

Gulf of Mexico Bathymetry Data Service

Interim Project Report

An FGDC CAP Grant project

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NOAA Coastal Services Center
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TASKS COMPLETED

Project Planning and Coordination

Project planning was conducted via conference calls between the Coastal Services Center, Coast Survey Development Laboratory and the Geophysical Data Center. During the early phase of the work most of planning pertained to accelerating the acquisition and archive of data for the Gulf of Mexico region. Personnel changes at the Atlantic Hydrographic Branch delayed delivery of some records for several months. Other planning tasks included facilitating the communications between database and application server development staff between NOAA offices. Some delays were also encountered in requesting assistance from the Geophysical Data Center due to difficulties in transferring funds between offices within the National Ocean Service.

Systems Design

The basic system design for storage, application servers and WFS deployment is based on the existing Geophysical Data Center configuration. Some uncertainties still exist in regards to the internal data flow. In some cases data moves from the Atlantic Hydrographic Branch offices directly to the Geophysical Data Center, and in other cases, the Coast Survey Development Laboratory receives the data from the Atlantic Hydrographic Branch, and then forwards it to the Geophysical Data Center. In all cases the Geophysical Data Center maintains an archive identified as the "bathyDB" in an Oracle Spatial configuration. This provides the storage for the ArcIMS application server that operates the WFS.

The bathyDB is a single instance database for records from all major ocean basins and includes approximately 80 million records. During planning meetings a decision was made to experiment with providing access to all records from the database and not only the Gulf of Mexico region. Current WFS implementations include the entire database and will remain in this configuration unless performance limitations are encountered.

Data Acquisition and Management

All data acquisition and data management was conducted by agency staff as part of their routine duties and was not at the expense of project funds. Some limited development and testing of a processing technique to extract only the "best available data" for any geographic area from the composite database was completed. This technique of spatial processing will be documented as part of the final report.

Schema Development

The existing data content model is a direct copy of all available fields in the archive database. This includes approximately 16 fields. Some fields contain values that remain consistent for all records on a survey basis. Other fields

are only directly relevant for data management and scientific uses. This original selection was based on a joint decision by both the Coast Survey Development Laboratory and the Geophysical Data Center.

Current plans are to evaluate the possibility of providing a simplified view of the database for the public access point, and that it will only include fields directly relevant to end user needs. See the Appendix for the proposed schema.

Service Deployment

The Geophysical Data Center deployed the WFS in a GML 2.x standard that was matched to their production version of ArcIMS 9.1. A new production version of ArcIMS 9.2 has recently been installed and the WFS deployment is in the process of being upgraded to meet the GML 3.1.1 specification. This should be completed by January 30 2007.

FUTURE PLANS:

Schema Modifications

The project partners will meet over the next month to review the proposed schema listed in the Appendix. A final schema using the GML 3.1.1 Simple Features Profile will be defined and deployed using the production capabilities of the ArcIMS 9.2 version. An XSD file will be made available and provided in the final report.

Server and Service Upgrades

The primary database server will be replaced and or upgraded sometime over the next 2 months. Down time is expected to be brief and on the order of several days. Application server software is already in the process of upgrade to meet the ArcIMS 9.2 / GML 3.1.1 specification.

Service Metadata Development

The Coast Survey Development Laboratory is conducting a massive metadata automation project to capture each survey since the late 1800's. The status of this project will be investigated to see if records are available for use prior to the end of the project. Whether or not these metadata records are available, summary service level metadata will be developed and will be used to populate a getCapabilities response, and other high level summaries appropriate for use by a none scientific audience.

End User Web Presences

Coastal Services Center will develop a web presences under the "Data Transport Lab" address at Coastal Services Center to introduce end users to the bathymetry web service and show them how to use a WFS.

Outreach

Over the next four months the primary outreach tool to share the bathymetry data service with the public will be the project web site, individual phone calls, emails and other forms of personal networking. Future options for outreach still include a poster session at a regional/national meeting, and a brief article in the Coastal Services Center magazine. Other meetings of opportunity such as those hosted under the Integrated Ocean Observing System, and FGDC will be used as mechanism to share the project results.

PROJECT MODIFICATIONS AND ISSUES:

WFS application server software release delays

The firming up of the GML 3.1.1 standard and the time that ESRI required to meet this specification was longer than expected. To provide basic WFS it was necessary to implement it using an earlier WFS version than was requested in the grant language.

Application schema instance variations and validation problems

During schema development a broad range of validation responses were encountered depending on which development tool was utilized. XMLSpy would reliably pass the schema and sample record while other tools reported errors that in some cases appeared to be tied to imports of numerous GML schemas.

A no cost extension was requested to complete the proposed tasks

APPENDIX:

Service Access Point

http://mapdevel.ngdc.noaa.gov/wfsconnector/com.esri.wfs.Esrimap/bathy_f?request=

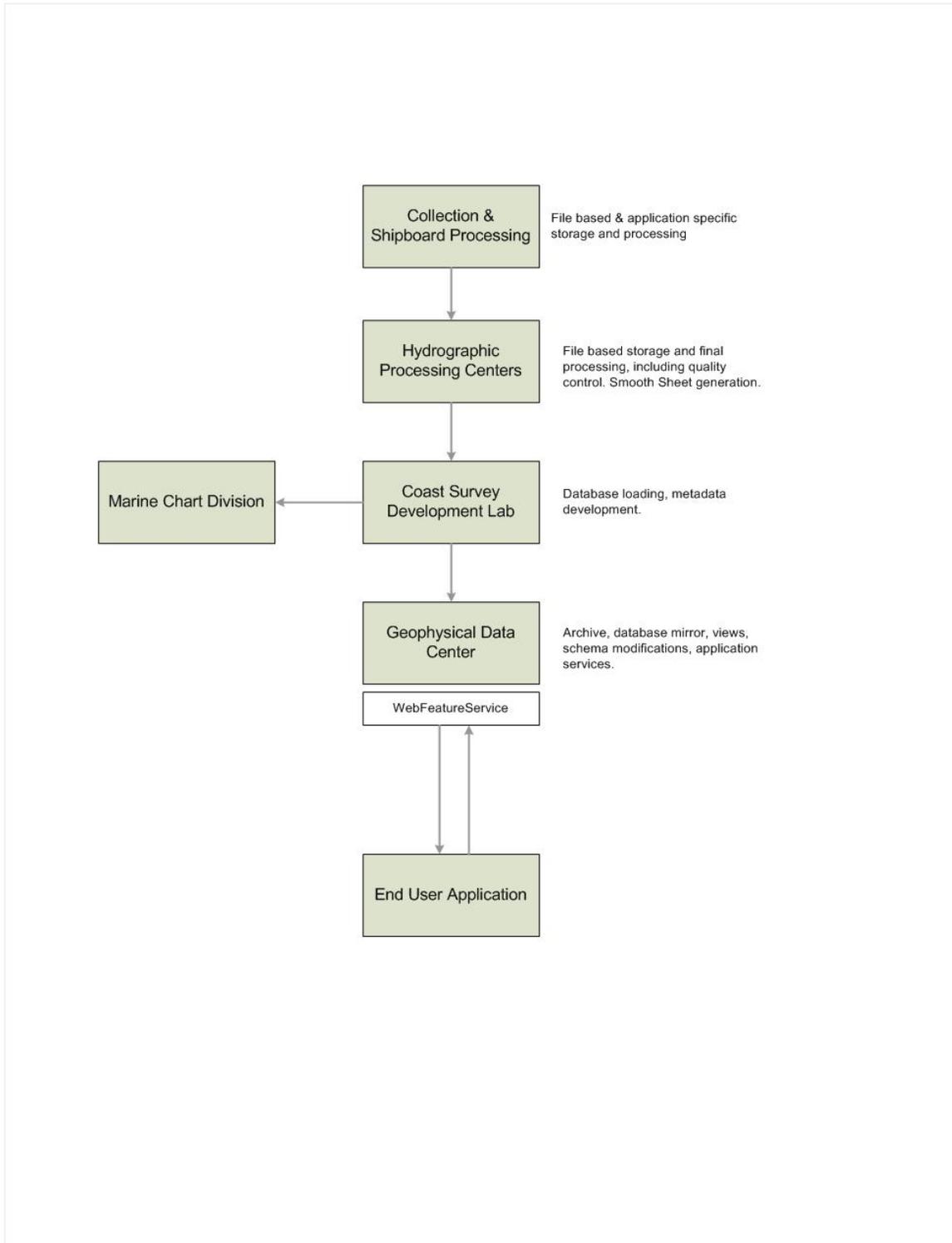
http://mapdevel.ngdc.noaa.gov:80/wfsconnector/com.esri.wfs.Esrimap/bathy_f?request=

Use Case Summary Statement

Client can submit a getCapabilities request and receive service metadata adequate to form a valid getFeature request.

Client can submit a GML 3.1.1/WFS encoded getFeature request for bathymetry enclosing a geographic area not to exceed 10 nautical miles on a side and receive a GML 3.1.1 valid response string.

Data Flow Diagram



Data Dictionary

Survey ID

Alias	surveyID
Description	Foreign key to survey metadata
Data Type	String
Length	16
Units	NA
Domain	Unrestricted
Example	HH123456
Required	Yes
Notes	

Survey Date

Alias	surveyDate
Description	Year survey was collected
Data Type	DateTime
Length	16
Units	NA
Domain	Unrestricted
Example	HH123456
Required	Yes
Notes	

Vertical Datum

Alias	verticalDatum
Description	Vertical datum of the sounding
Data Type	String
Length	32
Units	NA
Domain	(please reference the Schema)
Example	MLLW
Required	Yes
Notes	

Latitude

Alias	latitude
Description	Y value for horizontal position of the sounding
Data Type	Numeric
Length	9.5
Units	Decimal Degrees, WGS84
Domain	0 to -90, 0 to 90
Example	42.20416
Required	Yes
Notes	

Longitude

Alias	longitude
Description	X value for horizontal position of the sounding
Data Type	Numeric
Length	10.5
Units	Decimal Degrees, WGS84
Domain	0 to -180, 0 to 180

Example	-70.73262
Required	Yes
Notes	
Vertical Position	
Alias	verticalPosition
Description	Vertical position of the sounding where positive values are above the vertical datum, and negative values below the vertical datum
Data Type	Numeric
Length	6.2
Units	meters
Domain	-9999 to 9999
Example	-123.12
Required	Yes
Notes	

Data Content Reference

Sources

Sounding data originates from ship based hydrographic surveys. The collection techniques have evolved and include a range from lead lines, single beam echo sounders to shipboard and towed multi-beam arrays. Horizontal measurement techniques have evolved concurrently as well, including, dead reckoning, range and bearing to advanced GPS. Collection techniques shall be documented in the metadata record.

Datum

For bathymetry data the default reference for horizontal datum is the North American Datum of 1983 (NAD83). The default vertical datum is the tidal datum, Mean Lower Low Water (MLLW). In certain circumstances an alternate vertical datum may be functionally equivalent to MLLW and shall be noted in their metadata reference.

Integration of Survey Records and Shorelines

Natural and manmade processes result in a shift of the horizontal position of shorelines. Bathymetric records in the public access point shall contain only records from vertical positions below the apparent shoreline. Apparent shoreline is measured with a vertical datum of Mean High Water (MHW).

Integration of Multiple Surveys

According to standard hydrographic practices within NOAA, historic survey values are superseded by valid newer surveys. Because survey patterns and sounding locations rarely overlap precisely, circumstances can arise where a void exists in a modern survey and historic values can be used. No recognized practice exists to quantitatively select a horizontal filter distance that designates when it

is acceptable to begin using historic values to fill a void, or as a filter to remove a historic value.

Sample Methodology

Records distributed from the public access point represent a mass points collection of soundings. These values are irregularly spaced and originate from multiple surveys over a time period from 1888 to present.

Sample Record Instance from the 2.x Implementation

```
<wfs:FeatureCollection xsi:schemaLocation="http://www.ngdc.noaa.gov/maps
http://mapdevel.ngdc.noaa.gov/wfsconnector/com.esri.wfs.Esrimap/bathy_f?request
=describefeaturetype&service=WFS&version=1.0.0 http://www.opengis.net/wfs
http://mapdevel.ngdc.noaa.gov/wfsconnector/schema/wfs/1.0.0/WFS-basic.xsd">
<gml:boundedBy>
<gml:Box srsName="EPSG:4326">
<gml:coordinates> -95.00,26.50 -94.90,26.60</gml:coordinates>
</gml:Box>
</gml:boundedBy>

<gml:featureMember>
<ngdc:soundings-1 fid="soundings-1.1">
<gml:multiPointProperty>
<gml:MultiPoint srsName="EPSG:4326">
<gml:pointMember>
<gml:Point srsName="EPSG:4326">
<gml:coordinates>-94.9000301750151,26.5981442365721</gml:coordinates>
</gml:Point>
</gml:pointMember>
</gml:MultiPoint>
</gml:multiPointProperty>
<ngdc:bathyuser.sounding.object_id>28062484</ngdc:bathyuser.sounding.object_i
d>
<ngdc:bathyuser.sounding.survey_id>H06499A</ngdc:bathyuser.sounding.survey_i
d>
<ngdc:bathyuser.sounding.original_lat>26.597826</ngdc:bathyuser.sounding.origin
al_lat>
<ngdc:bathyuser.sounding.original_long>-
94.899861</ngdc:bathyuser.sounding.original_long>
<ngdc:bathyuser.sounding.calculated_lat>26.598144</ngdc:bathyuser.sounding.cal
culated_lat>
<ngdc:bathyuser.sounding.calculated_long>-
94.90003</ngdc:bathyuser.sounding.calculated_long>
<ngdc:bathyuser.sounding.original_depth>170.08</ngdc:bathyuser.sounding.origin
al_depth>
<ngdc:bathyuser.sounding.current_depth></ngdc:bathyuser.sounding.current_dept
h>
<ngdc:bathyuser.sounding.object_code></ngdc:bathyuser.sounding.object_code>
<ngdc:bathyuser.sounding.quality_code></ngdc:bathyuser.sounding.quality_code>
<ngdc:bathyuser.sounding.active></ngdc:bathyuser.sounding.active>
```

```
<ngdc:bathyuser.sounding.object_id>28062484</ngdc:bathyuser.sounding.object_id>
<ngdc:shape.area>0</ngdc:shape.area>
<ngdc:shape.len>0</ngdc:shape.len>
</ngdc:soundings-1>
</gml:featureMember>
<gml:featureMember>
```

Schema Fragment for Proposed GML 3.1.1 SFP Deployment

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!-- W3C Schema generated by NOAA Coastal Services Center 2006-->
<!-- Soundings from NOS Bathymetry Archive -->
<!-- -->
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:iios="http://www.csc.noaa.gov/iios"
xmlns:gml="http://www.opengis.net/gml"
xmlns:gmlsf="http://www.opengis.net/gmlsf"
targetNamespace="http://www.csc.noaa.gov/iios" elementFormDefault="qualified"
version="1.0">
<xs:annotation>
<xs:appinfo
source="http://schemas.opengis.net/gml/3.1.1/profiles/gmlsfProfile/1.0.0/gmlsfLevels.xsd">
<gmlsf:ComplianceLevel>0</gmlsf:ComplianceLevel>
<gmlsf:GMLProfileSchema>http://schemas.opengis.net/gml/3.1.1/profiles/gmlsfProfile/1.0.0/gmlsf.xsd</gmlsf:GMLProfileSchema>
</xs:appinfo>
</xs:annotation>
<!-- -->
<!-- includes and imports -->
<xs:import namespace="http://www.opengis.net/gml"
schemaLocation="http://schemas.opengis.net/gml/3.1.1/base/gml.xsd"/>
<xs:import namespace="http://www.opengis.net/gmlsf"
schemaLocation="http://schemas.opengis.net/gml/3.1.1/profiles/gmlsfProfile/1.0.0/gmlsfLevels.xsd"/>
<!-- -->
<!-- define feature types -->
<xs:element name="Soundings" type="iios:SoundingsType"
substitutionGroup="gml:_Feature"/>
<!-- -->
<xs:complexType name="SoundingsType">
<xs:complexContent>
<xs:extension base="gml:AbstractFeatureType">
<xs:sequence>
<xs:element name="surveyDate" type="xs:dateTime"/>
<xs:element name="surveyID">
<xs:simpleType>
<xs:restriction base="xs:string">
<xs:maxLength value="64"/>
</xs:restriction>
</xs:simpleType>
```

```
</xs:element>
<xs:element name="horizontalPosition" type="gml:PointPropertyType"/>
<xs:element name="verticalPosition" type="gml:MeasureType"/>
<xs:element name="verticalDatum">
<xs:simpleType>
<xs:restriction base="xs:string">
<xs:maxLength value="32"/>
<xs:enumeration value="NAVD88"/>
<xs:enumeration value="MHHW"/>
<xs:enumeration value="MHW"/>
<xs:enumeration value="MTL"/>
<xs:enumeration value="DTL"/>
<xs:enumeration value="MLW"/>
<xs:enumeration value="MLLW"/>
<xs:enumeration value="MSL"/>
</xs:restriction>
</xs:simpleType>
</xs:element>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<!--          -->
<!-- define feature collection -->
<xs:element name="SoundingsCollection" type="ioos:SoundingsCollectionType"
substitutionGroup="gml:_GML"/>
<xs:complexType name="SoundingsCollectionType">
<xs:complexContent>
<xs:extension base="gml:AbstractFeatureType">
<xs:sequence maxOccurs="unbounded">
<xs:element name="featureMember">
<xs:complexType>
<xs:sequence>
<xs:element ref="gml:_Feature"/>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
</xs:schema>
```