The Coast and Shoreline Change Analysis Program (CSCAP)

Maryellen Sault NOAA's National Geodetic Survey Remote Sensing Division



Our Focus

NOAA

- National Ocean Service
 - National Geodetic Survey
 - Remote Sensing Division
 - Primary programs

 Coastal Mapping
 Program
 - Aeronautical Survey
 Program







Coastal Mapping Program

- NOAA's National Geodetic Survey (NGS) has the mandate to survey coastal regions within the U.S. and territories.
- NGS delineates the shoreline through stereo photogrammetry, using tide-coordinated aerial photography controlled by kinematic Global Positioning System (GPS) techniques.
- CSCAP utilizes high resolution satellite imagery and NOAA's Electronic Navigational Charts (ENC) to look for shoreline change within major port cities.
- The Coast and Shoreline Change Analysis Program (CSCAP) is a sub-component within the CMP and is the first step in the Electronic Navigational Chart Validation Initiative.



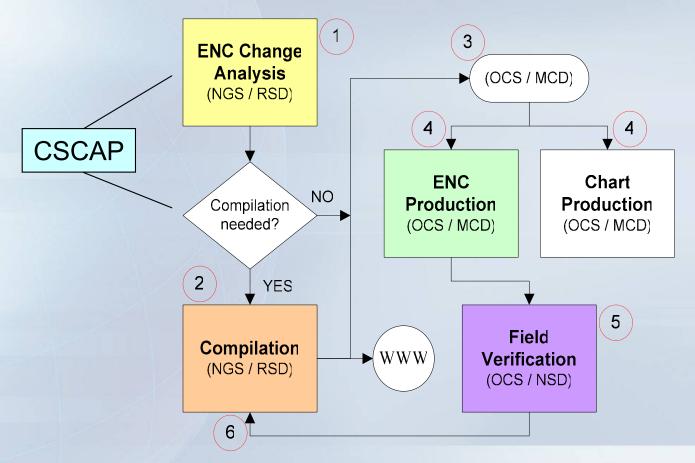
Digital Photogrammetric Workstation used for aerotriangulation and feature extraction







ENC VI: A Multi-Organizational Process



Life Cycle of the Chart Evaluation File

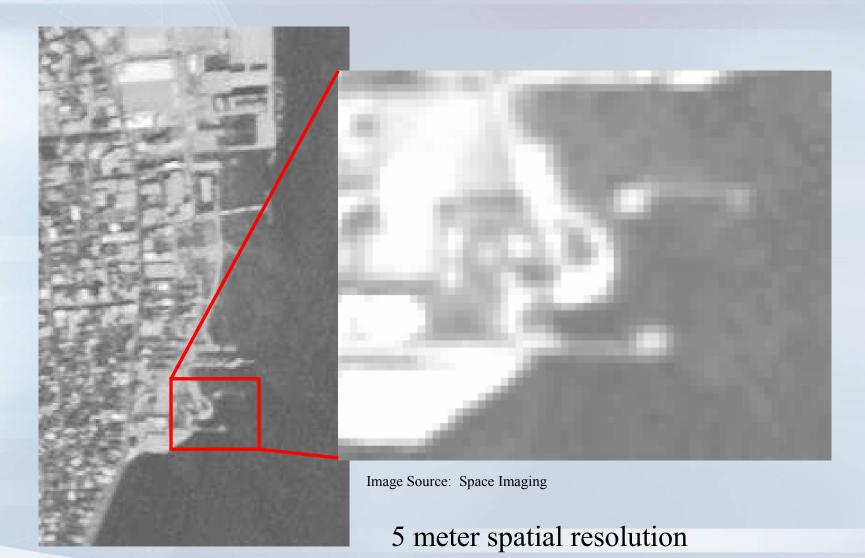


Evaluated Imagery

- SPOT 10 m spatial resolution
- IRS 5 m spatial resolution
- SPIN2 2 m spatial resolution
- IKONOS 1 m spatial resolution
- Quickbird 0.60 m spatial resolution

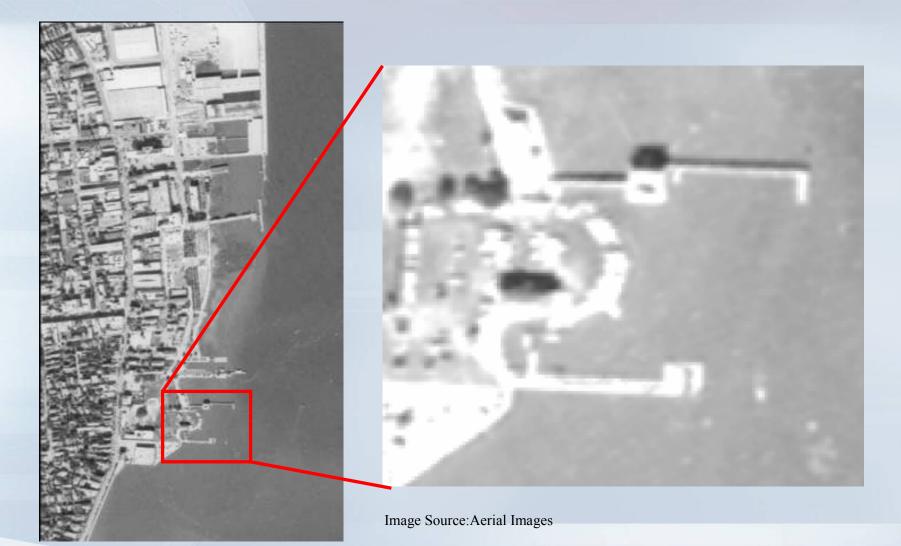


Charleston, SC IRS Image





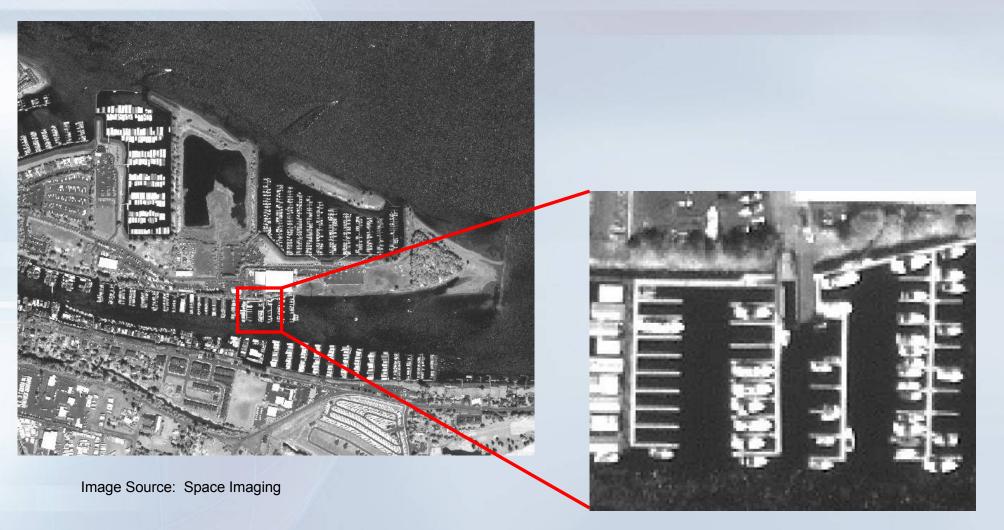
Charleston, SC SPIN2 Image



2 meter spatial resolution



Portland, OR IKONOS Image



1 meter spatial resolution



Ponce, PR Quickbird Image



Image Source: Digital Globe

60 centimeter spatial resolution



Future Satellites

GeoEye-1 (GeoEye)

- Anticipated launch in early 2007
- 0.41 m panchromatic spatial resolution
- 1.64 m multispectral spatial resolution
- 1.2 million sq. KM of imagery/day
- 1.5 day revisit period



National Oceanic and Atmospheric Administration

WorldView 1(Digital Globe)

- Anticipated launch in mid-2007
- 0.50 m panchromatic spatial resolution
- 500,000 sq. km of imagery/day
- 1.7 day average revisit time.

CSCAP Processing Steps

- Improve relative positioning
- Change Analysis
 - NOAA Electronic Navigational Chart and NOAA Raster Nautical Chart compared with High Resolution Satellite Imagery.
- Georeference Imagery using ground control
- Accuracy Assessment
- Shoreline Compilation



Field Verification

Relative vs Absolute Georeferencing

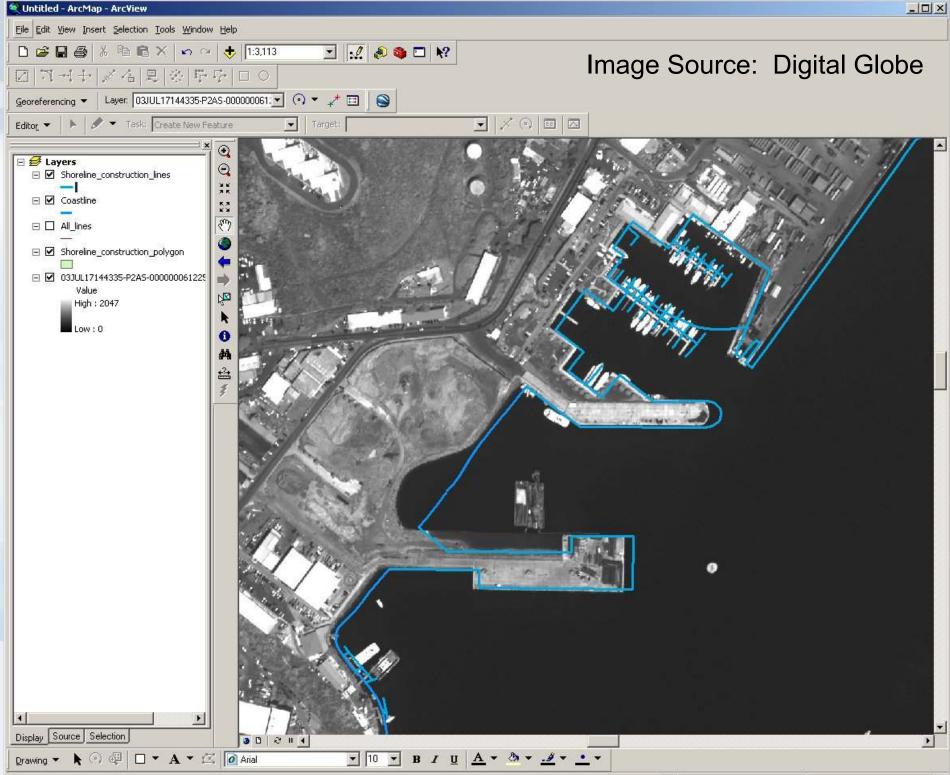
Relative

- Uses image coordinates to align shoreline with image.
- User defined links between features on image and shoreline
- Utilizes a first order
 polynomial transformation
- NO ACCURACY
 INFORMATION

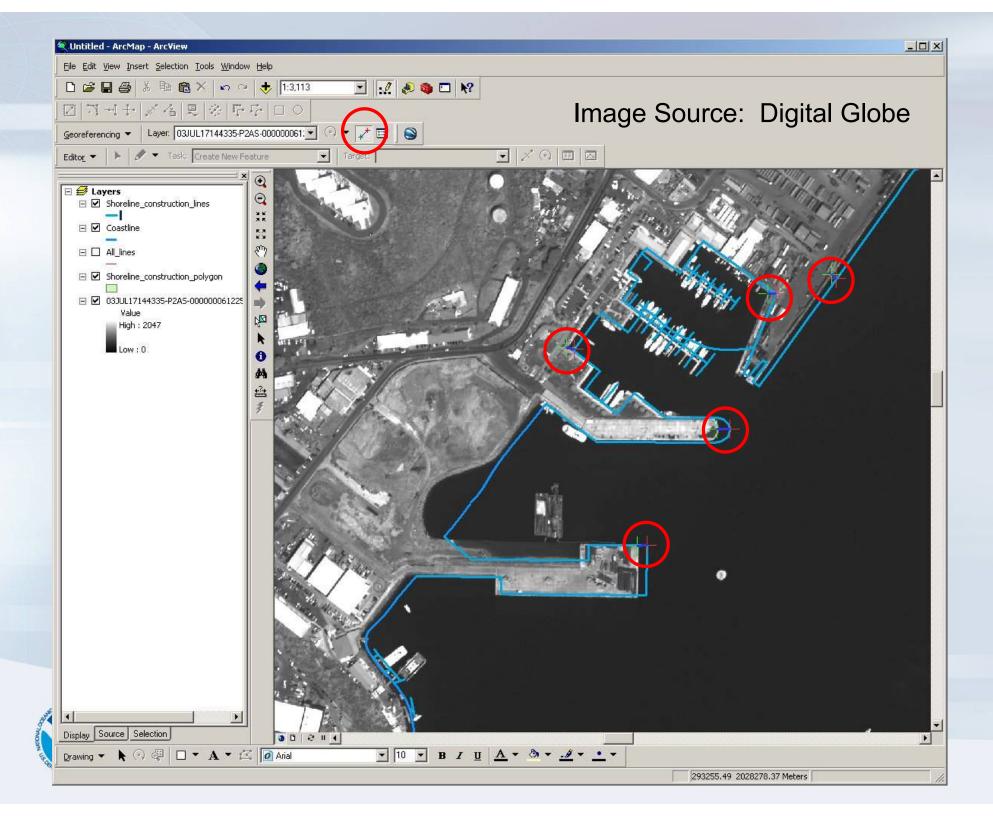


Absolute

- Utilizes best available control
- Register imagery to reference data
- Uses a first- order
 polynomial transformation
- IMAGE ACCURACY IS
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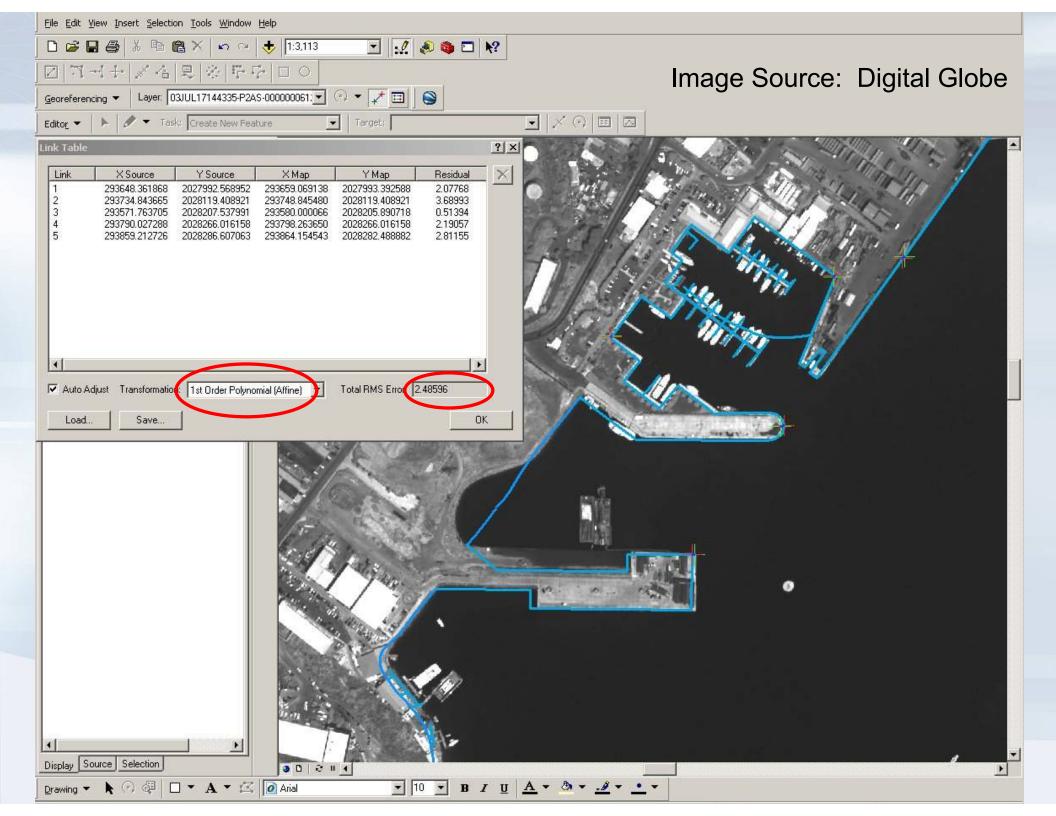


Chart Evaluation File (CEF)



Select Class	Select Attribu	te	Select Attribute Ext	ension	ENC vs RAS	(no conflict) CONFLICT
SHORELINE ALONGSHORE FEATURE OBSTRUCTION POINT OBSTRUCTION LINEAR FREESTANDING MARINE FE. LANDMARK AID TO NAVIGATION	Fender Gate Groin Jetty Marine Railway Pier Training Wall		no extension .Fixed .Floating .Ruins		Verifiable	YES NO DOUBTFUL
Current Class, Attribute a	nd Extension	ALONGSHORE FEAT	JRE Pier		Priority	
Change Note New Pier			CLEAR FORM	UPDATE	EXIT	HIGH

Identify Results

Layers: <Top-most layer>

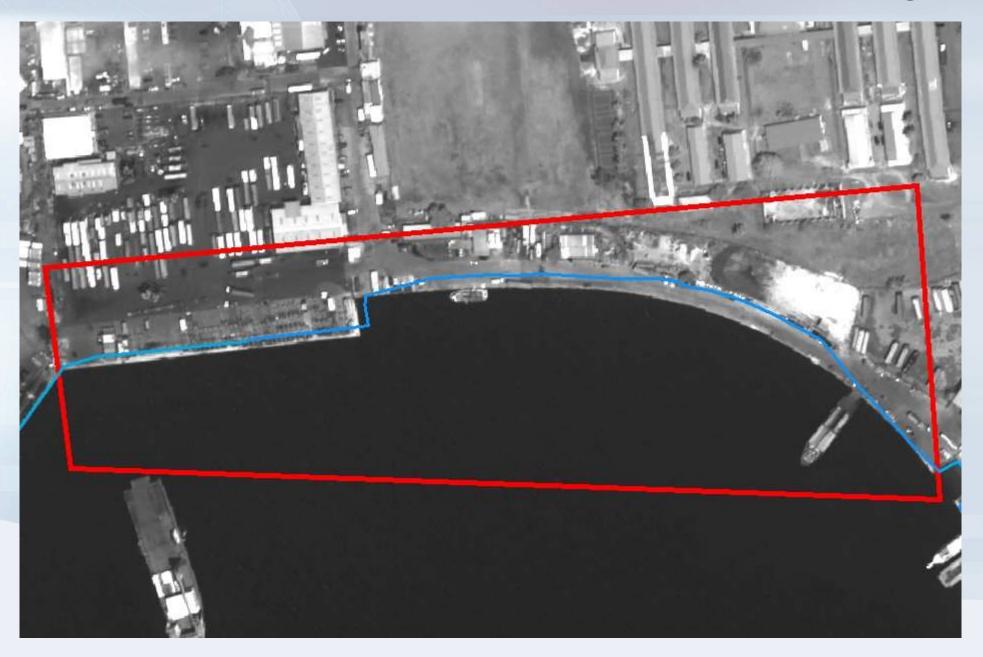
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⊡ Quick Bird

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Charlotte Amalie 2003 Quickbird Image



Christiansted 2003 Quickbird Image





Christiansted 2003 Quickbird Image



DOR DO COMPANY

Absolute Georeferencing

- Obtain ~ 30 GPS ground control points 10 – Re-georeferencing
 - 20 Accuracy Assessment
- Provide approximate locations for field crew
- Use a first-order
 polynomial







Accuracy Assessment Procedures

- Procedures are based on the Geospatial Positioning Accuracy Standards Part 3: National Standard for Spatial Data Accuracy document provided by the Federal Geographic Data Committee (FGDC)
- Root mean square error is used to estimate positional accuracy.
- An independent source of higher accuracy control must be used.
- A minimum of 20 check points shall be used.
- Check points must be distributed to reflect the geographic area of interest.



Image Georeferencing Accuracy

Location	Image georeferencing source	RMSx	RMSy	RMSr	CE at 95% confidence level
Alameda	GPS Data Points	0.57 m	0.55 m	0.79 m	1.36 m
Carquinez	GPS Data Points	0.49 m	0.47 m	0.68 m	1.17 m



Field Verification



Image Source: Space Imaging, LLC







Image Source: Space Imaging, LLC

Limitations

- Ground control and check points must be collected for areas to be compiled
- Factors that limit accuracy of compiled shoreline:
 - Spatial resolution
 - Georeferencing accuracy
 - Possibility of unknown, nonsystematic geometric problems with the imagery
 - Cannot be tide coordinated
 - Attribution is difficult and varies depending on atmospheric conditions



Data Distribution



NOAA Shoreline Data Explorer

intro search selection legend help

Introduction



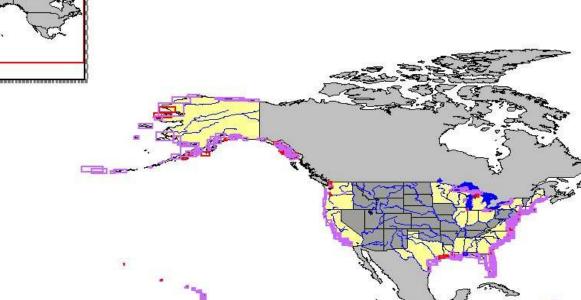
National Geodetic Survey NOAA Shoreline Data Explorer

-View vector shoreline data -View and download FGDC compliant

You may locate shoreline project boundaries, outlined in red-(post-1990) or purple (pre-1990), by zooming in (left button project(s) of interest using the "Select by Rectangle" 🖳 tool. This will highlight the project outline in green and present you with options to view and download the vector methods to locate vector shoreline data are outlined in the online tutorial

Shoreline Update Notice





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Data Distribution

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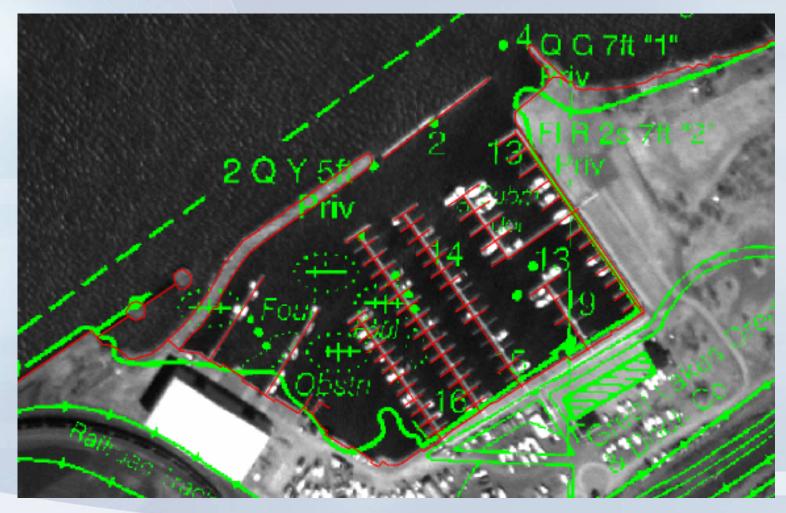
Shoreline Applications

NOAA's Shoreline may be used for:

- Application to Navigational Charts
- Historical Shoreline Change Analysis
- Land and marine geographic information systems (GIS) basemaps
- Property management, real estate
- Coastal disputes
- Natural resource management
- Coastal zone management
- Maritime boundaries



Shoreline Application to Nautical Charts





National Oceanic and Atmospheric Administration

Image Source: Space Imaging, LLC

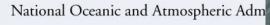
Historical Shoreline Change



1976

2004 Aerial photograph Fort Desoto Beach, FL







Summary

- High resolution satellite imagery can be a useful tool for shoreline feature change analysis in ports.
- Accurate georeferencing is crucial.
- The Chart Evaluation File (CEF) follows the project through the entire multi-organizational process of the ENC Validation Initiative
- Shoreline is delivered in a GIS friendly format and can be downloaded from http://www.ngs.noaa.gov/RSD/shoredata/NGS_Shoreline_Products.htm

