

# NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

## PROJECT AK2005-CS-C

### *Port of Kivalina, Alaska*

#### **Introduction**

Coastal Mapping Program (CMP) Project AK2005-CS-C provides highly accurate digital shoreline data for key areas of change within the port of Kivalina, 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 design of Project AK2005-CS-C was accomplished by the Requirements Branch (RB) of the Remote Sensing Division (RSD) in response to the need for updates to the NOAA Electronic Navigational Chart (ENC) series within key U.S. ports. Project requirements were formulated as a result of analysis conducted within the Coast and Shoreline Change Analysis Program (CSCAP), in which NOAA nautical chart products are compared to contemporary high-resolution imagery in order to ascertain the need for more current shoreline data. A Chart Evaluation File (CEF) was forwarded to the Applications Branch (AB) of RSD once the change analysis was complete. Refer to the CSCAP memorandum for AK2005-CS-C for details of the chart comparison process.

#### **Field Operations**

Quantum Spatial, Inc. (QSI) was contracted by NGS to perform field operations for project AK2005-CS-C consisting of the acquisition of aerial photographs and the surveying of ground control points (GCPs) and checkpoints (CPs). Base stations were used to support real-time kinematic survey operations.

The ground survey comprised a total of 13 GCPs and 4 CPs, which were surveyed by QSI using real time kinematic and fast survey techniques. Survey field work was performed September 22, 2020. For further information see the Ground Survey Report on file with other project data within the RSD Electronic Data Library.

The aerial photography phase of the project was conducted by QSI and included the collection of kinematic Global Positioning System (GPS) data, Inertial Measurement Unit (IMU) data and the acquisition of aerial imagery. Digital images utilized for this project were acquired with a Piper Navajo (N812TB) aircraft on September 23, 2020 using a Vexcel UltraCam Eagle M3 digital aerial camera at a nominal altitude of 5,000 meters resulting in an approximate ground sample distance (GSD) of 0.25 meters. The imagery was acquired with 4 bands comprised of both RGB (color) and near infrared (NIR) bands, however, only the RGB bands were used for compilation. Although imagery was not acquired in strict coordination with local tides, the goal was to collect all imagery below Mean High Water (MHW).

## GPS Data Processing

The GPS/IMU data were processed in September 2020 by QSI personnel to yield precise camera positions in order to provide a control network necessary for aerotriangulation. A static base station was not utilized in the processing. Instead, the kinematic GPS data was processed using Applanix POSPAC Mobile Mapping Suite (MMS) (ver. 8.4) software utilizing the IN-Fusion PP-RTX processing mode, which is an implementation of Trimble's *CenterPoint RTX* GNSS correction service. For further information refer to the Airborne Positioning and Orientation Report (APOR) on file with other project data within the RSD Electronic Data Library.

## Aerotriangulation

Routine softcopy aerotriangulation 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. This work was performed by QSI personnel in October 2020 utilizing INPHO's MATCH-AT (ver. 10.1) software on a Windows-based photogrammetric workstation. The images were measured and adjusted as a single block. Upon successful completion of this process, MATCH-AT provided the standard deviations for each aerotriangulated ground point, which were used to compute a predicted horizontal circular error of 0.09 meters based on a 95% confidence level. An Aerotriangulation Report was written and is on file with other project data within the RSD Electronic Data Library. Positional data is referenced to the North American Datum of 1983 (NAD83).

## Compilation

The data compilation phase of this project was accomplished by a member of AB in March 2021. Digital feature data was compiled from the aerotriangulated imagery, using the Feature Extraction software module of SOCET SET (ver. 5.6). Feature attribution was assigned in compliance 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.

Spatial data accuracies for Project AK2005-CS-C were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 0.2 meters at the 95% confidence level. This predicted accuracy of compiled well-defined points is derived by doubling the circular error calculated from the aerotriangulation statistics.

The following table provides information on images used in the project completion:

Date	Time (UTC)	Flight Line / Photo	Tide Level*
23-SEP-2020	21:22 – 21:29	25-002 / 00058 – 00115	- 0.1 m
23-SEP-2020	21:33 – 21:41	25-001 / 00116 – 00172	- 0.1 m
23-SEP-2020	21:46 – 21:53	25-003 / 00173 – 00229	- 0.1 m

\* Tide levels are given in meters above MLLW and are based on verified observations at the Red Dog Dock reference station (#9491094). The elevation of MHW in the project area is 0.26 meters above MLLW.

## **Quality Control / Final Review**

The final review of the project was completed by a senior member of RSD in March 2021, and included analysis of 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 Esri's ArcGIS desktop GIS software (ver. 10.8.1). All project data was evaluated for compliance to CMP requirements.

## **End Products and Deliverables**

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

### **Remote Sensing Division Electronic Data Library**

- CSCAP evaluation memorandum
- Photographic Flight Report
- Ground Survey Report
- Quality Assurance Report
- Airborne Positioning and Orientation Report (APOR)
- Project database
- Aerotriangulation Report
- Project Completion Report (PCR)
- GC11716 in shapefile format
- CEF in shapefile format

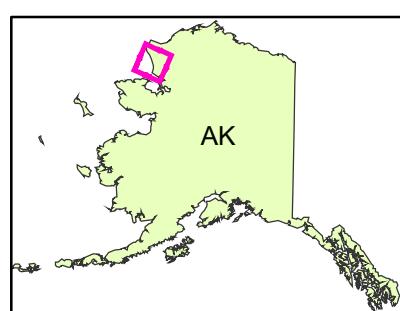
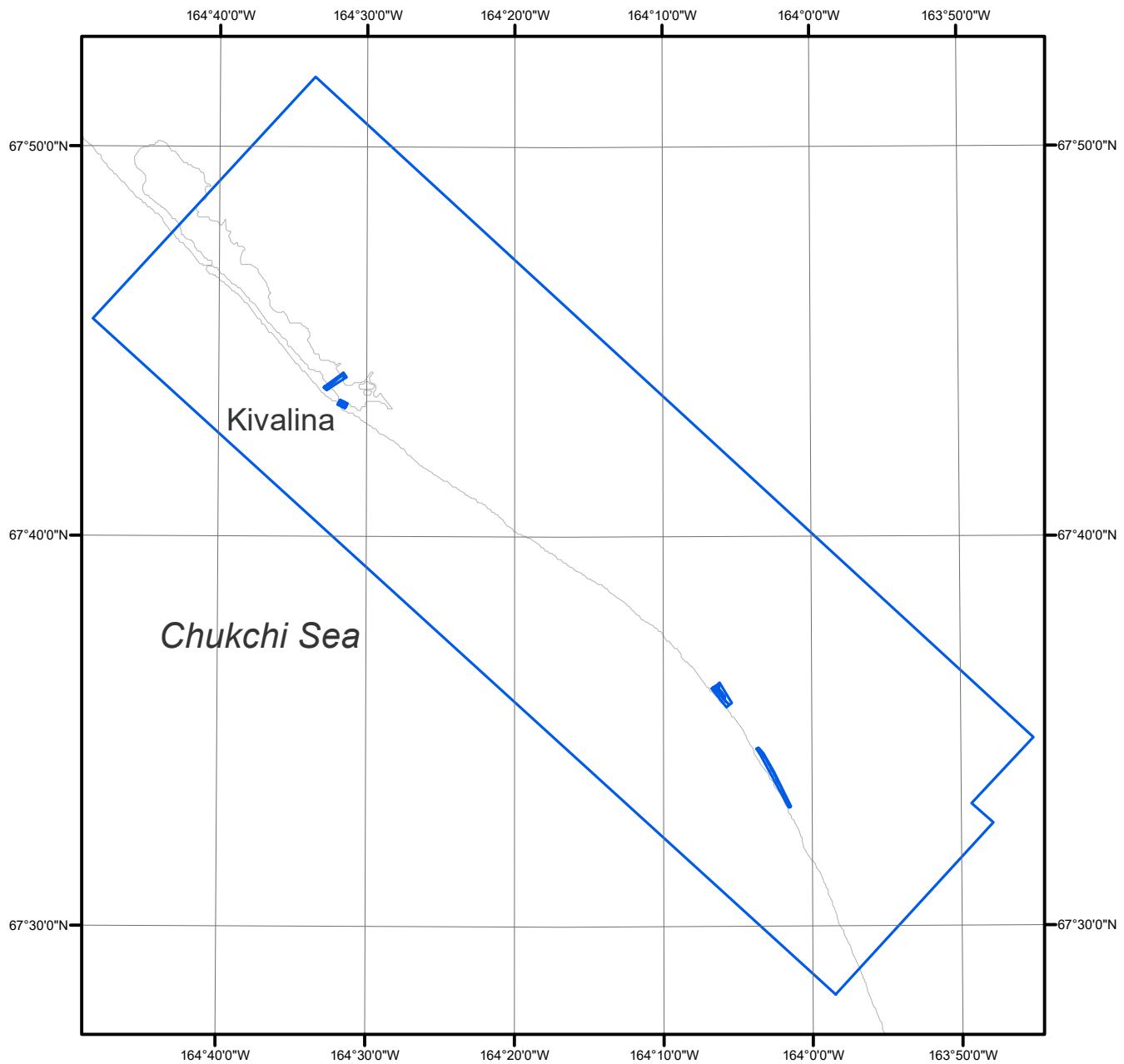
### **NOAA Shoreline Data Explorer**

- GC11716 in shapefile format
- Metadata file for GC11716
- PCR in Adobe PDF format

## **End of Report**

# PORT OF KIVALINA

## ALASKA



AK2005-CS-C

GC11716