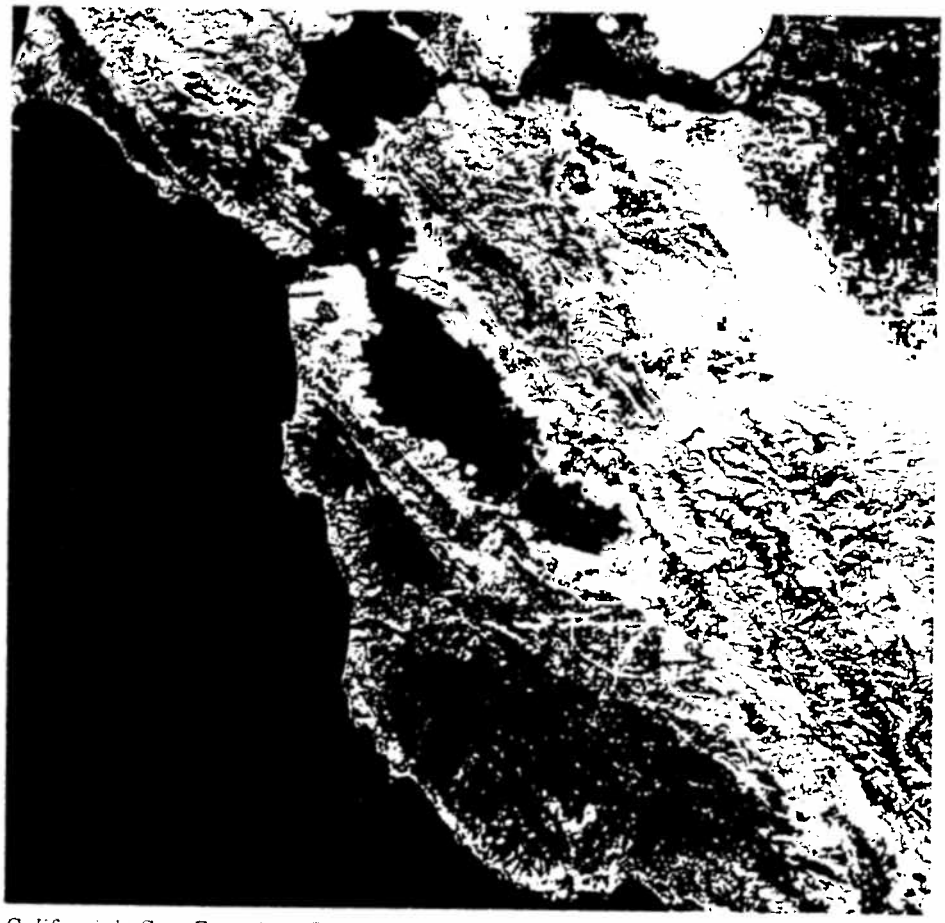
Remote Sensing at NOAA's National Ocean Service

summary of findings and recommendations



California's San Francisco Bay area produced by spectral clustering and editing of Landsat Thematic Mapper imagery (path 44/row 32) acquired on June 9, 1993. Ground resolution is 30x30 meters. Courtesy of **NOAA's Coastal Change Analysis Program** (C-CAP) which produces land cover data to monitor change in coastal environments.

a report from the
National Ocean Service
Remote Sensing Cross-cut Team

November 1998

The National Ocean Service

The National Ocean Service monitors, assesses, and forecasts conditions in the coastal and oceanic environment to support effective management, promoting a healthy, safe, and economically productive coastal and oceanic environment for present and future generations.

As part of NOAA, NOS is the primary civil agency within the Federal Government responsible for the health and safety of our nation's coastal and oceanic environment. From gathering data about the coast with cutting-edge technology to producing marine and aeronautical charts for safe navigation, NOS is at the forefront of merging coastal resources with a foreword moving economy. Thousands of private companies and government agencies use NOS services to save the public time and money, and to enrich our quality of life.

NOS produces a wide variety of publications and reports on the many aspects of its ongoing work. For more information on NOS or specific information on one of the aforementioned programs, contact:

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Remote Sensing at NOAA's National Ocean Service

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November 1998

National Ocean Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce
Silver Spring, Maryland 20910

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Silver Spring, Maryland 20910

November 6, 1998

MEMORANDUM FOR: NOS Senior Management Council

FROM: NOS Remote Sensing Cross-cut Team

SUBJECT: Report on findings and recommendations

This memorandum transmits the summary report on the findings and recommendations of the National Ocean Service Remote Sensing Cross-cut Team. The team was convened in December 1997 as a transition activity to help redefine NOS.

The report includes detailed information on NOS remote sensing projects, personnel, and equipment. It presents suggestions for five-year targets, and for operational and programmatic priorities. It also provides background materials on how this information was generated and by whom.

The report has five sections:

I. Introduction;
II. Findings and Recommendations;
III. Background Materials;
IV. Inventory; and
V. Targets and Opportunities.

Sections II-V are essentially appendices for organizing relevant products.

This report represents a milestone at NOS as this is the first time the agency has comprehensively evaluated remote sensing as a tool for coastal stewardship. It also represents the dedicated efforts of 15 NOS scientists and managers, support staff from Special Projects, NCCOS and the Coastal Services Center, and participating observers from NOAA's other line offices; NMFS, OAR, NESDIS, and NWS. The report should be a valuable reference for future discussions on this topic.

Charles Alexander, Co-chair
Special Projects Office

Anne Hale Miglarese, Co-chair
Coastal Services Center

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Acknowledgements

Staff from ORCA's SEA Division provided valuable support. Tim Goodspeed facilitated many of the Cross-cut Team's meetings, including a workshop, and was instrumental in helping the team reach consensus on targets and opportunities. David Lott and Craig Russell provided coordination support. Chris Clement helped design a data base to support the project and personnel inventory. Sharon Adamany and Julia Blackwell helped with data entry and coordination of meetings. Nina Petrovich from NOS's Coastal Services Center and Tony Reyer from SEA Division assisted with organizing inventory results.

I. Introduction

National Ocean Service
Remote Sensing Cross-cut Team

FINDINGS & RECOMMENDATIONS

Introduction

This report presents a summary of the findings and recommendations of the National Ocean Service Remote Sensing Cross-cut Team. It includes suggestions for NOS five-year targets, and recommendations for operational and programmatic priorities. It also includes background materials describing how the team conducted its work, and detailed information on NOS remote sensing projects, expertise, and equipment. Most of this material is presented in the form of appendices. The report should be a useful reference document for future discussions on this topic.

What is the Remote Sensing Cross-cut Team?

The National Ocean Service Remote Sensing Cross-cut Team is part of a series of "transition" activities to help redefine NOS and characterize key thematic elements of its mission. During the late summer of 1997, senior NOS managers suggested improvements in the integration and coordination of five topic areas; marine GIS, hazards, habitat, remote sensing, and technology transfer. Remote sensing was recommended as the highest priority. Based on this recommendation, a Remote Sensing Cross-cut Team was convened in December 1997 at the request of the NOS Assistant Administrator. The purpose was to describe and assess current and proposed NOS activities that involved remote sensing, and to make recommendations on the continued and expanded use of this technology at the agency. This would provide NOS the opportunity to: (1) comprehensively evaluate its position on remote sensing; (2) address more clearly the agency needs with respect to its primary mission of coastal stewardship; and (3) communicate these needs more effectively to partners inside and outside of NOAA.

What is remote sensing?

Remote sensing refers to the process of acquiring information while not in physical contact with the object or phenomenon under study (see definition in Section II). This includes the use of satellites, aircraft, and ships to investigate areas of the earth from a distance.

Why evaluate remote sensing at NOS?

First, to understand better the range and scope of existing NOS remote sensing activities. NOS has substantial investments in remote sensing, particularly in the areas of shoreline mapping, geodesy, and nautical charting. An accurate picture of these and other NOS activities will help promote cooperation and integration among NOS programs, including the identification of new ways to use existing capabilities.

Second, to identify potential uses of emerging technology. Remote sensing is becoming an increasingly useful and more cost effective method of looking synoptically at the coastal environment. Advances in computer and sensor technology are bringing new data and capabilities directly to the desktop of environmental scientists.

Who are the team members?

Fifteen senior NOS scientists and managers, including at least one representative from each NOS line office, were assigned (see team list in Section II). Support staff were designated and representatives from other NOAA line offices (NWS, NESDIS, OAR, and NMFS) volunteered to participate as observers.

How did the team conduct its work?

The team met in Silver Spring approximately once a month from December 1997 to August 1998. Participants from Seattle, WA and Charleston, SC often participated via

Summary of Findings

- 163 persons, or about 17% of the NOS workforce, have some remote sensing expertise.
- Most of the NOS remote sensing experts are in the Office of Coast Survey (58) followed by National Geodetic Survey (37), Center for Operational Oceanographic Products and Services (25), Coastal Services Center (20), National Centers for Coastal Ocean Science (18), and Special Projects Office (5).
- Expertise is dominated by aquatic remote sensing (104 persons) such as hydrography (60 persons), but there is also significant knowledge of airborne (56 persons) and spaceborne (40 persons) sensors.
- NOS has substantial investments in remote sensing equipment, particularly for data processing. However, many of the platforms and sensors relied upon for data aquisition are not NOS property (e.g. NOAA ships and aircraft use for hydrographic and photgrammetric survey missions).
- In FY98, NOS was conducting 73 remote sensing projects requiring a total of 334 person years. NOS personnel were conducting 61% of this work, 28% was conducted by NOS contractors, and 11% by other partners (including other NOAA line offices, state offices, and academia).
- Projects were categorized by type (research, applied science, monitoring/ assessment, service) and topic (underwater bottom mapping, shoreline mapping, water color, habitat mapping, aeronautical surveying, water currents, fish/mammal detection, other).
- 78% of the FY98 effort was for service projects, primarily underwater bottom mapping (57% of total effort, 73% of service projects), and shoreline mapping (14% of total effort, 10% of service projects). Other projects were equally distributed among research (8% of total effort), applied science (7% of total effort), and monitoring/assessment (7% of total effort).
- The most significant area of research was in water color (75% of research, 9% of total effort), and the major area of monitoring/assessment was habitat mapping (95% of monitoring/assessment, 7.5% of total effort).

video-teleconference. Some meetings were facilitated by NOS support staff. Among the first steps were establishing a work-plan and defining the term "remote sensing." Additional tasks included designing and conducting a detailed survey form to inventory NOS remote sensing projects and expertise, identifying important equipment assets, and conducting a two-day workshop to review on-going NOS remote sensing activities, and identify and discuss new opportunities. Opportunities and future targets were clarified and ranked at subsequent meetings using a consistent set of evaluation criteria (e.g. feasibility, costs, available expertise, etc.). The opportunity and target lists were eventually parsed into three subsets; five-year targets, operational priorities, and programmatic priorities. Team members were assigned to developed detailed descriptions of programmatic priorities.

What does this report include?

This report is presented in five sections: I. Introduction; II. Findings and Recommendations; III. Background Materials; IV. Inventory; and V. Targets and Opportunities. Except for the Introduction, the materials in this report are organized as appendices.

Section II, Findings and Recommendations, includes: presentation overheads from the final report given to the NOS Senior Management Council; additional tables highlighting NOS FY98 projects; and the complete text of recommended five-year targets, operational priorities, and programmatic priorities.

Summary of Recommendations

Targets (2003)

1. Improve data distribution network.
2. Establish national coastal digital data base (land and sea floor)
3. Develop protocols/standards for data acquisition and use
4. Ensure periodic production of comprehensive US shoreline and nearshore bathymetry

Operations

1. Establish permanent team to:
   - evaluatue progress towards objectives;
   - link emerging technology to priority issues; and
   - document NOS information and technology needs.
2. Train non-experts on uses/applications.
3. Increase partnership programs with universities, industry, and federal government (e.g. NOAA, NASA, NIMA, USGS).
4. Integrate GIS more directly into NOS programs.
5. Continue to evaluate the utility of National Technical Means data.

Programs

1. Conduct mapping and change analysis of bottom characteristics in US coastal, Great Lakes, and Exclusive Economic Zone waters.
2. Develop and integrate applications of advanced remote sensing systems into the NOS Coastal Mapping Program.
3. Develop remotely sensed data for application to coastal non-point source pollution.
4. Establish a monitoring program for addressing key indicators of coastal environmental health.
5. Develop an experimental, region-specific forecasting system to track harmful algal blooms.

Section III, Background Materials, includes: the tasking memo outlining the team's purpose and objectives; a list of team members; a definition of remote sensing and a list of remote sensing instruments understood by the team as included in their investigation; and the team's original work plan.

Section IV, Inventory, includes: survey instruments used to collect information on NOS remote sensing projects, personnel, and equipment; and summaries of the results of these surveys. The summary of equipment includes overviews of program mission and objectives.

Section V, Targets and Opportunities, includes results from a two-day workshop conducted in May, and other materials from which the final recommendations were derived.

How will this report be used?

It is hoped that this report will stimulate additional discussions and investigations on remote sensing at the National Ocean Service, especially on the Cross-cut Team's suggested targets, operations, and programs. The detailed information in Section II is intended to help NOS managers identify remote sensing priorities and evaluate the feasibility of the proposed topics.

This report is also expected to improve the visibility and understanding of NOS remote sensing products and services both inside and outside the agency and, as such, contribute to the overall process of redefining an NOS mission of coastal stewardship. It will provide a useful reference for future discussions on this topic and a practical template for other NOS-level programmatic investigations.

A Note About Inventory Results

Information on projects, personnel, and equipment presented in Section IV was difficult to acquire and verify. In some cases, the summaries are therefore incomplete and inaccurate. They are included to document how and what information was collected. Also, additional information was often developed through conversations with NOS personnel or by interpreting some of the inventory results. These additions are typically not reflected in the Section IV summaries. For example, the Center for Operational Oceanographic Products and Services (COOPS) submitted only one expertise form. Follow-up discussions indicated approximately 25 persons with expertise in the remote sensing of ocean currents. The NOS Offices of Response and Restoration, and Ocean and Coastal Resource Management did not report any discrete remote sensing activities or expertise though some individuals in these offices may have personal remote sensing experience or knowledge. Finally, it should be noted that this information was collected in the Spring of 1998, and changes in projects, personnel, and equipment since that time are not included.

II. Findings & Recommendations

a. Presentation to NOS Senior Management Council

b. Recommended Targets (2003)

c. Recommended Operations

d. Recommended Programs

National Ocean Service
REMOTE SENSING CROSS-CUT TEAM
presentation of:

FINDINGS & RECOMMENDATIONS

to:
THE NOS SENIOR MANAGEMENT COUNCIL

November 16, 1998

Our Team

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Rick Decker (NWS)
Jim Thomas (NMFS)
Lucia Tsaoussi (OAR)
Jim Zaitzeff (NESDIS)

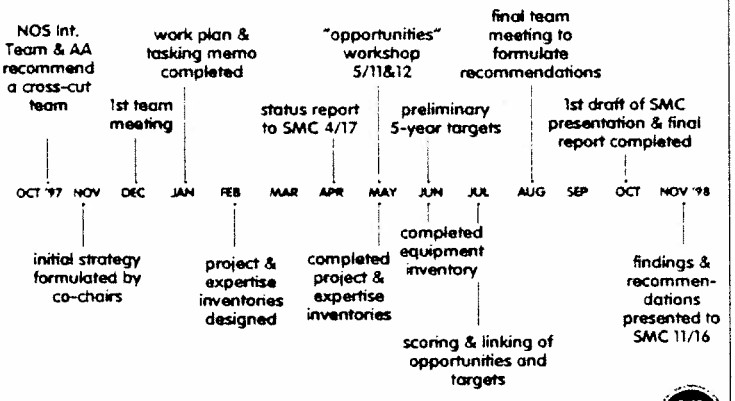
Our Purpose

WHY? remotely sensed data/products increasingly available & relevant

OBJECTIVES:

1. "snap shot" of NOS remote sensing activities (projects, expertise, equipment)
2. identify opportunities for continued and expanded use of this technology

Our Process



Remote Sensing is...

"The measurement or acquisition of information of some property of an object or phenomenon, by a recording device that is NOT IN PHYSICAL CONTACT with the phenomenon under study..."

Camera, metric, still
Camera, non-metric, still
Video

LIDAR
Laser line scanners
Laser fluorosensor

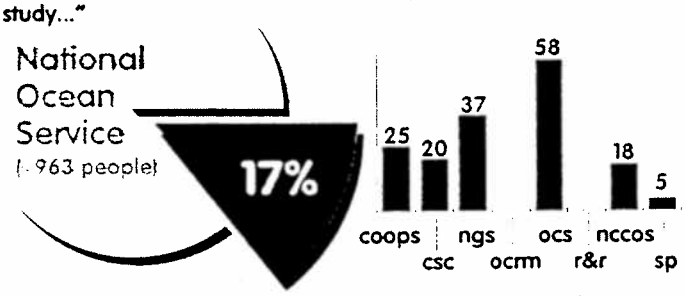
Multi-spectral imager
Hyper-spectral imager
Radar
Scatterometers
Synthetic aperture radar

Acoustic single beam
Acoustic multibeam
Acoustic sidescan
Acoustic doppler

Seismographs / seismometers
Magnetometer
Gravimeter
Scintillation counter
Gamma spectrometer
Spectral radiometer

Remote Sensing is...

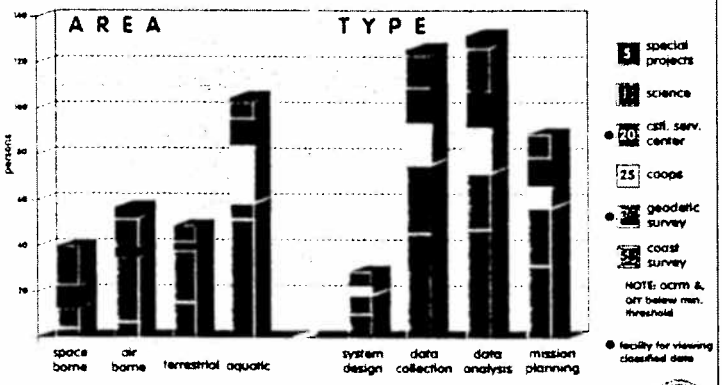
"The measurement or acquisition of information of some property of an object or phenomenon, by a recording device that is NOT IN PHYSICAL CONTACT with the phenomenon under study..."



163 persons with remote sensing expertise

Expertise

7



NOS Remote Sensing Cross-cut Team

Equipment

8

- mission
- platforms
- sensors
- computers
- software
- field/in-situ equip.
- peripherals/other equip.

NOS Remote Sensing Cross-cut Team

FY98 Activities (% level of effort)

9

61% NOS
28% NOS contractors
11% all others

73 total projects
334 total person yrs.

TOPIC

TYPE											TOTALS
		<1	2	4	<1			<1	1		8
		6	<1		<1					<1	7
					2	4			<1		7
	57	8	1	<1			5	4		3	78
TOTALS	57	14	4	5	2	4	5	4	2	3	100

NOS Remote Sensing Cross-cut Team

Towards Opportunities

10

- orientation to other line offices
- identification of "opportunities"
- identification of 5-year targets
- linking opportunities to targets
- sorting/ranking targets & opportunities with specific criteria

NOS Remote Sensing Cross-cut Team

RECOMMENDATIONS:

Targets (2003)

11

1. improve data distribution network (6)*
2. establish national coastal digital data base (land and sea floor) (19)
3. develop protocols/standards for data acquisition and use (10)
4. ensure periodic production of comprehensive US shoreline and near-shore bathymetry (6)

*related FY99 milestones

NOS Remote Sensing Cross-cut Team

RECOMMENDATIONS:

Programs

12

1. provide mapping and change analysis of bottom characteristics (9)*
2. develop and integrate new procedures for shoreline mapping (11)
3. provide remotely sensed data for non-point source pollution abatement strategy (6)
4. monitor key indicators of coastal health (10)
5. monitor and track harmful algal blooms (7)

*related FY99 milestones

NOS Remote Sensing Cross-cut Team

RECOMMENDATIONS:

13

Operations

1. Coordination
2. Training
3. Partnerships
4. GIS Integration
5. NTM Integration

RECOMMENDATIONS:

14

Next Steps

1. define more explicitly the NOS role in remote sensing with respect to coastal stewardship
2. designate panel as NOS lead for coordination of remote sensing
3. select one or more program areas for improved FY99 remote sensing integration
4. support short-term improvements to distribution of and access to NOS remote sensing products

1. FY98 NOS Remote Sensing Activities (% level of effort)

61% NOS
28% NOS contractors
11% all others

73 total projects
334 total person yrs.

TYPE \ TOPIC	UNDERWATER BOTTOM MAPPING	SHORELINE MAPPING	WATER COLOR		HABITAT MAPPING		AERO-NAUTICAL SURVEYING	WATER CURRENTS	FISH/ MAMMAL DETECTION	OTHER	TOTALS
			bio. features	phys. features	live bottom	land cover					
RESEARCH		<1	2	4	<1			<1	1		8
APPLIED SCIENCE		6	<1		<1					<1	7
MONITORING/ ASSESSMENT					2	4			<1		7
SERVICE	57	8	1	<1			5	4		3	78
TOTALS	57	14	4	5	2	4	5	4	2	3	100

Values in this table refer to the percent of the total FY98 level of effort, in person years, reported for each NOS project. This includes NOS personnel, NOS contractors, and others (other NOAA offices, state personnel, etc.). Seventy-three projects are represented in 10 topics and four types.

2. FY98 NOS Remote Sensing Activities (number of projects)

TYPE \ TOPIC	UNDERWATER BOTTOM MAPPING	SHORELINE MAPPING	WATER COLOR		HABITAT MAPPING		AERO-NAUTICAL SURVEYING	WATER CURRENTS	FISH/ MAMMAL DETECTION	OTHER	TOTALS
			bio. features	phys. features	live bottom	land cover					
RESEARCH		1	3	4	1			1	4		14
APPLIED SCIENCE		2	1		1					1	5
MONITORING/ ASSESSMENT					7	10			1		18
SERVICE	25	2	2	1			2	1		3	36
TOTALS	25	5	6	5	9	10	2	4	5	4	73

Values indicate number of FY98 NOS remote sensing projects reported for each type and topic.

3. FY98 NOS Remote Sensing Activities (person years)

TYPE	UNDERWATER BOTTOM MAPPING	SHORELINE MAPPING	WATER COLOR: bio. features	WATER COLOR: phys. features	HABITAT MAPPING: live bottom	HABITAT MAPPING: land cover	AERO-NAUTICAL SURVEYING	WATER CURRENTS	FISH/ MAMMAL DETECTION	OTHER	TOTALS
RESEARCH		0.25 0 1	2.25 1 4	4.75 0.25 10	0.5 0 0			0.5 0.5 0	2 2 1		10.25 3.75 16
APPLIED SCIENCE		2 4 13	0 2 0.5		0.75 0 0.25					1 0 0	3.75 6 13.75
MONITORING/ ASSESSMENT					1.5 1.25 2.5	2.75 6 3.5			0.25 1 1		4.5 8.25 7
SERVICE	127 64 0	23 3 0	2 2 0.5	1.5 0.25 0			17 0 0	10 2 0		3.5 4 1	184 75.25 1.5
TOTALS	127 64 0	25.25 7 14	4.25 5 5	6.25 0.5 10	2.75 1.25 2.75	2.75 6 3.5	17 0 0	10.5 2.5 0	2.25 3 2	4.5 4 1	202.5 93.25 38.25

NOS employess
NOS contractors
All others

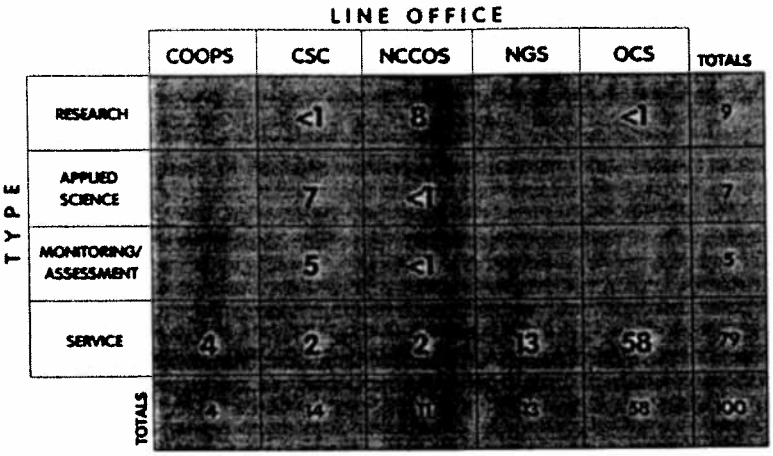
Values indicate total FY98 person years reported for 73 projects. The first number is NOS employees, followed by NOS contractors, and all others (other NOAA offices, state personnel, etc.).

4. FY98 NOS Remote Sensing Topics by Line Office (% level of effort)

LINE OFFICE	UNDERWATER BOTTOM MAPPING	SHORELINE MAPPING	WATER COLOR: bio. features	WATER COLOR: phys. features	HABITAT MAPPING: live bottom	HABITAT MAPPING: land cover	AERO-NAUTICAL SURVEYING	WATER CURRENTS	FISH/ MAMMAL DETECTION	OTHER	TOTALS
COOPS								3			3
CSC		6	<1	<1	1	4				2	14
NCCOS			3	4	<1				2	<1	11
NGS		8					5				13
OCS	57			<1				<1			59
TOTALS	57	14	4	5	2	4	5	4	2	3	100

Values in this table refer to the percent of the total FY98 level of effort, in person years, reported for each NOS project. This includes NOS personnel, NOS contractors, and others (other NOAA offices, state personnel, etc.). Seventy-three projects are represented in 10 topics and five lines offices.

5. FY98 NOS Remote Sensing Types of Activities by Line Office (% level of effort)



Values in this table refer to the percent of the <u>total</u> FY98 level of effort, in person years, reported for each NOS project. This includes NOS personnel, NOS contractors, and others (other NOAA offices, state personnel, etc.). Seventy-three projects are represented in four types and five line offices.

Remote Sensing at the National Ocean Service:

RECOMMENDATIONS

recommended
Targets (2003)

1. Establish a de-centralized network (Internet or Internet-like site) that provides information on and direct access to NOS spatial information products including remotely sensed data (e.g. aerial photography, satellite imagery, bathymetry, shoreline, benthic habitats, etc.).

2. National coastal digital land and sea floor cover data base derived from remote sensing sources at an appropriate level of resolution for assessments of specific topics (e.g. see 1 above). Integrated hard copy and electronic maps (integrated with various landside and water side layers) that can be seamlessly integrated into the "map" product (benthic habitats, USGS DLG files of roads and other layers, habitat data, ortho photo quads, satellite imagery, bathymetry).

3. Development and access to a library of specific protocols for the acquisition and use of established remotely sensed products suitable for specific types of coastal environmental analysis (e.g. water quality assessments, salinity mapping, non-point modeling, land use analysis, shoreline mapping, hazards planning, habitat mapping, EFH GAP analysis, shallow water bathymetry, etc.). Analytical toolbox of technical services and capabilities available to coastal managers, navigators, scientists (e.g. protocols (software), MapFinder, technical training, manuals, outreach and education on availability of NOS remote sensing products/services, Gulf stream analysis).

4. Put in place the mechanism to guarantee a timely and periodic production of a US national shoreline and near-shore bathymetry.

recommended
Operations

I. The Way We Do Business

1. Coordination - establish panel to:

(a) evaluate progress towards targets;

Provide written reports and assessments annually or biannually to the National Ocean Service's Senior Management Council regarding progress towards five-year targets and other NOS remote sensing priroities. Coordinate within NOS to ensure cooperation and minimal duplication of effort. Encourage joint projects where appropriate and share expertise and experiences.

(b) link emerging technology to priority issues; and

Provide occassional reports to NOS SMC suggesting how new and/or developing remote sensing technology can contribute to agency priorities.

(c) document NOS information/technology needs.

Develop periodical summary report on the National Ocean Service's coastal resource information priorities suitable for remote acquisition and, in some cases, the technical specifications (electromagnetic signature, temporal/spatial resolution, etc.) required for certain types of data. This document would help NESDIS, NASA, and other government and private sector developers and designers of remote sensing technology understand and respond to NOS remote sensing needs.

2. Training

Implement a more directed program of training (e.g. seminars, hands-on training sessions, open houses, etc.) to introduce non-experts to the existing and potential applications of remote sensing at the National Ocean Service. The goal would be to expose managers to the potential uses of NOS and other remote sensing capabilities.

3. Partnerships with

(a) universities;
(b) industry; and
(c) government (e.g. NOAA, NASA, NIMA, USGS)

Such partnerships would be primarily for the joint development and assessment of remote sensing technologies and applications for the improved understanding and management of the nation's coastal resources.

II. GIS (Geographic Information Systems)

Although the Team avoided nominating priorities that focused narrowly on GIS technology, it was acknowledged that these systems are often essential for the processing and interpretation of remotely sensed data. The structure of both GIS and remotely sensed data are usually compatible (e.g. spatially referenced), complementary (e.g. providing spatial and/or physiographic context) and easily integrated (e.g. similar digital formats). As NOS examines opportunities for new remote sensing efforts, it should concurrently consider the need to link these needs with an integrated NOS GIS strategy that provides for consistent internal data standards and formats. This policy will enhance the usefulness and application of remotely sensed data, particularly data collected by NOS.

III. NTM (National Technical Means)

NOS and NOAA have made substantial investments in facilities and other infrastructure to process, analyze, and archive classified or NTM remotely sensed data. NOS personnel have been using this type of data for more than 20 years and NOS facilities for analyzing NTM data are located in Silver Spring and Charleston. Recently, the access to and use of NTM data by NOS personnel has been expanding.

NTM data have many potential uses for monitoring and managing coastal resources, particularly for looking at areas where conventional imagery is not available or not technically useful. The Cross-cut Team recommends that NOS continue exploring the use of image-derived products from NTM data and build awareness of its potential applications among the coastal management community where appropriate.

recommended
Programs

I. Bottom Types & Benthic Habitats

1. Title: **Mapping and change analysis of bottom characteristics in U.S. Coastal, Great Lakes, and Exclusive Economic Zone Waters**

2. Submitted by: Millington Lockwood, Sam DeBow, and Mark Finkbeiner

3. Description: This project would involve comprehensive surveys of the critical near-shore submersed habitats and other high priority benthic environments of the seafloor under the jurisdiction of Federal, State and/or local governments. These areas will include shallow estuarine waters, coastal (continental shelves) and deep water >200 meters water depth to the extent of the 200-mile limit of the Exclusive Economic Zone. Submersed habitats of the Great Lakes will also be covered in this effort. Features that will be mapped include submersed aquatic vegetation (including sea grasses, and algae), coral reefs, artificial reefs, seafloor archeological artifacts, shellfish beds, hard bottom habitats, and critical deep-water geomorphic structures/features. This effort will involve a range of participants and technologies. It will also involve a long range monitoring aspect that will require re-surveying of the habitats on a 5-20 year cycle.

4. Purpose/Need: This information is needed for a variety of scientific and management purposes. Many of these relate specifically to certain Federal and state laws and policies. These include laws include the National Marine Sanctuaries Act, the Endangered Species Act, the Fisheries Conservation and Management Act, Sustainable Fisheries Act of 1996 (Essential Fish Habitats (EFH) and Gear Impacts), the Coral Reef Protection Act (or Executive Order), inter alia. In addition, many of the habitats to be mapped/monitored are good indicators of overall water quality or ecological health.

5. Remote Sensing Platforms/Sensors Involved: Orbital platforms deploying either existing sensors (Landsat TM, ETM, or SPOT Pan) can be useful for large-area, reconnaissance surveys of shallow water benthic habitats. Aircraft with metric cameras or hyper-spectral scanners should be used for medium level to low-level mapping. In addition, small, surface craft with sidescan sonar, multibeam sonar systems, LIDAR (laser Line Scan or the Navy's Laser Line Scan Fluorescence)), should be used to refine and complete this work. Larger moderate-endurance ships for coastal and continental shelf work, and high-endurance ships for deep water, offshore, arctic and areas where extreme weather events are common. Diving, submersible missions, ROVs, and underwater videography can be used to verify and supplement the remote mapping techniques.

6. Users/Customers: Customers include offices with in NOS, NOAA (NMFS) state/local government agencies, conservation groups, fishery management councils, universities, and research institutions.

7. Products: Products will most likely be various map type products, including digitally produced mosaics, that will include observations (ground truth) and imagery of a specific geographic area, i.e. a Coral Reef or Marine Sanctuary, this will include basic data sets as well as classification and interpretations of the data. Also individual separate (standalone) data sets will be prepared for uses by other agencies. The spatial data will be in digital form as well as hard copy and a combination of raster imagery with vector points, lines, and polygons. Digital maps may be available on the Internet and/or as CD-Rom products

8. Resources / Level of Effort:

- First 12 months
  - _X_ High: (>$1 million and/or > 5 person years)
  - ___ Medium: ($0.5 - 1 million and/or 2 - 5 person years)
  - ___ Low: (<$0.5 million and/or < 2 person years)

- For years 2- 5(if applicable)

Year			
2	_X_ High	____ Medium	____ Low
3	_X_ High	____ Medium	____ Low
4	_X_ High	____ Medium	____ Low
5	_X_ High	____ Medium	____ Low

9. Non-NOS partners required for success? State and Local Governments, and other Federal agencies. Maybe non-profit groups.

10. Schedule: (please check applicable statements below)

___ can start immediately (<3 months)
_X_ requires significant planning/investigation for startup (>3months)
___ can be completed in less than 12 months
_X_ will take more than 12 months for completion

II. Shoreline Mapping

1. Title: **Develop and integrate applications of advanced remote sensing systems into the NOS Coastal Mapping Program (CMP).**

2. Submitted by: Grady Tuell, Jim Lucas, George Leigh

3. Description: This project would develop new procedures for the precise mapping of the U.S. National Shoreline, (both MLLW and MHW), using a variety of remote sensing technologies. The National Shoreline must be accurate, timely, standard (in content and format), consistent, tide-coordinated, and complete - covering the 95,000 miles of the U.S. shoreline. Aerial photography, the primary data collection method today, is constrained by the simultaneous requirements for clear visibility, adequate sun angle, and correct tide stage. Also, the shoreline compilation is presently a very labor intensive process. Applying advanced remote sensing systems and the new digital (softcopy) photogrammetry to the CMP will reduce these constraints and reduce the manual data processing, finally enabling NOS to complete the National Shoreline, allowing for timely updates, and allowing for faster responses to requests for critical shoreline mapping. This project will include project planning, data collection (in-house and contracting), data processing and storage, and data delivery.

4. Purpose/Need: The NOS mandate to conduct precise shoreline mapping in support of the nations's nautical charting program can be traced to the original 1807 authorizing legislation for the Survey of the Coast. Of the 95,000 miles of U.S. shoreline, much of it as never been mapped by this agency (or any other) at the required scales and accuracy, and much of it has only been mapped with old, less accurate technology. This National Shoreline is the official U.S. shoreline which is depicted on NOAA's nautical charts, but today, in the age of Geographic Information Systems (GIS), many other users at the federal, state, local level also require this shoreline as the base layer in their GIS. Utilizing this new technology will allow mapping of critical areas of the U.S. shoreline on a five-year cycle and non-critical areas on a ten-year cycle, rather than the present 50+ year cycle.

5. Remote Sensing Platforms/Sensors Involved:

Platforms: Aircraft
Satellites

Sensors: Metric aerial cameras
Synthetic Aperture Radar (SAR)
Interferometric Synthetic Aperture Radar (IFSAR)

Light Detection And Ranging (LIDAR)
Multi-Spectral Imaging
Hyper-Spectral Imaging

6. Users/Customers:

All Nautical Chart Users (Paper & electronic)
Commercial shipping
Fishing Industry
Recreational Boating Industry
Department of Defense
Federal, State and Local Governments
Surveying and Engineering Firms
Coastal Managers studying:

Coastal Hazards
Storm surge modeling
Pollution trajectory modeling
Monitoring marshlands and wetlands
Coral reef & aquatic vegetation studies
Coastal erosion studies
Marine GIS Applications
Federal, State, & Personal Property Boundaries
Mineral lease boundaries

7. Products:

Remotely Sensed Data
Aerotriangulation Parameters
Digital Data Files, Containing Shoreline and other Features
Chart Revision Surveys
Historical Data:
500,000 aerial photographs
15,000 shoreline maps

8. Resources/Level of Effort:

- First 12 months
  - ____ High: (>$1 million and/or > 5 person years)
  - _X_ Medium: ($0.5 - 1 million and/or 2 - 5 person years)
  - ____ Low: (<$0.5 million and/or < 2 person years)

- For years 2- 5(if applicable)

Year			
2	___ High	_X_ Medium	____ Low
3	___ High	_X_ Medium	____ Low
4	___ High	_X_ Medium	____ Low
5	___ High	_X_ Medium	____ Low

9. Non-NOS partners required for success? No

10. Schedule: (please check applicable statements below)

___ can start immediately (<3 months)
_X_ requires significant planning/investigation for startup (>3months)
___ can be completed in less than 12 months
_X_ will take more than 12 months for completion

III. Non-point Source Pollution

1. Title: **Remote Sensed Data for Non-point source pollution implementation**

2. Submitted By: E. Kruse, D. Trueblood, John Brock, John Klein, Randy Ferguson

3. Description: Coastal communities, businesses, and human health are increasingly threatened by the impacts of degraded coastal water quality. As population growth, development pressures, and intensity of human use have dramatically increased in coastal areas, there has also been a worrisome increase in the incidence of harmful algal blooms, closure of shellfish beds, and loss of wetlands and valuable habitat for finfish, shellfish, and wildlife. Impervious surfaces on the land, hardening of shorelines, filling, and incresing the depth and extent of dredged waterways alters exposure to currents and waves and can change the mean and variability of salinity. Excess nutrients and other pollutant loadings have led to long-term changes in coastal ecosystems and habitats by reducing water quality, altering the abundance and diversity of biotic species, stimulating bacterial growth, reducing levels of dissolved oxygen (hypoxia and anoxia), taken together these factors can seriously alter ecosystem structure and function.

These changes have had dramatic impacts not only on natural resources, but have also affected coastal economies and public health. For example, there has been an increase in the range and magnitude of economic impacts associated with eutrophication and HAB outbreaks, including dramatic reductions in wholesale and retail seafood sales and loss of tourism revenues where outbreaks have occurred. Beach and shellfish bed closures resulting from stormwater overflows and bacterial contamination from failing septic systems have had similar impacts, including loss of jobs. Restoration of clean coastal waters is critical to maintain coastal habitat and to meet the core goals of the Coastal Zone Management Act.

Coastal states have been working with NOAA and EPA over the past eight years to develop state Coastal Nonpoint Pollution Control Programs, designed to specifically address one aspect of coastal water quality -- polluted runoff. Development of these programs are nearing completion and the focus will shift to implementation. NOAA and EPA share joint responsibility for evaluated state efforts to implement these pollution abatement strategies. Potential best management practices to be monitored by use of remote sensing technology could include: implementation of erosion and sediment control measures; development of nutrient management plans; protection of critical areas, and development of watershed management programs to reduce runoff pollutant concentrations.

4. Purpose/Need: To help NOS and EPA to monitor and evaluate the effectiveness of state/territorial Coastal Nonpoint Pollution Control Programs in addressing non-point source pollution in coastal watersheds. This effort will focus on predicting and assessing spatial and temporal changes in hydrologic characteristics and nonpoint pollution abatement strategies.
Relevant enabling legislation include Coastal Zone management Act of 1972 as amended; National Marine Sanctuaries Act; Fisheries Conservation and Management Act; Coral Reef Executive Order.

5. Remote Sensed Platforms/Sensors Involved: Diverse satellite, aircraft. Metric Aerial cameras; Multi-spectural imaging

6. Users/Customers: NOAA offices and programs (NMFS, OCRM, CSC,COP, Status & Trends);state and local governments,environmental/conservation groups, Fishery management councial,academia.

7. Products: Aerial orthodigital photography (hard copies and digital files); Color and color IR imagery

8. Resources / Level of Effort:

- First 12 months
  - ___ High: (>$1 million and/or > 5 person years)
  - _X_ Medium: ($0.5 - 1 million and/or 2 - 5 person years)
  - ___ Low: (<$0.5 million and/or < 2 person years)

- For years 2- 5(if applicable)

  Year

  2 ___ High _X_ Medium ____ Low
  3 ___ High _X_ Medium ____ Low
  4 ___ High _X_ Medium ____ Low
  5 ___ High _X_ Medium ____ Low

9. Non-NOS partners required for success? ???

10. Schedule: (please check applicable statements below)

___ can start immediately (<3months)
_X_ requires significant planning/investigation for startup (>3months)
___ can be completed in less than 12 months
_X_ will take more than 12 months for completion

IV. Indicators of Coastal Health

1. Title: **Monitoring program for addressing key indicators of coastal environmental health**

2. Submitted by: Randy Ferguson, John Klein and George Leshkevich

3. Description: Thisproject will apply remote sensing technologies to monitor water quality (e.g. chlorophyll, temperature, salinity, turbidity, lake ice) harmful algal blooms, wetlands, and submersed habitats) to characterize status and trends of coastal environments. The project will include a range of participants and is comprehensive and national in scope to monitor indicators of environmental health. It also will combine indicators of health with hydrographic assessments. The project builds upon ongoing efforts within NOAA (NESDIS/OAR, NOS/NCCOS, CSC) and utilizes appropriate sensors and sensor platforms to complement and expand existing capabilities. Standard protocols will be developed as necessary and applied to remote sensing and field-based water quality and habitat monitoring efforts. These protocols will facilitate regional participation in creation of the national data base. The protocols will be designed to optimize interpretation and temporal and spatial representativeness of the data to characterize the health and hydrographic regime of coastal environments.

4. Purpose/Need: This program will apply data on monitored indicators and hydrographic characteristics to predict and assess change in spatial and temporal distributions of living marine resources (LMR). This includes association of these changes in LMR with environmental quality and resource management pollution abatement strategies in support of NOAA's coastal stewardship responsibilities. Relevant legal authorities include the National Marine Sanctuaries Act, the Endangered Species act, the Fisheries Conservation and Management Act, Coral Reef protection, and etc..

5. Remote Sensing Platforms/Sensors Involved: Diverse satellite, aircraft, shipboard and in-situ platforms, and a variety of NOAA and commercially available sensors

6. Users/Customers: Customers include NOAA offices and programs (NMFS, NCCOS/NCCMA, Status and Trends Program, Coastal Ocean Program, OCRM, NERRs and Sanctuaries), state and local government agencies, conservation groups, fishery management councils, universities, and research institutions.

7. Products: Products will include CD-ROM and Internet accessible maps and tabulations, interpreted images and data compilations (e.g. a Coral Reef or Marine Sanctuary). Products will include source data sets as well as static spatial classifications and change analyses of the data.

8. Resources / Level of Effort:

- First 12 months
  _X_ High: (>$1 million and/or > 5 person years)
  ___ Medium: ($0.5 - 1 million and/or 2 - 5 person years)
  ___ Low: (<$0.5 million and/or < 2 person years)

- For years 2- 5(if applicable)

Year			
2	_X_ High	___ Medium	___ Low
3	_X_ High	___ Medium	___ Low
4	_X_ High	___ Medium	___ Low
5	_X_ High	___ Medium	___ Low

9. Non-NOS partners required for success? State and Local Governments, and other Federal agencies and possibly academic and non-profit organizations.

10. Schedule: (please check applicable statements below)

_X_ can start immediately (<3 months)
___ requires significant planning/investigation for startup (>3months)

___ can be completed in less than 12 months
___ will take more than 12 months for completion

V. Harmful Algal Blooms

1. Title: **Harmful algal bloom monitoring and tracking**

2. Submitted by: Randy Ferguson, John Klein, George Leshkevich and Mary Culver

3. Description: Develop an experimental, region-specific forecasting system to track the initiation, progress, and demise of harmful algal blooms (HABs). The forecasting system will be based on recommendations generated through workshops recently sponsored by the Coastal Ocean Program and the Coastal Services Center (e.g., Application of remote sensing to Red Tide forecasts in the eastern Gulf of Mexico, July 1997).

4. Purpose/Need: This program will apply data on monitored indicators such as sea-surface temperature, salinity and chlorophyll to predict and assess spatial and temporal distributions of HABs. Implementation of a forecast system for HABs will increase the efficiency of fisheries and water quality monitoring and research, and clean-up responses for HAB events.

5. Remote Sensing Platforms/Sensors Involved: Diverse satellite, aircraft, shipboard and in-situ platforms, and a variety of NOAA and commercially available sensors.

6. Users/Customers: Customers include NOAA offices and programs (NESDIS, NMFS, NCCOS/NCCMA, Status and Trends Program, Coastal Ocean Program, OCRM, NERRs and Sanctuaries), state and local government agencies, conservation groups, fishery management councils, universities, research institutions and the general public, chambers of commerce, tourism officials.

7. Products: Products will include CD-ROM and Internet accessible data and information, maps and tabulations of interpreted images and monitored and predicted trajectories of blooms.

8. Resources / Level of Effort:

- First 12 months
  - ___ High: (>$1 million and/or > 5 person years)
  - _X_ Medium: ($0.5 - 1 million and/or 2 - 5 person years)
  - ___ Low: (<$0.5 million and/or < 2 person years)
- For years 2- 5(if applicable)

Year			
2	___ High	_X_ Medium	____ Low
3	___ High	_X_ Medium	____ Low
4	___ High	_X_ Medium	____ Low
5	___ High	_X_ Medium	____ Low

9. Non-NOS partners required for success? State and Local Governments, and other Federal agencies. Forecasts of HAB dynamics would benifit from the participation of academic groups to develop ocean circulation models.

10. Schedule: (please check applicable statements below)

- _X_ can start immediately (<3 months)
- ___ requires significant planning/investigation for startup (>3 months)
- ___ can be completed in less than 12 months
- _X_ will take more than 12 months for completion

III. Background Materials

a. Tasking Memo

b. Cross-cut Team Members

c. Definition of Remote Sensing & Instrument List

d. Workplan

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Silver Spring, Maryland 20910

March 10, 1998

Part 1.

Title: Tasking Memo #3: Establish an NOS "Cross-Cut Team" on Remote Sensing

Task Team Members and Support Staff

National Ocean Service

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John Brock (CSC)
Ed Kruse (OCRM)
Bud Cross (Science)*
CDR Sam Debow (CS)
Randy Ferguson (Science)
Mark Finkbeiner (CSC)
Jamie Higgins (Science)
John Klein (Science)
CDR George Leigh (NGS)
George Leshkevich (Science)
Millington Lockwood (CS)
Jim Lucas (NGS)
Anne Hale Miglarese (CSC)
Debra Simecek-Beatty (Response)
Dwight Trueblood (OCRM)
Grady Tuell (NGS)

*on assignment from NMFS

Other NOAA Offices

Jim Thomas (NMFS)
Lucia Tsaoussi (OAR)
Lee Dantzler (NESDIS)
Jim Zaitzeff (NESDIS)

Description:

It is the goal of the National Ocean Service Remote Sensing Cross-Cut Team to develop and implement a plan for the use of Remote Sensing Technology to successfully meet our coastal stewardship responsibilities over both the short (next 18 months) and long (next three to five years) terms.

The objective is to describe and assess current and proposed NOS activities that involve remote sensing (including personnel and equipment) and to make recommendations on the continued and expanded use of this technology at the agency. This exercise will provide NOS the opportunity to: (1) comprehensively evaluate its position on remote sensing; (2) address more clearly the agency needs with respect to the primary mission of Coastal Stewardship; and (3) communicate these needs more effectively to partners inside and outside of NOAA.

A team of senior NOS personnel with expertise in the field of remote sensing will be assigned to conduct this work. The term "cross-cut" indicates that each NOS line office has an interest in either conducting remote sensing activities or using remotely sensed information; i.e., the topic cuts across all offices. It also refers to the potential for

recruiting more "cross-cut" participation in these activities from NOS line offices with similar or compatible needs.

For the purposes of this work, remote sensing is defined as:

> *The measurement or acquisition of information of some property of an object or phenomenon, by a recording device that is not in physical or intimate contact with the object or phenomenon under study; e.g., the utilization at a distance (as from aircraft, spacecraft, or ship) of any device and its attendant display for gathering information pertinent to the environment, such as measurements of force fields, electro-magnetic radiation, or acoustic energy. The technique employs such devices as the camera, lasers, and radio frequency receivers, radar systems, sonar, seismographs, gravimeters, magnetometers, and scintillation counters.*
>
> Manual of Remote Sensing, 2nd Edition, 1983,
> American Society of Photogrammetry and Remote Sensing

Part 2.

Requirements

1. Requirement to assemble a representative NOS team to conduct a remote sensing cross-cut excercise to inventory NOS remote sensing activities and make recommendations for improvements and new opportunities.

2. Requirement to accurately characterize, through a series of summary tables and/or graphics, the current types of NOS remote sensing activities. This includes determining the number of activities, where they are being conducted, by and with whom, for what purposes, and the products expected.

3. Requirement to characterize the experience base of NOS personnel with respect to remote sensing. In particular, to establish the types of expertise and where in NOS this expertise resides.

4. Requirement to characterize NOS's current investment in remote sensing technology (computers, sensors, etc.) and where in NOS these resources reside.

5. Requirement to identify the current mission priorities at NOS that lend themselves to the use/application of current and possibly future remote sensing technology.

6. Requirement to describe the current customer base for NOS remote sensing products and services and to determine if this base is changing/evolving.

7. Requirement to identify opportunities for improvements, new directions, and/or growth of remote sensing applications at NOS based upon agency priorities and customer needs.

8. Requirement to produce a summary report and recommendations to be presented to NOS senior management.

Part 3.

Major Tasks Required:

1. Assemble a Cross-Cut Team **Dec 22**

A team of NOS staff will be proposed to participate directly in this activity over the next six months. This work is expected to require up to 20 percent of each person's time. The Team will include at least one representative from each NOS line office. The Team (including staff support of at least two persons) will be approved by NOS Line Office Directors. The team may also include observers nominated by other NOAA Services (NWS, NESDIS, NMFS, OAR - maximum of six) who will participate in Cross-Cut Team meetings.

2. Develop a work plan **Jan 12**

The Cross-Cut Team will develop a detailed work plan. The plan will include, at a minimum, a list of major tasks, assignments, and products to be completed over the next six months. The plan will be submitted for review to the NOS Transition Team before implementation begins.

3. Conduct an inventory of NOS remote sensing projects, personnel, equipment, and information assets. **Apr 3**

The Cross-Cut Team will identify all major ongoing and planned NOS activities that involve remote sensing or the application of remotely sensed data. The Team will also identify all NOS personnel with remote sensing expertise, all major equipment used to collect and/or process remotely sensed data, and all NOS significant remotely sensed data assets (e.g., aerial photos, satellite imagery).

4. Evaluate customer needs **Apr 3**

The Cross-Cut Team will identify existing and potential future remote sensing needs of NOS customers. This assessment will be based upon recent surveys conducted by NOS and USGS as well as the perceptions and understandings of Team members.

5. Identify remote sensing opportunities **Apr 24**

The Cross-Cut Team will identify and describe opportunities for improving and/or expanding NOS remote sensing products and services based upon NOS mission priorities and perceived customer needs.

6. Assess inventory results **May 8**

The Cross-Cut Team will conduct an assessment of what the inventory results suggest with respect to NOS's current and future investment in remote sensing.

7. Develop recommendations **May 29**

The Cross-Cut Team will develop a broad set of recommendations for future NOS remote sensing activities based on the integration of inventory results and the new opportunities the team has identified. Operational elements about each recommendation (how to implement, estimates of resources required, etc.) will be included.

8. Submit a Strategic Plan for Remote Sensing at NOS **Jun 30**

The Strategic Plan will transmit the Team's broad recommendations for the use and application of existing and emerging remote sensing technologies at NOS with respect to its mission of Coastal Stewardship. This report will also include a summary of the Team's findings (e.g. inventories of projects, personnel, and equipment; a summary of customer needs and other NOAA remote sensing programs (non-NOS); and a list of new opportunities for remote sensing at NOS).

9. Provide input for NOS planning activities **As Required**

The Cross-Cut Team will also provide input for the NOS planning process. This will include suggesting priorities for the NOAA Strategic Planning Teams that meet annually to nominate out-year budget priorities, and reviewing NOS line office draft annual operating plans with respect to NOS remote sensing priorities.

Outcomes:

1. Cross-cut team (Dec 22)
2. Work plan for next six months (Jan 16)
3. Assessment of inventory results (May 1)
4. Recommendations on remote sensing opportunities for NOS (May 29)
5. Strategic Plan for Remote Sensing at NOS (Jun 30)
6. Suggestions on NOS planning activities. (As Required)

Resource Requirements:

1. NOS senior staff (app. 15) committed for up to 20 percent of their time over the next six months (December 1997 to June 1998).

2. Staff support of one to two persons required to assist in conducting project activities.

Approved: _____ **Date**: _____

Nancy Foster, Ph.D.
Assistant Administrator

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National Ocean Service Remote Sensing Cross-cut Team

Definition of Remote Sensing

The National Ocean Service Remote Sensing Cross-cut Team developed this material to establish a common basis for discussions of this topic across organizational units of NOS and NOAA. The definition, sensor list, and sensor descriptions are not meant to be comprehensive. They represent the topic of remote sensing from the perspective of (1) the types of activities conducted by NOAA's National Ocean Service, and (2) the technology in general as understood by Team members.

DEFINITION:
The Manual of Remote Sensing, 2nd Edition, 1983, of the American Society of Photogrammetry and Remote Sensing defines remote sensing as:

> The measurement or acquisition of information of some property of an object or phenomenon, by a recording device that is not in physical or intimate contact with the object or phenomenon under study; e.g., the utilization at a distance (as from aircraft, spacecraft, or ship) of any device and its attendant display for gathering information pertinent to the environment, such as measurements of force fields, electro-magnetic radiation, or acoustic energy. The technique employs such devices as the camera, lasers, and radio frequency receivers, radar systems, sonar, seismographs, gravimeters, magnetometers, and scintillation counters.

SENSORS:
The following list of sensors, platform locations, and possible applications represents the spectrum of remote sensing understood by the Team as included in the above definition.

	PLATFORM LOCATION			
SENSOR	*Terrestrial*	*Marine*	*Airborne*	*Space*
Camera:				
Metric, still	Y	Y	Y	Y
Non-metric, still	Y	Y	Y	Y
Video	Y	Y	Y	Y
LIDAR	Y	Y	Y	Y
Laser line scanners	N	Y	N	N
Laser fluorosensor	N	Y	Y	Y
Multi-spectral imager	N	N	Y	Y
Hyper-spectral imager	N	N	Y	Y
Radar	Y	Y	Y	Y
Scatterometers	N	N	Y	Y
Synthetic aperture radar	N	N	Y	Y
Acoustic:				
Single Beam	N	Y	N	N
Multibeam	N	Y	N	N
Sidescan	N	Y	N	N
Acoustic doppler	Y	Y	N	N
Seismographs / seismometers	Y	Y	N	N
Magnetometer	Y	Y	Y	Y
Gravimeter	Y	Y	Y	N
Scintillation counter	N	N	Y	N
Gamma spectrometer	N	N	Y	N
Spectral radiometer	Y	Y	N	N

N- no applications, Y- known applications

SENSOR DESCRIPTIONS:

Camera - A light proof chamber or box in which the image of an exterior object is projected upon a sensitized plate or film, through an opening usually equipped with a lens or lenses, shutter, and variable aperture.*

Aerial Camera - A camera specially designed for use in aircraft.*

Metric Camera - A camera whose interior orientation is known, stable, and reproducible.*

Non-metric Camera - (to be added)

Interior Orientation - The determining of the interior perspective of the photograph as it was at the instant of exposure. Elements of interior orientation are the calibrated focal length, location of the calibrated principal point, and the calibrated lens distortion.*

Video Camera - A device capable of recording and playing back sounds and images.

Laser - An acronym for "Light Amplification by Stimulated Emission of Radiation." A device producing coherent-energy beams in the spectrum of light-or-near-light frequencies.* In remote sensing, normally used to measure distance, given the known speed of light.

LIDAR - LIght **D**etection **A**nd **R**anging. Is laser-based remote sensing i.e. radar principle applied in the optical (and IR) regions of the electromagnetic spectrum. Lidars are based on the principle of a laser-light pulse being sent into the atmosphere or water to probe the distance, physical state, or chemical composition of the backscattering medium (atmospheric layers, sea floor, etc.). LIDAR technology uses the reflective and transmissive properties of the medium (i.e. water, atmosphere, etc.) to gather high-density survey data. When a light beam hits a medium part of the energy is reflected off the surface and the rest, unless absorbed by particles in the medium is transmitted throught the column.

Laser Line Scanners - A line scanner projects a beam of light on the object being digitized. It then takes points from the entire line. This line is typically one to three inches long and collects up to 600 points at a time depending on the line scanner.

Laser Fluorosensor - Active sensor (of OLS heritage) with the objective to analyze the upper layers of the sea surface (in the nadir direction) from airborne altitudes in the 100-300 m range.*****

Multi-Spectral Imager - An imager that acquires data in several to tens of contiguous spectral bands covering the electromagnetic spectrum. The bandwidth is a few micrometers.

Hyper-Spectral Imager - An imager that acquires data in hundreds of contiguous spectral bands covering the electromagnetic spectrum. The bandwidth is approximately 50-100 nanometers.

Ultraspectral Imager - An imager that acquires data in thousands of contiguous spectral bands covering the electromagnetic spectrum. The bandwidth is less than one nanometer.

Radar - Acronym for "RAdio Detection And Ranging." An instrument for determining the distance and direction to an object by measuring the time needed for radio signals to travel from the instrument to the object and back, and by measuring the angle through which the instrument's antenna has traveled.***

Scatterometer - Used in active remote sensing to accurately measure the backscattered field when the surface is illuminated by a signal with a narrow spectral bandwidth. Measurement of surface roughness.*****

Synthetic Aperture Radar (SAR) - A radar in which a synthetically long apparent or effective aperture is constructed by integrating multiple returns from the same ground cell, taking advantage of the Doppler effect to produce a phase history film or tape that may be optically or digitally processed to reproduce an image.*
- A radar containing a moving or scanning antenna; the signals received are combined to produce a signal equivalent to that which would have been received by a larger, stationary antenna. The amplitudes and phases of the signals received at the antenna are stored for each position the antenna occupies. These quantities are subsequently combined to yield a signal with the angular resolution of a standard stationary antenna.***

Acoustic -

Single beam - A method of surveying which utilizes the generation and reflection of sound waves to reveal the structure of a particular surface. In ocean studies, sound waves are emitted from a ship which return at different rates depending on the depth they travel to. The surface of the ocean floor can then be mapped using the variation in these rates.

Multibeam - A technique similar to sidescan sonar, but differing in the form of data produced. Multibeam sonar reveals changes in ocean floor depth, whereas sidescan sonar indicates objects or height variations. Multibeam depth sounders have one or two nadir looking beams and 15 to over 100 beams which fan out at increasingly off-nadir angles. These instruments have a separate transducer for transmitting and receiving which are identical but mounted at right angles.

Sidescan - A type of sonar used to reveal the structure of the ocean floor. Sound energy in the shape of a fan is sent out from beneath a tow body to either side. The sound waves are reflected back to the tow body by objects along the ocean floor and used to create an image of the sea floor surface.

Acoustic doppler - A method utilizing the Doppler effect in order to measure the relative velocity between the sound wave transmitter and scatterers within the ocean. This technique eliminates error due to velocity, as well as salinity and temperature.

Seismographs / seismometers - A type of survey utilizing explosives or mechanical devices in order to transmit waves of sonic energy below the surface. The reflected waves are used to produce seismic maps detailing subsurface geologic structures.

Magnetometer - An instrument for measuring the intensity and direction of the earth's magnetic field.**

Gravimeter - An instrument for determining either the value of gravity at a point, or the difference in gravity between that point and another point. Also call a gravity meter.***

Scintillation counter - A device used to measure the rapid displacement of an object, as indicated by variation in the brightness and color of the object when viewed through the atmosphere.

Gamma spectrometer - An instrument which measures gamma radiation as an indicator of the intensity and flux of Earth's magnetic field.

Spectral radiometer - An instrument which measures the distribution of radiant energy within a specific spectrum, in order to determine the wavelengths.

Interferometric SAR - Interferometric SAR uses the relative phase difference between two coherent SAR images, obtained by two antennae separated by an across track baseline, to derive an estimate of the surface height. Single pass, dual antenna Interferometric Synthetic Aperture Radar (IFSAR) is a proposed solution for the need of an all weather, day or night operations, high speed collection and processing capability to quickly determine accurate terrain elevations over large areas to produce map products for military, environmental and commercial applications. A dual pass, single antenna technique is also possible.****

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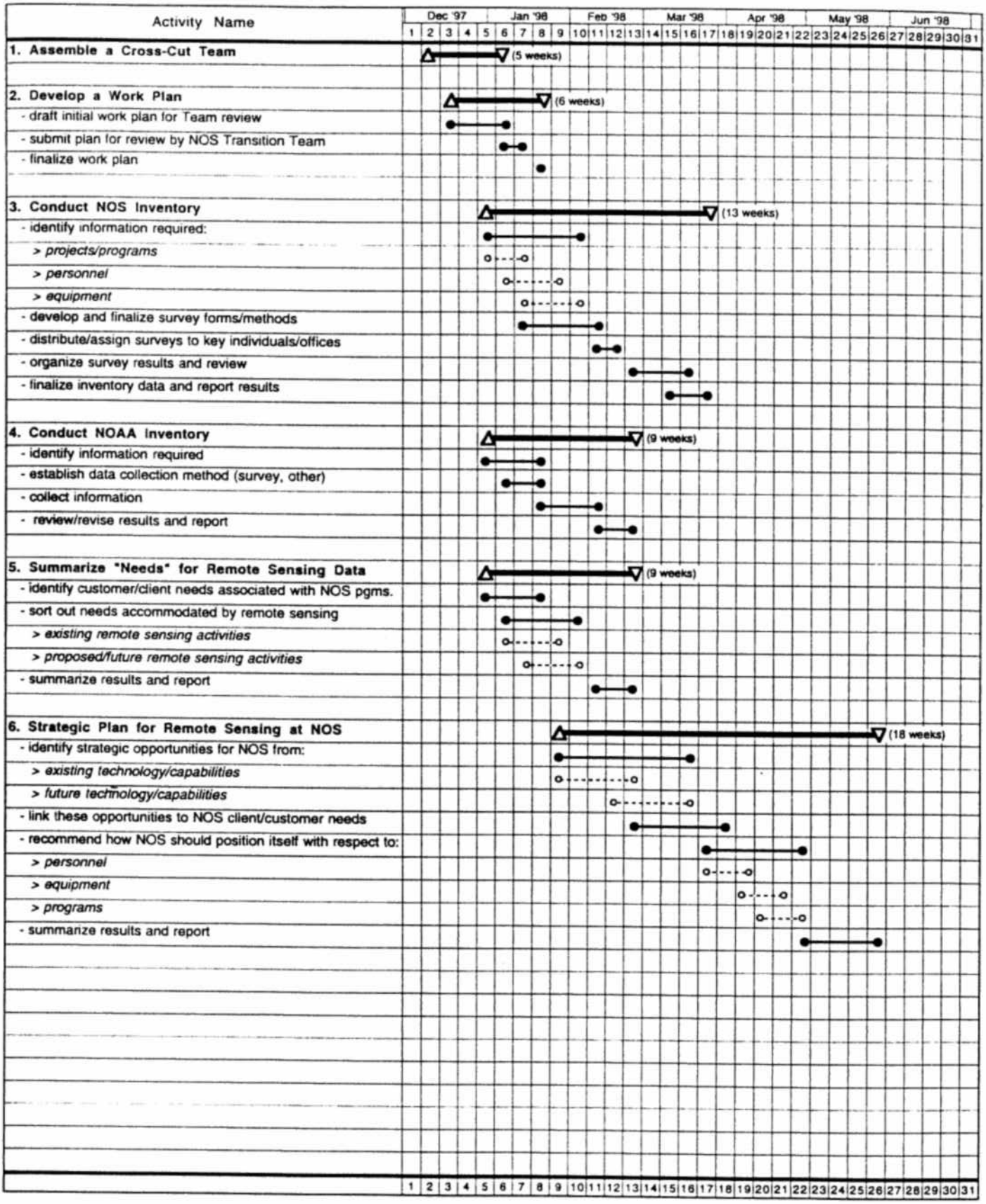
* Definition from ASPRS
** Definition from "THE AMERICAN PRACTICAL NAVIGATOR", NIMA, 1995.
** Definition from "GEODETIC GLOSSARY", NGS, 1986.
**** Paper by Intermap Technologies Ltd. 1997.
*****Definitions from "Observation of the Earth and It's Environment", Springer, 1996.

NOS Remote Sensing Cross-cut Team

Proposed Work Plan (12/97-6/98)



IV. Inventory

a. Projects
- *(1) survey form*
- *(2) FY98 projects summary*
- *(3) contacts*

b. Personnel
- *(1) survey form*
- *(2) FY98 expertise summaries*
- *(3) suggestions from NOS personnel*

c. Equipment
- *(1) survey memo*
- *(2) report on FY98 equipment*
- *(3) tabular summaries*

IV. a. Projects

(1) survey form

(2) FY98 projects summary

(3) contacts

Remote Sensing: Project Inventory

3/16/98

National Ocean Service Cross-cut Team

1. Your Name

name: _____ NOS office: _____

phone: _____ fax: _____ email: _____

2. Project Title

_____

_____

3. Project Description

Check one or more			*Check one only*		
mandated ☐	research & development ☐	program activity ☐	recently completed (after 10/97) ☐	on-going ☐	proposed ☐

_____

_____

_____

_____

_____

4. Program Description *If this project is part of a larger on-going program, please describe the program.*

_____

_____

_____

_____

_____

5. Objectives

1. _____
2. _____
3. _____
4. _____
5. _____

6. Partners/Users *Within and outside of NOAA, check one or both.*

	partner	user
1. _____	☐	☐
2. _____	☐	☐
3. _____	☐	☐
4. _____	☐	☐
5. _____	☐	☐
6. _____	☐	☐
7. _____	☐	☐

7. Schedule *Please write "ongoing" for work that continues from year to year (e.g., coastal hydrography.)*

start (mm/yr:): _____ finish (mm/yr:): _____

8. Resources *Please estimate the TOTAL level of effort required over the life of the project by indicating the approximate person years required over a 12 month period in 0.25 increments including management and non-technical support. For work that continues year to year (as indicated in question 6 above), estimate ANNUAL level of effort.*

	Your Office	Other NOS		Other NOAA		Other non-NOAA	
	people	*people*	*office*	*people*	*office*	*people*	*office*
U.S. Govt. employees	____	____	_____	____	_____	____	_____
Contractors	____	____	_____	____	_____	____	_____

9. Location *Please be as specific as possible.*

_____

_____

_____

_____

10. Project Data *Include image data, vector/point data, and other important ancillary data used for the project.*

Source	Type	Resolution/Min. Mapping Unit	Time period

11. Products *List major interim and final products (data, maps, reports, etc.) and the approximate data of completion - for products generated on a cyclical basis (e.g. navigation charts), please provide some estimate of how often and/or how long it takes to create them.*

	Date
1.	
2.	
3.	
4.	
5.	
6.	

12. Comments *Please add any additional information about the project that you feel is relevant. Any comments you have on the inventory are also appreciated.*

National Ocean Service Remote Sensing Cross-cut Team

NOS FY98 Remote Sensing Projects

No.	Office	Type	Title	Description	start	finish	NOAA Person Years: your office	NOAA Person Years: other NOS	NOAA Person Years: other NOAA	NOAA Person Years: Non-NOAA	Contractor Person Years: your office	Contractor Person Years: other NOS	Contractor Person Years: other NOAA	Contractor Person Years: Non-NOAA
Underwater Bottom Mapping														
P049	OCS	S	Hydrographic Surveys: A	1. Chesapeake Bay entrance-vicinity of Cape Henry, VA (S-E900-RU-98) - 3/98 to 2/98 2. Approaches to Jacksonville, FL (OPR-G354-WH-98) - 3/98 to 6/98 3. Northern Chesapeake Bay, MD (OPR-E346-AHP-BH-98) 4/95 to ongoing 4. Nautilus Shoal, VA 9/98 to 11/98 5. Penobscot Bay, ME 7/98 to 9/98 6. Approaches to Portland Harbor, ME 9/98 to 11/98 7. Approaches to Penobscot, Bay (Two Bush Channel), ME OPR-A366-RU) 7/98 TO 8/98	7 proj.									
P050	OCS	S	Hydrographic Surveys: B	1. Sinclair Inlet and Rich Passage, WA (S-N904-RA-98) 3/98 to 4/98 2. Elliot Bay, WA (S-N903-RA-98) 3/98 to 4/98 3. Approaches to Moorehead City, NC (OPR-F344-WH-98) 7/98 to 11/98 4. Lynn Canal, AK (OPR-0340-RA 98) 4/98 to 6/98 5. Port San Luis, CA (OPR-L356-KR) 7/98 to 9/98 6. Northern Approach to Nikiski, AK (OPR-P367-KR) 5/98 to 11/98 7. Approaches to Brunswick, GA (OPR-G311-WH-97) 5/98 to 11/98	7 proj.									
P051	OCS	S	Hydrographic Surveys: C	1. Approaches to Miami, FL (OPR-H300-KR/AHP) 1/98 to 4/98 2. Approaches to Port Everglades, FL (OPR-H395-KR/AHP) 4/98 to 6/98 3. Block Island Sound, NY & RI (OPR-B663-RU) 4/98 to 6/98 4. Point Judith, RI (OPR-B902-RU) 7/98 to 10/98 5. Southwest Prince William Sound, AK (OPR-P139-RA) 7/98 to 11/98	5 proj.									
P052	OCS	S	Hydrographic Surveys: D	1. Northern Puget Sound, WA (OPR-N368-PHP) 1/98 to 4/98 2. Charleston Harbor, SC and adjoining waterways (OPR-H395-KR/AHP) 4/97 to ongoing 3. Delaware Bay, DE; vicinity of Big Stone anchorage area (S-D907-RU) 11/97 to 11/97 4. Cameron, LA to Sabine, TX (OPR-K171-KR) 5/98 to ongoing 5. Cook Inlet, AK (OPR-P385-KR) 8/98 to ongoing 6. Shakan Strait and approaches, AK (OPR-0380-RA) 5/98 to 6/98	6 proj.									
P054	OCS	S	Hydrographic Surveying	Hydrographic surveying coastal waters in the United States and it's territories.	ongoing									
						subtotals	127.00				64.00			
Shoreline Mapping														
P022	CSC	AS	Airborne LIDAR Assessment of Coastal Erosion (ALACE) Project	The ALACE Project will establist the capability of aircraft laser swath mapping to provide highly accurate, cost-effective information on coastal topography, erosion, and other variables of interest to the mission at the CRS Program and NOAA CSC.	ongoing		1.00		3.00	1.00	2.00			9.00

National Ocean Service Remote Sensing Cross-cut Team

NOS FY98 Remote Sensing Projects

No.	Office	Type	Title	Description	start	finish	NOAA Person Years: your office	other NOS	other NOAA	Non-NOAA	Contractor Person Years: your office	other NOS	other NOAA	Non-NOAA
P034	CSC	AS	Beach Map Project	The Beach Map Project is the operational, national creation of high-resolution coastal topographic information for all coastal states, collected ancillary data sets, and advanced analysis tools, to be made available via the WWW and CD-ROM.	ongoing		1.00				2.00			
P039	CSC	R	Shoreline Change Detection Using High Resolution Imagery	CSC is providing financial support to the Ohio State University's Civil Engineering Department to help research the feasibility of using the upcoming high-resolution commercial satellite imagery for shoreline change detection in Ohio.	Mar-98	Feb-00	0.25			1.00				
P001	NGS	S	Coastal Mapping Program - Compilation	The Coastal Mapping Program targets project sites based on Hydrographic Surveys Division and Marine Chart Division requirements, and other related program needs.	ongoing		8.00	2.00						
P046	NGS	S	Coastal Mapping Program - Planning and Photography	Collect aerial photography over priority areas of the U.S. shoreline. This year photograph missions are being conducted over TX, LA, AK, WA, OR, CA, OH, PA, MI, WI, MN, ME, NY, DE, MD, U.S., VI, and other areas as schedules permit.	ongoing	ongoing	10.00	3.00			3.00			
						subtotals	20.25	5.00	3.00	2.00	7.00			9.00
Water Color - physical features														
P002	NCCOS	R	Water Color and Salinity Mapping in Florida Bay	Utilize the passive scanning low frequency microwave radiometer along with SAS or AISA color sensors and demonstrate the ability for these instruments to support measurements in water quality.	Sep-97	Oct-98	0.50		0.50					
P004	NCCOS	R	EEGLE: The impact of episodic events on the nearshore-offshore transport and transformation of biogeochemical important materials in the Great Lakes	Create an integrated observational program and numeric modeling effort to identify, quantify, and develop prediction tools for the winter-spring resuspension event and to access the impact of this event on the transport of BIMS and on lake ecology.	Oct-97	ongoing	4.00			9.00				
P036	CSC	R	Estuarine Habitat Project	Aircraft remote sensing of estuarine water qualities and color, temperature, salinity and turbidity. Develop scheme for examining estuarine water quality at higher resolution than possible with satellites.										0.50
P038	CSC	R	Ocean Color Algorithms	CSC/CRS has begun multi-regional collection of bio-optical data in diverse coastal waters. The data is analyzed to yield a suite of geographically wide-spread measurements that are appropriate for the evaluation, inter-comparison, and regional enchancement of the NASA in-water bio-optical algorithms for SeaWifs satellite ocean color data products.	ongoing		0.25				0.25			

National Ocean Service Remote Sensing Cross-cut Team

NOS FY98 Remote Sensing Projects

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P045	OCS	S	Assimilation of In-situ and Remotely Sensed SST Data into NOAA's Coastal Ocean Forecast System (COFS)	This project fosuces on assimilating near real time SST data into the Princeton ocean model of COFS to provide a better estimate of the initial ocean state prior to the generation of a 24-L forecast.	Aug-93	ongoing	1.50				0.25			
						subtotals	6.25			9.00	0.50			0.50
Water Color - biological features														
P020	CSC	AS	Coastal Ocean Habitat Project	Uses new remote sensing techniques and data types to provide information on water column characteristics (biological, optical, and geological) and their trends for the US coastal ocean, and large embayments, estuaries, and major river outflow regions along the US coast.	Oct-97	ongoing					2.00			0.50
P003	NCCOS	R	Development of an in-situ plankton monitor for calibration of ADEOS/OCTS ocean color sensor.	An in-site phytoplankton monitoring system to provide accurate calibration data for ocean color sensors.	Apr-96		1.00							
P005	NCCOS	R	Great Lakes CoastWatch Research and Product Development	To apply remote sensing, image processing, and research and analysis techniques to CoastWatch(and other) data for validation and for the development of regional products and uses of benefit to the user community.	1990	ongoing	1.00		1.00	3.00				
P037	NCCOS	R	Harmful Algal Blooms Forecasts	HAB forecasts will develop experimental, region spec. forecast systems to track the initiation, progress, and demise of harmful algal blooms. The pilot project concentrates on toxic blooms of a dinofiagellate alga in the Gulf of Mex. on FL's west coast.	Oct-96	Sep-99	0.25				1.00			
P006	NCCOS	S	Great Lakes CoastWatch Operations	CoastWatch is a nationwide NOAA program within which the Great Lakes Research Lab (GLERL) functions as the Great Lakes regional node. In this capacity, GLERL obtains, produces, and delivers environmental data and products. It uses real time monitoring of the Great Lakes to support environmental science, decision making and supporting research	Apr-90	ongoing	1.00		0.25	0.25	1.00			
P042		S	Southeast Regional Coast Watch Node	The Southeast Coast Watch Regional Node distributes near real-time AVHRR sea surface temperature imagery to internal and external users (academic institutions, governmental agencies, general public) through ftp and bhp services.	ongoing		1.00				1.00			
						subtotals	4.25		1.25	3.25	5.00			0.50

National Ocean Service Remote Sensing Cross-cut Team

NOS FY98 Remote Sensing Projects

No.	Office	Type	Title	Description	start	finish	NOAA Person Years: your office	NOAA Person Years: other NOS	NOAA Person Years: other NOAA	NOAA Person Years: Non-NOAA	Contractor Person Years: your office	Contractor Person Years: other NOS	Contractor Person Years: other NOAA	Contractor Person Years: Non-NOAA
Habitat Mapping - live bottom														
P009	NCCOS	AS	Use of UTM data to assess the channels, mudbanks, and land cover of Florida Bay	Using classified as well as open data source, prepare maps of physical and biological regions of Florida Bay.	Sep-97	Feb-98	0.75		0.25					
P013	CSC	M/A	Coastal Change Analysis Program (C-CAP): Indian River Seagrass	The St. Johns River and South Florida Water Management Divisions map SAV's in Indian River Lagoon every 2 years. CSC/C-CAP is producing 1996 SAV data using analytical photogrammetry to form a baseline for future change detection.	May-96	Sep-98	0.50							
P014	CSC	M/A	Coastal Change Analysis Program (C-CAP): Florida Bay Seagrass	An effort to map SAV and other benthic habitat using the C-CAP protocol has been underway since 1992. Acquiring comprehensive coverage and digitization have been problematic. CSC/C-CAP is providing technical support for filling in coverage/change gaps.	May-92	Sep-99	0.50							
P015	CSC	M/A	Coastal Change Analysis Program (C-CAP): Benthic habitat mapping for Puget Sound, WA	Washington state DNR has contributed to the design and implementation of the C-CAP program. Aquatic habitat mapping has begun in Puget Sound. They will also be involved in incorp./gen. C-CAP compatible benthic habitat data for future change detection.	Mar-98	Jan-00	0.25							
P016	CSC	M/A	Coastal Change Analysis Program (C-CAP): Benthic habitat mapping for Atlantic Coast, ME	Maine Dept. of Marine Resources has completed mapping/vectorizing it's Atlantic coast using the C-CAP protocol. This new project will involve assessing the accuracy of the data for inclusion into the C-CAP database and planning future change detection.	Apr-98		0.25							0.50
P017	CSC	M/A	Coastal Change Analysis Program (C-CAP): Hudson River Submerged Rooted Vegetation	1995 aerial photo. is being used to map SAV in the lower Hudson R. according to C-CAP protocols. Presence of zebra mussels have increased the suitability of this river for SAV. Trends ident. will be used to document the effectiveness of CZM measures.	Sep-94	Sep-99					0.25			2.00
P018	CSC	M/A	Coastal Change Analysis Program (C-CAP): Willapa Bay, Washington SAV project	June 1995 aerial photography and airborne and submerged videography has been used to map SAV according to C-CAP protocol. A depth-segmented accuracy assessment has been part of the discrimination of sub and inter-tidal SAV habitat.	Oct-95	Sep-98					0.25			
P019	CSC	M/A	Coastal Change Analysis Program (C-CAP): Massachusetts Seagrass	1993 to 1996 aerial photography, and airborne and submerged videography was used to map SAV according to the C-CAP protocol. A depth-segmented accuracy assessment has been part of the discrimination of sub and inter-tidal SAV habitat.	Oct-93	Sep-98					0.75			
P041	CSC	R	C-CAP inventory and change analysis of aquatic beds	R and D methods to improve quality and assessment of seagrass meadows and other aquatic beds in the U.S.	ongoing/ unfunded		0.50							
						subtotals	2.75		0.25		1.25			2.50

National Ocean Service Remote Sensing Cross-cut Team

NOS FY98 Remote Sensing Projects

No.	Office	Type	Title	Description	start	finish	NOAA Person Years: your office	NOAA Person Years: other NOS	NOAA Person Years: other NOAA	NOAA Person Years: Non-NOAA	Contractor Person Years: your office	Contractor Person Years: other NOS	Contractor Person Years: other NOAA	Contractor Person Years: Non-NOAA
Habitat Mapping - land cover														
P023	CSC	M/A	Florida Big Bend Land Cover Change	This project is directly tied to the FMRI Florida project. It covers two TM scene area just north of Tampa Bay. All processing is being conducted by the USGS Center for Coastal Geology.	Oct-96	Jun-99					0.25			0.25
P024	CSC	M/A	Coastal New Jersey Land Cover Change	This project will extend the area already completed for New Jersey. It will be a change detection analysis for the northern part of the state; with all processing done by Rutgers University.	Sep-94	Dec-99	0.25				0.25			0.50
P025	CSC	M/A	Coastal Louisiana Land Cover Change	This project will examine land cover change in eastern coastal Louisiana. It will extend the C-CAP data already completed for the Mermentaw River Basin. All processing is being done by the USGS National Wetlands Research Center.	Nov-94	Dec-99	0.25							0.50
P026	CSC	M/A	Georgia Land Cover Change	This project is examining land cover change for all of coastal Georgia. The study area encompasses tow TM scenes and also covers one of Georgia's hottest coastal management issues - proposed titanium mining adjacent to Okeefenokee swamp.	Jan-98	Apr-99	0.25				1.50			0.25
P027	CSC	M/A	Long Island, NY Land Cover Change	This project is examining land cover change for all of Long Island. The study area is covered by parts of 2 TM scenes and covers an area that ranges from rural/agriculture to highly developed residential and industrial land uses.	Oct-94	Dec-99	0.25							0.50
P028	CSC	M/A	Coastal Texas Land Cover Change	This is a long term project to examine land cover change for all of coastal Texas. All image processing is being carried out by the Texas Parks & Wildlife Dept.	Jun-93	Dec-00	0.25				0.25			0.50
P029	CSC	M/A	Florida Land Cover Change	This project is looking at land cover change for all of Florida. It is conducted in close cooperation with the USGS GAP program and Center for Coastal Geology. All image processing is being carried out by the Florida Marine Research Institute (FMRI).	Dec-97	Jun-00					0.50			0.25
P030	CSC	M/A	Coastal Oregon Land Cover Change	This project will continue the effort already completed for the Columbia River Estuary. It will look at a five scene area and all processing will be carried out by the OR Fish and Wildlife Dept.	Sep-98	Sep-00	0.25				0.25			0.50
P031	CSC	M/A	North Carolina Land Cover Change	This project will examine land cover change for all of coastal North Carolina, and will encompass 2 complete Landsat TM images. When completed these data will be merged eith the existing CCAP seagrass data for North Carolina.	Nov-97	Dec-99	0.25				1.00			0.25

National Ocean Service Remote Sensing Cross-cut Team

NOS FY98 Remote Sensing Projects

No.	Office	Type	Title	Description	start	finish	NOAA Person Years: your office	other NOS	other NOAA	Non-NOAA	Contractor Person Years: your office	other NOS	other NOAA	Non-NOAA
P032	CSC	M/A	Gulf of Maine/Northern New England Land Cover Change	This project is a synthesis of several projects looking at land cover change in the northeast. Two TM scene projects, one in ME and one in NH have already been completed. One TM scene in ME and one in MA will be completed in calendar year 1998.	Jun-93	Dec-99	1.00				2.00			
						subtotals	2.75				6.00			3.50
Aeronautical Surveying														
P047	NGS	S	Aeronautical Surveys - Planning and Photography	Aerial photographs are collected by FAA regions. This year the program covers the following regions: SW, Texas, SE, NE. The data (aerial photographs) are collected to support the program, specificially to provide runwayl taxiway, apron, NAVAID, and aircraft obstruction data to support the determination of precision or non-percision aircraft approaches, including GPS approaches.	ongoing		10.00							
P048	NGS	S	Airport Survey Program - Compilation			ongoing	7.00							
						subtotals	17.00							
Water Currents														
P044	OCS	R	Coastal Delta-K System	Development of a high spatial resolution (100mx100m grid)surface current mapping microwave radar. SBIR supported. Requires further test and evaluation. Activities are being halted due to lack of funding.			0.25	0.25			0.50			
P053	COOPS	S	1. Physical Oceanographic Real-Time System (PORTS) 2. National Water Level Observation Program (NWLOP)	1. PORTS provides accurate, real-time information on currents, water levels, winds, salinity, and other phyical oceanographic parameters. This real-time data access is critical to the navigation community for ensuring safe and efficient marine navigation.	ongoing		10.00				2.00			
						subtotals	10.25	0.25			2.50			
Fish / Mammal Detection														
P043	NCCOS	M/A	Spatial analysis of the co-occurrence of dolphins and fishing gear in coastal waters of the Mid-Atlantic	Determine distribution (spatial/temporal) of dolphins, fishing gear, env. parameters to see how they are related. Determine co-occurrence of dolphins and fishing gear, and cond. under which these occur via beach based, aerial and sea sampling surveys.	2/19/97	ongoing	0.25				1.00			1.00
P007	NCCOS	R	Modeling and Measuring Acoustic Backscatter of Fish	Use Kirchoff-Ray Mode backscatter models to examine and quantify magnitudes and causes of acoustic scattering by fish. Scattering models span Rayleigh to Geometric frequency ranges and are species, length, aspect, and frequency dependent.	Sep-97	Sep-99					1.00			

National Ocean Service Remote Sensing Cross-cut Team

NOS FY98 Remote Sensing Projects

No.	Office	Type	Title	Description	start	finish	NOAA Person Years: your office	NOAA Person Years: other NOS	NOAA Person Years: other NOAA	NOAA Person Years: Non-NOAA	Contractor Person Years: your office	Contractor Person Years: other NOS	Contractor Person Years: other NOAA	Contractor Person Years: Non-NOAA
P008	NCCOS	R	Modeling and Measuring Backscatter from Fish Ensembles	To quantify, understand, and predict distributions of fish in coastal environments using acoustic technology.	Oct-98	Oct-00					1.00			
P011	NCCOS	R	Spatial Distributions of Planktivorous Fish in Lake Ontario: Implications for fish thermal ecology, fish bioenergetics modeling, and trophic economics	Thesis research conducted in ass. w/ Lake Ontario Trophic Transfer (LOTT) Program. Research focused on the spatial distr. of Planktivorous fishes in west. Lake Ontario & how variability in these distr. changes bioenergetics @ a variety of spatial scales.	Jul-95	Oct-97	2.00							
P012	NCCOS	R	Acoustic Measurements of Fish Abundance in the Delaware Bay	Use underwater acoustics and midwater trawls to assess spatial and temporal distribution and abundance of pelagic fishes in the Delaware Bay estuary.	May-96	May-97								1.00
						subtotals	2.25				3.00			2.00
Other														
P033	CSC	AS	Applications Software Project	The project will enhance or develop software in support of the data analysis needs of Coastal Remote Sensing projects and other CSC programs.	ongoing	ongoing	1.00							
P010	NCCOS	S	Great Lakes Coastal Forecasting System	The Great Lakes Coastal forecasting system is a series of computerized models for forecasting environmental conditions in the Great Lakes. Users include recreational, commercial, and education interests. Products are disseminated over the Internet.	ongoing		0.50			1.00				
P035	CSC	S	Coastal Bio-Optical Data Analysis and Storage System (CoBASS)	CoBASS is the dev. of a system to store and access point and profile data in an efficient manner. Data consist of hist. and recent bio., optical, and WQ parameters collected in coastal regions. The CoBASS tool will be made available via the WWW.	Jan-97	Sep-98	1.50				4.00			
P040	CSC	S	Image Derived Products Program	The project involves producing Imagery Derived Products (IDPs) from National Technical Means (NTM) assets. IDPs consist of vector data layers and literal image products.	ongoing		1.50							
						subtotals	4.50			1.00	4.00			
						TOTALS	197.25	5.25	4.50	15.25	93.25			18.00

TYPE: R=Research, A/S=Applied Science, M/A=Monitoring/Assessment, S=Service

GRAND TOTAL 333.50

National Ocean Service Remote Sensing Cross-cut Team
Project Inventory - CONTACT LIST

no.	project title	contact	office	telephone	e-mail
P001	Coastal Mapping Program - Compilation	Leigh, George	NGS	301-713-2663	gleigh@ngs.noaa.gov
P002	Water Color and Salinity Mapping in Florida Bay	Ives, Russell P.	ORCA/SEA	301-713-3000x179	Russell.Ives@noaa.gov
P003	Development of an in-situ plankton monitor for calibration of ADEOS/OCTS ocean color sensor.	Warner, Robert A.	ORCA/SEA	301-713-3000x105	Rob.Warner@noaa.gov
P004	EEGLE: The impact of episodic events on the nearshore-offshore transport and transformation of biogeochemical important materials in the Great Lakes	Miller, Gerald S.	GLERL	734-741-2119	miller@glerl.noaa.gov
P005	Great Lakes CoastWatch Research and Product Development	Leshkevich, George A.	GLERL	734-741-2265	leshkevich@glerl.noaa.gov
P006	Great Lakes CoastWatch Operations	Leskevich, George A.	GLERL	734-741-2265	lesjkevich@glerl.noaa.gov
P007	Modeling and Measuring Acoustic Backscatter of Fish	Horne, John	GLERL	734-741-2269	horne@glerl.noaa.gov
P008	Modeling and Measuring Backscatter from Fish Ensembles	Horne, John	GLERL	734-741-2269	horne@glerl.noaa.gov
P009	Use of UTM data to assess the channels, mudbanks, and land cover of Florida Bay	Warner, Robert A.	ORCA/SEA	301-713-3000x105	Rob.Warner@noaa.gov
P010	Great Lakes Coastal Forecasting System	Schwab, David	GLERL	734-741-2120	schwab@glerl.noaa.gov
P011	Spatial Distributions of Planktivorous Fish in Lake Ontario: Implications for fish thermal ecology, fish bioenergetics modeling, and trophic economics	Hondrop, Darryl W.	GLERL	734-741-2354	hondorp@glerl.noaa.gov
P012	Acoustic Measurements of Fish Abundance in the Delaware Bay	Demers, Eric	GLERL	734-741-2392	demers@glerl.noaa.gov
P013	Coastal Change Analysis Program (C-CAP): Indian River Seagrass	Finkbeiner, Mark	CSC	843-740-1264	mfinkbei@csc.noaa.gov
P014	Coastal Change Analysis Program (C-CAP): Florida Bay Seagrass	Finkbeiner, Mark	CSC	843-740-1264	mfinkbei@csc.noaa.gov
P015	Coastal Change Analysis Program (C-CAP): Benthic habitat mapping for Puget Sound, WA	Finkbeiner, Mark	CSC	843-740-1264	mfinkbei@csc.noaa.gov
P016	Coastal Change Analysis Program (C-CAP): Benthic habitat mapping for Atlantic Coast, ME	Finkbeiner, Mark	CSC	843-740-1264	mfinkbei@csc.noaa.gov

National Ocean Service Remote Sensing Cross-cut Team
Project Inventory - CONTACT LIST

no.	project title	contact	office	telephone	e-mail
P017	Coastal Change Analysis Program (C-CAP): Hudson River Submerged Rooted Vegetation	Finkbeiner, Mark	CSC	843-740-1264	mfinkbei@csc.noaa.gov
P018	Coastal Change Analysis Program (C-CAP): Willapa Bay, Washington SAV project	Finkbeiner, Mark	CSC	843-740-1264	mfinkbei@csc.noaa.gov
P019	Coastal Change Analysis Program (C-CAP): Massachusetts Seagrass	Finkbeiner, Mark	CSC	843-740-1264	mfinkbei@csc.noaa.gov
P020	Coastal Ocean Habitat Project	Armstrong, Edward E.	CSC	843-740-1265	earmstrong@csc.noaa.gov
P022	Airborne LIDAR Assessment of Coastal Erosion (ALACE) Project	Mike Hearne	CSC	843-740-1281	mhearne.csc.noaa.gov
P023	Florida Big Bend Land Cover Change	Don Field	CSC	843-740-1233	dfield@csc.noaa.gov
P024	Coastal New Jersey Land Cover Change	Don Field	CSC	843-740-1233	dfield@csc.noaa.gov
P025	Coastal Louisiana Land Cover Change	Don Field	CSC	843-740-1233	dfield@csc.noaa.gov
P026	Georgia Land Cover Change	Don Field	CSC	843-740-1233	dfield@csc.noaa.gov
P027	Long Island, NY Land Cover Change	Don Field	CSC	843-740-1233	dfield@csc.noaa.gov
P028	Coastal Texas Land Cover Change	Don Field	CSC	843-740-1233	dfield@csc.noaa.gov
P029	Florida Land Cover Change	Don Field	CSC	843-740-1233	dfield@csc.noaa.gov
P030	Coastal Oregon Land Cover Change	Don Field	CSC	843-740-1233	dfield@csc.noaa.gov
P031	North Carolina Land Cover Change	Don Field	CSC	843-740-1233	dfield@csc.noaa.gov
P032	Gulf of Maine/Northern New England Land Cover Change	Field, Don	CSC	843-740-1233	dfield@csc.noaa.gov
P033	Applications Software Project	Waters, Kirk	CSC	843-740-1227	kwaters@csc.noaa.gov

National Ocean Service Remote Sensing Cross-cut Team
Project Inventory - CONTACT LIST

no.	project title	contact	office	telephone	e-mail
P034	Beach Map Project	Hearne, Mike	CSC	843-740-1281	mhearne@csc.noaa.gov
P035	Coastal Bio-Optical Data Analysis and Storage System (CoBASS)	Culver, Mary	CSC	843-740-1250	mculver@csc.noaa.gov
P036	Estuarine Habitat Project	Eslinger, David L.	CSC	843-740-1270	deslinger@csc.noaa.gov
P037	Harmful Algal Blooms Forecasts	Culver, Mary	CSC	843-740-1250	mculver@csc.noaa.gov
P038	Ocean Color Algorithms	Culver, Mary	CSC	843-740-1250	mculver@csc.noaa.gov
P039	Shoreline Change Detection Using High Resolution Imagery	Schmidt, Nicholas	CSC	843-740-1237	mschmidt@csc.noaa.gov
P040	Image Derived Products Program	Hund, Erik	CSC	843-740-1280	ehund@csc.noaa.gov
P041	C-CAP inventory and change analysis of aquatic beds	Ferguson, Randolph L.	Beaufort Lab	919-728-8764	rferguson@hatteras.bea.nmfs.gov
P042	Southeast Regional Coast Watch Node	Woodruff, Dana Dr.	Beaufort Lab	919-728-8778	dwoodruff@hatteras.bea.nmfs.gov
P043	Spatial analysis of the co-occurrence of dolphins and fishing gear in coastal waters of the Mid-Atlantic	Hohn, Dr. Aleta A.	Beaufort Lab	525-728-8797	aleta.hohn@noaa.gov
P044	Coastal Delta-K System	Shih, Hsing-Hua	NES/CSDL	301-713-2809 x103	shis@wlnet1.nos.noaa.gov
P045	Assimilation of In-situ and Remotely Sensed SST Data into NOAA's Coastal Ocean Forecast System (COFS)	Kelly, Dr. John G.W.	Coast Survey	301-713-2809x107	johnk@ceab.nos.noaa.gov
P046	Coastal Mapping Program - Planning and Photography	Leigh, CDR George	NGS/RSD	301-713-2663	gleigh@ngs.noaa.gov
P047	Aeronautical Surveys - Planning and Photography	Leigh, George & Solbeck,	NGS/RSD	301-713-2663	gleigh@ngs.noaa.gov
P048	Airport Survey Program - Compilation	Leigh, George	NGS/RSD	301-713-2663	gleigh@ngs.noaa.gov
P049	Hydrographic Surveys: A	Verry, Stephen	Coast Survey		

National Ocean Service Remote Sensing Cross-cut Team
Project Inventory - CONTACT LIST

no.	project title	contact	office	telephone	e-mail
P050	Hydrographic Surveys: B	Derkazarian, Robert	Coast Survey		
P051	Hydrographic Surveys: C	Riddle, Mike	Coast Survey		
P052	Hydrographic Surveys: D	Hickson, Maurice	Coast Survey		
P053	1. Physical Oceanographic Real-Time System (PORTS) 2. National Water Level Observation Program (NWLOP)	Bourgerie, Richard W.	CS/OPSD	301/713-2890x148	richard.bourgerie@noaa.gov
P054	Hydrographic Surveying	Fletcher, Rick	NOAA Ship Rainer	206/553-4794	FOO.RAINIER@NOAA.GOV

IV. b. Personnel

(1) survey form

(2) FY98 personnel summary

(3) suggestions from NOS personnel

Remote Sensing: Personnel Inventory

National Ocean Service Cross-cut Team

1. Name/Organization

Name: _____ Title: _____

NOS office: _____ Security clearance granted (Yes/No): _____

Contractor name: _____

Phone: _____ Fax: _____ e-mail: _____

Undergraduate degree(s): _____ Graduate degree(s): _____

Other RS/GIS training : _____

2. Position/Primary Expertise

Program manager - supervisory and project design and development responsibilities, all others would be staff/technical. Overall expertise - approximate technical experience in one or more areas.

Present position: ☐ program manager ☐ staff/technical

Overall Expertise:

Spaceborne (e.g., ERS, Landsat, AVHRR)	no. of years	Airborne (e.g., LIDAR, Shoals, DAEDALUS)	no. of years	Terrestrial (e.g., surveying, etc.)	no. of years	Marine (e.g., sidescan sonar)	no. of years

3. Characterize Your Expertise

Please answer ONLY if you have HANDS ON experience in one or more of the four categories for one or more instruments. Years refers to ALL experience (at NOAA and elsewhere).

	System Design/ Engineering Knowledge (years)	Data Collection, Knowledge & Experience (years)	Data Analysis (years)	Operational / Mission Planning (years)
Camera - metric, still				
Camera - non-metric still				
Camera - video				
LIDAR				
Laser line scanners				
Laser flourosensor				
Multi-spectral imager				
Hyper-spectral imager				
Radar				
Scatterometers				
Synthetic aperture radar				

3. Characterize Your Expertise (cont.)

Please answer ONLY if you have HANDS ON experience in one or more of the four categories for one or more instruments. Years refers to ALL experience (at NOAA and elsewhere).

	System Design/ Engineering Knowledge (years)	Data Collection, Knowledge & Experience (years)	Data Analysis (years)	Operational / Mission Planning (years)
Acoustic (single beam)				
Acoustic (multibeam)				
Acoustic (sidescan)				
Acoustic doppler				
Seismographs / seismometers				
Magnetometer				
Gravimeter				
Scintillation counter				
Gamma spectrometer				
Spectral radiometer				
Radiance measurement				
Other _____				
Other _____				
Other _____				
Other _____				
Other _____				

4. Subject Areas Expertise Applied To

Please indicate one or more subjects to which your expertise in Remote Sensing IS or HAS BEEN applied to.

	years		years		years
Navigation		Env. Monitoring		Env. Assessment	
Photogrammetry		Modeling		Est./Marine Ecology	
Geodesy		Coastal Mgt.		Hydrography	
Satellite Systems		Cartography		Positioning	
Geology		Phytoplankton Ecol.		*Other* _____	
Oceanography		Biological Oceanography		*Other* _____	
Fisheries Biology		Hydrology		*Other* _____	

5. Programming Language Expertise

Please indicate one or more with which you have SPECIFIC HANDS ON experience.

	years		years		years		years		no. of years
IDL	____	C	____	PV-Wave	____	*Other* _____	____	*Other* _____	____
Fortran	____	C++	____	HTML	____	*Other* _____	____	*Other* _____	____

6. Software Expertise

Please indicate one or more with which you have SPECIFIC HANDS ON experience.

	years		years		years		years
ARCINFO	____	StatMap	____	Atlas GIS	____	SEAPAK	____
Arc View	____	GRASS	____	Gena Map	____	*Other* _____	____
Intergraph	____	MapINFO	____	IDRISI	____	*Other* _____	____
ERDAS	____	ELAS	____	SeaDAS	____	*Other* _____	____
MIPS	____	Resource	____	PCI	____	*Other* _____	____
IDIMS	____	ENVI	____	ERMapper	____	*Other* _____	____
IDL	____	LAS	____	DSP	____	*Other* _____	____

7. Data Base Management Expertise

Please indicate one or more with which you have SPECIFIC HANDS ON experience.

	years		years		years
Oracle	____	*Other* _____	____	*Other* _____	____
Sybase	____	*Other* _____	____	*Other* _____	____
Access	____	*Other* _____	____	*Other* _____	____

8. Image Processing Techniques Routinely Used

Please indicate one or more.

Landcover Classification	☐	Principal Components Analysis	☐	Sediment classification	☐
Image Mosaicing	☐	Ocean Color Analysis	☐	Texture analysis	☐
Edge Detection	☐	Georectification	☐	*Other* _____	☐
RADAR Processing	☐	Feature Extraction	☐	*Other* _____	☐
Image Algebra	☐	Hyperspectral Analysis	☐	*Other* _____	☐
Bio-optical Algorithms	☐	Primary Production Modeling	☐	*Other* _____	☐

9. Types of Products Developed

Please indicate one or more.

Posters	☐	3D Visualizations	☐	Georectified Raster Data	☐	*Other* _____	☐
Land Use/Cover Maps	☐	Vector Data Layers	☐	Backscatter Maps	☐	*Other* _____	☐
Bathymetric Maps	☐	Shoreline Maps	☐	Algorithms	☐	*Other* _____	☐
Ocean Color Maps	☐	SST Maps	☐	Bottom Class. Maps	☐	*Other* _____	☐
Hydrographic Surveys (smooth sheet)	☐	Models	☐	Seafloor Reflectivity Maps	☐	*Other* _____	☐

10. Regional Expertise

Please indicate the coastal and/or oceanic areas where you have conducted remote sensing activities. Case 1 waters are open ocean waters, very clear and low primary productivity; Case 2 waters are near shore, have highly variable clarity due to a combination of higher productivity and suspended particulates.

U.S.	Land	Water EEZ Case 1	Water EEZ Case 2
Northeast	☐	☐	☐
Southeast	☐	☐	☐
Gulf of Mexico	☐	☐	☐
West Coast	☐	☐	☐
Great Lakes	☐	☐	☐
Alaska	☐	☐	☐
Hawaii	☐	☐	☐
Territories/Other	☐	☐	☐

International	Land	Water EEZ Case 1	Water EEZ Case 2
_____	☐	☐	☐
_____	☐	☐	☐
_____	☐	☐	☐
_____	☐	☐	☐

Other "Blue" Water

_____

_____

_____

11. Recent Projects

List up to 5 significant projects currently being worked on or completed in the past 4 years.

1. _____
2. _____
3. _____
4. _____
5. _____

12. Suggestions for Future Remote Sensing Activities at NOS *e.g., emerging technology, new applications, etc. - please be specific.*

1. _____
2. _____
3. _____
4. _____
5. _____

13. Comments *Please add any additional information about your expertise you feel is relevant. Any comments you have on the inventory are appreciated.*

Personnel Inventory - Summary of "Instrument" Expertise

(137 Respondents)

A. System Design/Engineering Knowledge (28 responses)

Instrument Types	NUMBER OF PERSONS									YRS. EXP.		
		NOS Line Offices										
	Total	*CS*	*CSC*	*RR*	*NGS*	*OCRM*	*SP*	*NCCOS*	*COOPS*	*Avg.*	*hi*	*low*
Spaceborne	(28)	(11)	(4)	-	(8)	-	-	(2)	(1)			
1. AR												
2. AVHRR												
3. Hyper - spectral imager	3	1	1		1					1.6	2	1
4. Microwave Radar												
5. Multi - spectral imager	4	1	2		1					2.5	5	1
6. NTM Systems												
7. Scatterometers	1							1		4.0		
8. Synthetic aperture radar	4	1	1		2					0.8	1	1
Airborne												
9. Aerial Cameras												
10. Camera - metric, still	5		2		3					6.0	10	2
11. Camera - non - metric still	2				1			1		5.5	6	5
12. Camera - video	1		1							5.0		
13. Forward Looking Infrared												
14. Gamma spectrometer												
15. Gravimeter												
16. LIDAR	3	2	1							6.0	14	2
17. Magnetometer	1	1								1.0		
18. Photographic												
19. Radar	1	1								4.0		
20. Radiance measurement	2		2							5.0	8	2
21. Radio Telemetry												
22. Scintillation counter	1							1		2.0		
23. Spectral radiometer	2		2							5.0	8	2
Terrestrial												
24. Seismographs/seismometers	1	1								2.0		
25. GPS Surveying Applications												
Marine												
26. Acoustic Data link	1	1									1	
27. Acoustic (multibeam)	9	8						1		6.0	15	1
28. Acoustic (sidescan)	9	9								9.0	20	2
29. Acoustic (single beam)	12	11						1		10.0	30	1
30. Acoustic doppler	4	3							1	13.0	20	8
31. Acoustic-Dual Beam	1							1		8.0		
32. Acoustic-Split Beam	1							1		3.0		
33. Bathythermographs	1	1								6.0		
34. Current Meters	1	1								6.0		
35. In situ calibration productivity	1							1		15.0		
36. Laser flourosensor	1		1							1.0		
37. Laser line scanners	1				1					2.0		
38. STD/CTD	1	1								4.0		
39. Sub-bottom Profiler												
40. Temp/thermistar												
41. Tide Gages	1	1								1.0		
Processing Data												
42. 3rd Order Stereo Plotters												
43. Analog Stereoplotter												
44. Analytical Stereoplotter	4				4					10.0	17	2
45. Digitizer												
46. Photo Lab	1				1					10.0		
47. Softcopy Stereoplotter	2				2					2.5	4	1
Other												
48. A - P	1				1						5	
49. GPS	2	2								1.7	3	1
50. HPLC												

Personnel Inventory - Summary of "Instrument" Expertise

(137 Respondents)

B. Data Collection, Knowledge and Experience (109 responses)

Instument Types	NUMBER OF PERSONS									YRS. EXP.		
		NOS Line Offices										
	Total	*CS*	*CSC*	*RR*	*NGS*	*OCRM*	*SP*	*NCCOS*	*COOPS*	*Avg.*	*hi*	*low*
Spaceborne	(109)	(46)	(15)	-	(30)	-	-	(15)	(1)			
1. AR	1				1					1.0		
2. AVHRR												
3. Hyper - spectral imager	6		2		2			2		2.1	8	1
4. Microwave Radar												
5. Multi - spectral imager	12		5		6			1		6.4	19	2
6. NTM Systems	1		1							5.0		
7. Scatterometers	4		1					3		2.2	6	1
8. Synthetic aperture radar	7	1	1		2			3		1.5	4	0.5
Airborne												
9. Aerial Cameras	1				1					15.0		
10. Camera - metric, still	25	2	4		15			4		11.0	30	1
11. Camera - non - metric still	12	2	1		7			2		16.2	32	5
12. Camera - video	11	2	2		5			2		7.4	23	<1
13. Forward Looking Infrared												
14. Gamma spectrometer	1							1		25.0		
15. Gravimeter	2	1						1		5.5	10	1
16. LIDAR	8	2	4					2		2.7	8	1
17. Magnetometer	7	5						1	1	1.1	2	<1
18. Photographic	1							1		5.0		
19. Radar	4	2			2					4.8	15	1
20. Radiance measurement	10		5					5		4.5	8	1
21. Radio Telemetry	1							1		5.0		
22. Scintillation counter	7		4					3		8.3	25	1
23. Spectral radiometer	11		6					5		3.9	8	1
Terrestrial												
24. Seismographs/seismometers	6	4						2		1.8	4	1
25. GPS Surveying Applications	1				1					7.0		
Marine												
26. Acoustic Data link	1	1								3.0		
27. Acoustic (multibeam)	33	25			1			6	1	4.9	10	1
28. Acoustic (sidescan)	42	35			2			4	1	5.0	20	<1
29. Acoustic (single beam)	50	41			2			7		11.7	35	<1
30. Acoustic doppler	10	4						5	1	4.4	10	1
31. Acoustic-Dual Beam	1							1		8.0		
32. Acoustic-Split Beam	1							1		3.0		
33. Bathythermographs	1	1								2.0		
34. Current Meters	1	1								6.0		
35. In situ calibration productivity	1							1		20.0		
36. Laser flourosensor	3		2					1		3.7	5	1
37. Laser line scanners	3	2			1					1.7	2	1
38. STD/CTD	1	1								2.0		
39. Sub-bottom Profiler	1	1								1.0		
40. Temp/thermistar	1							1		10.0		
41. Tide Gages												
Processing Data												
42. 3rd Order Stereo Plotters	1				1					8.0		
43. Analog Stereoplotter	13				13					9.8	35	1
44. Analytical Stereoplotter	12				12					4.6	10	1
45. Digitizer	1				1					20.0		
46. Photo Lab												
47. Softcopy Stereoplotter	7				7					1.4	4	<1
Other												
48. A - P												
49. GPS	2	2								5.0	8	2
50. HPLC	1		1							5.0		

Personnel Inventory - Summary of "Instrument" Expertise

(137 Respondents)

Instument Types	C. Data Analysis Experience (110 responses)											
	NUMBER OF PERSONS									YRS. EXP.		
		NOS Line Offices										
	Total	*CS*	*CSC*	*RR*	*NGS*	*OCRM*	*SP*	*NCCOS*	*COOPS*	*Avg.*	*hi*	*low*
Spaceborne	(110)	(48)	(19)	-	(24)	-	-	(16)	(1)			
1. AR	1				1					1.0		
2. AVHRR	2	2								3.0		
3. Hyper - spectral imager	14		6		4			4		3.6	20	<1
4. Microwave Radar												
5. Multi - spectral imager	28	2	15		3			8		6.5	25	<1
6. NTM Systems	1		1							13.0		
7. Scatterometers	4		2					2		2.3	6	1
8. Synthetic aperture radar	15	1	4		6			4		1.7	6	<1
Airborne												
9. Aerial Cameras												
10. Camera - metric, still	33		8		21			4		12.5	34	1
11. Camera - non - metric still	8	1			5			2		8.6	23	2
12. Camera - video	5		2		2			1		8.0	23	1
13. Forward Looking Infrared	1		1							1.0		
14. Gamma spectrometer	2							2		13.5	27	2
15. Gravimeter	1	1								10.0		
16. LIDAR	10	3	4					3		2.2	10	<1
17. Magnetometer	4	2	1						1	3.0	2	1
18. Photographic	1							1		5.0		
19. Radar	7		3		2			2		1.7	5	1
20. Radiance measurement	13		7					6		5.3	15	1
21. Radio Telemetry	1							1		5.0		
22. Scintillation counter	7		4					3		8.3	25	1
23. Spectral radiometer	11		6					5				
Terrestrial												
24. Seismographs/seismometers	3	2						1		3.0	4	1
25. GPS Surveying Applications	1				1					7.0		
Marine												
26. Acoustic Data link	1	1								3.0		
27. Acoustic (multibeam)	35	30			1			3	1	4.3	15	<1
28. Acoustic (sidescan)	34	26			3			4	1	5.8	20	1
29. Acoustic (single beam)	50	42			2			6		13.3	35	1
30. Acoustic doppler	9	4			1			3	1	4.9	10	1
31. Acoustic-Dual Beam	1							1		8.0		
32. Acoustic-Split Beam	1							1		3.0		
33. Bathythermographs												
34. Current Meters												
35. In situ calibration productivity	1							1		20.0		
36. Laser flourosensor	2		1					1		3.5	5	2
37. Laser line scanners	1				1					5.0		
38. STD/CTD	1	1								12.0		
39. Sub-bottom Profiler	1	1								1.0		
40. Temp/thermistar	1							1		10.0		
41. Tide Gages												
Processing Data												
42. 3rd Order Stereo Plotters												
43. Analog Stereoplotter	11				11					13.2	30	1
44. Analytical Stereoplotter	11				11					11.2	32	1
45. Digitizer	1				1					20.0		
46. Photo Lab												
47. Softcopy Stereoplotter	8				8					4.0	<1	
Other												
48. A - P												
49. GPS	2	2								5.0	8	2
50. HPLC	1		1							5.0		

Personnel Inventory - Summary of "Instrument" Expertise

(137 Respondents)

D. Operational/Mission Planning Experience (82 responses)

Instrument Types	NUMBER OF PERSONS									YRS. EXP.		
		NOS Line Offices										
	Total (82)	*CS* (32)	*CSC* (10)	*RR* -	*NGS* (25)	*OCRM* -	*SP* -	*NCCOS* (12)	*COOPS* (1)	*Avg.*	*hi*	*low*
Spaceborne												
1. AR												
2. AVHRR												
3. Hyper - spectral imager	4		2					2		1.0	1	1
4. Microwave Radar	1	1								3.0		
5. Multi - spectral imager	9		5					4		2.9	6	1
6. NTM Systems												
7. Scatterometers	2		1					1		3.5	7	1
8. Synthetic aperture radar	6		1		3			2		1.4	4	<1
Airborne												
9. Aerial Cameras												
10. Camera - metric, still	28		5		20			3		8.0	30	1
11. Camera - non - metric still	2		1					1		14.5	24	5
12. Camera - video	3		2		1					5.6	11	1
13. Forward Looking Infrared												
14. Gamma spectrometer	1							1		25.0		
15. Gravimeter												
16. LIDAR	6	3	2					1		2.2	3	1
17. Magnetometer												
18. Photographic												
19. Radar	1	1								10.0		
20. Radiance measurement	5		4					1		6.2	15	1
21. Radio Telemetry	1							1		5.0		
22. Scintillation counter	4		1					3		10.3	25	1
23. Spectral radiometer	8		5					3		2.9	7	1
Terrestrial												
24. Seismographs/seismometers	1							1		1.0		
25. GPS Surveying Applications	1				1					7.0		
Marine												
26. Acoustic Data link	1	1								3.0		
27. Acoustic (multibeam)	21	17			1			3		3.9	10	1
28. Acoustic (sidescan)	28	22			3			3				
29. Acoustic (single beam)	32	25			2			5		9.9	35	1
30. Acoustic doppler	7	3						3	1	5.3	10	1
31. Acoustic-Dual Beam	1							1		8.0		
32. Acoustic-Split Beam	1							1		3.0		
33. Bathythermographs												
34. Current Meters												
35. In situ calibration productivity	1							1		10.0		
36. Laser flourosensor	3		2					1		3.3	5	1
37. Laser line scanners	1	1								1.0		
38. STD/CTD												
39. Sub-bottom Profiler												
40. Temp/thermistar												
41. Tide Gages												
Processing Data												
42. 3rd Order Stereo Plotters												
43. Analog Stereoplotter	4				4					12.0	29	1
44. Analytical Stereoplotter	5				5					8.2	24	1
45. Digitizer												
46. Photo Lab												
47. Softcopy Stereoplotter	4				4					1.9	3	1
Other												
48. A - P												
49. GPS	2	2								3.5	5	2
50. HPLC												

National Ocean Service

Remote Sensing Cross-cut Team

Personnel Inventory - 137 respondents

SUMMARY OF "PRODUCTS DEVELOPED"

	NUMBER OF PERSONS (123 responses)								
		NOS Line Offices							
	Total (123)	CS (58)	CSC (17)	RR	NGS (32)	OCRM	SP	NCCOS (15)	COOPS (1)
1. Hydrographic Surveys	**58**	48			8			2	
2. Shoreline Maps	**49**	15	4		27			3	
3. Bathymetric Maps	**45**	26			14			5	
4. Posters	**38**	7	16		8			6	1
5. Georectified Raster Data	**37**	5	10		15			7	
6. Vector Data Layers	**32**	8	9		6			8	1
7. 3D Visualizations	**23**	12	5		2			4	
8. Land Use/Cover Maps	**23**	2	9		9			3	
9. Algorithms	**21**	7	4		5			5	
10. SST Maps	**18**	2	4					11	1
11. Bottom Class Maps	**16**	5	2		7			2	
12. Ocean Color Maps	**15**	4	5		1			5	
13. Airport Obstruction Chart	**9**				9				
14. Models	**9**		4		1			3	1
15. Backscatter Maps	**8**	3						4	1
16. Seafloor Reflectivity Maps	**5**	3			1			1	
17. CD-ROMs	**2**		2						
18. Coastal Ocean Forecasts	**2**	2							
19. Digital Elevation Models	**2**		1		1				
20. Topographic Maps	**2**		1		1				
21. Air Target Charts	**1**				1				
22. Application Software	**1**				1				
23. Change detection	**1**		1						
24. Charts	**1**	1							
25. Controlled Semi-Controlled and Uncontrolled Mosaics	**1**				1				
26. Expert Witness Reports	**1**		1						
27. Graduate School Research Paper	**1**	1							
28. HEBBLE Maps	**1**				1				
29. Index	**1**	1							
30. Land Cover Change Maps	**1**		1						
31. Multi-source fusion	**1**							1	
32. Nautical Charts	**1**	1							
33. Photo Bathymetry	**1**				1				
34. Presentations	**1**		1						
35. Research shoreline/etc.	**1**				1				
36. SAV Maps	**1**				1				
37. Scatter Models	**1**							1	
38. Seagrass Maps	**1**							1	
39. Self Contained Data Acquisition and Storage Containers for GPS	**1**	1							
40. Site Property Studies	**1**		1						
41. Soil Maps	**1**				1				
42. Sonar Targets	**1**	1							
43. STANDARDS	**1**	1							
44. Tech. Reports	**1**		1						
45. Tonal corrected aerial mosiacs	**1**		1						
46. Training Materials	**1**		1						
47. Wetland Delineations	**1**		1						

National Ocean Service

Remote Sensing Cross-cut Team

Personnel Inventory - 137 respondents

SUMMARY OF "SUBJECT AREAS EXPERTISE APPLIED TO"

	NUMBER OF PERSONS (135 respondents)									YRS. EXP.		
		NOS Line Offices										
Subjects	*Total* (135)	*CS* (59)	*CSC* (20)	*RR* -	*NGS* (37)	*OCRM* -	*SP* -	*NCCOS* (18)	*COOPS* (1)	*Avg.**	*hi*	*low*
1. Cartography	**63**	*31*	*5*		*27*					**15.4**	*36*	*1*
2. Hydrography	**60**	*50*	*1*		*8*			*1*		**15.5**	*36*	*<1*
3. Navigation	**52**	*36*	*2*		*11*			*2*	*1*	**13.3**	*32*	*1*
4. Photogrametry	**50**	*7*	*8*		*33*			*2*		**14.9**	*36*	*1*
5. Positioning	**37**	*17*	*3*		*14*			*3*		**9.2**	*35*	*<1*
6. Oceanography	**36**	*14*	*9*		*3*			*9*	*1*	**6.5**	*20*	*1*
7. Geodesy	**27**	10	1		16					**8.2**	*30*	*1*
8. Modeling	**26**	*4*	*10*		*2*			*9*	*1*	**5.6**	*17*	*1*
9. Env. Monitoring	**23**	*3*	*10*					*9*	*1*	**7.8**	*20*	*1*
10. Satellite Systems	**23**	*7*	*6*		*7*			*3*		**7.7**	*25*	*1*
11. Coastal Mgt.	**18**	*1*	*9*		*4*			*4*		**4.7**	*25*	*1*
12. Env. Assessment	**18**	*3*	*10*		*1*			*4*		**7.0**	*20*	*1*
13. Est./Marine Ecology	**17**	*2*	*5*		*1*			*9*		**6.3**	*20*	*<1*
14. Fisheries Biology	**17**	1	4		1			11		**5.7**	*20*	*<1*
15. Geology	**15**	*4*	*6*		3			*2*		**4.5**	*20*	*1*
16. Biological Oceanography	**14**	*1*	*6*					*7*		**7.6**	20	2
17. Phytoplankton Ecol.	**8**	*1*	*4*					3		**6.3**	*13*	*2*
18. Hydrology	**6**	2	3					*1*		**1.2**	2	1
19. Photography	**2**	*1*			*1*					**22.5**	*25*	*20*
20. Cryosphere	**1**							*1*		**4.0**		
21. Disaster Response	**1**		*1*							**3.0**		
22. Geographical Info Systems	**1**		*1*							**1.0**		
23. Intelligence	**1**		*1*							**13.0**		
24. Limnology	**1**	*1*								**4.0**		
25. Marine Mammal Biology	**1**							*1*		**5.0**		
26. Private sector	**1**		1							**2.0**		
27. Remote Sensing	**1**		1							**1.0**		
28. Topography	**1**		*1*							**1.0**		
29. Urban planning	**1**		*1*							**4.0**		
30. Wetlands	**1**		1							**15.0**		

* Based only on respondents who included "years"

National Ocean Service
Remote Sensing Cross-cut Team

Personnel Inventory - 137 respondents

SUMMARY OF "DATA BASE MANAGEMENT EXPERTISE"

	NUMBER OF PERSONS (48 responses)									YRS. EXP.		
		NOS Line Offices										
	Total	CS	CSC	RR	NGS	OCRM	SP	NCCOS	COOPS	Avg.	hi	low
	(48)	(21)	(6)		(16)			(5)		3.1	25	0.5
1. Access	15	11	4							1.7	7	0.5
2. DBase	14	6	1		6			1		3.4	10	0.5
3. Dbase 3	8	5			3					3.0	6	1
4. Oracle	6	2			3			1		4.7	10	1
5. Excel	5	2			1			2		3.0	6	1
6. Sybase	4	2	1					1		1.1	2	0.5
7. DBase 4	3	2			1					1.0	1	1
8. Paradox	3	1	1		1					4.7	8	1
9. Informix	2	2								2.5	4	1
10. Vax	2				2					1.5	2	1
11. Advanced Revelation	1		1							2.0		
12. Britton-lee data base machine	1	1								0.5		
13. Claris Works	1				1					5.0		
14. IDMS	1		1							2.0		
15. IDPF-(VAX)	1				1					25.0		
16. Lotis 123	1	1								3.0		
17. Map Info	1	1								4.0		
18. NESDIS	1							1		6.0		
19. PB/2	1		1							1.0		
20. RDB	1				1					5.0		
21. SAS	1		1							2.0		
22. TOTAL	1	1								3.0		
23. Visual DBase 5.0	1	1								3.0		

National Ocean Service

Remote Sensing Cross-cut Team

Personnel Inventory - 137 respondents

SUMMARY OF "PROGRAMMING LANGUAGE EXPERTISE"

software types	NUMBER OF PERSONS (69 responses)									YRS. EXP.		
		NOS Line Offices										
	Total (69)	*CS* (22)	*CSC* (14)	*RR* -	*NGS* (18)	*OCRM* -	*SP* -	*NCCOS* (14)	*COOPS* (1)	*Avg.*	*hi*	*low*
1. Fortran	52	20	9		15			8		2.8	40	<1
2. C	27	7	9		8			3		2.9	13	<1
3. HTML	19	2	10		4			3		1.5	4	<1
4. IDL	18	2	6		1			9		2.3	5	<1
5. Basic	12	4	2		5			1		5.8	17	1
6. Pascal	8	3			5					7.3	20	1
7. C++	7	2	1		3			1		1.3	7	1
8. Visual Basic	5	2	1		2					3.2	10	1
9. Java	4		4							1.0	1	1
10. Perl	3		3							1.0	1	1
11. COBOL	2		2							4.0	5	3
12. DBase	2	2								2.5	3	2
13. Map Basic	2	2								3.5	3	4
14. MATLAB	2		2							4.0	5	3
15. ADA	1	1								1.0		
16. AML	1							1		1.0		
17. Assembly	1	1								1.0		
18. Delphi	1	1								1.0		
19. HiQ	1				1					4.0		
20. LISP	1				1					13.0		
21. PL/SQL	1	1								0.5		
22. Quick Basic	1	1								13.0		
23. Rocky Mountain Basic	1	1								4.0		
24. SQL	1	1								7.0		

National Ocean Service

Remote Sensing Cross-cut Team

Personnel Inventory - 137 respondents

SUMMARY OF "IMAGE PROCESSING SOFTWARE EXPERTISE"

	NUMBER OF PERSONS (76 responses)								
		NOS Line Offices							
	Total	*CS*	*CSC*	*RR*	*NGS*	*OCRM*	*SP*	*NCCOS*	*COOPS*
	(76)	*(16)*	*(17)*		*(29)*			*(14)*	
1. Georectification	**49**	3	12		25			9	
2. Feature Extraction	**45**	8	8		20			9	
3. Image Mosaicing	**35**	7	11		14			3	
4. Edge Detection	**21**	1	8		4			8	
5. Landcover Classification	**21**	1	11		3			6	
6. Image Algebra	**17**	1	9		1			6	
7. Principal Components Analysis	**17**		9		1			7	
8. Ocean Color Analysis	**10**		6					4	
9. Radar Processing	**10**	1	3		3			3	
10. Hyperspectral Analysis	**9**	1	4		1			3	
11. Sediment Classification	**9**	6			1			2	
12. Bio-optical Algorithms	**8**		5					3	
13. Texture Analysis	**7**	2	1		1			3	
14. Primary Production Modeling	**6**		4		1			1	
15. MCSST	**2**	2							
16. 3D Visualizations	**1**		1					1	
17. Acoustic Data	**1**								
18. Change Analysis	**1**		1						
19. Contouring	**1**	1							
20. Estimation	**1**	1							
21. Map composition	**1**		1						
22. Multi Image Co-Registration	**1**		1						
23. Oceanic turbidity	**1**		1						
24. Post-classification comparison	**1**							1	
25. Posters	**1**		1						
26. Siginal Classification	**1**							1	
27. Soil Maps	**1**				1				
28. Tonal correction	**1**		1						
29. Vector Data Layers	**1**		1						
30. Visualization	**1**							1	

National Ocean Service
Remote Sensing Cross-cut Team

Personnel Inventory - 137 respondents

SUMMARY OF "REGIONAL EXPERTISE"

(116 responses)

		Land	Open Ocean Water	Nearshore Water	Other Blue Water
COAST SURVEY	United States				
	Northeast	3	18	29	
	Southeast	4	16	26	
49 responses	*Gulf of Mexico*	5	20	25	
	West Coast	4	12	17	
	Great Lakes	2	9	18	
	Alaska	6	12	18	
	Hawaii		4	5	
	Territories/Other	1	4	3	
	International	2	13	11	
	Other Blue Water				3
COASTAL SERVICES CENTER	United States				
	Northeast	7	4	5	
	Southeast	10	6	9	
	Gulf of Mexico	6	6	5	
18 responses	*West Coast*	8	5	5	
	Great Lakes	3	3	2	
	Alaska	4	1	1	
	Hawaii				
	Territories/Other	1			
	International	5	6	6	
	Other Blue Water				3
RESPONSE AND RESTORATION	United States				
	Northeast				
	Southeast				
	Gulf of Mexico				
(none)	*West Coast*				
	Great Lakes				
	Alaska				
	Hawaii				
	Territories/Other				
	International				
	Other Blue Water				
NATIONAL GEODETIC SURVEY	United States				
	Northeast	23	2	22	
	Southeast	25	3	21	
	Gulf of Mexico	24	3	21	
(30 responses)	*West Coast*	23	2	18	
	Great Lakes	23	2	18	
	Alaska	22	2	21	
	Hawaii	16	2	13	
	Territories/Other	20	3	16	
	International	9	1	4	
	Other Blue Water				1
OCEAN AND COASTAL RESOURCE MANAGEMENT	United States				
	Northeast				
	Southeast				
	Gulf of Mexico				
	West Coast				
(none)	*Great Lakes*				
	Alaska				
	Hawaii				
	Territories/Other				
	International				
	Other Blue Water				

National Ocean Service
Remote Sensing Cross-cut Team

Personnel Inventory - 137 respondents

SUMMARY OF "REGIONAL EXPERTISE"

(116 responses)

		Land	Open Ocean Water	Nearshore Water	Other Blue Water
SPECIAL PROJECTS	United States				
	Northeast				
	Southeast				
(none)	*Gulf of Mexico*				
	West Coast				
	Great Lakes				
	Alaska				
	Hawaii				
	Territories/Other				
	International				
	Other Blue Water				
NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE	United States				
	Northeast		3	4	
	Southeast	3	8	8	
	Gulf of Mexico		4	3	
	West Coast		1		
	Great Lakes	1	5	4	
(18 responses)	*Alaska*	1	1		
	Hawaii		2	2	
	Territories/Other		2	2	
	International		5	5	
	Other Blue Water				1
CENTER FOR OPERATIONAL OCEANOGPHC. PRODUCTS AND SERVICES	United States				
	Northeast		1	1	
	Southeast		1	1	
	Gulf of Mexico		1	1	
	West Coast			1	
	Great Lakes				
(1 response)	*Alaska*				
	Hawaii				
	Territories/Other				
	International				
	Other Blue Water				
TOTALS	United States				
	Northeast	33	28	61	
	Southeast	42	34	65	
	Gulf of Mexico	35	34	55	
	West Coast	35	20	41	
	Great Lakes	29	19	42	
	Alaska	33	16	40	
	Hawaii	16	8	20	
	Territories/Other	22	9	21	
	International	16	25	26	
	Other Blue Water				8

National Ocean Service
Remote Sensing Cross-cut Team

Personnel Inventory - 137 respondents

SUMMARY OF "SOFTWARE EXPERTISE" (primarily "mapping" software)

	NUMBER OF PERSONS (101 responses)								YRS. EXP.		
		NOS Line Offices									
	Total	CS	CSC	RR	NGS	OCRM	SP	NCCOS	COOPS	Avg.	hi	low
	(101)	(36)	(19)		(27)			(18)	(1)	3.1	25	0.1
1. MapINFO	33	25	2		2			3	1	2.4	5	0.2
2. ArcInfo	30	3	13		7			6	1	3.4	15	0.5
3. Arc View	29	3	16		3			7		2.2	5	0.5
4. ERDAS	29	2	15		7			5		3.4	15	0.5
5. Microstation	19	9			10					2.3	10	0.4
6. IDL	17	1	5		1			10		2.4	7	1
7. IDRISI	16	2	5		4			5		1.7	6	0.5
8. Auto CAD	13	5			8					4.3	10	1
9. Intergraph	11	5	3		1			2		5.1	20	1
10. ENVI	10		6					4		1.7	3	1
11. PCI	9	1	5					3		2.7	8	1
12. GRASS	7	1	4		1			1		1.0	2	0.5
13. SeaDAS	7		4		1			2		1.1	2	1
14. CARIS	5	5								2.0	3	1
15. GIANT	5				5					5.0	10	1
16. MIPS	4	1	2		1					2.6	8	0.5
17. VAPAD	4				4					1.0	2	0.1
18. Atlas GIS	3				1			2		2.0	4	1
19. DSP	3		3							1.5	3	0.5
20. ELAS	3		3							4.7	5	4
21. Microsoft Excel	3				3					1.3	2	1
22. Hypack	3	3								3.3	5	2
23. LAS	3		2					1		2.7	5	1
24. SEAPAK	3		3							4.0	8	3
25. ACAD	2	2								2.5	3	2
26. HDAPS	2	1			1					8.5	13	4
27. IDPF (in house)	2				2					15.5	25	6
28. Imagine	2				2					1.8	2	1.5
29. KARS	2				2					4.5	7	2
30. SAS	2		1					1		8.5	15	2
31. Access	1				1					2.0		
32. ADIDAS	1							1		0.8		
33. Adobe Photoshop	1				1					5.0		
34. ARC GMP	1	1								1.0		
35. bchoros	1		1							5.0		
36. CAMS GIS	1	1								2.0		
37. Custom FORTRAN	1		1							18.0		
38. DIFAS1	1							1		4.0		
39. DIFASO	1							1		4.0		
40. Enhance	1							1		8.0		
41. EPA image analysis programs	1		1							2.0		
42. ERMapper	1	1								1.5		
43. Field Notes	1		1							4.0		
44. GAPP	1				1					12.0		
45. GMT	1		1							4.0		
46. GPSurvey, ER	1				1					7.0		
47. HPS	1	1								13.0		
48. IDIDAR	1							1		3.0		
49. IDIDAS	1							1		10.0		

National Ocean Service
Remote Sensing Cross-cut Team

Personnel Inventory - 137 respondents

SUMMARY OF "SOFTWARE EXPERTISE" (primarily "mapping" software)

	NUMBER OF PERSONS (101 responses)									YRS. EXP.		
		NOS Line Offices										
	Total (101)	CS (36)	CSC (19)	RR	NGS (27)	QCRM	SP	NCCOS (18)	COOPS (1)	Avg. 3.1	hi 25	low 0.1
50. IRASB	1	1								5.0		
51. LOTUS 1-2-3	1	1								6.0		
52. MATHCAD	1	1								10.0		
53. Matlab	1		1							3.0		
54. MET	1		1							1.0		
55. Microsoft Word	1		1							6.0		
56. NCAR Graphics	1		1							14.0		
57. NSIPS	1							1		6.0		
58. Omni	1				1					7.0		
59. Orthovista	1		1							0.5		
60. Photoshop	1		1							2.0		
61. Polyvue	1	1								1.0		
62. Primavera Project Planner	1	1								3.0		
63. Quick surf	1				1					1.0		
64. QUICKSWRF	1	1								8.0		
65. Seasoft	1	1								1.0		
66. SIPS	1							1		5.0		
67. Soft Plotter	1				1					1.5		
68. SPSS	1							1		1.0		
69. StatMap	1	1								2.0		
70. Surfer	1								1	6.0		
71. Symap	1	1								2.0		
72. Visual Basic	1	1								1.0		
73. Windows	1				1					5.0		
74. X-Map	1				1					4.0		

NOS Remote Sensing Cross-cut Team

Suggestions submitted in Question 12 of the Personnel Inventory
(59 inventory forms with suggestions, 133 total suggestions)

Question 12. Suggestions for future remote sensing activities at NOS (e.g. emerging technologies, new applications, etc. - please be specific).

1. Technical Suggestions (69)
    a. *Instrumentation (sensors, platforms, ancillary equipment) (41)*
    b. *Processing (data combination/evalaution, methodology) (28)*

2. Management Suggestions (64)
    a. *New Products (25)*
    b. *Product distribution/services (11)*
    c. *Resources management (28)*

1. TECHNICAL SUGGESTIONS (69)

a. Instrumentaion (sensors, platforms, ancillary equipment) (41)

1. Increased emphasis on the use of active sensors (LIDAR, SAR) for shoreline mapping.

2. Use of shallow water multibeam (SWMB) sonar systems for determination of bottom classification (benthic habitats).

3. Use of digital side scan sonar data to define sea floor morphology.

4. DAEDALUS scanner upgraded with inertial system and used for cross-cutting NOS programs

5. IFSAR brought from research and testing to production

6. LIDAR tested for shoreline mapping

8. Follow development of Kodak's 1m resolution digital aerial camera (large format).

9. Persue Zeiss' digital large scale format aerial camera.

10. Video and digital collection process for hydrographic field units, (move away from paper recorders) data collection for sidescan sonar to tape or disk with with page plots for contacts.

11. Multibeam applications for small hydrographic launches.

12. The use of SAR for the delineation of the high and low water lines.

13. The use of multi and hyper spectral scanning into the thermal IR range of the detection of the high and low water line.

14. The use of LIDAR for high and low water line mapping.

15. Synthetic aperture radar for determining shoreline, particularly remote and cloud covered areas like Alaska.

16. LIDAR for determining shoreline and obstructions at airports (Aeronautical Program).

17. Use the multi-spectral scanner for mapping shoreline.

18. SAR technology in areas overcast with cloud cover where regular photogrammetry fails for coastal applications.

19. Use of thermal channel of Daedalus scanner for coastal mapping.

20. S.A.R. (Synthetic Aperture Radar) to map regions common with cloud cover where traditional photography is not possible.

21. Lidar for shoreline and near shore mapping

22. Hyperspectral for shoreline and marches GIS mapping

23. SAR (Radar) shoreline detection.

24. Emphasize LIDAR terrain elevation mapping for rapid shoreline monitoring.

25. Additional ocean color bands for future NOAA POES satellites.

26. All surveys (hydrographic) should be conducted using the latest multibean hydrography or side scan sonar.

27. Phase in the Showls Laser hydrographic system into shoreline mapping (within NGS) for quick delivery of shoreline data.

28. Implementation of multi-beam survey systems to field units tasked with data acquisition for nautical charting.

29. Investigation of new high-spatial resolution panchromatic and multispectral systems for land cover analysis.

30. Support development of next generation acoustic sensors, both wide-area and high resolution to generate bathymetric surfaces of the near coastal area.

31. Airborne Digital Videography for enhancing field observations for ground truth and data verification.

32. Investigations into applicability of new satellite sensors.

33. Modernize and upgrade hydrographic survey platforms with NOS.

34. Multispectral and SAR analysis of seagrasses and coral

35. Utilize emerging technology (Earlybird, Compact Airborne Spectrographer CASI, hyperspectral data, Calibrated Airborne Multispectral Scanner CAMS), to detect change in seagrass habitt and relate to water quality issues and coastal development.

36. Development of techniques to improve the operational method used to compute tidal correctors with emphasis on the use of the High Water (HW) and Low Water (LW) correctors.

37. Synthetic aperture sonar.

38. Remotely Operated Vehicles (ROV) and Autonomous Underwater Vehicles (AUV)

39. Develop an acoustic remote sensing tool for determining several speed profiles.

40. NOS should support further development of microwave surface current mapping radar - important for PORTS.

41. NOS should support developments of Horizontal - ADCP technology - Important for PORTS.

b. Processing (data combination/evaluation, methodology) (28)

1. Full conversion of RSD to softcopy (digital photogrammetry)

2. Integration of OC/ANA charts into softcopy

3. Better use of available technology and imagery.

4. Put Flight Cards On Line

5. The integration of the above three items with traditional photogrammetry, through digital image processing, for coastal mapping.

6. More concentrated use of softcopy photogrammetry for mapping and change detection.

7. ArcInfo for preparing (structuring) vector data collected by photogrammetry for GIS use.

8. Coastal management - image processing for classification using hyperspectral analysis.

9. Use of auxillary navigation data to assist in georeferencing (aero-triangulation)

10. Beach profiling Study; compare LIDAR (including SHOALS), Airborne IFSAR, nad Photogrammetrically derived DEM's for accuracy, cost effectiveness, etc.

11. Evaluation of Airborne SAR processed as magnitud images vs IFSAR processing for coastal mapping.

12. Combination of Daedalus MSS with LIDAR in same aircraft for coastal mapping and analysis.

13. Evaluation of Hyperspectral imagery for coastal mapping, bathymetry and Remote Sensing.

14. Orthophoto development

15. Hyperspectral

16. Investigation of hyperspectral techniques for benthic analysis:

17. Investigate applications and availability of digital airborne scanner data for semi-automated coastal mapping.

18. Development of advanced data handling and processing for large image and multi-temporal analysis.

19. Development of methodologies for combining archival imagery from a variety of sensors, projections and formats.

20. Aircraft LIDAR sensing of coastal bathymetry, coupled with topographic LIDAR

21. Identify new RS procedures for delineating shoreline so VECTOR Shoreline Data can be timely.

22. Continue and expand capability to acquire and process digital side scan sonar data for use by the program offices.

23. Remote sensing of bathymetry in optically shallow water using Landsat TM and other sensors.

24. Better use of SHOALS by HSD.

25. Develop a Map Basic (MapInfo) utility that will assist the automation of determining if a given aerial photo is taken during a prescribed tolerance from the tidal datums MLLW and HWL.

26. Process side scan sonar data for archiving as moasics.

27. Establish dedicated telecommunications links between NOS and NESDIS, NWS/NCEP and NWS/OSO to obtain real-time products (including satellite-derived data; meteorological observations; and gridbed analyzed and model-derived forecast fields).

28. Establish dedicated telecommunication link between NOS and NESDIS and NWS NCEP in order to obtain current and future remotely sensed products in near real-time.

2. MANAGEMENT SUGGESTIONS (64)

a. New Products (25)

1. New technology can now measure fish biomass (SWMB) while also define habitat - simultaneously.

2. Data fusion and instrument integration for coastal waters. This includes the management with all types of planimetric data which could provide insight and benefit to estuarine and watershed management.

3. Stay focused on who our customers are and don't become involved in possible projects that can't be produced in short term!

4. Sensors that determine moisture content in soil, to prevent flooding, erosion in areas where ground water saturation can cost lives and property damage!

5. Apply proposed SSEC radiometer aboard next generation GOES for real-time post-hurricane environmental monitoring of turbidity river plumes.

6. Combine terrestrial and oceanic remote sensing analyses using models to examine watershed and water-quality issues.

7. Terrestrial RS which focuses on land use and change could be linked, via modeling to water quality, (esp. turbidity and color), determined from satellite. There are usually different sensors, resolutions, sensitivities, etc. to be dealt with -- a challenge that hasn't been well addressed at this time.

8. Currently to use remote sensing for coastal applications one can use low altitude platforms (e.g. aircraft) and NTM, thus develop new coastal products using data from these assets.

9. Fuse data from spaceborne, airborne, and in-situ data for products useful to the decision making.

10. Great Lakes - sediment mapping, macrophyto mapping

11. Multiple Sensor Integrations - E.G. LIDAR and Echousounder, U/W Optics and Echosounder

12. Biological definitions of coastal zones - compare spatial and temporal variability of coastal color to SST and Water mass movements

13. Scaling up/down of remotely sensed measurements local<>regional<>global

14. Comparison of biological and physical characters of Great Lakes, Estuaries, and 'Coastal' Oceans

15. The use of hyperspatial data for land cover and charge detection analysis

16. Temporal analysis of digital satellite imagery

17. Integrate C-CAP benthic habitat data into the Essential Fish HAbitat efforts.Continue to refine C_CAP benthic habitat data into applicable decision making tools.

18. Coral reef mapping and monitoring.

19. All new shoreline for Alaska and U.S.

20. Bathymetry measurements concurrent with LIDAR data collection over the beaches. There seems to be a great demand for bathymetry for purposes of understanding sediment budgets.

21. Aircraft active/passive remote sensing of estuarine water quality (eutrophication, salinity, temperature, turbidity)

22. Bathymetric LIDAR - Mapping Nearshore Dea Floor so as to combine with Topographic LIDAR currently being collected.

23. Develop operational NESDIS products (e.g., MCSST retrievals) for assimilation into NOS real time estaurine nowcast-forecast models.

24. Develop a spectral library/or signatures to identify and encode navigational features into a GIS.

25. Work with NESDIS to generate operational products (ex. MCSST retrievals) for U.S. Estuaries to be assimilated into NOS real-time nowcast/forecast systems for estuaries.

b. Produce distribution/services (11)

1. Make remote sensing products more readily available, especially shoreline data.

2. Additional resources need to be applied to improve the update cycle for shoreline maps from the current 50+ years to 5 - 10 years.

3. Provide Airport Obstruction Chart to public in digital (vector or raster) Format. (can be used for moving display maps)

4. Producing orthorectified Airport Obstruction Charts and perhaps other related products.

5. More Chart Updates and Revisions

6. Better publication of remote sensing products availability to other federal and state agencies and the general public.

7. Focus on end products regarding users, data format, and metadata.

8. Multi-resolution approach focusing more resolved satellites in areas of rapid coastal land cover change.

9. SAR imagery more widely available

10. Provide ships with mean and expertise to pull and process satellite data.

11. NOS can produce Imagery derived products (vector data layers) by using National Technical means data sources.

c. Resources Management (28)

1. Urgent need to dramatically increase production of up-to-date shoreline data sets - critical to numerous national programs related to coastal zone management.

2. Critical need to retain in-house hydrographic survey data acquisition capability to promote new technology development and retain contract monitoring expertise.

3. Commercial satellites tested for shoreline mapping (on-going)

4. To work in concert with other agencies, i.e., nerrs, marine sanctuaries.

5. Since there are fewer people doing more -- we need more microstations and up-to-the-moment computer equipment. Making do with what we can put together from old DC's does not do it.

6. Hire additional personnel to achieve the objectives of the mandated coastal mappaing and Airport Obstruction Charts and ANA program critical to air safety.

7. Integration of all NOS RS Applications to better exploit the people and data that is available.

8. Implement better coordination and information means. Ex right hand talking to left hand.

9. The NGS RSD programs need to be more publicized.

10. It is critical for other programs to know the importance of the need for tide coordinated shoreline.

11. The NOS goals along RS activities need to be clearly defined.

12. Greater coordination for projects, utilizing NOS remote sensing platforms.

13. Gain thorough understanding of new commercial data sources as they come on line including: cost/benefit, application potential, and customer use.

14. NOS should consider wholesale support for GIS systems – we use MapInfo and it works very well.

15. Increase image data availability to the general public, with emphasis on educating public on the use of imagery.

16. I was one of two U.S.A. Principal Investigators for the National Space Development Aging of Japan's (NASDA) polar orbitor satellite Marine Observation Satellite (MOS), from which a good partnership was established for years. I would suggest increased activity in various domestic as well as foreign partnerships.

17. Develop purchasing agreements with software vendors (IDL, ERDAS) for large purchases across NOAA/NOS.

18. Develop broad purchasing agreement for next generation high resolution imagery.

19. Permit funding for training/travel for other than the "chosen"!

20. NOS should always maintain inhouse surveying capability and have a fleet for this purpose.

21. Facilitate exchange of intermediate products among NOS offices (ex. acoustic sounding data and aerial photography).

22. There should always be a check and balance - There should be a system of checks in the field or procedure that should be manditory to follow.

23. Develp a partnership with NWS to study and evaluate the zone where "The Rivers meet the Oceans" (wild idea no?)

24. Based on NOS program needs, identify remote sensing tools (such as land-vessel-based and airborne current sensors for PORTS, space-borne wind sensor for forecast modeling) and develop plans for technology transfer/development.

25. Sponsor internship with well established researchers in NASA, JPL, and universities to facilitate the transfer of research tools into products.

26. Encourage and support participation in interagency remote sensing activities (to keep abreast of new developments).

27. Set up seed funds for pilot project or interagency participation.

28. NOS and NESDIS need to consolidate or clearly define mission in their respective NOS Coastal Services Centers and NESDIS Coast Watch Nodes.

IV. c. Equipment

(1) survey memo

(2) report on FY98 equipment

(3) tabular summaries

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Silver Spring, Maryland 20910

APR 22 1998

MEMORANDUM

TO: National Ocean Service Units Conducting Remote Sensing Activities

FROM: NOS Remote Sensing Cross-cut Team

SUBJECT: Inventory of NOS Remote Sensing Equipment

You have been identified by the NOS Remote Sensing Cross-cut Team as a representative from your NOS unit to write a report summarizing the equipment used by your unit to either collect, process, or analyze remotely sensed data. This information is being collected as part of a NOS-wide inventory of current remote sensing activities within the agency. The purpose is to describe and assess current and proposed NOS activities that involve remote sensing on the continued and expanded use of this technology at the agency. Separate inventories of current projects and personnel are underway. These exercises will provide NOS the opportunity to: (1) comprehensively evaluate its position on remote sensing; (2) address more clearly the agency needs with respect to the primary mission Coastal Stewardship; and (3) communicate these needs more effectively to partners inside and outside of NOAA.

The report should provide an overview in narrative form (no long lists please). There is no specific format required. However, we do request that you include thorough information, where applicable, on each of the categories listed below. It is expected that your report will between two and four typed pages. This report should include your name, phone number, and the name of the unit for which the report is generated (e.g. Geodetic Services Division of the National Geodetic Survey, or the Marine Chart Division of the Coast Survey, etc.). Attached is an example inventory from the NOAA ship RUDE.

Please send completed reports preferably via e-mail to:

Anne Hale Miglarese
NOAA/CSC
2234 Hobson Ave.
Charleston, SC 29405
v (803)974-6238 f (803) 974-6315
amiglarese@csc.noaa.gov

or

Charles Alexander
NOAA/NOS/SEA Div.
9537 SSMCIV
1305 East West Hwy
Silver Spring, MD
v (301) 713-3000x172 f (301)713-4384
calexander@seamail.nos.noaa.gov

Information to be included in the report (does not have to be organized exactly this way).

A. **Mission:** Describe briefly and in your own words the remote sensing activities conducted by your unit.

B. **Sensors:** Describe any sensors owned and/or operated by your unit, the platforms used (e.g. fixed winged aircraft, ships, etc.) and generally how they are used. Please provide an overview about the make and model of the sensors and if they represent state-of-the-art equipment.

C. **Computers:** Describe any computers owned and/or operated by your unit and generally how they are used (e.g. image processing, data processing, etc.) Please provide an overview about the number of computers, the make and models, the operating system(s) used, and if they represent state-of –the-art equipment.

D. **Software:** Describe the software used to process remotely sensed information. Please provide an overview of which computers the software is used on, how the software is used, who wrote it (e.g. in-house or commercial off-the-shelf).

E. **Field/In Situ Equipment:** Describe any specialized equipment used for calibrating sensors or conducting other remote sensing activities in the field (luggable PC's, GPS receivers, radiometers, video/still cameras, etc.)

F. **Other Equipment/Peripherals:** Describe any other unique equipment used either for collecting data (e.g. video equipment, special antennas for direct downloading, etc.) or processing data (e.g. stereo analytical plotters, unique scanning or printing equipment, optical transfer instruments, etc.)

Equipment Inventory - NOAA Ship RUDE

A: Mission:

The NOAA Ship RUDE is a 90 foot coastal survey vessel with a crew of 11. RUDE's current mission is to conduct basic hydrographic and item investigation surveys from the Mid-Atlantic to Northeastern coastal areas. These data are used primarily in support of NOAA's Nautical Charting Program.

B: Sensors:

RUDE is outfitted with survey systems to acquire and process single-beam hydrographic, Shallow Water MultiBeam (SWMB) bathymetric, and Side Scan Sonar (SSS) data. Nearly all of the components on board RUDE are commercial off the shelf systems. The RESON SEABAT ä 9003 SWMB System is considered state-of-the-art. The SeaBat 9003 is capable of surveying a swath of the sea floor as wide as 3.5 times the depth of water. With the proper survey line spacing this system is capable of completely ensonafying the seafloor with both detailed bathymetric soundings and acoustic backscatter imagery (similar to SSS).

Multibeam acquisition requires the exact position and attitude of the vessel (heave, roll, pitch, & heading) in order to interpret this data. A Seatex Seapath200 Inertial Navigation System was installed on board RUDE at the beginning of the 1998 field season.

The ODECO (previously Raytheon) DFS6000 dual-frequency survey echosounder and the EdgeTech 262 analog/digital Side Scan Sonar (SSS) are considered conventional survey systems. Vessel position is determined with an ASHTECH 12-channel OEM Global Positioning System(GPS) sensor. The GPS position is then refined by the USCG radio beacon Differential Global Positioning System (DGPS) network to provide positioning to 3-5 meters accuracy.

C: Computers:

RUDE has a 100 Base T network of 10 Pentium computers running under Windows NT. In addition, on one of the nodes is a Silicon Graphics, Inc (SGI) "Indy" workstation for processing the SWMB data.

D: Software:

Single-beam hydrographic data acquisition and processing:

At the heart of RUDE's single-beam Data Acquisition System (DAS) is HYPACK. HYPACK is a PC based hydrographic survey package from Coastal Oceanographics Inc. HYPACK acquires the digital soundings, time tags, applies offsets, and stores all the data via serial communications to/from the suite of survey sensors. In addition to logging these data, HYPACK annotates the analog paper records of the SSS and echosounder, and provides helmsman line control for the survey operations. The survey data acquired by HYPACK is then processed on a PC based, database management system (dBase IV) by the name of the

Hydrographic Processing System (HPS). HPS converts the raw data into final field Hydrographic surveys by applying edits, tidal, and speed of sound correctors to the sounding data. HPS's main components are the only part of the RUDE's systems that are maintained in-house. HPS is tightly integrated with two other commercial software packages, MapInfo and Vertical Mapper. MapInfo is a Geographic Information System (GIS), from MapInfo Corporation, and Vertical Mapper is a contour, modeling and display package, from Northwood Geoscience. These programs allow the hydrographer to review, visualize, correlate and analyze the data to determine if the mission objectives have been accomplished. Graphic representations of these data are created on a wide bed HP-750 color DesignJet Plotter.

Shallow Water Multibeam and digital side scan sonar:
The data generated by SWMB and digital SSS systems are logged by the Triton-Elics International, Inc., ISIS ä Data Acquisition and Real-time Visualization System. This commercial system runs on a industrialized PC under Windows NT. ISIS is capable of georeferencing, visualizing, and capturing the output of the necessary survey sensor, in addition to digitizing and displaying the imagery data from the EdgeTech SSS recorder.

In order to process the SWMB and digital SSS data, NOAA has worked closely with Universal Systems Limited (USL) of Frederickton, New Brunswick, Canada to modify the Hydrographic Information Processing Systems (HIPS) and Sidescan Image Processing System (SIPS) modules of their GIS package CARIS. This software runs on the UNIX-based Indy workstation. Graphic representations of this data are created on a wide bed HP-750 color DesignJet Plotter.

E: Field/In Situ Equipment:
The speed of sound in the water (velocity) is measured periodically with a SEACAT CTD sensor and processed with in house developed software - VELOCITY..

F: Other Equipment / Peripherals:
RUDE is equipped with full scuba diving capabilities.
SENSORS:

Acoustic:

- Single Beam
- Multibeam
- Sidescan

Remote Sensing Equipment Inventory

NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE (NCCOS)

I. GREAT LAKES ENVIRONMENTAL RESEARCH LAB:

Mission:
Remote Sensing activities include calibration/validation of Coast Watch products for the Great Lakes such as sea surface temperature (SST), algorithm development and validation of using new satellite sensors (multi-spectral, synthetic aperture radar, etc.), and development of products (algorithms) to address problems such as harmful algal blooms, macrophyte mapping, etc. using existing or new airborne or space-borne sensors (hyper-spectral, SLAR, etc.). Most, if not all, of these activities include "ground truth" activities.

Sensors:
For ocean color algorithm development, optical measurements are made with a state-of-the-art Satlantic profiling radiometer and surface reference (SPMR/SMSR) operating in the SeaWiFS bands. Measurements are processed with software provided by Satlantic based on MATLAB. Biological measurements (ground truth) are made coincident with optical measurement. These measurements are made from GLERL's research vessels and other agency vessels (depending on the lake). Some coincident fixed wing aircraft measurements are planned.

For ice classification/mapping development, radar (scatterometer) measurements are made with a JPL developed C-band polarimetric scatterometer. This state-of-the-art instrument can measure backscatter in multiple incident and azimuth angles. Scatterometer measurements are made from ice breaking vessels such as the US Coast Guard cutter Mackinaw along with "ground truth" measurements.

Other sensors, such as aircraft hyper-spectral or multi-spectral are used for specific projects when available.

Computers:
Computers used include an SGI Indigo2 and Sun Sparc20 for image processing/research, a Sun Ultra2 for CoastWatch operations/product development, a Pentium PC and IDIDAS PC for image processing/development and administrative functions, a Macintosh IIfx with two monitors and external disk for image processing and a luggable PC and laptop for field work and data processing.

Software:
On Unix workstations (SGI and Sun Sparc20): IDL, ENVI, PCI, SeaDAS, PV- WAVE, NSIPS (NAVY DEVELOPED), GRASS SUN ULTRA2-IDL

On PCs (IDIDAS, Pentium, and laptops): Microsoft Office(2), Corel Draw, Lview (2), two CCOAST (2) for CoastWatch work, IDIDAS, VIDAS, VGALoad (CoastWatch), MATLAB, AAPLAY

On Macintosh: AAPLAY, QUICKVIEW (for animation)

Field/In Situ Equipment:
GPS receiver, video and still cameras, deck unit and luggable PC for use with Satlantic radiometer.

Other Equipment/Peripherals:
SGI-9 GB external drive,
4mm DAT and 8mm tape drives
SUN ULTRA2 – 2, 9GB external drives, 72GB tape backup
SUN Sparc20- 4 GB external drive
Tektronix color printers (2), also laser and large format network printers and CD-ROM writer
BaSO4 calibration panel

Contact: George Leshkevich (313) 741-2265

II. GLERL OCEANOGRAPHY GROUP

Mission:
Measuring water currents in large lakes to track sediment and other plumes.

Sensors:
Acoustic Doppler Current Profilers (ADCPs) at 300, 600, and 1200 kHz. These instruments are moored in the lake for up to one year at a time. With present commitments, the instruments will be in continuous use for at least the next three years.

Software:
Data is processed and analyzed on any reasonable PC. Software provided by the ADCP manufacturer and in-house developed IDL are used to process and analyze data.

Contact: Gerald Miller (313) 741-2119

III. GLERL/CILER (Cooperative Institute with University of Michigan)

Mission:

Our group uses underwater acoustic technology to examine dynamics of fish populations and to verify theoretical model predictions of fish backscatter. Mobile surveys of fish density are combined with environmental measures to assess distributions, predator-prey interactions, habitat section, and growth of fish in the Great Lakes and in major estuaries along the Northeastern US coast. To ensure that acoustic field data accurately represents fish sizes and densities, acoustic scattering models are used to compute acoustic backscatter of individual and aggregated fish as a function of carrier frequency , fish species, fish length, and aspect.

Sensors:

A variety of commercial and prototype echosounders are regularly used in field and laboratory sampling. The primary sampling tool is a Simrad 120 kHz split beam echosounder. The lab also has a 38 kHz-120 kHz BioSonics dual-beam multiplexed system, and two Biosonics single-beam systems (70 kHz and 420 kHz operating frequencies). The prototype echosounder is a four frequency, digital sounder developed by engineers at the University of Wisconsin-Madison. This sounder may simultaneously operate up to four frequencies and sample received signals at four times that of commercial scientific sounders. All of these systems can be deployed using a deadweight towbody for towing alongside a vessel or mounted on a frame for laboratory measures.

Data processing, analysis, and visualization is accomplished using two sets of computers. Data acquisition for the split-beam system and multifrequency sounder is controlled by PC notebooks. The BioSonics system records data to DAT tape and it is processed in near real time or later with PC software. Data processing is performed using a Sun or HP UNIX machine. Software routines written in IDL (Interactive Data Language, Research Systems Inc.) are used to process, analyze, and visualize all acoustic data. All process parameters are user defined using widget and field based descriptors. Bioenergetics programs, also written in IDL, accept output from the acoustic processing package, and calculate abundance biomass density, and predicted growth of a specified predator for observed prey and temperature distributions. All software development has been conducted in house.

Ancillary equipment in support of these research programs comes in many forms. All acoustic field data is geo-referenced using GPS data. All echosounders are calibrated using known tungsten-carbide reference spheres. Temperature and salinity are sampled using SEAbird SEAcat 19 CTD. A computer controlled aspect frame is used in the laboratory to measure species, length, and aspect dependent backscatter from individual fish.

Contacts: Steve Brandt (313) 741-2003

IV. CENTER FOR COASTAL FISHERIES HABITAT RESEARCH - BEAUFORT LABORATORY

Mission:
The Beaufort Laboratory applies remote sensing to develop spatial data to support NOAA's Sustain Healthy Coasts Initiative and to advance research and management of fisheries and essential fish habitat.

Sensors:
Beaufort Laboratory obtains remote source data from NOAA, commercial and National Technical Means sensors and platforms and is a node for the archiving and distribution of CoastWatch reflectance and Sea Surface Temperature (SST) date for the southeast region.

Computers:
Beaufort Laboratory has a number of multi-purpose PCs and three SGI workstations. Most of the PCs are running Windows 3.1 and less than ¼ are running Windows 95. The lab has a small number of dual-boot PCs. Six machines boot Windows or Linux and two machines boot Windows or Windows NT. The Linux machines have access to the SGI workstations through X-Window software. The workstations are INDIGO, INDIGO 2 and an Origin 200 server.

Software:
Remote sensing data are processed with ERDAS Imagine, ENVI, PCI (1 Windows NT version), IDRISI (1 Windows version) and Arc/View Spatial Analyst (2 UNIX seats). GIS software supporting remote sensing include Arc/Info (2 UNIX seats, including GRID 2 seats), TIN and Plotting, and ArcView (2 UNIX, 1 Windows and 1 Windows 95 version). One PC runs IDIDAS for CoastWatch SST data.

Field/In-Situ Equipment:
- GPS units (10) including Trimble Basic Plus (2 units) and Trimble Pro-XR (1 remote unit)
- LI COR LI 1800 UW underwater spectro-radiometer (1)
- Sony VX 700 digital color video camera with Amphibico VH 700 aluminum underwater camera housing (1)

Other Equipment:
Wild APT 2 photo-stereoscope
Bausch and Lomb Stereo Zoom Transfer Scope
Trimble Community Base Station
Hewlett Packard Scan Jet 4 C/T color scanner

Contacts: Randy Ferguson (919) 728-8764

NATIONAL GEODETIC SURVEY (NGS)

I. REMOTE SENSING DIVISION

Mission:
The Remote Sensing Division (RSD) has two responsibilities, the Coastal Mapping Program and the Airport Survey Program.

The Coastal Mapping Program (CMP) involves mapping the 95,000 miles of United States shoreline. The primary mission of the CMP is to provide the official U.S. shoreline, which must be accurate, consistent, tide-coordinated, and up-to-date. This shoreline is the official shoreline on NOAA's nautical charts, but today, in the age of Geographic Information Systems (GIS), many other users at the federal state, and local level also require this shoreline as the base layer in their GIS.

The RSD portion of the airport survey program (ASP) involves identifying and locating aircraft obstructions on and near airports in the United States. Other portions of the program include: geodetic control on the airports, positioning runway end points, determining runway profiles, and positioning aeronautical aids to navigation.

Sensors:
RSD has several metric mapping cameras: two older, Leica RC-8 cameras (none in use), two RC-10 cameras (both in use), and one modern RC-30 (in use) with forward motion compensation and kinematic GPS control. RSD also has one Deadalus multi-spectral scanner (occasional use, needs go-referencing capability).

For the CMP RSD uses two cameras in the NOAA Citation aircraft, one RC-10 and one RC-30, one with color negative film and one with panchromatic infra-red film. For the Airport Survey Program an RC-10 in the NOAA Turbo-Commander aircraft is used. The AC&C also uses one additional RC-8 in the NOAA Shrike aircraft.

Computers:
Personal computers – 21 Pentium with NT, 13 Pentium without NT, 12 "486", and 2 "386" computers. Most of the first type are used (or will be used in the near future) for image processing with Microstation and/or various softcopy photogrammetry software.

UNIX Workstations – The RSD analytical data collection and software development processes use DEC Microvax workstations (11) and the division is presently migrating to DEC Alphas (5 on-hand, 4 yet to procure). The RSD also uses one VAX workstation and one VAS terminal. A Sun Sparc20 and a Sun Ultra are used for SAR and other image processing. Two Silicon Graphic computers (Indigo and Indigo 2) are used for softcopy photogrammetry.

Peripherals:
Printers, plotters, digitizers, scanners, etc. are connected to the computers listed above.

Software:
Commercial softwares include: ArcView, ArcInfo, Microstation, DeLorme Mapping

In-house softwares used are: KARS (GPS processing), VAPAD (flight planning), Integrated Digital Photogrammetric Facility (IDPF: various modules for aerial triangulation, compilation, data base entry, etc.)

Field/In-Situ Equipment:
- Trimble GPS receivers (5) - (three aircraft and two tripod antennas), dual frequency, used to position the photo center at the time of exposure, using kinematic GPS processing.
- Hand-held cameras (5)
- Computer Controlled Navigation System (CCNS4) automates aerial photo process
- Notebook computers (7), for aircraft and ground use.

Other Equipment/Peripherals:
Stereo analytical plotters (5)
Softcopy photogrammetry software/hardware systems (3)
Besseler enlarger
Large format plotters (3)

Contact: George Leigh (301) 713-2663

COASTAL SERVICES CENTER (CSC)

I. COASTAL CHANGE ANALYSIS PROGRAM

Mission:

The Coastal Change Analysis Program is designed to monitor change in terrestrial land cover and nearshore benthic resources within coastal environments of the United States including the Atlantic, Pacific and Gulf of Mexico, the Great Lakes, Alaska, Hawaii, and all U.S. territories and possessions. C-CAP classifies types of land cover, analyzes and monitors changes in coastal submerged habitats, wetland habitats, and adjacent uplands using remote sensing techniques (satellite imagery and aerial photography). Through this analysis, scientists can correlate the changes in terrestrial regions with those in coastal aquatic habitats, and with changes in the distribution, abundance, and health of living marine resources.

Sensors:

The program does not have ownership of any sensors but utilizes data from a variety of sources. These include Landsat Thematic Mapper imagery acquired through the USGS Eros Data Center. It also relies on metric aerial photography acquired on a project-by-project basis through private contracted aerial survey companies. National Technical Means imagery also contributes to the program in selected cases.

Computers:

The program relies primarily on four silicon Graphics Indigo-2 workstations and one sun UltraSparc workstation to accomplish most of the image processing associated with land cover classification and benthic habitat mapping. These workstations are networked to allow transfer of files between program analysts and other programs within CSC. The program also employs six desktop Personal Computers and three laptop Personal computers for documenting project activities and results, for producing presentation materials, and for individual project management. These PC's are also networked among each other and with the UNIX workstations. Four of the systems have Iomega Jaz drives attached for removable storage space.

Software:

A variety of software packages are used in the program. Most of the UNIX-based software is shared by floating licenses with other programs at the center. A list of these applications and license information is included in the Shared Resources Section. The program uses ERDAS Imagine 8.3 to do most of the image processing. This includes land cover classification, image rectification, vector editing and analysis, and map production. A number of other software packages are used by program participants. These are listed below and are mounted on specific platforms and not shared resources. They are primarily used for spatial analysis, field date recording, and photogrammetric compilation.

FieldNotes 4.0 (6)
ArcView 3.0 (6)
PixelFX (1); Scanner operation and image input/editing
Reliance Processor (4); Ashtech GPS data post-processing/analysis
Orima-T (1); Photogrammetric orientation management
Leila RTP-P2 (1); Photogrammetric plate processing
ERDAS Orthomax (1); softcopy photogrammetric/orthorectification
KLT Atlas photogrammetric compilation/application software

Field/In Situ Equipment:

The C-CAP program relies heavily on field work to support it's own internal remote sensing work and to validate the work of program cooperators who do much of the processing/mapping in their own local area. The field equipment suit consists of an integrated package of field computers, GPS units, video cameras, camcorders, etc. These are used to assist in signature development for the image processing and photo-analysis. They are also important as data sources to supplement the mapping effort and for accuracy assessment at the conclusion of the remote sensing work.

The benthic mapping program also employs underwater video units in it's field work. A number of recording and power generation devices are associated with this field equipment.

- FieldWorks P133 ruggedized luggable field PC (2)
- IBM Thinkpad laptop PC's (2); field data logger
- Ashtech Super SCA 12 GPS receivers (2)
- Husky ruggedized Data Logger (1); for use with the Ashtech receivers
- Starlink USCG Beacon Receiver (1); for real-time differential correction use with the Garmin receiver.
- Rockwell PLGR GPS (2); Y-code precise positioning system GPS receivers
- Yamaha EF1000 generator (1); power supply for benthic mapping field equipment on small boats
- Fishers TOV-1 towed underwater video cameras (2)
- Panasonic AG-7450 portable super VHS video tape recorders (2)
- Sony 8mm Handycam CCD-TRV40 NTSC camcorders (2)
- Leica Geovid 7x42 BD (1) laser ranging binoculars (1)
- Horita GPT-50 GPS video titler (1)
- Magnavox color television monitor (1)

Other Equipment:

In addition to hardware and software dedicated to image processing/mapping and field operations, the C-CAP program routinely uses several important peripherals and other data input/output devices. These devices are used to exchange data, input raw analog or hard-copy data into digital format, and for production of display, presentation, or demonstration materials and products. The benthic mapping program also uses a number of equipment items for photoanalysis, photogrammetric compilation, and analysis of underwater videography.

Young Minds CD writer (1)
Yamaha CD writer (1)
Contex Large Format Scanner (1)
4mm DAT Tape Drive (1)
8mm Exabyte Tape Drive (1)
9-track Tape Drive (1)
Imagecorder Focus film recorder (1)
AGFA Horizon Plus Flat-Bed Scanner (1)
Tektronix Dye-sublimation Printer (1)
Richards light table MIM 4A710R (1)
Leica Aviopret AV-1 Stereoscope and light table (1)
Baush and Lomb zoom 240 stereoscope (3)
Leica SD3000 Universal Analytical Stereoplotter (1)
Compaq Prolinea 466 (1); for real-time plate processing in the SD3000
Compaq Deskpro 575 (1); for running photogrammetric compilation applications
Sony Trinitron color monitors (2)
Sony SVO-2000 Stereo Videocassette recorders (2)
Sony Video Editing Controller RM-250 (1)

There are other peripheral devices that fall into this category, but they are shared resources and will be covered in the Shared Resources section.

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II. COASTAL REMOTE SENSING PROGRAM

Mission:
The Coastal Remote Sensing (CRS) Program undertakes applied research on new aircraft and satellite remote sensing methods and creates products that benefit coastal resource managers. Applied research focuses on the development of new remote sensing techniques to create new data products to aid coastal decision makers. Data products provide information on high resolution coastal topography and erosion, Harmful Algal Bloom monitoring and tracking, coastal pollution and eutrophication, and coastal ocean habitat trends. Data products include near real time imagery, near real time image analysis tools, reports on new processing techniques, posters, web pages, and CD-ROMS.

Sensors:
The program does not possess any sensors on its own but relies heavily on NOAA AVHRR imagery to conduct its ocean color work. Other satellite imagery such as SeaWiFs is also used.

Computers:

The CSC/CRS group has four Silicon Graphics Indigo-2 workstations, which are networked with the rest of the CSC computing facility. Ten PC compatible computers running Windows NT are used for office automation purposes and as additional terminals for X Windows access to the SGI workstations. An IBM Thinkpad and TI Travelmate 4000 notebook computers are used for field data acquisition.

Software:

The SGI workstations are equipped with IDL and ENVI, ERDAS Imagine, PCI, MATLAB from MathWorks, and the SeaDAS package for analysis for SeaWiFS satellite data. IDL is used as the base for SeaDAS and used for general graphing and analysis for the LIDAR work on beaches. ERDAS Imagine is used for specialized image work requiring combinations of multiple images and vectors. PCI is used for automated generation of satellite image products. MATLAB is used in the processing of aircraft ocean color data (SASII data) and in part of the processing of in-situ spectroradiometer data. Specialized software for bio-optical algorithm work includes Discrete Ordinates radiative transfer code with refractive index change boundary, Monte Carlo radiative transfer code, and the Bermuda Bio-Optics Project (BBOP) data processing system. One UNIX copy of Adobe Photoshop is also used.

Field/In Situ Equipment:

The information collected by the following instruments is used to evaluate algorithms quantifying ocean color and chlorophyll concentration. These parameters provide information on plant biomass availability and eutrophication processes in oceanic and coastal waters. These instruments provide information on the optical nature of the water column, both spectrally and vertically, to separate the components contributing to the water color. All of the instruments in the following section are intended for use in the water column.

- Bio-spherical Instruments MER-2048 and PRR-600s irradiance and radiance profiling systems, and scalar quantum photosynthetically active radiation (PAR) sensor
- WetLabs Spectral Flourescence Instrument (SAFIRE), WetStar flourometer, and 9-channel in-situ absorption and attenuation meter (ac-9)
- Sequoia Scientific, Inc. Laser In-Situ Scattering and Transmissometry (LISST-100) Instrument
- Hydro-Optics and biology Instrumentation (HOBI) Labs – 6-channel spectral backscattering meter (HydroScat-6)
- SeaTech Light Scattering Sensor (scattering coefficient at 880nm)
- SeaBird conductivity, temperature, and depth (CTD) sensor, and 25 cm pathlength transmissometer
- Three moorable hydroLab DataSonde3 conductivity, temperature, PH, and dissolved oxygen sensors

The MER-2048 profiling system from Bio-spherical Instruments includes underwater measurements of 13 channels of downwelling irradiance, 7 channels of upwelling irradiance, and 7 channels of unwilling radiance. An above water radiometer measuring the same 13

channels of down welling irradiance is incorporated into the data stream, as well as measurements of fluorescence, transmissivity, temperature, conduction, pressure, quantum scalar irradiance in the photosynthetically active region, and backscattering at 855nm. The PRR-600s profiling system from Bio-Spherical Instruments includes underwater measurements of 7 channels of down welling irradiance and 7 channels of unwilling radiance, as well as a matching above water sensor. Pressure and temperature sensors are included in all configurations, while fluorescence, transmissivity, quantum scalar irradiance and backscattering can be added. The PRR-600s is arranged such that the irradiance and radiance sensors are at the same depth, allowing accurate measurement of the remote sensing reflectance.

The Spectral Absorption and Fluorescence Instrument (SAFIRE) from WetLabs Incorporated is a device designed for in-situ characterization of fluorescence and absorption from the UV throughout the visible spectrum. The ac-9 dual path absorption and attenuation meter from WetLabs Incorporated concurrently determines the spectral transmittance and spectral absorption of water over nine wavelengths. The Laser In-Situ Scattering and Transmissometry (model LISST-100, produced by Sequoia Scientific, Inc.) uses the technique of laser diffraction to obtain an estimate of the particle size distribution. The HOBI HyroScat-6 is a state-of-the-art instrument used to measure the backscattering coefficient at 6 channels in the visible wavelengths.

Above water remote sensing reflectance determination is made available by the hand-held FieldSpec UV/VNIR from Analytical Spectral Devices Incorporated, which provides a full spectral (350-1000 nm in 512 channels) measurement of irradiance at 3.5 nm spectral resolution. The Satlantic SeaWIFS Airborne Simulator (SASII) is used with a GPS to measure radiance from an aircraft-platform. This instrument is configured to simulate the signal received by the NASA ocean color satellite SEA-viewing WIde Field of view Sensor (SeaWiFS). This instrument is used for algorithm evaluation and ocean color work in estuaries and other areas near-shore where satellite coverage is contaminated by land.

Other Equipment:

CRS uses a 1.8 meter SmartAntenna from Smartech Incorporated as a downlink station for polar orbiting satellites using the HRPT format. This includes the TIROS series of satellites with the AVHRR sensor and the upcoming SeaWiFS sensor on the Seastar satellite. The data are initially received and stored on a Digital Equipment computer running Windows NT and are further processed on our SGI machines.

Contacts: Mary Culver (843) 740-1250, Robert Wilhite (843) 740-1261

III. CSC SHARED RESOURCES

Some computing resources used by the remote sensing programs at the Coastal Services Center are not dedicated to those programs, but rather are shared with other programs at the center.

Computers:

The web server, a Sun UltraSparc system, is used in part by the remote sensing programs to disseminate information.

The main file server, a Network Appliance F-540, has a portion of its storage space allocated to each program. The remote sensing programs use about 100 GB of this space to store imagery and other data during processing.

Software:

On the Center's UNIX network there are licenses for ESRI Arc/Info (16), ArcView (7), and ArcScan (11). These are used occasionally by the remote sensing programs, but the primary use is in other program areas. There are licenses for ERDAS Imagine (5), IDL (3), and ENVI (2), PCI (1), MATLAB (1), Image Alchemy (1), and XV (site license), which are used primarily by the two remote sensing program areas. Image Alchemy and XV are tools to manipulate image sizes and formats. Al applications and operating systems are running current versions.

Other Equipment:

The backup system, a 560 GB DLT tape library, provides file archival and recovery for all programs at the Center. Other peripherals that are shared by different program areas are two HP designjet E-size plotters, which are used to produce large charts; two Apple color laserwriter printers and four HP laserjet printers; and an E-size poster laminator

Contact: Robert Wilhite (843) 740-1261

OFFICE OF COAST SURVEY (CS)

I. NOAA SHIP WHITING

Mission:
The NOAA ship WHITING is a 163-foot coastal survey vessel with a crew of 35, WHITING's current mission is to conduct basic hydrographic and item investigation surveys along the Atlantic coastal areas. The ship carries two 30-foot aluminum-hulled Jensen survey launches and two 17 foot work boats. These data are used primarily in support of NOAA's Nautical Charting Program.

Sensors:
WHITING is outfitted with survey systems to acquire and process single-beam hydrographic and Side Scan Sonar (SSS) data. Nearly all of the surveying components on board WHITING are commercial off-the-shelf systems. Survey sensors include a Differential Global Positioning System (DGPS), ADDUCE DFS6000 dual-frequency survey echosounder, T.S. DMS-05 Motion Reference Unit, and an EdgeTech 262 SSS analog recorder.

The ADDUCE (previously Raytheon) DFS6000 dual-frequency survey echosounder and the EdgeTech 252 analog/digital Side Scan Sonar (SSS) are considered conventional survey systems. Vessel position is determined with an ASHTECH 12-channel OEM Global Positioning System (DIPS) sensor. The GPS position is then refined by the USCG radio beacon differential Global Positioning System (DGPS) network to provide positioning to 3 to 5 meters accuracy.

Computers:
WHITING has a 100 Base T network of 10 Pentium computers running Windows NT.

Software:
Single-beam hydrographic and Side Scan Sonar data acquisition system - At the heart of WHITING's single-beam Data Acquisition System (DAS) is HYPACK. HYPACK is a Personal Computer (PC) based hydrographic survey package from Coastal Oceanographics Inc. This application runs on a standard Windows-95 Pentium computer and is connected, via serial communications, to all of the survey sensors. HYPACK acquires the digital soundings, time tags, applies offsets, and stores all the data via serial communications to/from the suite of survey sensors. In addition to logging this data, HYPACK annotates the analog paper records of the SSS and echosounder, and provides line control for the survey operations. The two Jensen launches and the ship itself are configured as single-beam hydrographics and SSS data collection platforms.

Single-beam hydrographic and Side Scan Sonar data processing system - They survey data collected by HYPACK is then processed on a PC based data processing system named HPS

(Hydrographic Processing System). HPS's main components are the only part of the WHITING's systems that are maintained in-house. HPS is tightly integrated with two other commercial software packages, MapInfo and Vertical Mapper. MapInfo is a Geographic Information System, from MapInfo Corporation, and Vertical Mapper is a contour, modeling and display package, from Northwood Geoscience. These programs allow the hydrographer to review, visualize, correlate and analyze survey data to determine if the mission objectives have been accomplished. WHITING operates four standard Pentium PCs for processing this data. Graphic representations of this data are captured by and HP-750 color DesignJet Plotter. Since the SSS data is still collected in analog format (paper imagery), the processing method is also analog. The SSS imagery data (sonargrams) are manually reviewed by ships survey complement. Significant sonar contacts are hand measured. This information is manually entered into the HPS database where their position is computer generated and correlated with other contacts.
VELOCITY is the in-house generated software used aboard WHITING to determine the speed of sound in water. It is used with the SEACAT CTD sensor

Field/In Situ Equipment:
The speed of sound in the water (velocity) is measured periodically with a SEACAT CTD sensor.

Contact: Sam DeBow (301) 713-2702

II. NOAA SHIP RUDE

Mission:
The NOAA ship WHITING is a 90-foot coastal survey vessel with a crew of 11. RUDE's current mission is to conduct basic hydrographic and item investigation surveys from the Mid-Atlantic to Northeastern coastal areas. These data are used primarily in support of NOAA's Nautical Charting Program.

Sensors:
RUDE is outfitted with survey systems to acquire and process single-beam hydrographic, Shallow Water Multi-Beam (SWMB) bathymetric, and Side Scan Sonar (SSS) data. Nearly all of the components on board RUDE are commercial off-the-shelf systems. The RESON SeaBat 9003 SWMB system is considered state-of-the-art. The SeaBat is capable of surveying a swath of the sea floor as wide as 3.5 times the depth of water. With the proper survey line spacing this system is capable of completely ensonafying the seafloor with both detailed bathymetric sounding and acoustic backscatter imagery similar to SSS.

Multi-beam acquisition requires the exact position and attitude of the vessel (heave, roll, pitch, & heading) in order to interpret this data. A Seatex Seapath200 Inertial Navigation System was installed on board RUDE at the beginning of the 1998 field season.

The ODECO (previously Raytheon) DFS6000 dual-frequency survey echosounder and the EdgeTech 262 analog/digital SSS are considered conventional survey systems. Vessel position is determined with an ASHTECH 12 -channel OEM Global Positioning System receiver. The GPS position is then refined by the USCG radio beacon Differential Global Positioning System network to provide positioning to 3.5 meters accuracy.

Computers:

RUDE has a 100 Base T network of 10 Pentium computers running Windows NT. In addition, on one of the nodes is a Silicon Graphics Indy UNIX workstation for processing the SWMB data.

Software:

Single-Beam hydrographic data acquisition and processing - At the heart of RUDE's single-beam Data Acquisition System (DAS) is HYPACK. HYPACK is a PC-based hydrographic survey package from Coastal Oceanographics. Inc. HYPACK acquires the digital soundings, time tags, applies offsets, and stores all the data via serial communications to and from the suite of survey sensors. In addition to logging these data, HYPACK annotates the survey operations. The survey data acquired by HYPACK is then processed on a PC-based database management system (dBase IV) by the name of Hydrographic Processing System (HPS). HPS converts the raw data into final field Hydrographic surveys by applying edits, tidal and speed of sound correctors to the sounding data. HPS's main components are the only part of RUDE's systems that are maintained in-house. HPS is tightly integrated with two other commercial software packages, MapInfo and Vertical Mapper. MapInfo is a Geographic Information System (GIS) from MapInfo Corporation, and Vertical Mappper is a contour modeling and display package from Northwood Geoscience. These programs allow the hydrographer to review, visualize, correlate, and analyze the data to determine if the mission objectives have been accomplished. Graphic representations of these data are created on a wide bed HP-750 color DesignJet Plotter.

Shallow Water Multi-Beam and Digital Side Scan Sonar - The data generated by SWMB and digital SSS systems are logged by the Triton-Elics International, Inc., ISIS is a Data Acquisition and Real-Time Visualization System. This commercial system runs on an industrialized PC with a Windows NT operating system. ISIS is capable of georeferencing, visualizing, and capturing the output of the necessary survey sensor, in addition to digitizing and displaying the imagery from the EdgeTech SSS recorder.

In order to process the SWMD and digital SSS data, NOAA has worked closely with Universal Systems Limited (USL) of Frederickton, New Brunswick, Canada to modify the Hydrographic Information Processing Systems (HPS) and Sidescan Image Processing System (SIPS) modules of their GIS package CARIS. This software runs on the UNIX-based Indy workstation. Graphic representations of this data are created on wide bed HP-750 color Design Jet Plotter.

Field/In-Situ Equipment:

The speed of sound in water (velocity) is measured periodically with a SEACAT CTD sensor and processed with the in-house developed software VELOCITY.

Other Equipment/Peripherals:
RUDE is equipped with full scuba diving capabilities.

Contact: Sam DeBow (301) 713-2702

III. NOAA SHIP RAINIER

Mission:
The NOAA Ship RAINIER is a 231-foot coastal survey vessel with a crew of 65. Her survey department consists of, as many as, ten Commissioned Officers and twelve Survey Technicians. The RAINIER's current mission is to conduct basic hydrographic and item investigation surveys in the Alaskan coastal areas. The ship carries six aluminum-hulled survey launches and two smaller work boats. Nearly all of the components on board RAINIER are commercial off the shelf systems. The sensors and computer systems necessary to carry out this mission are detailed below

Sensors:
RAINIER is outfitted with survey systems to acquire and process both single-beam hydrographic, and Shallow Water Multi-Beam (SWMB), bathymetric and Side Scan Sonar (SSS) data.

Single-beam hydrographic data acquisition and processing:
RAINIER's hydrographic sensors are networked through the HYPACK surveying/processing software. These sensors include a Differential Global Positioning System (DGPS) receiver, DFS6000 or Knudsen 320M dual-frequency survey echosounder and an EdgeTech 262 SSS analog recorder. The six survey launches and the ship itself are configured as single-beam hydrographic data collection platforms.

Multi-beam and digital side scan sonar data acquisition and processing:
RAINIER operates two Reson Inc., SeaBat 8101 multi-beam sonar system mounted in two of the survey launches. The SeaBat 8101 is capable of surveying a swath of the sea floor as wide as 7.5 times the depth of water. With the proper survey line spacing this system is capable of completely ensonafying the bottom in the entire survey area. Multi-beam acquisition requires the exact position and attitude of the vessel (heave, roll, pitch, & heading) in order to interpret this data. A POS/MV (Position and Orientation system for Marine Vessel) Inertial Navigation Sensor was installed on board the two RAINIER multi-beam launches to provide this information. The data generated by these systems are logged by the Triton-Elics International, Inc., ISIS
Data Acquisition and Real-time Visualization System. This commercial system runs on an industrial Windows-95 PC. ISIS is capable of visualizing and capturing the output of the necessary survey sensor, in addition to digitizing and displaying the imagery data from the EdgeTech SSS recorder. The RAINIER is outfitted with a SeaBeam Instruments Inc., Hydrochart

II Intermediate Depth Swath Sonar System (IDSS). The IDSS operates in a depth range of 100 - 1000 meters and is capable of covering a swath of 2.5 times the water depth. Vessel attitude for this system is provided by a Data General HIPPY heave/roll/pitch sensor. The data acquisition software for this system runs on a Digital Equipment Corp. MicroVAX computer.

Computers:
RAINIER has a Silicon Graphics Inc. (SGI) Origin2000 data and application server. This server manages the CARIS processing software and the massive volume of data on a disk storage subsystem of over 350 GB. The ship also has over a dozen Pentium PCs running Windows 95. A Digital Equipment Corporation MicroVAX computer is also used to process vessel heave, pitch, and roll information.

Software:
At the heart of RAINIER's single-beam Data Acquisition System (DAS) is HYPACK. HYPACK is a Personal Computer (PC) based hydrographic survey package from Coastal Oceanographics Inc. This application runs on a standard Windows-95 Pentium computer and is connected, via serial communications, to all of the survey sensors. In addition to logging the single-beam data, HYPACK annotates the analog paper records of the SSS and echosounder, and provides line control for the survey operations.

The survey data collected by HYPACK is then processed on a PC based Data Processing System (DPS) named HPS (Hydrographic Processing System). HPS's main components are the only part of the RAINIER's systems that are maintained in-house. HPS is tightly integrate with two other commercial software packages, MapInfo and Vertical Mapper. MapInfo is a Geographic Information System (GIS), from MapInfo Corporation, and Vertical Mapper is a contour, modeling and display package, from Northwood Geoscience. These programs allow the hydrographer to review, visualize, correlate and analyze to determine if the mission objectives have been accomplished.

In order to process the SWMB and digital SSS data, NOAA has worked closely with Universal Systems Limited (USL) of Frederickton, New Brunswick, Canada to modify their Hydrographic Information Processing Systems (HIPS) and Sidescan Image Processing System (SIPS) modules of their GIS package CARIS. This software runs on UNIX-based computers.

Other Equipment/Peripherals:
Graphic representations of this data are captured by an HP-750 color DesignJet Plotter.

Contact: Sam DeBow (301) 713-2702

Remote Sensing Equipment by LINE OFFICE

Line Office	Platform	Sensor	Computers	Field Equipment	Lab Equipment	Software	Peripherals
NCCOS	Unnamed Vessels	Profiling Radiomenter Polarimetric Scatterometer ADCP Split Beam Echosounder Dual Beam Multi. Echosounder Single Beam Echosounder Four Frequency Echosounder Underwater Spectro-Radiometer Digital Underwater Camcorder	SGI-Indigo2 Sun Sparc20 Sun Ultra Pentium PCs IDIDAS PC Mac IIfx Luggable PC Laptop PC SGI-Indigo Origin 200 Server	DGPS Receivers Video Camera Still Camera SeaBird CTD SeaCat CTD	Aviopret Stereoscope Zoom Transfer Scope	IDL ENVI PCI SeaDAS PV-Wave NSIPS GRASS IDIDAS VIDAS VGALoad CCOAST ADCP In-House Acoustic Proc. Bio-Energetics IMAGINE IDRISI ArcInfo ArcView	9GB Drives 4mm DAT 8mm Tape 4GB Drive Tektronix Dye Sub Print. CD Writer Calibration Panel HP Color Scanner
NGS	Citation Aircraft Turbo-Commander Air. Shrike Aircraft	RC-10 Metric Cameras RC-30 Metric Camera Hand-Held Cameras	Pentium PCs Other PCs DEC MicroVax DEC Alphas SGI Indigo SGI Indigo2 Sun Ultra Sun Sparc20 Notebook Computers	GPS Receivers	CCNS-4 Analytical Stereoplotters Besseler Enlarger Large-format Plotters	Microstation Other DeILorme Mapping KARS VAPAD IDPF ArcView	Printers Plotters Digitzers Scanners
CSC			SGI Maximum Impact SGI Impact SGI Indigo2s Sun Ultra Laptop PCs Luggable PCs Sun Ultrasparc Server Net. Appliance f540 Serv. Pentium PCs	DGPS Receivers VideoCamcorders Ranging Binoculars Portable Generator Color Monitor GPS Encoder SuperVHS VTRs Irradiance/Radiance Profiling Sys. PAR Sensor Spectral Flourescence Instrument Flourometer Absorpton/Attenuation Meter Laser Scat./Transmissometry Instr. Spectral Backscattering Meter CTD Sensors Moorable CTD Sensors TOV Underwater VideoCameras	Analytical Stereoplotter Aviopret Stereocope Richards Light Table B&L Zoom Stereoscopes SVO VCRs Trinitron Monitors Video Editing Console SmartTech HRPT Anten.	IMAGINE PCI ENVI IDL FieldNotes Relianc Processor ArcInfo ArcView PixelFX Orima-T KLT Atlas Leica RTP-2 MATLAB SeaDAS BBOP In-House Optical Algor. PhotoShop Image Alchemy XV OrthoMax	Photogrammetric Scan. CD Writers HP E-Size Plotters Large Format Scanner Film Recorder 4mm Dat Drives 8mm Exabyte Drives 9-Track Drive Tektronix Dye Sub Print. E-Size Laminator 9 GB Drives JAZ Drives Laser Printers
CS	Whiting Vessel Rude Vessel Rainier Vessel Survey Launches Work Boats	Dual-Frequency Echosounder Analog/Digital Side-Scan Sonar Motion Reference Unit EdgeTech Recorder Shallow water Multi-Beam (SWMB) Intermed. Depth Swath Sonar Sys. (IDSS)	Pentium PCs MicroVAX Silicon Graph. Indy Unix Workstation	DGPS Receivers CTD Sensors Inertial Navigation System		HYPACK HPS MapInfo Vertical Mapper Velocity dBase IV ISIS CARIS	E-Size Plotter HP750 Design Jet Plotter

Key: NCCOS - National Centers for Coastal Ocean Science; NGS - National Geodetic Survey; CSC - Coastal Services Center; CS - Coast Survey.

Remote Sensing Equipment by MISSION AND LINE OFFICE

Mission & Line Office	Platform	Sensor	Computers	Field Equipment	Lab Equipment	Software
OCEAN COLOR						
NCCOS						
	Vessels	Profiling Radiometer	Sun Ultra Pentium PCs IDIDAS PC Mac IIfx Luggable PC Laptop PC	DGPS Receivers Video Camera Still Camera		IDL ENVI PCI SeaDAS PV-Wave NSIPS GRASS VIDAS VGALoad CCOAST
CSC						
			SGI Maximum Impact SGI Impact SGI Indigo2s Sun Ultra Sun Ultrasparc Server Net. Appliance f540 Server Pentium PCs	Irradiance/Radiance Profiling Sys. PAR Sensor Spectral Flourescence Instrument Flourometer Absorpton/Attenuation Meter Laser Scat./Transmissometry Instr. Spectral Backscattering Meter CTD Sensors Moorable CTD Sensors	SmartTech HRPT Ant.	MATLAB SeaDAS BBOP In-House Optical Algor. PhotoShop Image Alchemy IMAGINE PCI ENVI IDL
ICE MAPPING						
NCCOS						
	Vessels	Polarimetric Scatterometer	SGI Indigo2 Sun Sparc20 Pentium PCs			
LAND COVER / BENTHIC CLASSIFICATION						
NCCOS						
		Underwater Spectro-Radiometer Digital Underwater Camcorder	SGI-Indigo Origin 200 Server Pentium PCs			
CSC						
			SGI Maximum Impact SGI Impact SGI Indigo2s Sun Ultra Laptop PCs Luggable PCs Sun Ultrasparc Server	DGPS Receivers VideoCamcorders Ranging Binoculars Portable Generator Color Monitor GPS Encoder SuperVHS VTRs	Analytical Stereoplotter Aviopret Stereocope Richards Light Table B&L Zoom Stereoscopes SVO VCRs Trinitron Monitors Video Editing Console	IMAGINE PCI ENVI FieldNotes Reliance Processor ArcInfo ArcView

Key: NCCOS - National Centers for Coastal Ocean Science; CSC - Coastal Services Center; CS - Coast Survey; NGS - National Geodetic Survey.

Remote Sensing Equipment by MISSION AND LINE OFFICE

Mission & Line Office	Platform	Sensor	Computers	Field Equipment	Lab Equipment	Software
LAND COVER / BENTHIC CLASSIFICATION (cont.)						
[redacted]						
			Net. Appliance f540 Server Pentium PCs	TOV Underwater VideoCameras		PixelFX Orima-T KLT Atlas Leica RTP-2 Image Alchemy XV OrthoMax
BATHYMETRIC SURVEYING						
[redacted]						
Vessels Survey Launches Work Boats		Dual-Frequency Echosounder Analog/Digital Side-Scan Sonar Motion Reference Unit EdgeTech Recorder Shallow water Multi-Beam (SWMB) Intermed. Depth Swath Sonar Sys. (IDSS)	Pentium PCs MicroVAX Silicon Graph. Indy Unix Workstation	DGPS Receivers CTD Sensors Inertial Navigation System		HYPACK HPS MapInfo Vertical Mapper Velocity dBase IV ISIS
SHORELINE MAPPING						
[redacted]						
Citation Aircraft Turbo-Commander Air.		RC-10 Metric Cameras RC-30 Metric Camera Hand-Held Cameras Deadalus Airborne Scanner	Pentium PCs Other PCs DEC MicroVax DEC Alphas SGI Indigo SGI Indigo2 Sun Ultra Sun Sparc20 Notebook Computers	DGPS Receivers	CCNS-4 Analytical Stereoplotters Besseler Enlarger Large-format Plotters	Microstation Other DeLorme Mapping KARS VAPAD IDPF ArcView
AIRPORT SURVEYING						
[redacted]						
Citation Aircraft Turbo-Commander Air. Shrike Aircraft		RC-10 Metric Cameras	Pentium PCs DEC MicroVax DEC Alphas		Analytical Stereoplotters	
FISH MONITORING						
[redacted]						
			HP Unix	Seabird CTD Seacat CTD	In-House Acoustic Proc.	
CURRENT MEASUREMENT						
[redacted]						
Vessels		ADCP				

Key: NCCOS - National Centers for Coastal Ocean Science; CSC - Coastal Services Center; CS - Coast Survey; NGS - National Geodetic Survey.

V. Targets & Opportunities

a. Workshop Agenda & Summary Materials

b. Preliminary Five-year Targets

c. Cross-section of Targets & Opportunities

d. Opportunity Scoring Sheets

National Ocean Service
Remote Sensing Cross-cut Team

Results of:

"OPPORTUNITIES" Workshop

May 11-12, 1998

June 8, 1998

FINAL AGENDA

"OPPORTUNITIES" WORKSHOP

National Ocean Service Remote Sensing Cross-cut Team

May 11th & 12th - Large Conference Room - 9th Floor SSMC4, Silver Spring, Maryland

Objectives:

1. Initiate discussion of mission objective for remote sensing at NOS;
2. Educate ourselves regarding remote sensing capabilities and operations within NOS; and
3. Identify and discuss candidate areas for improving and possibly expanding the use of remote sensing per the NOS mission of coastal stewardship.

DAY ONE - Monday May 11

8:30 AM	- Coffee, juice, etc.
9:00	- Opening Remarks - **Dr. Nancy Foster, Assistant Administrator**
	- Review agenda and objectives
9:15	**PART I. DEFINING THE ROLE OF REMOTE SENSING AT NOS**
10:30	- BREAK
10:45	- Defining the role... (continued)
11:15	**PART II. LINE OFFICE PRESENTATIONS**
	- Coast Survey
11:45	- Coastal Services Center
12:15 PM	- LUNCH (on your own)
1:15	- Office of Restoration and Response
1:45	- National Centers for Coastal Ocean Science
2:15	- Office of Ocean and Coastal Resource Management
2:45	- BREAK
3:00	- National Geodetic Survey
3:30	**PART III. OPPORTUNITIES**
	- review initial list, discuss additions, nominate criteria for evaluation
4:30	- ADJOURN

DAY TWO - Tuesday May 12

8:30 AM	- Review Day One & objectives for Day Two
8:45	**PART III. OPPORTUNITIES (continued)**
	- Define criteria for evaluating opportunities
9:45	- BREAK
10:00	- Review "opportunity" list and assign write-ups to groups
11:00	- Break into write-up groups
12:30 PM	- Turn in write-ups and break for LUNCH (on your own)
1:30	- Apply criteria to opportunities
3:00	- BREAK
3:15	- Continue application of criteria
4:00	**PART IV. NEXT STEPS**
	- review workshop results
	- discuss next steps
	- make assignments
4:30	- ADJOURN

NOS Remote Sensing Cross-cut Team
Summary of "Opportunities" Workshop - May 11-12, 1998

Participants

Jim Thomas	Jim Lucas	Jim Zeitzeff	George Leigh
John Klein	George Leshkevich	Ed Kruse	Dwight Trueblood
Anne Hale Miglarese	Lee Dantzler	John Brock	Mark Finkbeiner
Millington Lockwood	Randy Ferguson	Rick Decker	Bud Cross
Lucia Tsaoussi	Sam DeBow	Debra Simececk-Beatty	Grady Tuell
Charly Alexander	David Lott		

SETTING THE ENVIRONMENT

NATIONAL ENVIRONMENT

- Human pressure coastal ecosystem
- 3 dimensional ecosystem need to add 4th dimension (time)
- need to recognize change
- typically we only look at one or two dimensions
- Physteria
- Decline in species diversity
- Water quality
- Exotic species (e.g. zebra mussels)
- Terrestrial coastal habitat changes
- Harmful algal bloom
- Recognition of Dynamics of Natural Environment
- Ability to discern temporal/spatial trends
- Locally identified problems driven by regional trends
- Difficulty in discerning long-term trends
- Serves as an economic engine
- May be missing historical references and events
- Catastrophic events appear to be more frequent
- Habitat fragmentation
- Global climate change
- human impact
- natural variability
- Coastal erosion due to sea level rise
- Human pressure – ecosystem cause and effect
- Decline of landscape/habitat function
- Symptoms versus causes
- Data is local or with few variable and hard to extrapolate to larger problems
- Shift changes in key variables (e.g. species) in local systems
- Frequency of occurrence and size of hypoxic events
- Hydrologic modification on coastal environment
- Infrastructure modifications on the coastal environment (e.g. ports)
- Development of surrogate indicators
- Decrease in species diversity

DEMOGRAPHICS

- Future surge in raw numbers of coastal population (due to baby boom?)
- Increase in demands of government by coastal landowners (i.e. expensive land)
- Regional differences in growth lead to inequities
- Recreation is in increasing demand – land use changes over time (versus historical)
- Conversion of land leads to an increase in atmospheric changes

TECHNOLOGY

- Increased performance and decreased cost over time
- Not quite on par with PC revolution
- Data is becoming more and more available
- Regional views becoming more available
- Increase processing on sensor platform

- GPS makes positioning more accurate and standardized
- Advance in presentation of visual information (need standards)
- Increase in commercially available products/services/sensors
- Increasing frequency in time sampling
- Geometric resolution increasing on pace with radiometric resolution
- Convergence of intelligence and civilian communities towards similar resolution
- Increase machine interpretation/automation (machine vision)
- Increase coupling machine/computer vision
- Soft copy photogrammetry
- LIDAR, SAR
- Big increase in data volume
- Capacity of coastal mangers lags
- Technology//data shifts in production
- Need for translation of data for "lay" users, education
- Quick turn around times in greater demand (charts on demand)
- Penetration of ocean surface by sensors
- Flexible formats for interchanging data
- Miniaturization of sensor components (more options for platforms)
- Increased emphasis on active sensors
- Sonar technology allows more information from a single sensor
- measure biomas
- benthic habitat
- Moving from UNIX to PC platforms
- People lag behind shift in technology -need training
- Usability testing of software needs to occur
- Outreach on how to use technology beyond internal uses
- Establishment of standards would bring consistency & users to a common focus

INTERNATIONAL

- Use of international sensors (e.g. Japan, ESA)
- Caribbean interest
- Political/cultural roadblocks
- Data sharing roadblocks (copyrights, access)
- National security and proprietary data issues
- Need to establish protocols
- Need input from technicians/users
- International spatial data transfer standards
- Hazmat used in foreign spills, increase in requests from other countries
- Increase in collaboration of projects between countries
- Mechanisms: more involvement in international conferences, international literature
- Some environmental problems are international (cross boundaries)
- More collaboration in the beginning for operational use of data
- North American Datum (NAD83)
- Sharing of gravity data

MACRO ECONOMIC

- Technology costs are declining
- Commercial satellite industry is subsidized and regulated, will they remain available especially access to data for production?
- Role of NOAA versus commercial sector
- we do good job, then it is farmed out
- Contracting costs more than in-house
- Expertise shifting to private sector, they pay more
- NOAA may not be able control what the private sector develops (data)
- Trend towards service economy
- manufacturing shifting offshore
- Money is available to acquire latest technology
- Increase value of coastal real estate
- increase in power of insurance, litigation, representatives
- Changes in infrastructure (i.e., bridges and channels)
- NOAA is behind the curve keeping up with construction
- Y2K

SOCIAL

- "Big brother" concerns as sensors get more accurate
- People want data on demand
- kids are not intimidated by technology
- Education/outreach takes time
- Increasing visibility of products by media etc.

NATIONAL INFRASTRUCTURE

- WAAS: FAA's new navigation network
- Next generation internet
- Wireless communications
- Overlap and coordination with other federal agencies
- People are better connected to products and are demanding services
- Recreational users, counties, states can supply data to government
- Increasing sophistication of non-federal community
- May not need our traditional help
- "Blue Booking" of other's data
- Detailed coastal floodplain mapping zoning
- jurisdictions
- hazards
- Ships have doubled their draft and length in the last 50 years
- Deeper channels mean more dredging and changes in currents
- Intermodal transportation (marine, truck, train, air)
- VTS: vessel traffic safety system
- CORS – GPS 24hr / 1-2cm accuracy for survey purposes (NGS data)
- Inshore bathymetry lagging
- Shoreline mapping lagging

NOS SPECIFIC

- We have very diverse missions/set of constituents
- Reorganization
- NOAA strategic plan limits scope of office work (hard wired missions)
- Lack of knowledge of NOS line office missions outside of agency
- Continuous change in leadership
- Increased contracting
- Not a member of Federal Response Plans
- MOU may be in place for reimbursement?
- Difficult to take advantage of (red tape)
- Pacific data, particularly Islands data are lagging
- Moving of Aeronautical Charting out of NOS may affect performance in other areas
- Mission/pilot readiness and flexibility
- Distribution, printing, GPO connections
- Rapid response (HAZMAT)
- We create unrealistic expectations on the availability of products and services
- Demands from habitat-related issues is way behind

WORKFORCE

- Training lags behind technology
- How to retrain/build technical capability
- Software/hardware usability testing
- NOS Employees aging, hard to retrain
- Decreasing in #
- Lack of new hires varies by office
- Contractors increasing numbers
- Overeducated
- Costs 2 or more times government employees
- Loose in-house expertise
- Contracting obligated upfront in budget
- Less flexibility in nature of assignments
- Retirement flexibility

CRITERIA DISCUSSION

Additional criteria suggested:

- ability to leverage w/ other projects
- competes with private sector
- meet NOS mission
- explores new areas for NOS
- improve morale and staff performance
- spin-offs to private sector
- Removed criteria
- timing
- timing to success
- institutional complexity
- availability of data
- competes with public sector

Criteria agreed upon

- Expertise
- Technology
- Cost
- Meets timely issue/need
- Explores new product areas for NOS
- Visibility for NOS/NOAA
- Improves the real world/ Fills requested customer need
- Builds stronger internal and external partnerships
- Meets Mandate

Comments

- Trouble using cost/resource as an evaluation measure
- Lot of discussion about improving the real world vs. visibility

Sidebar comments:

Discussion of the NOAA side-scan and multibeam sonar which is not digitally recorded
NOAA charting missions record only the obstruction locations
Could be collected rather easily– data management and recording device logistics

Light aircraft for remote sensing are under attack by IG.
IG wants contracting out to private sector

Discussion of the loss of Aeronautical Charting will lead to difficulty in flights, printing and distribution of nautical charts

PROGRAM CONCERNS

COAST SURVEY

- "Limited" and "sporadic" upgrades to data acquisition and processing technology due to budget process
- erosion of cartographic "corporate knowledge" due to downsizing
- erosion of hydrographic talent base due to office hirng freeze
- inability to efficiently perform multi-programmatic missions simultaneously, e.g. hydrography and benthic mapping

NATIONAL GEODETIC SURVEY

1. Inadequate funding for coastal mapping program
    - 95,000 miles of US shoreline
    - 1/3 never mapped photogrammetrically
    - 1/3 mapped prior to 1978
    - only 1/10 mapped digitally
2. New technologies needed to lower cost and time
    Data Collection

- SAR, multi-spectral scanners, hyper-spectral scanners, LIDAR

Data Processing

- softcopy photogrammetry

3. Airport survey program funding inconsistency

COASTAL SERVICES CENTER

C-CAP Program concerns

- Landsat 5 is way past design standards. If Landsat 7 fails (planned launch December 1998), the Landsat data stream will be interrupted.
- Three of the new small satellites have already failed, two after launch and one was cancelled prior to launch due to cost over-runs.
- Little progress has been made establishing the links between land cover change and fisheries resources.
- Little progress has been made with mapping forms of live bottom other than seagrasses (corals, oyster reefs, etc.)

OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT

National Priorities and the Future

- improving coastal water quality
- improving coastal habitat and productivity
- preparing for and responding to natural disasters
- revitalizing waterfront communities (large and small)
- managing the effects of population growth and development
- linking science to management
- public outreach and education
- management oriented research and monitoring

NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

- availability of aircraft platforms and sensors
- upgrading and maintaining computer hardware, software, and training

OFFICE OF RESPONSE AND RESTORATION

- loss of National Weather Service product "Gulf Stream Analysis"
- lack of hardware and software integration (handling anything but paper images is a problem)
- access to aerial photography both for emergency response and contingency planning

ORIGINAL Remote Sensing "OPPORTUNITIES"

*Proposals for new and/or expanded remote sensing opportunities for NOAA's National Ocean Service presented at a workshop on May 11-12, 1998 conducted by the **NOS Remote Sensing Cross-cut Team.***

A. COAST SURVEY

1. Satellite imagery for shoreline delineation (1)

Satellite imagery has the potential of being very useful to provide up-to-date shoreline feature identification. While probably less accurate than traditional photogrammetry-derived shoreline maps, they offer the potential of being more timely and the possibility of providing synoptic (seasonal) coverage.

Purpose/Need: The United States has approximately 95,000 miles of coastline (including the Great Lakes and Trust Territories). Much of this shoreline has never been adequately mapped. Coastal change due to natural and anthropogenic impacts causes (in many areas) the shoreline to be out of date within a short (<5 years) time frame. The desire is to maintain a "multi-purpose" national shoreline.

Platform/Sensors: SPOT, IRS, LANDSAT, MOS-1 (Japanese), SAR, AVHRR, RADAR-SAT.

User/Customer: National mapping agencies (NOAA, USGS, NIMA), state/local coastal management agencies

Products: Digital national shoreline, in SDTS or other suitable GIS vector interchange format, with complete metadata and data quality attribution.

2. Coastal imagery (digital orthophoto or satellite) for landside information on nautical charts (2)

Digitial orthophoto data sets collected from high accuracy aerial photography are available for much of the United States (exclusive of Alaska). These images are at approxiamtely 1-meter pixel size and are suitable for delineating the majority of manmade and natural features and "events" (storm damage, geolocical change, etc.). The Department of the Interior is "committed" to collecting these images on approximately a 5-year cycle.

Purpose/Need: Much of the landside information on nautical charts - while of minor significance to the navigation community - is useful for many other applications in the coastal zone. These charts are the highest accurate portrayals of coastal features including wetlands, shoals, reefs, estuaries, rivers, waterways, etc. However, the other coastal infrastructure items like roads, bridges, etc. are not kept up-to-date nor do they cover the entire chart area.

Platform/Sensors: Aerial photographs

User/Customer: coastal zone management community, coastal recreational uses, GIS applications

Products: Digital coastal map series at approximately the level of detail contained on 1:24,000 scale USGS topographic maps and the 1:40,000 scale NOAA coastal navigation charts.

NOTE: Numbers in parans correspond to sequential numbering used at workshop

3. Hydrographic/Bathymetric surveys in shallow water/non- navigational significant areas (3)

The vast majority of seafloor of the nation's coastal waters has only been surveyed once or not at all. Much of this area is not significant to maritime commerce but is necessary for other applications.

Purpose/Need: Shallow (<5m) water bathymetry needs to be collected to be able to produce a current rendition of the seafloor of the coastal waters that undergo frequent change. Many areas have not been surveyed for 50-100 years. It is unlikely that these aras will ever be re-surveyed by the NOS Nautical Charting Program.

Platform/Sensor: Accoustic sidescan sonar and multibeam sonar from relatively small boats and aircraft.

User/Customer: Coastal management community, spill response, hazard mitigation, etc.

Products: Digital elevation models, selected contour, and underwater features (shoals, reefs, bars, banks, etc.)

4. Satellite imager (ERS-1, LASER, LANDSAT, SPOT) and other new techniques for coastal/estuarine bathymetry. (4)

Much of the continental shelf water, 30m-200m needs to be surveyed at a scale/resolution that will allows the indentificatio nof the major seafloor features contained there on. these include sandwaves, pinnacle reefs, coral reefs, canyon heads, slumps, slides, etc.

Purpose/Need: The Fishery Conservation and Management Act requires NOAA to assess the habitats of significance to benthic fish species in order to better manage these diminishing resources.

Platform/Sensor: Aircraft, certain satellites, ships, primarily by acoustic means but there may be advances in laser and other optical techniques.

Users/Customers: NMFS and the fishery community

Products: Digital seafloor classification maps

5. Coastal maritime archaeology assessments. (5)

The coastal, estuarine, and riverine waters of the United States are "littered" with shipwrecks and other discarded maritime derelicts. Many of these are historically significant.

Purpose/Need: Areas around marine sanctuaries and other harbors should be surveyed to assess their valuableness to the various USES and to determine whether or not they should be recovered or preserved.

Platform/Sensor: Ships, aircraft, small boats, acoustic imagery, magnetometer, and laser line scan. Also 3.5 kHz or other sub bottom profiling.

User/Customer: Marine sanctuary managers, state departments of natural and cultural history.

Products: Comprehensive "wreck" and other obstruction maps of the coastal waters of the United States.

6. Define benthic habitats from digital sidescan sonar. (6)

Benthic habitats can be defined in a reconn fashion by the use of medium frequency (50-100kHz) sidescan sonar systems. These systems will provide a preliminary determination of some of the fundamental fishery

habitats (hard bottom, reefs, gravel, mud, etc.) as well as significant habitat morphological features such as canyon heads, reefs, banks, etc.

Purpose/Need: The Fishery Conservation and Management Act requires NOAA to assess the habitats of significance for benthic fish species in order to better manage these diminishing resources.

Platform/Sensors: Ships and towed sidescan sonar systems - either single or multi-frequency systems. Accompanied by sub-bottom profiling in some areas.

User/Customer: Fishery management agencies.

Products: large-scale acoustic imagery mosaics with acoustic classification and sediment provincing.

B. NATIONAL GEODETIC SURVEY

1. Increased awareness/usage of NGS coastal database. (7)

Upgrade and publicize the coastal database of aerial photographs and shoreline data. Need to accelerate the digital indexing of the 500,000 aerial photos dating back to 1943 to allow on-line browsing and ordering. Presently scanning and vectorizing many of the 15,000 shoreline maps. New shoreline data sets are captured digitally. Presently scanning every second color, coastal aerial photograph collected. Need to increase reate of data collection and processing.

Purpose/Need: NOS should produce (1) a seamless digital database of the U.S. shoreline which is accurate, consistent, and tide coordinated; (2) an aerial photograph database with a digital index and recent photos scanned; and (3) a remote sensing digital database.

Platform/Sensors: Aircraft with aerial, large format, metric cameras, kinematic GPS control. Other airborne and space remote sensors.

User/Customer: All of NOS, other parts of NOAA, government agencies, coastal managers, coastal engineers and surveyors, and other private sector agencies.

Products: Aerial photographs, digital aerial photographs, digital shoreline data, other remote sensing digital data such as IFSAR, LIDAR, MSS, and HSS.

2. Develop new sensor technologies. (8)

Includes:

- Interferometric synthetic aperture radar for data collection through clouds;
- SHOALS (LIDAR) for simultaneous bathymetry and shoreline;
- Daedulus (MSS), in-house, add IMU for geo-referencing;
- AVIRIS (HSS), 100 hours offered to NOAA in FY 98, need NOAA partners; and
- Commercial satellite data usage.

Purpose/Need: Need to increase the rate of data collection and processing in order to complete the mapping of the the U.S. shoreline and to provide timely data for all critical areas of the shoreline. New sensors will allow data collection under conditions not previously possible (e.g. SAR through clouds). New sensors and new processing technology will also, hopefully, reduce the cost of the coastal mapping program.

Platform/Sensors: Airborne and spaceborne sensors listed above.

User/Customer: All of NOS, other parts of NOAA, government agencies, coastal managers, coastal engineers and surveyors, and other private sector agencies.

Products: Various data sets of the coastal area, including digital shoreline data.

3. NOS remote sensing database of the coastal zone. (9)

Let's begin with the definition of a groundel. Just as a pixel is an element of a picture, a groundel is an element of the terrain. Its size is determined by need. In high volume port areas one-meter groundels or even half-meter groundels may be required while 5-meter or even 10-meter groundels may be satisfactory for most of the coast. A groundel's postition must be know in all four dimensions -- latitude, longitude, elevation, and time. Like size, the positional accuracy and frequency or re-observation will be dictated by the need associated with a particular location. It is also essential that a groundel's composition be known -- is it water, sand, asphalt pavement, etc., or some combination of materials. In the case of water, we may want to consider the groundel to be the bottom below the water surface but consider the characteristics of the water in the column above it as well when we describe its composition. Again, there is a time associated with the composition attribute, i.e., the material may have changed since the last observation due to natural forces or human activities.

Using this definition, then my vision of remote sensing of the coastal zeone is the construction of a database of groundels that extends x-meters seaward and y-meters landward from the shoreline, where x and y are parameters to be determined by need, which can be expected to vary with both location and time. The frequency with which particular sets of groundels would need to be re-observed would also be determined by their locations as would th eaccuracy with which theri parameters would need to be known. An important feature of this database is thai must include statistical measures of the accuracy with which each of the rpertinent parameters would need to be known. An important feature of this database is that it must include statistical measures of the accuracy with which each of the pertinent parameters were determined each time they were observed and a probability assigned to the premise that they remain unchanged up to the present time.

With our present capabilities it is unrealisitc to consider the direct population of such a database. We do not have the wherewithal to accurately identify the composition of all groundels, so we must begin by cataloging the information we are able to glean - the raw observations, corrected observations, etc. These data will then be valuable for current practical applications of existing technology and will become the source material with which to develop new technology that will eventually result in our being able to fully characterize the goundels in our database.

Are there any of our coastal remote sensing projects that would not benfit from such a database or some enhancement thereof or would not benfit from the synergy to be realized from combining our data in this manner? are there any of our remote sensing projects that woul not make some significant contribution to such a database?

Platform/Sensor: All

User/Customer: All users of remote sensed data.

Products: User-defined and produced from the database.

4. National Technical Means. (10)

Need to increase use of NTM data and new technology to process that data. Softcopy photogrammetry now in use in NGS skif.

Purpose/Need:

Platform/Sensor:

User/Customer:

Products:

C. COASTAL SERVICES CENTER

1. Using new satellite sensors to improve coastal habitat change detection. (11)

Within the next decade, several new satellite remote sensing platforms will be launched. Many of these platforms will provide improved spectral and spatial resolution.

Purpose/Need: Most of the available satellite sensors are inadequate for the small area, local applications needed by some coastal managers. In addition, one of the most important sensors available, the Landsat Thematic Mapper, is well past its design life. New sensors that will be taking place must be investigated.

Platforms/Sensors: A variety of new satellite systems with improved spectral and spatial resolution, are being planned by both private industry and private/government cooperatives.

User/Customer: A wide variety of regional, state, and local coastal resource managers.

Products: Digital and hard copy maps, tabular information on distribution and abundance, integrated CD-ROM products with the change detection data plus a wide variety of pertinent GIS layers.

2. Harmful algal bloom monitoring and tracking. (12)

Develop an experimental, region-specific forecasting system to track the initiation, progress, and demise of HABs (*G. breve*).

Purpose/Need: Mitigation and control of impacts on natural and economic resources.

Platform/Sensor: Satellite, fixed wing aircraft, and buoys.

User/Customer: Federal, state, local, government coastal resource managers and public health officials.

Products: Technical reports and a near-real-time prototype HAB forecasting system.

3. Mapping of near-shore bathymetry. (13)

Utilitize airborne bathymetric LIDAR to capture near-shore bathymetry.

Purpose/Need: Shallow coastal bathymetry is a key variable for numerous coastal resource management and natural hasard mitigation applications.

Platform/Sensor: Fixed-wing aircraft or helicopters.

User/Customer: Federal, state, and local government coastal resource managers.

Products: High-resolution, vertically accurate coastal bathymetric data.

4. Mapping trend analysis of live bottom in the coastal U.S. (14)

While progress has been made in the last decade to map the SAV resources of the U.S., little progress has been made on comprehensive monitoring of other forms of live bottom (coral reefs, oyster beds, etc.). Often these resources are too deep to be effectively mapped by optical sensors.

Purpose/Need: Live bottom supplies crucial habitat to a wide assortment of living marine resources. They are extensively utilized, both directly and indirectly, by the commercial and recreational fishing industries. Furthermore, in many areas, these resources are being negatively impacted by natural and anthropogeninc forces.

Platform/Sensor: Satellite imaging systems, aerial photography, airborne LIDAR, side-scan and multibeam sonar, high resolution acoustic imaging, underwater video.

User/Customer: State shellfish and reef managers, the regional marine fisheries management councils, essential fish habitat program.

Products: Digital and hard copy maps, tablular information on distribution and abundance, integrated CD-ROM products withthe change detection data plus a sied variety of pertinent GIS layers.

D. OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT

1. GIS technical assistance for Fed and state CZM and marine protected areas. (15)

Increased GIS support from the Coastal Services Center and NOS Science Office to the Federal and state coastal management customers is needed. Once again, this support has been initiated for the NERRS and SE coastal states, but needs to be expanded to include all state CZ programs and sanctuary sites.

Purpose/Need: Technical assistance is the form of GIS training, metadata development, and GIS data layer development is needed. As are the development of standards for sharing data.

Platform/Sensor:

User/Customer: NERRS, sanctuary, and coastal zone and OCRM managers. NERRS and sanctuary research and education communities.

Products: Training workshops (GIS/metadata), data layer standards, data layer development using NOS remote sensing data.

2. Priority on supporting coastal management data collection needs. (16)

NOS should make it a priority to collect remote sensed data with NOS resources in direct support of the coastal management and marine protected area management responsibilities NOS has.

Purpose/Need: High quality remote sensed data is needed to support informed management and policy decisions in the state CZM programs and marine protected area programs.

Platform/Sensor: Ship, aircraft, and satellite-based platforms are all needed.

User/Customer: Fed and state coastal management community, NERRS and sanctuary managers, researchers, educators, and the academic community.

Products: Bathymetry data, shoreline data, ocean color data, digitial photography data.

3. Corporate database of remote sensed data. (17)

A centralized cataloge or database that is updated regularly that inventories the GIS data available within NOS. This could be distributed on the Web.

Purpose/Need: Such a database/inventory is needed in order to allow Fed and state CZ managers to know what is available and from where. Now it is catch as catch can.

Platform/Sensor:

User/Custormer: Fed and state coastal zone community, NERRS and sanctuary managers, researchers and educators, and the academic community.

Products: Web-based inventory or GIS database.

4. Web-based GIS system. (18)

Create an integrated GIS database on the Web for all the state CZ aeras and marine proteced areas NOS manages.

Purpose/Need: To allow any Fed or state manager to access GIS data at any CZ or marine protected area for management and research purposes.

Platform/Sensor:

User/Custormer: Fed and state coastal zone community, NERRS and sanctuary managers, researchers and educators, and other Fed agencies.

Products: Web-based GIS system.

5. Remote sensed data for non-point source pollution implementation. (19)

Collect remote sensed data to help evaluate and the implementation of state non-point source pollution best management practices.

Purpose/Need: To help NOS and EPA evaluate the effectiveness of state best management practices to mitigate non-point source pollution.

Platform/Sensor: Unknown.

User/Customer: NOAA, EPA, and state CZ managers.

Products: Unknown.

6. Photogrammetry mission expansion. (20)

OCRM feels better collaboration and coordination is necessary with Photogrammetry in order to take advantage of the flight opportunities to collect digital photography. Efforts are underway to do this. However, it is clear that the data can be collected only as time permits. We feel that it would be good for NOS to expand the mission of photogrammetry to include regularly scheduled flights in the in the NERRS, marine sanctuaries, and the coastal zone.

Purpose/Need: Regular scheduled flights are a must for collecting useful data on coastal changes. For example, if each NERR site could be flown once every 5 yers, this would provide very useful inforamtion on coastal changes at the site for management, research, and monitoring purposes.

Platform/Sensor: Aircraft, digital/IR cameras.

User/Customer: NERRs, sanctuary, coastal zone, and OCRM managers, research scientists, the education community, and the academic community.

Products: Digital photo maps of coastal changes for use in GIS.

E. NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

1. Monitoring program for addressing key indicators of coastal environmental health. (21)

The proposed effort utilizes remote sensing technologies to monitor water quality (e.g. chlorophyl, temperature, salinity, turbidity, lake ice) harmful algal blooms, wetlands, and submersed habitats to characterize the status and trends of coastal environments. The program is a national, comprehensive, operational remote sensing effort to monitor indicators of environmental health. The program builds upon on-going efforts within NOAA (NESDIS/OAR, NOS/NCCOS, CSC) and utilizes appropriate sensors and sensor platforms to complement and expand existing capabilities. Standard protocols will be applied to remote sensing and field-based water quality and habitat monitoring efforts to optimize both the interpretation and temporal and spatial representativeness of indicators characterizing the health of coastal environments.

Purpose/Need: To assess changes in living marine resources and the association of these changes, with environmental quality, effectiveness of resource management pollution abatement strategies and in general to support NOAA's coastal stewardship responsibilities.

Platform/Sensor: Satellite, aircraft, shipboard and in-situ platforms, and commercially available sensors.

User/Customer: NCCOS/NCCMA, NOAA's National Status and Trends Program, OCRM's NERRs and Sanctuaries, and state monitoring efforts.

Products: Geospatial data sets and periodic assessments of monitoring results as an indication of coastal environmental health.

2. Research and development program to improve monitoring of coastal and estuarine water quality, lake ice, benthic habitats, and harmful algal blooms. (22)

The program will conduct research and development in support of operational efforts ongoing with COP, NS&T, NESDIS, GLERL, CSC, and NMFS to maintain quality and improve cost effectiveness of monitoring coastal and estuarine environments (including Essential Fish Habitat). This effort will evaluate

the utility and cost effectiveness of various remote sensing platforms, sensors, and commerical and National Technical Means remote data sources.

Purpose/Need: The primary purpose is to develop and improve standard protocols for collection, processing and validation of remotely derived data products in support of the national remote sensing monitoring program addressing key indicators of coastal environmental health.

Platfom/Sensor: Effective monitoring of coastal ecosystems ultimately requires testing of variable spatial and spectral resolution data sources, active and passive remote sensors, a diversity of satellite, aircraft, and shipboard platforms, and new systems as they become available.

User/Customer: Coastal states and Federal agencies.

Products: Standard protocols for collection, processing, and validation of remote data and data products for remote monitoring of water quality, harmful algal blooms, wetlands, and submersed habitats.

3. GIS-based research program to integrate remotely derived and other geographic contextual information and to conduct coastal and estuarine spatial modeling. (23)

Develop and apply a spatial analysis framework tailored to the integratiuon of remote sensing data products with other goegraphic contextual information focusing on factors affecting estuarine and near coastal habitats. This program will incorporate a number of currently available data sets for anslayiss and predictive modeling of the helath of coastal environments.

Purpose/Need: The product would support on-going habitat suitability and essential fish habitat analyses. Specifically it would advance and apply our understandingof coastal environmnts to describe and predict changes in the spatial distribution, helath and change through time of these habitats in the context of environmental factors affecting them (e.g. coastal land and waterway development, water quality and salinity management, and harmful algal blooms).

Platform/Sensor: Primary focus is the use of GIS as an analytical tool for geospatial data on coastal environments.

User/Customer: Coastal states and Federal agencies.

Products: Periodic assessments of monitoring results and regional predictions of future trends in estuarine and ocastal envorinemental health.

4. Environmental framework program to produce integrated products of remotely derived and other contextual environmental information in support of coastal and estuarine management. (24)

Develop and apply a spatial analysis framework tailored to the integration of remote sensing data products and other geographic contextual information focusing on factors affecting estuarine and near coastal habitats. This program would incorporate a number of currently available data sets and provide these information sets in user friendly formats for visualization and assessment by coastal habitat managers and decision makers.

Purpose/Need: The program would integrate data from on-going remote sensing, habitat suitability and essential fish habitat studies in a form suitable for efficient and straight forward visualization and evaluation by coastal and estuarine habitat managers and decision makers. Specifically if would advance their access to information on the spatial distribution, health and change through time of these habitats in the context of environmental factors affecting them (i.e. coastal land and waterway development, water quality and salinity management, coastal hydrodynamics and harmful algal blooms).

Platform/Sensor: Primary focus is the use of GIS as a visualization and interpretative framework for remotely derived and other geogrpahic contextual information.

User/Customer: NMFS, coastal states

Products: Custom user-friendly GIS applications and associated CD and Internet accessible information products.

F. OFFICE OF RESPONSE AND RESTORATION

1. Gulf stream analysis. (25)

(description)

Purpose/Need:
Platform/Sensor:
User/Customer:
Products:

2. Rapid access to high resolution images (1m) - IR, SLAR, and "dark stuff" (26)

(description)

Purpose/Need:
Platform/Sensor:
User/Customer:
Products:

3. Aerial photographs. (27)

(description)

Purpose/Need:
Platform/Sensor:
User/Customer:
Products:

4. Educational outreach. (28)

(description)

Purpose/Need:
Platform/Sensor:
User/Customer:
Products:

Remote Sensing at NOAA's National Ocean Service
PROPOSED 5 YEAR TARGETS

Based on discussions at Team meeting on June 16th, 1998. Numbers reflect original target number.

1. Establish a de-centralized network (Internet or Internet-like site) that provides information on and FREE (?) direct access to NOS spatial information products including remotely sensed data (e.g. aerial photography, satellite imagery, bathymetry, shoreline, benthic habitats, etc.).

3. Documentation (report) of National Ocean Service remote sensing instrumentation and information needs/priorities for coastal management and science to be shared internally and with other NOAA, Federal, private sector, and academic remote sensing groups.

4. Annual planning process to link emerging remote sensing technologies and applications to priority management and research issues at the National Ocean Service.

5. Permanent "team" to evaluate agency progress towards remote sensing technology, information, and program objectives.

6. National coastal digital land and sea floor cover data base derived from remote sensing sources at an appropriate level of resolution for assessments of specific topics (e.g. see 1 above).

8. Development and access to a Library of specific protocols for the acquisition and use of established remotely sensed products suitable for specific types of coastal environmental analysis (e.g. water quality assessments, salinity mapping, non-point modeling, land use analysis, shoreline mapping, hazards planning, habitat mapping, EFH GAP analysis, shallow water bathymetry, etc.)

9. Analytical toolbox of technical services and capabilities available to coastal managers, navigators, scientists (e.g. protocols (software), MapFinder, technical training, manuals, outreach and education on availability of NOS remote sensing products/services, Gulf stream analysis).

10. Integrated hard copy and electronic maps (integrated with various landside and water side layers) that can be seamlessly integrated into the "map" product (benthic habitats, USGS DLG files of roads and other layers, habitat data, ortho photo quads, satellite imagery, bathymetry).

12. Expand NOAA industry, university partnership programs for the joint development of state-of-the-art remote sensing technology to meet objectives of the NOS strategic plan.

13. Direct NOAA parternship programS with NASA, USGS, NIMA that establishes a series of high priority national and regional remote sensing products.

14. Develop an infrastructure (hardware, software, people) that enhances the ability to communicate and transfer information.

15. Articulate NOS remote sensing role vis a vis the rest of NOAA.

16. Make significant progress on completing the mapping of the US shoreline to NOS/NGS standards.

National Ocean Service

Remote Sensing Cross-cut Team

Intersection of "Targets" and "Opportunities" from 6/16 Meeting

TARGETS

OPPORTUNITIES	1.	3.	4.	5.	6.	8.	9.	10.	12.	13.	14.	15.	16.	*number of "targets" linked to each opportunity*
1.	O	O	O	O	O	O		O	O	O			O	*10*
2.	O				O			O				O	O	*5*
3.	O				O	O	O	O						*5*
4.	O	O			O	O	O	O						*6*
5.	O		O			O	O	O	O					*6*
6.	O				O		O	O						*4*
7.	O						O	O			O			*4*
9.	O				O			O						*3*
10.										O			O	*2*
11.		O	O		O	O		O	O					*6*
12.	O					O	O			O				*4*
15.	O				O		O	O	O					*5*
16.	O	O	O	O				O					O	*6*
17.	O				O	O		O						*4*
18.	O					O	O		O					*4*
19.					O	O	O							*3*
21.	O		O			O		O		O		O		*6*
22.		O	O			O			O	O				*5*
23.		O	O			O			O	O				*5*
24.			O	O	O	O		O	O					*6*
25.							O	O						*2*
27.				O			O						O	*3*
number of "opportunities" supporting each target	*14*	*6*	*8*	*4*	*11*	*13*	*11*	*15*	*8*	*6*	*1*	*2*	*5*	

National Ocean Service
Remote Sensing Cross-cut Team

REVISED OPPORTUNITIES - Criteria Assessment and Scoring

count	No.		Available Expertise	Technology Requirements	Costs	Meets timely issue/need	New product areas for NOS
1.	1.	Develop and integrate applications of advanced remote sensing systems into the NOS shoreline mapping mission.	(4)	(4)	(5)	4	3
2.	2.	Coastal imagery (digital orthophoto or satellite) for landside information on nautical charts	(3)	(2)	(5)	4	5
3.	3.	Hydrographic/Bathymetric surveys in shallow water/non-navigational significant areas	(3)	(3)	(5)	5	3
4.	4.	Satellite imager (ERS-1, LASER, LANDSAT, SPOT) and other new techniques for coastal/estuarine bathymetry (R&D)	(3)	(3)	(1)	1	5
5.	5.	Mapping and trend analysis of bottom types and other benthic habitat in coastal US and the EEZ.	(3)	(3)	(5)	5	5
6.	6.	Define benthic habitats from digital sidescan sonar.	(combined with #5)				
7.	7.	Increased awareness/usage of NGS coastal database.	(3)	(3)	(5)	3	3
8.	9.	NOS remote sensing database of the coastal zone.	(5)	(5)	(5)	1	5
9.	10.	Increased use of NTM and better access to these data.	(2)	(2)	(1)	1	5
10.	11.	Using new satellite sensors to improve coastal habitat change detection.	(2)	(3)	(5)	5	3
11.	12.	Harmful algal bloom monitoring and tracking.	(2)	(3)	(3)	5	4
12.	15.	GIS technical assistance for Fed and state CZM and marine protected areas. *	No Score				
13.	16.	Coordination of NOS remote sensing data needs with NOS program missions. (B)	No Score				
14.	17.	Corporate database of remote sensed data.	(3)	(3)	(5)	1	3
15.	18.	Web-based GIS system. *	No Score				
16.	19.	Remote sensed data for non-point source pollution control efforts and activities.	(4)	(4)	(5)	4	5
17.	21.	Monitoring program addressing key indicators of coastal environmental health.	(4)	(4)	(5)	4	3
18.	22.	Research and development program to improve monitoring of coastal and estuarine water quality, lake ice, benthic habitats, and harmful algal blooms.	(4)	(4)	(5)	4	3
19.	23.	GIS-based research program to integrate remotely derived and other geographic contextual information and to conduct coastal and estuarine spatial modeling. *	No Score				
20.	24.	Environmental framework program to produce integrated products of remotely derived and other contextual information in support of coastal and estuarine management. *	No Score				
21.	25.	Gulf stream analysis. (handled off-line)	No Score				
22.	27.	Training (includes uses of data). (B)	No Score				

* in report mention overlap with GIS effort
(B) identifies opportunities that will be covered by the "how we do business" section of the report

Improves real world/fills customer need	Stronger internal/external partnerships	Meets mandate	SCORE	# Meets RmtSng Team Targets	Weighted # Meets RmtSng Team Targets
5	3	5	7	10	50
3	5	1	8	4	29
5	5	5	12	5	30
3	5	1	8	5	30
5	5	5	14	6	34
				4	25
5	3	5	8	5	24
5	5	1	2	3	24
1	2	3	7	2	5
5	5	4	12	6	31
5	5	3	14	4	16
				5	29
				6	36
5	5	3	6	4	29
				4	20
5	5	4	10	3	11
5	5	4	8	6	31
3	5	3	5	5	17
				5	17
				7	42
				3	20
				3	10
				Median = 5	Median = 29

CRITERIA FOR EVALUATING OPPORTUNITIES

Available Expertise
- (1) - on-hand and available
- (3) - on-hand, otherwise committed
- (5) - not on-hand, but known

Technology Requirements
- (1) - on-hand and available
- (3) - on-hand, otherwise committed
- (5) - not on-hand, but known

Cost
- (1) - total expense less than $500K
- (3) - total expense less than $1,000K
- (5) - total expense over $1,000K

Meets Timely issue/need
- 5 – Very hot topic, short attention horizon
- 3 - Regularly visited topic with periodic peaks
- 1 – long-term interest

New Product Areas for NOS
- 5 – totally new area with significant potential
- 3 – expansion of existing area with significant potential
- 1 – marginal move into new area

Visisibility for NOS/NOAA
- 5 - wide exposure inside and outside agency
- 3 - recognition in the remote sensing community
- 1 - someone will notice

Improves Real World/Fills Customer Need
- 5 - direct/lasting impact on environment or other conditions and/or meets significant need articulated by customers
- 3 - indirect impact
- 1 - potential impact

Stronger Internal & External Parnterships
- 5 - connects int./ext. components that need to work together
- 3 - connects logical NOS components
- 1 - connects any NOS components

Meets Mandate
- 5 - completely and directly meets mandate
- 3 - partially meets mandate
- 1- may help meet mandate

Meets Rmt. Snsng. Team Targets (#)

Meets Rmt. Snsng. Team Targets (Weighted #)