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14. ABSTRACT
The National Imagery and Mapping Agency (NIMA) has established "Phase 1 Proof-of-Concept Demonstration for an Integrated Interagency Characterization of the Littoral Zone" under the program direction of Chung Hye Read. The purpose of this task was to examine and demonstrate advanced spatial database techniques that allow for the efficient and timely integration of large spatial databases relative to Littoral "Areas of Interest (AOI)." To accomplish this effort, the Naval Research Laboratory's Digital Mapping, Charting & Geodesy Analysis Program (DMAP) expanded its Geospatial Information Database (GIDB), an object-oriented database system, to handle the Littoral-zone dynamics which tend to be highly variable in both the temporal and spatial domains. GIDB stores this data with large quantities of topographic, navigational, and cultural features data, to offer a high-resolution digital representation of both wet and dry environments within the coastal regions.

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Characterization of the Dynamic Littoral Zone
An Exercise in the Real-Time Dynamics of Spatial Data Integration

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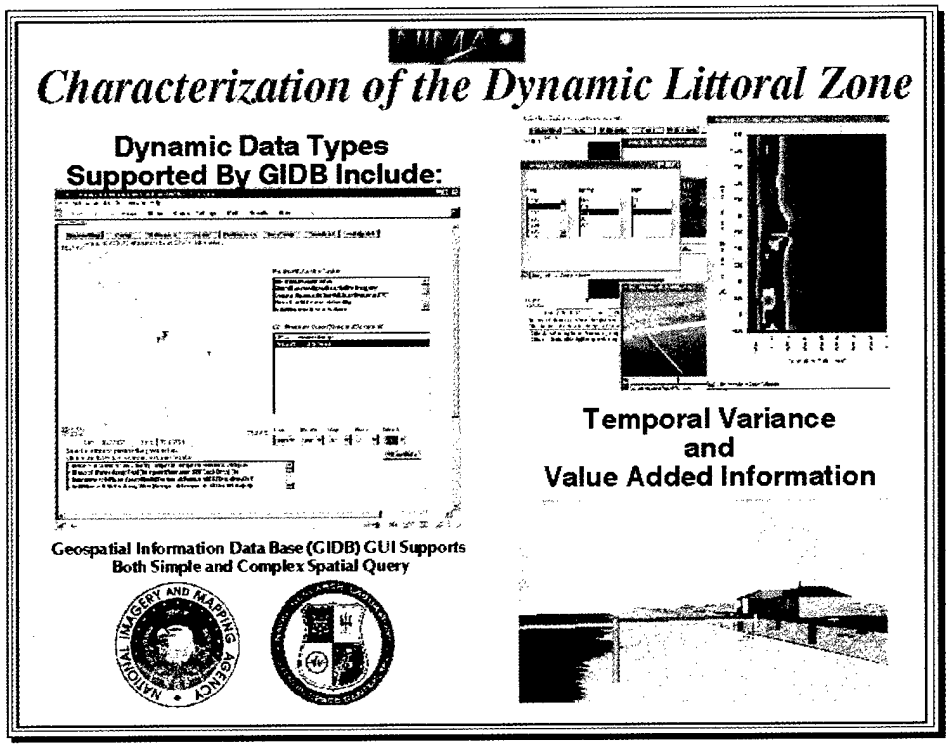
Abstract



The National Imagery and Mapping Agency (NIMA) has established "Phase 1 Proof-of-Concept Demonstration for an Integrated Interagency Characterization of the Littoral Zone" under the program direction of Chung Hye Read. The purpose of this task was to examine and demonstrate advanced spatial database techniques that allow for the efficient and timely integration of large spatial databases relative to Littoral "Areas of Interest (AOI)." To accomplish this effort, the Naval Research Laboratory's Digital Mapping, Charting & Geodesy Analysis Program (DMAP) expanded its Geospatial Information Database (GIDB), an object-oriented database system, to handle the Littoral-zone dynamics which tend to be highly variable in both the temporal and spatial domains. GIDB stores this data with large quantities of topographic, navigational, and cultural features data, to offer a high-resolution digital representation of both wet and dry environments within the coastal regions.

This paper examines the Naval Research Laboratory's (NRL) initiative to develop a geospatial Characterization of the Dynamic Littoral Zone (CDLZ). Through this effort, methods were investigated for identifying and collecting digital spatial data from multiple sources, including government, academia, and the private sector. Described are steps taken to identify and collect the data and the processes used to persist these data entities within NRL's GIDB. The GIDB offers a unique framework for facilitating efforts of data compilation and AOI representation for specialized missions. Through its object-oriented data model, GIDB can provide spatial data entities that are functionally capable of representing the dynamics of the littoral region. The environmental, cultural, hydrographic and oceanographic features are more consistent with their real world counterparts. The GIDB also offers a unique way of blending complex temporal data sets with other environmental data and even rendering that information using 3-Dimensional

viewing tools within the context of a common Web-Browser as depicted in the preceding illustration.

The efforts presented focus upon the region surrounding the U.S. Army Corps of Engineers Field Research Facility (FRF) at Duck, North Carolina. The Duck facility was chosen because it offers both an extremely dynamic littoral region, while also providing detailed and substantial data archives of nearshore measurements. Through this effort, the NRL will refine processes for compiling the information necessary to digitally portray and analyze the complexity and dynamics of coastal/nearshore environment. It is further anticipated that the experience gained and methods refined through development of this CDLZ are applicable to data integration efforts in other regions of the world.

Introduction

The littoral zone is a dynamic and complex environment that presents distinct challenges for naval operations. The collection and integration of digital spatial data for this region is likewise extremely challenging. Both cumbersome and time-consuming, the task of merging these data is often carried out based largely on the geo-processor's personal experiences. Their intuition as to what organizations may provide digital data within an AOI is very limited by his/her previous involvement with spatial data activities for that region. As the AOI changes, the complexity of this data collection task may also vary due to both scarcities of data and/or inherent incompatibilities of any data that is available. In fact data that does exist is more often collected by a number of different public and private organizations using inconsistent methods, formats, and classification schemes. Typically there is no single authoritative source of information as to what data sets exist for any given area of interest. Thus, an effective means is needed for identifying and gathering littoral zone data on an AOI basis. It must be done in a manner that fosters sharing the efforts required to spatially describe these dynamic regions. Thus this effort can be as much a political or liaison job as it is technical in nature. Likewise, the timeliness of acquiring the data from local sources can significantly diminish any hopes of providing near real-time responsiveness to operations such as war fighting exercises. Dissemination efforts must facilitate sharing in real or near real-time modes that can respond to activities like Dynamically Re-configurable Surveys (DRS) (Bourgeois, et. al. 1999) or tactical planning operations. These techniques must also be flexible enough to support the current expansion of the geospatial technologies in areas that include using autonomous vehicles and video-based environmental measurement systems as describe by Harris, et. al., 2000.

Background

U.S. military interests in the littoral zone are deeply rooted in a significant shift that occurred in the early 1990's, whereby a focus on a global Cold War threat was revised to concentrate primarily on regional challenges. Naval orientation also shifted accordingly from primarily a "blue water" focus to a coastal one (Kelso and Mundy, 1992). To accomplish Phase 1 of Characterization of the Dynamic Littoral Zone, NRL began by examining the regional challenges and opportunities presented by this change of focus. Kelso and Mundy identified a need to concentrate upon the complex operating environment of the littoral and the coastlines of the earth. To parallel naval operational planning policies, NRL identified and collected data holdings based upon three scales of data resolution (e.g. 6, 100, and 250 nautical miles) surrounding a geographic point located at the Duck, N.C. Field Research Facility. Each of the data sets were

geographically clipped to one of these boundaries and stored within the GIDB as persistent objects. The primary contents of the littoral GIDB include DNC/VPF modifications, Elevation, Bathymetry and Topographic/Cultural Features Surveys, Dynamic Ocean Features Data, and any associated meta-data. Since these data were collected from a host of government, academic, and private industry sources, it offers a unique opportunity for supporting a wide range of end-user applications. GIS query and analysis functions within the GIDB were utilized to orchestrate a full multi-media demonstration of the dynamic conditions found in this region.

The synergism gained by integrating the large scale, multi-source data within these regions, as demonstrated by the GIDB prototype, further offers NIMA improved opportunities for bringing together the many commercial, technical and operational communities found in littoral zones. More recently, in the wake of military operations in the Middle East, Europe, and Africa, substantial emphasis has been placed on enhancing joint (multi-service) and combined (multi-national) capabilities. While the combination of resources from diverse military organizations increases operational potential, it also substantially increases complexity in various ways. The GIDB offers the ability to accurately portray the littoral environment in which forces often find themselves. One advantage offered by the GIDB is a common database framework for both vector and raster data. The initialization of this data into common objects further facilitates uniformity in queries and retrieval processes. The use of GIDB for temporal data storage has offered NIMA a unique capability to examine the dynamics of the littoral zone without the limitations of referencing a single window of time as is often imposed by relational data structures. In particular, GIDB allows the user to reference time series of oceanographic and meteorological conditions. Examples of this type data are well described on the web pages found at http://www.frf.usace.army.mil/gauges.stm , http://www.frf.usace.army.mil/waves.html and http://www.frf.usace.army.mil/weather.html. Further discussion of these and other benefits of GIDB to spatial data query and data extraction are provided by Holland, et. al. (re: as submitted) along with a more detailed examination of the dynamics of the littoral zone.

Littoral operations can be distinguished from those in the open ocean environment by a number of factors. These include more diverse potential threats and reduced reaction times (Ya'ari, 1995). Additionally, operations in the coastal environment may be constrained by interrelated environmental feature and cultural activities that are not typically found in a blue water environment. Some of these are listed in Table 1.

Table 1. Regionally Dependent Features Affecting Littoral Operations

Environmental Parameters	Cultural Activities
Bathymetry	Civil air transportation routes
Proximity to land	Commercial navigation routes
Sea temperature	Other public use areas (fisheries, etc.)
Currents	Terrestrial transportation systems
Shoreline erosion or accretion	Public utilities
Wave height and period	Land use activities (farming, mining, etc.)
Beach width, slope, and composition	Population density and distribution
Tide range and period	Significant man-made structures
Vegetation cover	Shoreline hardening
Topography	Environmental Interest of Community

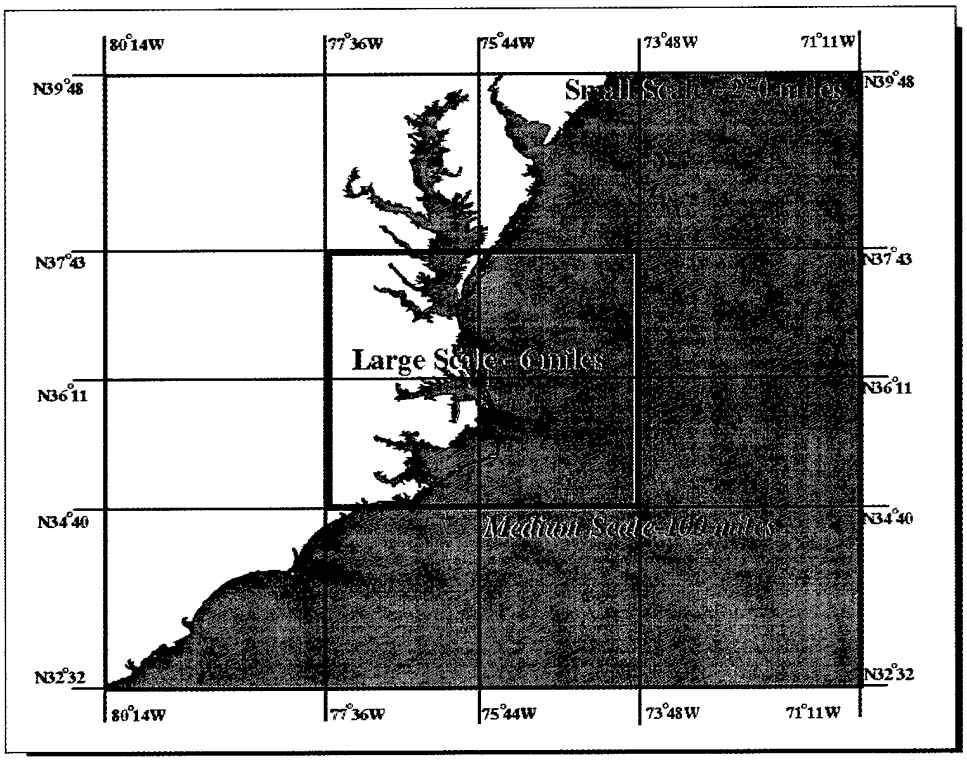
This abbreviated list may vary greatly depending upon the relevant factors of a particular mission (e.g., noncombatant/humanitarian vs. more traditional military missions). Also including in this variance is the permissiveness of the operating environment and the characteristics of locally specific challenges (e.g. topography/weather etc.).

The Latin root word "litus" suggests that the focus of the littoral zone must be on the shore. It is in fact "a shore or coastal region" (Webster, 1994), the expanse of which is governed by one's primary interest in features near that shore. There appears to be no single definition for the limits of the littoral zone. A military delineation, however, would be governed by such operational characteristics as sustainable operating ranges for aircraft, ships, and landing craft; the area within which environmental and cultural characteristics present particular challenges and risks; and likely land-based threat ranges. Specific geographic limits vary from one location to another and may change over time due to the evolution of sensor and platform technology.

Study Area Delineation

For this analysis, the littoral zone was defined as extending approximately 200-500 nautical miles from the shore, depending on the operating ranges of the air, sea, and land-based craft expected to be involved. Data collection was focused on an area extending 250 nautical miles in each cardinal direction from a point at the end of the U.S. Army Corps of Engineers research pier at Duck, NC.

Illustration 1 shows the overall area for the characterization effort. The outermost boundary shown in red represents small scale information (250 nm outward from Duck, NC) Within this area one might expect to use the general themes needed to support operational planning. The mid-level zoom area provides a medium scale for demonstrating the coastal regime. The innermost boundary shaded in green represents an AOI within which much larger scale oceanographic features will be demonstrated. Latitude and longitude coordinate pairs for the boundary features are as follows:



Point of Reference	Latitude	Longitude
End Point of Research Pier/11 NOAA Tide Gauge	36 °11' 1.25" N	075 ° 44' 42.6" W
Overall Littoral Characterization Area, SW Point	32° 32' 0.00" N	080°14' 0.00" W
Overall Littoral Characterization Area, NE Point	39° 48' 0.00" N	071°11' 0.00" W

Methodology

The process makes use of common Geographic Information System (GIS) tools in conjunction with the advancing technology of the Object-Oriented (OO) paradigm. Each data set is geographically clipped to one of the boundaries described above and stored within a single project area to isolate it from other data holdings. During the initial phase of data collection, the data was stored as both Arc Shape™ and Arc/Info® coverages and archived to CD-ROM for delivery to GIDB data programmers and the sponsor.

It was initially accepted that sufficient medium scale data would be available for a generalized characterization of the study area. This assumption was based upon previous experience with public domain data sources from agencies such as the National Geophysical Data Center, U.S. Geological Service and the National Oceans Service. Additional investigation was required to determine the availability of larger scale (i.e. higher resolution) oceanographic features. Thus,

the total capability for characterizing the littoral zone at an extreme scale (i.e. 1:300) remains unclear.

Definition of Primary Data Themes
Discussions between NIMA, NRL and the Naval Oceanographic Office (NAVOCEANO) resulted in a consensus concerning the common thematic interests for the littoral zone. A preliminary investigation of these themes provided the following list of primary and secondary features for the littoral zone:

DNC w/VPF modifications including value added data as Additional Military Layers (AML)
DTED or DEM Elevation Data (i.e. hypsography)
Bathymetry
Topography (i.e. merged bathymetry and hypsography)
Wave Height
Wave Period
Wave Direction
Tide Range
Imagery
Shoreline Location
Beach Slope
Bar Position
Surf Zone Width
Nearshore Currents
Winds
Rain
Atmospheric Pressure
Sediment Type
Meta Data (where/who/how/when data was collected)

These features are a limited subset of those previously defined by NRL and NIMA to support development of the Master Seafloor Digital DataBase (MSDDB) under the direction of the Defense Hydrographic Initiative. Based upon these two lists, NRL proposed that data for the characterization of the littoral zone be organized within the following thematic categories:

- **Shorezone/Datums** (Delineated boundaries for backshore, foreshore, nearshore, and prescribed vertical and horizontal datums of reference)
- **Bathymetry** (Water depth in positive or negative values, including soundings, isopleths, grids, and Triangulated Irregular Networks (TINS))
- **Hypsography** (Elevation of terrain above a prescribed datum, including vertical height data, digital elevation models, TINS, grids, and delta values from P.O.B)
- **Topography** (Data products where bathymetry and hypsography have been integrated on one vertical datum and where other surface features may have been added)
- **Navigation** (Buoys, beacons, Digital Nautical Chart data, and IHO data)

- **Cultural Features** (Roads, railroads, urban limits, structures, etc.)
- **Value Added Features** (Ancillary or descriptive data, e.g. building floor plans, harbor engineering drawings)
- **Geophysical** (Geology, morphology, terrestrial ecology/biology sediment types, etc.)
- **Hydrography/Hydrology** (Ocean Climatology including currents, tides, estuarine boundaries, mixing layers, stream flow, river deltas, etc.)
- **Imagery** (Geo-referenced Raw Images, Classified/Filtered/Characterized Images. *Raster and vector data sets derived from imagery will be stored in appropriate theme.)
- **Dynamic Oceanography** (Temperature, attenuation coefficient, salinity, sound speed/conductivity, wave action, etc.)
- **Biology/Marine Life** (Coral, reef structures, mammal/fish populations, hazardous marine life, vegetation types, etc.)

Further examination of the primary data entities expected to be contained in each of these themes reveals that the littoral zone incorporates a majority of all data features previously suggested for the MSDDB. Although other themes could be broken out of this list, the thematic groups listed above are offered because they adequately represent the data entities expected to be of interest to NIMA's intended audience of commercial, civilian and military users.

Data Gathering

The data collection task was accomplished in three phases:

1) Review and supplementation of in-house data holdings in reference to established geographic boundaries;
2) Acquisition of additional known DOD and public domain data sets; and
3) Identification and acquisition of previously unknown data holdings within government, academia and the private sector.

NRL's review of in-house data determined a significant void of coverage in the immediate vicinity of Duck, NC. Numerous data sets, however, were previously collected in the area of Onslow, NC. south of Duck, and is inclusive in the small scale littoral region previously defined. These data sets were reviewed by re-visiting original sources to include any updates within the study area.

Organizations that were considered during this phase of data collection included:

- Naval Research Laboratory (Washington, DC, Monterey, CA, and SSC, MS)
- National Imagery and Mapping Agency (NIMA)
- Naval Oceanographic Office and operational commands
- U.S. Geological Survey (USGS)
- U.S. Army Corps of Engineers (USACE)
- National Oceanic and Atmospheric Administration, National Ocean Service (NOAA, NOS)
- Federal Geographic Data Committee/ Geospatial Data Clearinghouse
- State and local governments; regional government agencies
- Universities
- ESRI, LaserScan, CARIS, Intergraph, and other commercial GIS Vendors

- GeoCommunity™ GIS Data Depot, GEOWorld, GPSWorld, and other GIS Trade Magazines

All data were integrated into the GIDB through three primary data translators currently available in the framework. These include common NIMA DOD standard formats, such as the Vector Product Format (VPF) and Raster Product Format (RPF), and the Arc Info® Shapefile™ commercial GIS file format. Data transformation to one of these formats was required for some data sets. Most commonly, ASCII data sets were imported into formats readily acceptable by the ArcInfo or ArcView® GIS software and then saved to a Shapefile™ format.

A request was made to the NOS for hydrographic/oceanographic data in the Duck, NC region. It was indicated that the volume of data would require the focus to be narrowed to 8 square nautical miles around the point centered at the end of the research pier. Beach surveys available from Marine Topographic Units were also considered for inclusion in the master database.

Specific Data Holdings

Based upon the data categories identified above, the following table offers a listing of the data collected during this phase of the littoral zone characterization.

Theme/Data Name	***Data Description***	***Source***	***Data Type***	***Resolution/ Scale***
Shorezone/ Datum				
DCW Browse	Digital Chart of the World Shoreline	NIMA	VPF	1:3,000,000
WVS Plus – 3m	World Vector Shoreline Polygon Features – Generalized	NIMA	VPF	1:3,000,000
NOS 70K Shoreline	Shoreline for Conterminous US Extracted to Outer Boundary	NOS	Vector	1:70,000
24K Shoreline	Shoreline Extracted from USGS Quadrangle Topographic Maps	USGS	Vector	1:24,000
Outbound	Outer Most Boundary from FRF Pier – Smallest Scale Data	NRL-Derived	Polygon	1:70,000
Midbound	Middle Boundary from FRF Pier – Medium Scale Data	NRL-Derived	Polygon	1:70,000
10Kbox	Inner Most Boundary – Largest Scale Data	NRL-Derived	Polygon	1:70,000

Bathymetry				
NOS	Bathymetric Soundings	NOS	Grid	3 Second
Duck Bathy	Duck 94 Exercise Bathymetry-CRAB survey data as a time variable bathymetry. Profile lines collected biweekly by the Coastal Research Amphibious Buggy at the FRF using a Trimble 4000 SSE differential GPS survey system	NRL	Grid	To Be Determined
Hypsography				
1 Degree DEM	Digital Elevation Model – 1 Degree	USGS/NIMA	Grid	3 Arc Second
100K DEM	Digital Elevation Model – 1:100K	USGS	Grid	1:100,000
24K DEM	Digital Elevation Model – 1:24K	USGS	Grid	1:24,000
Topography				
Topo30	Topography – Integrated Bathymetry and Hypsography based on MSL Vertical Datum	USGS/NOS	Grid	30 Second
Coastal Relief	Coastal Relief Model Vol. 02 Grid Locator	NGDC	Grid	3 Second
Navigation				
Nav. Buoy Markers	Navigation Buoy Markers	NOS	Vector – Point	Variable – 1:70,000
Cultural Features				
DLG 100K	Digital Line Graph – 1:100k Roads/Rivers/Railroads/Populate d Places	USGS	Vector	1:100,000
Value Added Features				
Digital Raster Graphics	Digitized 1:100K Quads	USGS	Raster/JPG	1:100,000
*Digital Raster Graphics	Digitized 1:24K Topo. Maps	USGS	Raster/JPG	1:24,000
Geophysical				
***Gravity	North America Gravity Index	NGDC	Grid	5 Degree
***NC Geology	North Carolina Geology	NC Geologic Survey/USGS	Raster/BMP	1:3,000,000
Hydrography/ Hydrology				
To Be Determined				
Imagery				
*Digital OrthoPhoto Quads	Ortho/Center Corrected Imagery from State Photography	USGS	Raster/DRG	1:24,000

***SIR-C/X-SAR	Spaceborne Imaging Radar-C/X-Band Synthetic Aperture Radar	NASA/JPL Imaging Radar Program	Raster	Variable
Dynamic Oceanography				
To Be Determined				
Biology/Marine Life[1]				
To Be Determined				

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It was also determined that the USGS, and the National Biological Service/Wetland Research Center (re: offices in Cajundome, Louisiana) have data coverage for biological communities (seagrasses, wetlands, etc.) in the Duck area of interest. However, this data was not collected due to time constraints, but may be added later.

Conclusion

As a result of NRL's activities to collect data over the Duck, NC littoral region, a master database was developed within the GIDB. This first phase of characterization of the littoral zone was accomplished to facilitate additional examination of the concept under future funding. The effort described here was primarily oriented to identifying, collecting and integrating the data found through previous knowledge of the region, phone interviews, and web-browsing activities. The current effort did not allow for the construction of a flow diagram or functional model that could identify key steps that need to be taken for any newly defined AOI. NRL anticipates that additional work in 2001 will allow for the modeling of this data collection process.

Acknowledgements

The National Imagery and Mapping Agency, Program Manager Chung Hye Read, funded this work based upon NIMA's concern for improving their ability to rapidly collect, integrate and disseminate spatial data for the littoral regions of the world. NIMA funding of this effort under Program Element # 34345B has allowed NRL Code 7440 to establish a preliminary understanding of the issues involved with data acquisition for this complex regime. The continued technical review and encouragement received from both Chung Hye Read and Jon Dale, NIMA provided vital assistance to NRL in this ongoing effort. Likewise, the technical assistance of LCDR Paul Thorpe, USNR in editing this document was also essential to the review process.

References

Bourgeois, B., Petry, F., et. al, (1999). A GIS Integration Approach for Dynamically Re-configurable Surveys. The Hydrographic Journal, 91, 3-10.

Harris, M. M., Holland, K. T., and Shaw, K. B., (September 1997), Video – Environmental Measurement Systems for Tactical Support in the Littoral, NRL/OP/7440-97-004.

Holland, K.T., Wilson, R., Chung, M., Breckenridge, J. and Shaw, K. as submitted (2000), An object-oriented approach to characterization of the dynamic littoral environment at Duck, NC., Journal of Coastal Research, submitted 6/00.

Kelso, F. and C. Mundy, (September 1992), ...From the Sea, Navy Public Affairs Library, www.chinfo.navy.mil/navpalib/policy/fromsea/fromsea.txt, NNS130, NavNews 048/92.

Soukhanov, A. H., Ellis, K. E.,(1994).Webster's II New Riverside University Dictionary, pg. 699, The Riverside Publishing Co./Houghton Mifflin Co., Boston, MA.

Ya'ari, Yedidia. 1995. "The Littoral Arena: A Word of Caution." Naval War College Review, XLVIII, 2 (Spring 1995): 7-21.

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

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