

# **NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT**

## ***PROJECT AK0704***

### ***Nome Harbor, AK***

#### **Introduction**

Coastal Mapping Program (CMP) Project AK0704 provides highly accurate digital shoreline data for Nome Harbor, Alaska. The Geographic Cell (GC) may be used in support of the NOAA Nautical Charting Program (NCP) as well as geographic information systems (GIS) for coastal zone management applications.

The project database is a composite of information measured and extracted from both aerial photographs and satellite imagery, as well as the metadata for both. Base mapping was conducted in a digital environment using both stereo softcopy photogrammetry and monoscopic feature extraction.

#### **Project Design**

The design of Project AK0704 was accomplished by the Applications Branch (AB) of the Remote Sensing Division (RSD) in response to a request from NOAA's Office of Coast Survey (OCS) for data necessary to produce a new chart inset for Nome Harbor, AK. Project extents and requirements were formulated as a result of input from OCS. Raw high resolution commercial satellite image data was obtained which covered the area of interest, and a plan was formulated to refine the geopositioning of the raw data to support extraction of feature data of sufficient accuracy for the new large scale inset. A search of the RSD project archive yielded geodetic control stations from Aeronautical Survey Program (ASP) Project OC01231\_601, Nome Airport, Alaska, and previously acquired aerial photography from Project AAL001. These data were combined to provide adequate control for the georeferencing phase of this project.

#### **Field Operations**

Routine CMP field operations did not apply for this project based on the origin of the project source data. Existing sources of horizontal control were used for the georeferencing process.

#### **Aerotriangulation**

Routine softcopy aerotriangulation methods were applied to establish the network of precise camera positions and other control for mapping, and to provide model parameters and orientation elements required for digital compilation. This work was initiated by AB personnel in December 2007 utilizing a Digital Photogrammetric Workstation (DPW), which is a configuration of computer hardware, modular software components and other associated peripheral devices. Ten panchromatic (black and white) aerial photographs from archived Project AAL001 were measured and adjusted as one block using BAE's

SOCET SET<sup>®</sup> (version 5.3.0) suite of digital photogrammetric software. BAE's Multi-Sensor Triangulation (MST<sup>®</sup>) module was used to perform the aerotriangulation and evaluate the accuracy of the adjustment. Upon successful completion of the aerotriangulation process, the MST module provided the RMS of the standard deviations of the residuals for each aerotriangulated ground point which were used to compute a predicted horizontal circular error of 1.3 meters for the entire block based on a 95% confidence level (CE95). For more information on this phase of project completion refer to the Aerotriangulation Report, which is on file with other project data within RSD's AB Project Archive.

The project database consists of project parameters and options, camera calibration data, interior orientation parameters, ground control parameters, adjusted exterior orientation parameters, and positional listing of all measured points. Positional data is referenced to the North American Datum of 1983 (NAD 83).

### **Georeferencing**

One QuickBird non-orthorectified color image with a spatial resolution of 61 centimeters, acquired from DigitalGlobe, Inc., was georeferenced using Erdas IMAGINE 9.0 software on a Windows platform. Ground control points (GCPs), photogrammetrically measured from the aerotriangulated aerial photographs described above, were imported into IMAGINE and used to georeference the satellite imagery. Within IMAGINE, the Raster Geometric Correction tool was used with a 1<sup>st</sup> order polynomial model. The imagery was resampled using the Nearest Neighbor sampling method. The RMS of the residuals for measured check points was used to compute a CE95 of 1.0 meters for the satellite image. This CE value was tripled and then added to the CE95 of the source imagery given above, in order to conservatively predict the accuracy of well-defined points measured during the compilation process. A Georeferencing Report was written and is on file with other project data within the AB Project Archive.

### **Compilation**

The compilation of cartographic feature data for this project was accomplished by a member of AB in January 2007. Digital feature data was compiled in ESRI shapefile format from imagery using ESRI's ArcGIS<sup>®</sup> version 9.1 desktop GIS software. Feature attributes were established using the Coastal Cartographic Object Attribute Source Table (C-COAST), which provides the definition and attribution scheme for the full range of cartographic features pertinent to the CMP. Selected cartographic features were further modified with additional descriptive information to refine general classification.

A composite approach to compilation of feature data was taken for this project, given the availability of multiple sources of image data. The imagery most recently acquired, that acquired via the QuickBird sensor, was utilized for compilation of the shoreline and alongshore feature data. On the other hand, the imagery best suited for extraction of elevated and inland features, the stereo aerial imagery, was utilized for extraction of roads, bridges, overhead cables, landmarks, and the like.

Spatial data accuracies for Project AK0704 were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features extracted from georeferenced commercial satellite imagery (see Table 1) were tested to have a horizontal accuracy of 4.2 meters at the 95% confidence level, a predicted accuracy of well-defined points based on a minimum of twenty (20) check points which were compared to an independent source of higher accuracy. Features extracted from aerial photographs (see Table 2) were compiled to meet a horizontal accuracy of 2.6 meters at the 95% confidence level, a predicted accuracy of compiled, well defined points derived by doubling the circular error derived from aerotriangulation statistics.

**Table 1**

Date	Time (UTC)	Image Source	Source ID	Tide Level*
09-01-06	23:03	QuickBird	005537419010_01_P001	0.1 m

\* Tide levels are given in meters above MLLW and are based on actual observations recorded by the NOS reference gauge at Norton Sound, AK. The elevation of MHW at Norton Sound, AK is 0.4 meters above MLLW.

**Table 2**

Date	Time (UTC)	Roll Number	Photo Numbers	Scale (nominal)	Tide Level*
08-02-02	20:09-20:14	0201P01	00010-00019	1:30,000	N/A

\* Since these aerial photos were only used for extraction of elevated and inland features, and not for the extraction of shoreline or alongshore features, tide levels were not determined.

## Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by a senior member of AB. The final QC review was completed in February 2007. The review process included analysis of the georeferencing results and assessment of the identification and attribution of digital feature data according to image analysis and criteria defined in C-COAST. The quality control process concluded with an inspection of topological connectivity within the GC using ESRI's ArcGIS® version 9.1 desktop GIS software. The entire suite of project products was evaluated for compliance to CMP requirements.

Comparisons of the largest scale NOAA nautical charts with the satellite imagery and compiled project data resulted in creation of the Chart Evaluation File (CEF). The following nautical chart was used in the comparison process:

16206, Nome Harbor and Approaches, AK, 1:20,000 scale, 7th edition

## End Products and Deliverables

The following specifies the location and identification of end products generated during the completion of this project:

**RSD Applications Branch Archive**

- Hardcopy of the Project Completion Report (PCR)
- Page size graphic plot of GC10644 file contents, attached to PCR

**Remote Sensing Division Electronic Data Library**

- Project database
- GC10644 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

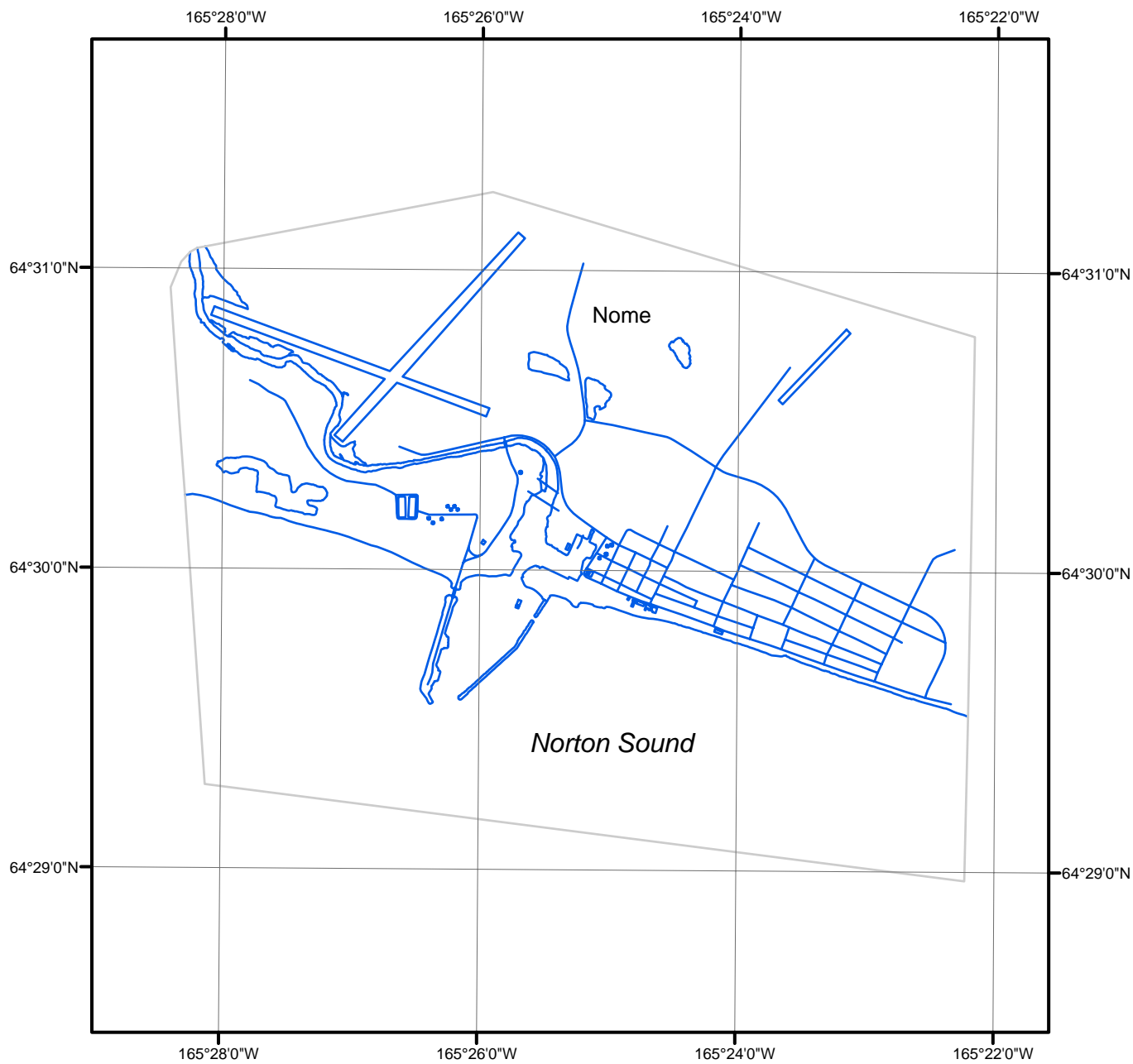
**NOAA Shoreline Data Explorer**

- GC10644 in shapefile format
- Metadata file for GC10644
- Digital copy of the PCR in Adobe PDF format

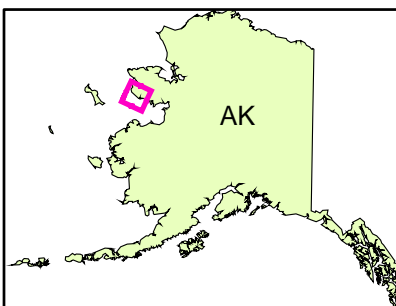
**End of Report**

# NOME HARBOR

## ALASKA



Overview



AK0704

GC10644