing infrastructure. The additional areas where expanded use of open source is thought appropriate to replace proprietary platforms are:

- Data Warehouse Systems – Sun E450/E3000 servers and x86 GUI servers
- Web Server Systems – Sun E220R servers and Sun A1000 disk arrays
- Satellite Data Systems – SGI Origin 2000 servers and Sun workstations of various configuration.

The results of this study recommend that migrating some or all of these legacy Unix platforms to open source will enable NAVO to realize significant cost savings and other benefits. Under conservative assumptions and based upon larger configurations than the existing, over-utilized legacy systems, the projected costs, financial metrics, and net savings of the recommended additional uses of open-source are:

Additional Open Source	Cost	IRR	ROI	Net Savings
Data Warehouse Systems	\$72,589	446%	391%	\$284,129
Web Server Systems	\$58,305	156%	173%	\$100,636
Satellite Data Systems	\$145,521	253%	251%	\$365,323
Totals	\$276,415	272%	271%	\$750,089

Estimated net savings are in hard dollars. Projected financial returns (IRR and ROI) were calculated over a 5-year basis using the U.S. Treasury 5-year real discount rate of 1.9%.

Migration and deployment strategies were addressed, as well as organizational challenges that are unique to NAVO. This study also identified other opportunities enabled by open source that the CIO might wish to address separately, including:

- Centralization of onshore processing to open-source platforms closely coupled to data storage platforms
- Adoption of open-source development methods and tools to improve in-house development effectiveness
- The “open sourcing” of in-house developed applications to build a greater community of users and thereby gain the benefits of broader developer participation and access to otherwise unavailable external expertise.

Summary

This study outlined the following key lessons from the current deployments of open-source software within NAVO:

Migration

NAVO's experience in porting shipboard applications has proven that migration from proprietary to Linux-based platforms can provide significant financial and technical benefits.

Deployment

The procedures already developed and tested for migration of shipboard applications to Linux-based platforms are readily adaptable to the deployment of onshore applications to open-source environments on a variety of platforms.

Support & Maintenance

A base of open-source software support and maintenance skills has been developed within NAVO that should be easily transferable to additional technical staff through instruction and expert assistance.

Training

It is common for experienced technical staff to quickly make the transition from working with proprietary Unix systems to working with Linux. NAVO's training protocol already includes open-source software training options. Industry-recognized IT certification programs are also available for a number of open-source operating systems, including Linux. Linux vendors' certification programs and vendor-neutral certifications such as [Linux Professional Institute](#) programs can be administered either at existing NAVO training facilities or at established facilities off base.

Reliability

The Linux distributions NAVO has installed have well-deserved reputations for reliability, as NAVO's experience has confirmed. NAVO is confident to stay a release level behind the latest production version to maintain reliability.

Security

For NAVO's environment and needs, this study found that Linux was equally as secure as most legacy Unix systems, and capable of being more highly secured than the competing operating system environments, particularly those for desktop workstations.

Financial

NAVO has found that an industry standard hardware platform running open-source software can be acquired for approximately the annual maintenance cost of a comparable proprietary Unix platform. We anticipate that NAVO can realize similar order of magnitude cost savings on larger open-source platforms compared to legacy platforms.

Conclusion

The key challenges for the CIO's office going forward will be to place open-source opportunities in a broad, cohesive IT strategy that leverages the advantages of open source within NAVO, and to oversee rolling transitions to open-source software and development methods in an orderly, well coordinated manner.