NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT

PROJECT AK1705A-CM-N

Kivalina, Alaska

Introduction

NOAA Coastal Mapping Program (CMP) Project AK1705A-CM-N provides a highly accurate dataset of coastal feature data for Kivalina, Alaska. Project AK1705A-CM-N is a subset of a larger project, AK1705-CM-N, covering the vicinity of Delong Mountain Terminal, 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

Photographic mission instructions for AK1705-CM-N were formulated by the Requirements Branch (RB) of the Remote Sensing Division (RSD) following the guidelines of RSD's Photo Mission Standard Operating Procedures. The instructions discussed the project's purpose, geographic area of coverage, scope and priority, image requirements, Global Positioning System (GPS) data collection procedures and guidelines, instructions for data recording and handling, and mission communication protocols. RB created a Project Layout Diagram, flight maps and input files for the aircraft flight management system.

Subproject AK1705A-CM-N was created to provide updated shoreline data in response to a notable chart discrepancy identified by Coast and Shoreline Change Analysis Program (CSCAP) Project AK1701-CS-T. For details of the analysis, see the CSCAP Memorandum of February 13, 2017. The CSCAP analysis extent was also fully covered by AK1705-CM-N.

Field Operations

Field operations for AK1705-CM-N consisted of the collection of static and kinematic GPS data and Inertial Measurement Unit (IMU) data, and the acquisition of digital aerial imagery. Aerial survey operations, conducted in July 2017 with the NOAA King Air aircraft (N68RF), consisted of 7 flight lines of natural color and near-infrared (NIR) imagery acquired concurrently using an Applanix DSS 580/560 dual camera system. The acquisition of imagery was not coordinated with local tides. All imagery was acquired at a nominal altitude of 7,500 feet, resulting in an approximate ground sample distance (GSD) of 0.24-0.25 meters. Subproject AK1705A-CM-N utilized a subset of 6 color images. NIR imagery was not used for this project.

Direct Georeferencing Data Processing

The GPS/IMU data were processed by RSD personnel to yield precise camera positions and orientations for direct georeferencing (DG) of the imagery. A local GPS base station was established for use as a reference station for 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. Airborne kinematic data was processed using Applanix POSPac (ver. 7.1) software on September 2017. For further information refer to the Airborne Positioning and Orientation Reports (APOR) on file with other project data within the RSD Electronic Data Library.

The processed GPS/IMU data were used to derive precise exterior orientation (EO) values of the camera centers required for digital feature extraction. 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 all project imagery was calculated to be 0.7 meters. Previously compiled CMP GC data (GC10568) was used to verify the horizontal integrity of the directly georeferenced (DG) data. Stereo-models were examined and found to have acceptable levels of parallax for mapping purposes.

Compilation

The data compilation phase of this project was accomplished by RSD Applications Branch (AB) personnel in August 2018. Digital mapping was performed using the Feature Extraction software module within SOCET SET (ver. 5.6). Feature identification and attribution within the GC were based on image analysis of the aerial imagery and information extracted from the largest scale NOAA nautical chart and other ancillary sources. 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 AK1705A-CM-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.4 meters. This predicted accuracy of compiled well-defined points is derived by doubling the horizontal uncertainty calculated from the EO-TPU tool. The table below provides information on the imagery used to complete this project:

Date	Time (UTC)	Roll #	Photo #s	Tide Level *
07/09/2017	19:42 – 19:43	17VC31	6399 – 6404	0.62 m

* Tide levels are 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 time of photography from various NOS gauges in the vicinity of the project. The elevation of the MHW tidal datum in the project area is equal to approximately 0.24 meters above MLLW.

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by a senior member of RSD. The final QC review was completed in December 2018. The review process included analysis of the DG 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 (ver. 10.5) software. All project data was evaluated for compliance to CMP requirements.

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

16145, Delong Mountain Terminal, 1st Ed., Jul. 2014

End Products and Deliverables

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

Remote Sensing Division Electronic Data Library

- Project database
- Airborne Positioning and Orientation Report (APOR)
- GC11441 in shapefile format
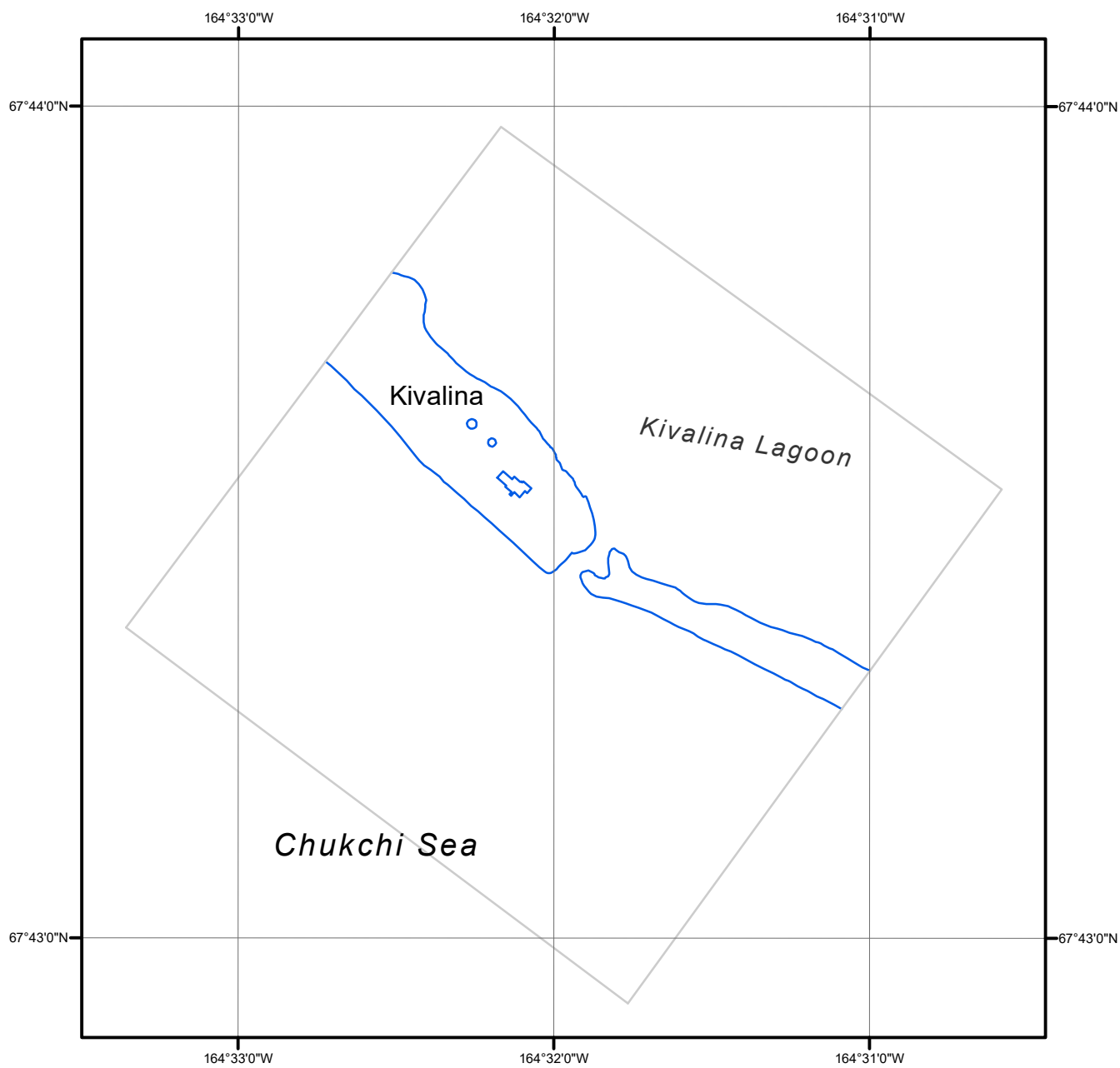- Project Completion Report (PCR)
- CEF in shapefile format

NOAA Shoreline Data Explorer

- GC11441 in shapefile format
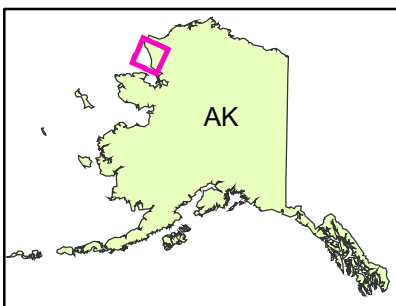- Metadata file for GC11441
- PCR in Adobe PDF format

End of Report

KIVALINA

ALASKA

164°33'0"W   164°32'0"W   164°31'0"W

67°44'0"N

Kivalina

Kivalina Lagoon

Chukchi Sea

67°43'0"N

164°33'0"W   164°32'0"W   164°31'0"W

Overview

AK

AK1705A-CM-N

GC11441