National Oceanic and Atmospheric Administration
NOS
Nautical Charting System
6501
Operational Analysis
2006

Table of Contents

Executive Summary

The Nautical Charting System, managed by the NOAA Office of Coast Survey, underpins production and distribution of NOAA's nautical charts. The Nautical Charting system currently maintains two production lines to deliver raster/paper nautical charts and ENCs. Data is ingested into the pipeline through one process and then the processing bifurcates to traditional chart production—generation of raster and lithographic charts—and ENC production. The data contained within the nautical charts, in both electronic and paper form, are the basis for safe, efficient and environmentally sound navigation in U.S. waters. This operational analysis (OA) is an annual, in-depth review of the program's performance based on the following:

- Customer Results
- Strategic and Business Results
- Financial Performance
- Innovation

This report focuses on the operational state of the program as of December 31, 2006, and is based on guidance developed by the Department of Commerce. The Nautical Charting System directly facilitates NOAA's Strategic Goal to "Support the nation's commerce with information for safe, efficient, and environmentally sound transportation." The current program meets established cost, schedule and performance parameters.

2006 Achievements:

New Charted Shipping Routes to Contribute to Right Whale Safety
NOS began charting new recommended East Coast ship traffic routes for the Florida ports of Jacksonville and Fernandina, and Brunswick, Ga., as well as in Cape Cod Bay off Massachusetts. These new routes are expected to reduce the chances of ship strikes with endangered right whales. The recommended routes take into account safety and economic impact to the mariner. Although the routes are voluntary, they have been incorporated into the Raster Nautical Charts and the Print on Demand chart product. The new designations will help mariners decrease whale strikes by reducing vessel activity in areas frequented by ships and whales. The integration of these recommended routes to our suite of chart products helps protect the nation's living marine resources, in addition to providing up-to-date navigation information vital to the economy.

New Chart Critical to Maritime Commerce Created
NOS Nautical Charting Program published a new chart for the Calcasieu Ship Channel and Port of Lake Charles, LA, in support of maritime commerce and the growing liquid natural gas (LNG) industry. The Port of Lake Charles is the 12th largest port in the nation, and the new NOAA chart will be valuable for the growth of the Port and increased safety in the Calcasieu Ship Channel. The area contains several LNG facilities, and is experiencing rapid growth with increased use of the waterway and port facilities each year. Ports like Lake Charles are extremely important to the United States' economy because of the role they play in facilitating waterborne commerce which contributes more that $742 billions to the United States gross domestic product. U.S. Department of Commerce Deputy Secretary David A. Sampson joined the official chart presentation to the Port of Lake Charles in October 2006.

NOAA Raster Navigational Charts Made Available for Free Download
In November 2005, NOAA began offering its Raster Navigational Charts (RNC) available for free download from the official web site at http://nauticalcharts.noaa.gov. The files offered are geo-referenced, full-color images of NOAA's paper nautical charts, published and updated by NOAA in the internationally accepted BSB format. The RNCs have become an important and successful contributor to safe and efficient marine transportation. They have been incorporated into international standards for electronic chart systems, and have been accepted as meeting U.S. federal chart carriage regulations for a certain class of vessels. The response to the "free on the Internet" policy has been overwhelmingly positive-- within the first year over 2.6 million NOAA RNCs were downloaded from the new site. In the future, NOAA plans to provide the raster charts on the Web site in an easy-to-view GeoTIFF format for non-navigational purposes, such as port security and management, marine boundary delineation, environmental assessment, spill response, and coastal zone management.

1.0 Customer Results

The Nautical Charting Program is meeting customer needs by providing information for safe, efficient and environmentally sound marine transportation for our Nation's commerce via our nautical charts and related products. Up to date, accurate, and internationally standardized navigational products are provided to our customer by a wide variety of means. The value of this program in terms of reduced shipping costs, avoided environmental disasters and lives saved mandates a continued need for this investment. Figure 1 describes the logic model employed by the program to determine its outputs and outcomes. The program provides all required outputs and continues to reach the required customer focused outcomes.

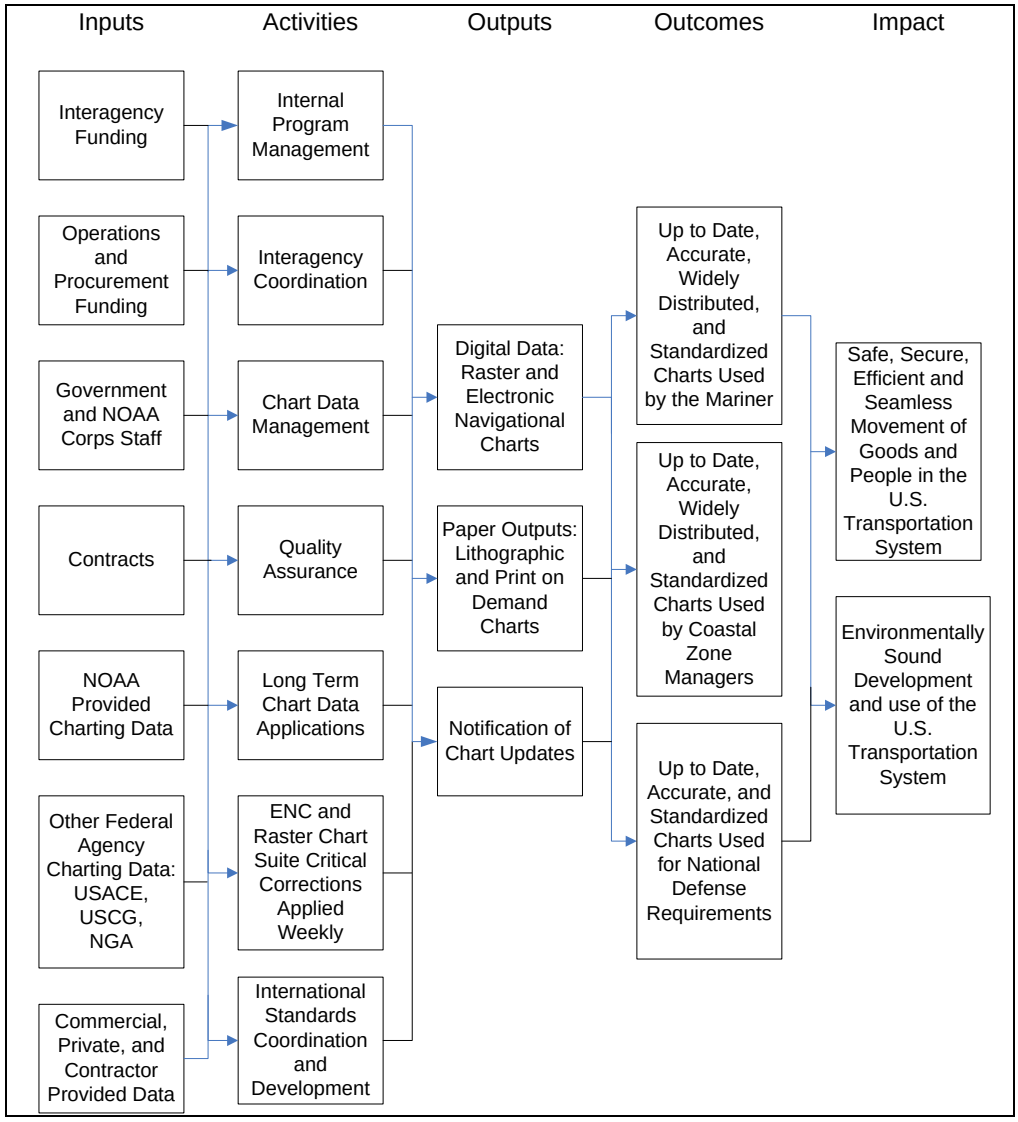

Figure 1: Nautical Charting Program Logic Model

1.1 Customer Requirements and Costs

The products generated by the Nautical Charting Program serve commercial and recreational mariners, other NOAA programs and government agencies such as US Coast Guard, US Navy, National Geospatial Intelligence Agency and many other non-governmental organizations such as

American Pilots Association and US Power Squadron. Ultimately, the American consumer is the beneficiary, as safe maritime transportation keeps costs low by moving over two thirds of all consumer goods purchased in the United States.

Coastal resource managers, the scientific community, emergency planners and environmental protection authorities also have a stake in ensuring the U.S. waterways can be safely navigated without causing environmental damage. Americans benefit by having environmentally sound development of the nation's coasts.

Customers participate in funding decisions through their elected representatives through the annual appropriations process. Further, NOAA does the following to solicit customer requirements and input:

- Supports an organization of 14 Regional Navigation Managers whose function is to solicit such input.
- Prepares and distributes for comment charting plans which are used to prioritize the work
- Is guided by a Federal Advisory Committee Act (FACA) called the hydrographic services review panel to provide direct guidance to the administrator.
- Monitors the uptake of the products and reacts to changes
- Conducts annual OMB-approved customer satisfaction surveys

Customers also provide feedback and new requirements using a web accessible chart inquiry and discrepancy reporting system. The program has also long maintained relationships with trade and user organizations, such as the United States Power Squadron, American Association of Port Authorities, and American Pilots Association, in order to keep abreast of user needs.

In terms of costs, NOAA provides hardcopy nautical chart and Coast Pilot products through chart agents at costs determined by 44 USC 1307, which specifies recovering costs of printing, distribution and database management. NOAA's electronic products – the raster nautical chart, the vector Electronic Navigational Chart, the web-based Coast Pilot – are available for free on the Internet. There is no direct charge to the customer for downloadable products.

1.2 Performance Measures

The long-established measures used to assess the program's performance at the NOAA level include "Number of Raster Charts Produced Annually," and "Number of Electronic Navigational Charts (ENC) Built and Maintained." The program internally tracks the free Internet downloads of raster and ENC vector charts, as well as Coast Pilot downloads, the number of Print on Demand Charts requested, and the number of booklet charts printed. The program also measures employee performance based on indicators such as amount of source data applied, responsiveness to customer queries and services accessibility.

Customer satisfaction surveys are performed every 1.5 years by the program. The surveys cover a broad range of topics and relate to several services provided by the NOAA Office of Coast Survey.

These measures align with the "Customer Results Measurement Area" of the Performance Reference Model developed by the Federal Enterprise Architecture Program Management Office (FEA-PMO). Table 1 summarizes the performance measures.

Table 1: Customer Results Performance Measures

Measurement Indicators	Indicator	2005 Baseline	2006 Actual Result	Comments
Timeliness and Responsiveness	Average Time to Respond to Help Desk Inquiries	1.7 Days	2.1 Days	FY 2005 1062 Requests FY 2006 1323 Requests
Service Accessibility	Number of ENC's Downloaded (Base Cells, Reissues and Updates)	12,241,938	44,370,504	Freely available product from http://nauticalcharts.noaa.gov
Service Accessibility	Number of RNC Downloads	n/a	2,315,743	Freely available product from http://nauticalcharts.noaa.gov
Service Accessibility	Print on Demand Sales	85200	104321	For FY2006
Service Accessibility	Lithographic Chart Sales	201762	201631	For FY2006 – both conventional and small craft

2.0 Strategic and Business Results

The Nautical Charting program is meeting its own goals and objectives as well as those of the agency. Program management and controls are in place to ensure the program continues to meet its goals and objectives and monitor how well the Nautical Charting System program performs.

2.1 Nautical Charting Program Helps to Achieve Strategic Goals

Nautical charting for safe navigation and homeland security is NOAA's oldest mission, with a clear legislative mandate for performing the function. The Office of Coast Survey has delivered this service since 1807, when our nation determined that its maritime and economic security depended upon safe movement of its ships. Today nautical charts bring the added benefits of promoting the efficient transport of goods to market, environmental security and homeland security. Maritime commerce enables the United States to be a leader in the global marketplace. But it is incidents like the Exxon Valdez, the New Carissa grounding, the 2004 Athos I strike of a submerged object in a navigation channel, and the disarray left behind in Gulf waterways by the 2005 hurricanes that demonstrate critical vulnerabilities in our Marine Transportation System. Accurate, timely, updated nautical charts are the primary defense against harm to life, property, and the environment.

NOAA is required to chart the 3.4 million square nautical miles of the U.S. Exclusive Economic Zone (EEZ) are clearly stated in the Coast and Geodetic Survey Act of 1947, which authorizes hydrographic and topographic survey activities "to provide charts and related information for the safe navigation of marine… commerce." The Hydrographic Services Improvement Acts (HSIA) of 1998/2002 reiterate this responsibility. HSIA 2002 also codifies NOAA's Homeland Security-enhancing activities with respect to electronic charts and other navigation services; the U.S. Navy and Coast Guard look to NOAA for its expertise in charting to support safe navigation.

The Nautical Charting System plays a large role in NOAA's Marine Transportation System Program, which falls under the NOAA Strategic goal to "Support the Nation's commerce with information for safe, efficient, and environmentally sound transportation." The Department of Commerce folds NOAA's navigation safety work into its Strategic Goal to "Observe, protect, and manage the earth's resources to promote environmental stewardship," with the objective of "enhancing the conservation and management of coastal and marine resources to meet America's economic, social and environmental needs."

2.2 Business Results

2.2.1 Program Management and Controls

The Office of Coast Survey's Nautical Charting program, like all of NOAA, collects and reports on performance measures on its mapping and charting activities. Internal quarterly reports are required by the National Ocean Service office annual operating plans, along with cost, schedule, and performance data monthly. Annual and long-term performance measures are used to help manage the program and improve program performance. The program tracks internal metrics such as time spent to compile and review data to all charts, number of charts in continual maintenance, and customer service response times. These metrics help managers gauge employee and contractor performance, identify potential production and service shortfalls early on for redress, and adjust personnel assignments based on target requirements. Contracts are handled in accordance with the Federal Acquisition Regulations, which requires reporting on goals and milestones. Based on these regular reporting requirements, the program manages performance and takes corrective action, including redirection of funding or shifting personnel, as necessary.

NOAA also actively solicits feedback and recommendations for improving products from key partners and customers. Key partner and customer information is gathered through the Regional Navigation Managers, providing feedback to the charting program and process improvement. External customers have the opportunity to provide direct feedback to the Nautical Charting System via an Office of Coast Survey Website at http://ocsdata.ncd.noaa.gov/dr. The information is reviewed daily and routed to the correct responder. The external customer will receive conformation that the request has been received. Responses to requests are typically sent within a few days.

In terms of international coordination and controls, the Nautical Charting Program output conforms to international standards: IHO S-44, and IHO S-57 for ENC; and International Standard S-61 for raster chart data. The program maintains strong ties to international partners and the organizations establishing these standards to keep abreast and influence decisions on standards.

2.2.2 Monitoring Cost, Schedule and Performance

Cost – Nautical Charting program requirements are listed before the budget year and then the OCS Management team evaluates priorities. A budget and operating plan is established. Managers and contractors are held accountable for cost, schedule and performance results.

Schedule – The Nautical Charting program has planned quarterly milestones. The production managers report to the OCS Management team on a production statistics on a bi-weekly basis. Quarterly reports also include production performance metrics.

For FY 2006 the program met most of its milestones related to chart production, with the exception of continual maintenance for source applications for ENCs. This goal was not achieved due to resource limitations caused by budgetary impacts and management decisions to reallocate personnel to address shortfalls in related areas.

Performance –

NOAA managers are held accountable for performance beginning with senior NOAA management. The program is included in quarterly program updates on cost, schedule and performance to the NOAA Executive Panel, which oversees the NOAA planning, programming and budgeting process. The National Ocean Service Management and Budget Office requires monthly reporting on budget plans versus actuals to closely track execution. Furthermore, the program reports monthly to NOAA via quad charts summarizing cost, schedule and performance to ensure project targets and goals are being attained. Annual performance elements are reported in OMB's Program Assessment Rating Tool, and play a role in higher level measures reported in the Department of Commerce's Annual Performance Review documents. Program partners, such as contractors, are held accountable for performance through deliverables specified in their contracts including requirements on quality and timing associated with the deliverables.

2.3 Reviews

The NOAA Nautical Charting Program has implemented major program improvements stemming from recommendations made in National Research Council (NRC) studies such as *Charting a Course into the Digital Era: Guidance for NOAA's Nautical Charting Mission* (1994). Changes have been made in responding to customer requirements and in the role of advancing technologies, along with response to a growing demand for customized and digital nautical information products. The Hydrographic Services Improvements Acts of 1998/2002 provided Congress and NOAA an opportunity to evaluate NOAA's navigation programs, and authorized a Hydrographic Services Review Panel Federal Advisory Committee to advise the NOAA Administrator on issues regarding NOAA's Navigation Services, such as mapping and charting. Additional internal reviews such as Management Control Reviews and NOAA Inspector General Audits provide an objective look at program performance and processes. Virtually all recommendations of the recent audits and reviews were adopted. Socioeconomic studies have been conducted to align Program products and services with user groups and identify benefits. The Nautical Charting Program contracts with an independent survey firm to conduct annual surveys of mariners and customers of navigation services on the utility of NOAA nautical charts and tide and current data. These surveys are conducted to establish customer satisfaction with the program's products and services as well as to track improvement.

2.4 Security

The Nautical Charting System, which underpins the work of the Nautical Charting Program, is accredited under requirements spelled out in NOA 212-13 (08/06/90), NIST 800-53a and DOC IT Security Program Policy [June 26, 2005] that are based on OMB and NIST guidance. System Security Plans, Risk Assessments, and Contingency Plans were certified and approved for Nautical Charting System/NOAA6501 in July 2006. Management, operational, and technical security controls are adequate to ensure the confidentiality, integrity and availability of information.

2.5 Performance Measures

The performance measures in Table 2 show the Nautical Charting System's performance with respect to Mission and Business Results. Mission and Business Results performance measures reported include "Number of ENCs maintained in Critical Corrections" and "Maintain the Raster Database of 1025 Charts with Critical Updates." The measurement category is "Transportation" with the Measurement Grouping of "Water Transportation". These subcategories are part of the Performance Reference Model developed by the FEA-PMO.

Table 2: Business Results Performance Measures

Measurement Area	Indicator	2005 Baseline	2006 Actual Result	Comments
Mission and Business Results	Number of New Editions of Raster Charts Produced	261	263	Goal was to produce 250 for FY 2005 and FY 2006.
	Number of ENCs Maintained in Critical Corrections and Accessible	510	580	Goal was to produce 50 new ENC's for FY 2006. Produced 70.
	Maintain the Raster DB of 1025 Charts With Critical Updates	93%	99%	Percent of Critical updates applied to Raster charts within 1 week of publication.
	Maintain the ENC DB of 580 Charts in With Critical Updates	97%	97%	Percent of Critical updates applied to ENCs within 2 weeks of publication.
	Percent of Raster Charts Kept in Continual Maintenance for Source Applications	93%	95%	

3.0 Financial Performance

3.1 Current Performance vs. Baseline

The Nautical Chart Program follows prescribed Department of Commerce-wide financial management and accounting policies, procedures, and controls. Planning and spending is done via Annual Operating Plans, and routine financial and performance execution reports. Budgets are planned, executed and tracked on a monthly basis with variances identified, justified and mitigated. Advance Acquisition Plans are developed annually that identify all procurement actions submitted during the year to the NOAA Acquisitions and Grants Office to ensure close coordination and tracking of procurement actions. Spending is tracked within the NOAA financial system (CAMS/CBS) and is evaluated quarterly by Navigation Services financial management officers. Program managers perform quarterly reconciliation (comparing internal tracking against CBS) and must satisfactorily justify any significant variances from plan. Furthermore, NOAA has begun to implement recommendations resulting from a multi-year Business Process Reengineering study intended to improve the management and delivery of financial and administrative services. The study team examined NOAA's financial management practices across 8 functional areas (Acquisitions; Budget; Finance; Grants; IT; Workforce Management; Facilities and Logistics; and Environmental Compliance, Health and Safety). The team then researched relevant best practices that could be applied to improve NOAA's budget and financial systems. Improved financial management procedures, processes, systems, and training developed through the Business Process Reengineering implementation are being adopted by the program.

3.2 Performance Measures

The program's planned versus actual expenditures are reviewed monthly, quarterly and annually via quad charts presented to National Ocean Service management and Budget, NOAA Budget, and the NOAA Deputy Undersecretary.

3.3 Cost Benefit Analysis

The program's FY2007 budget request included funds to support a cost benefit analysis. Given the Continuing Resolution and uncertain funding scenario at this time, the program lacks resources to conduct such an analysis in FY2007. However, the President's FY2008 request does include funds, and the program is committed to pursuing this effort when resources are in hand.

3.4 Financial Performance Review

Financial performance is typically subjected to a periodic review for reasonableness and cost efficiency. Monthly budget reviews are held with the program manager, CORs and contract managers to ensure contracts are within cost and on schedule. Monthly reports from contractors are required to ensure the Government has the information it needs to evaluate cost performance. A detailed review of work and priorities is undertaken if cost is significantly above base lined values. Also, any necessary corrective actions are also identified and implemented.

4.0 Innovation to Meet Future Customer Needs

The following projects were implemented in FY2006, or are being implemented in FY2007 to address future challenges, better meet customer needs, make better use of technology, and lower operating costs.

4.1 Number and Types of Users

Nautical Charting Program users include commercial and recreational mariners, other NOAA programs and government agencies such as US Coast Guard, US Navy, National Geospatial Intelligence Agency and many other non-governmental organizations such as American Pilots Association and US Power Squadron. Over the past 5 years there has been an increase in nontraditional users, such as scientists, coastal zone planners, and environmental protection authorities. These individuals are accessing Nautical Charting System data for non-navigational purposes.

Project to Address Challenge: *Deliver raster charts for download via the Internet*

In November 2005, NOAA began offering its Raster Navigational Charts (RNC) available for free download from the official web site at http://nauticalcharts.noaa.gov. The files offered are geo-referenced, full-color images of NOAA's paper nautical charts, published and updated by NOAA in the internationally accepted BSB format. The RNCs have become an important and successful contributor to safe and efficient marine transportation. They have been incorporated into international standards for electronic chart systems, and have been accepted as meeting U.S. federal chart carriage regulations for a certain class of vessels. The response to the "free on the Internet"

policy has been overwhelmingly positive-- within the first year over 2.6 million NOAA RNCs were downloaded from the new site. In the future, NOAA plans to provide the raster charts on the Web site in an easy-to-view GeoTIFF format for non-navigational purposes, such as port security and management, marine boundary delineation, environmental assessment, spill response, and coastal zone management.

Project to Address Challenge: *Make Nautical Charting System data easier to use by non-mariners*

To this end, the program hosts a number of derivative products developed in 2005/2006 to make its charting products more accessible, broadening the base of users and broadening data usage:

- Coast Survey's ENC Direct. It allows NOAA ENC data to be translated from S-57 to standard GIS Format. This allows for broader pubic access to the NOAA ENC data as a resource.
- Coast Survey's On-Line Chart Viewer allows NOAA's suite of 1025 raster charts to be viewable on-line. These charts can be used as a ready reference or planning tool.
- The Coastal Services Center (linking people, information, and technology) developed a product called "Chart Viewer" to allow BSB-formatted raster nautical charts to be using in the ArcView GIS.

4.2 Single Line Production System (SPLS)

After data is ingested in the Nautical Charting System the processing bifurcates into processes which generate ENC's and processes which generate raster/paper nautical charts. The two pipelines produce fundamentally different products using fundamentally different tools.

At a conceptual level the information contained within each product is identical as is their purpose. What is different is one end product, the raster/paper, is basically a drawing and the images and symbols are interpreted by the user according to convention. This product is used as a print on demand chart, a lithographic chart or a raster chart (digital file for use on an electronic charting system).

The other end product is entirely vector. Every point, line or area object is attributed by the cartographer. It is assigned to be a buoy, a sounding, a land contour or a depth area, or some other feature according to the S-57 convention. These objects are gathered together over a region and make up an ENC. Vector data allows NOAA to build more information and far more accuracy into the nautical chart that the mariner now wants to view onscreen. Greater accuracy is particularly important, as mariners increasingly rely on GPS positioning to navigate, and the charting products they use must reflect the same level of accuracy as GPS.

The need to have two separate data pipelines is inefficient. It is anticipated in FY 2007 the SPLS will begin to be integrated into the production process and will allow the generation of raster/lithographic products from S-57 data. This will unify the data pipelines.

Project to Address Challenge: *Unify both raster/paper and ENC production pipelines.*

The Office of Coast Survey has worked for several years to leverage technology to improve efficiencies in the nautical chart production process (reference OMB300: 006-48-01-15-01-3401-00). In the first quarter of FY2005, the Office of Coast Survey's (OCS) Marine Chart Division (MCD) embarked upon a five year contract with McDonald Bradley, Inc (MBI) in order to acquire a new single production line system that integrates the ENC production line and the raster production line into a seamless vector database where multiple products can be extracted. This contract is broken into four separate phases.

Phase 1: Requirements Analysis (Completed: May 2005)
Phase 2: Trade Study and System Test (Completed: December 2005)
Phase 3: System Selection (Estimated: January 2007)
Phase 4: System Integration (Will take at least 1-3 years after system selection)
Phase 5: System Migration (Will take at least 3-4 years after system selection)

Phase 1 was completed on time and within budget in May 2005. Phase 2 trade study was completed within budget December 21, 2005. An RFQ was issued in early June with responses due back by July 5, 2005. MBI received four vendor responses and down selected vendors in preparation for the test period which commenced August 1, 2005. MBI made a recommendation in a management briefing January 11, 2006 and is going forth with negations for best and final pricing and integration planning. A final selection will be determined February 15, 2006.

Three vendors were selected for the Phase 2 Trade Study and Demonstration period. Each vendor was invited for a two week period to demonstrate their proposed solution. The first week was spent demonstrating the functionality of their system against the requirements, and the second week was spent demonstrating test scenarios that were developed by the MCD/MBI team. As of now MBI is in the process of seeking a "Best and Final Submission" from each vendor. This submission will clarify deficiencies that were found in the two week system evaluation period. After the clarifications are received and reviewed, MBI will recommend to MCD One or more systems to be integrated by MBI into a single production system. This next phase commenced on February 1, 2006.

Currently, the project is in the integration phase. This phase includes functional testing of the solution. Ensuring that the requirements baseline documented in phase one is met, developing workflow modules, and tying in legacy database systems to the new system.

The COR meets with the integration team weekly to monitor progress, and communicates daily with the team on an ad hoc basis. Formal status reports are done on a monthly basis.

4.4 Funding Levels

The Nautical Charting Program budget has essentially been flat since 2004, when it received a $1M increase for Electronic Navigation Charts. Though President's Budgets since that time have annually requested $2M additional to bring the total ENC effort to $6.35M, the program has held constant at $16,182,887 (before rescissions and overhead - $15,773,079 after). The level of effort these funds procure is slowly declining, as inflationary costs increase. This has an impact on the program's ability to maintain the raster and vector production systems, as well as the development of the single production system.

Project to Address Challenge: *SLPS to increase chart creation efficiencies.*

The adoption, integration and migration to the SLPS are anticipated to take 3-4 years. During this time the Nautical Charting System will support 3 data pipelines. System efficiencies are anticipated to decrease during the transition period. Factors for the decrease include retraining of existing personnel, system documentation, determining and eliminating errors in the new data pipeline, populating a hydrographic product database, and development of new processes and techniques. Once migration is complete there will be an estimated 20% increase in the efficiency of chart production over the pre-transition period.