

# NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

## *PROJECT AK1619-CM-N*

### *Nome, Alaska*

#### **Introduction**

NOAA Coastal Mapping Program (CMP) Project AK1619-CM-N provides highly accurate digital shoreline data in the vicinity of Nome, 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 a variety of coastal zone management applications.

#### **Project Design**

The Requirements Branch (RB) of the Remote Sensing Division (RSD) formulated photographic mission instructions for this project following standard mission guidelines. The instructions discussed the project's purpose, geographic area of coverage, scope and priority; photographic requirements; flight line priority; Global Positioning System (GPS) data collection procedures and guidelines for both kinematic and static surveys; data recording and handling instructions; and contact and communication information. RB created a Project Layout Diagram, flight maps and input files for the aircraft's flight management system.

#### **Field Operations**

The field operations consisted of the collection of static and kinematic GPS data, Inertial Measurement Unit (IMU) data, and the acquisition of aerial imagery. Photographic mission operations were conducted on May 18, 2016 with the NOAA King Air (N68RF) aircraft. Color/RGB and near infrared (NIR) digital images were acquired concurrently with an Applanix Digital Sensor System (DSS) 580/560 dual camera system. Two flight lines were acquired at a nominal altitude of 7,250 feet, resulting in an approximate ground sample distance (GSD) of 0.22 meters for the color imagery and 0.25 for the NIR. Although imagery was not acquired in strict coordination with local tides, the goal was to collect all imagery below Mean High Water (MHW) tide stage.

#### **GPS Data Processing**

GPS/IMU data was processed by RSD personnel to yield precise camera positions and orientations for direct georeferencing (DG) of the imagery as well as to provide a control network necessary for aerotriangulation (AT). A local GPS base station was referenced for the kinematic GPS processing operations. The position of the base station was determined using the NGS Online Processing User Service (OPUS), which computed fixed baseline solutions from nearby CORS stations. Final processing of kinematic GPS/IMU data using Applanix POSPAC (ver. 7.1) was completed in July 2016. For more information, refer to the Airborne Positioning and Orientation Report (APOR) on file in the RSD Electronic Data Library.

The processed GPS/IMU data yielded precise exterior orientation (EO) values of the camera centers, enabling extraction of features from the directly georeferenced imagery. Only the NIR imagery was utilized in this manner. The predicted horizontal accuracy of the imagery was determined by propagating sensor EO and image measurement uncertainties through the photogrammetric collinearity equations using the Exterior Orientation Total Propagated Uncertainty (EO-TPU) tool developed by NGS. Using this tool, the predicted horizontal uncertainty at the 95% confidence level for the NIR imagery was 0.6 meters.

## **Aerotriangulation**

The AT phase was completed in October 2018. Routine softcopy AT methods were applied to establish a network of precise camera positions and other control for mapping, and to provide model parameters and orientation elements required for digital compilation. A member of the Applications Branch (AB) of RSD accomplished this work utilizing a Digital Photogrammetric Workstation (DPW), which is a configuration of computer hardware, modular software components, and other associated peripheral devices. The color images were measured and adjusted as a single block using BAE Systems' SOCET SET (ver. 5.6) software. Upon successful completion of this process, the triangulation software provided the standard deviations for each aerotriangulated ground point, which computed to a predicted horizontal circular error of 0.4 meters based on a 95% confidence level. An AT Report is on file with other project data within the RSD Electronic Data Library. Positional data is referenced to the North American Datum of 1983 (NAD 83).

Control points from a previous airport survey of the Nome airport were used to evaluate the AT solution. All stereo-models examined had acceptable levels of parallax for mapping purposes.

## **Compilation**

A member of AB accomplished the data compilation phase of this project in November 2018. The Feature Extraction module of BAE Systems' SOCET SET (ver. 5.6) photogrammetric software was used to compile feature data from imagery. Feature identification and the assignment of cartographic codes were based on image analysis of the project digital images and information extracted from the appropriate NOAA Nautical Charts, U.S. Coast Guard Light List and other ancillary sources. Feature attribution complies with 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 features had modifications with additional descriptive information to refine general classification.

Spatial data accuracies for Project AK1619-CM-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features compiled from the aerotriangulated color imagery were compiled to meet a horizontal accuracy of 0.8 meters, an accuracy derived by doubling the horizontal uncertainty calculated from the AT statistics. Features compiled from the NIR imagery were compiled to meet a horizontal accuracy of 1.2 meters, a horizontal uncertainty calculated by doubling the output from the EO-TPU tool. All predicted accuracies were computed at the 95% confidence level.

The following table provides information on the imagery used to complete this project:

Date	Time (UTC)	Color Imagery		Infrared Imagery		Tide Level*
		Roll	Strip/Images	Roll	Strip/Images	
5/18/2016	18:46 – 18:48	16VC59	45-002 /14150 - 14161	16VR59	45-002 /14154 - 14165	0.1 m
5/18/2016	18:51 – 18:54	16VC59	45-001 /14162 - 14173	16VR59	45-001 /14166 - 14177	0.1 m

\* Tide levels given in meters above MLLW and were calculated using the Pydro software tool with a TCARI grid referenced to verified water level observations at the NOS gauge in the project area. The height of the MHW tidal datum in the project area is approximately 0.41 meters above MLLW.

## Quality Control / Final Review

A senior member of AB conducted quality control tasks during all phases of project completion. The final QC review was completed in November 2018. The review process included analysis of the aerotriangulation results and assessment of the identification and attribution of digital feature data within the GC 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 ArcGIS Pro 2.2.4 software. All project data was evaluated for compliance to CMP requirements.

Comparisons of the largest scale NOAA nautical charts with natural color images 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, 9<sup>th</sup> Ed., Mar. 2015

## End Products and Deliverables

The following specifies the location and identification of products generated for project:

### Remote Sensing Division Electronic Data Library

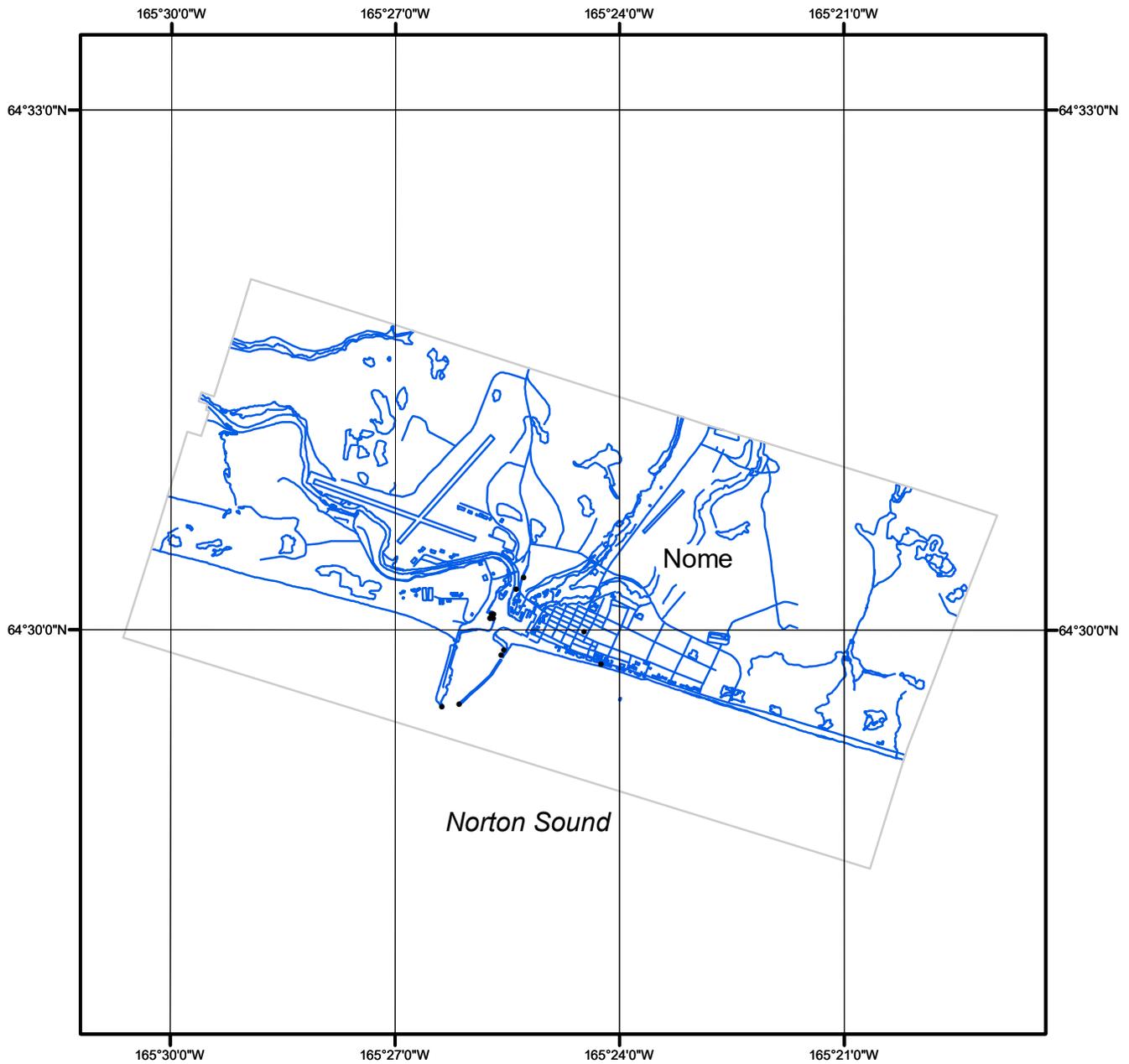
- Project database
- Airborne Positioning and Orientation Report (APOR)
- Aerotriangulation Report
- GC11457 in shapefile format
- Project Completion Report (PCR)
- CEF in shapefile format

### NOAA Shoreline Data Explorer

- GC11457 in shapefile format
- Metadata file for GC11457
- PCR in Adobe PDF format

## End of Report

# NOME ALASKA



Overview



AK1619-CM-N

GC11457