doi: 10.25923/6hv8-cx12

Mapping Data Acquisition and Processing Summary Report

EX-21-06: 2021 U.S. Blake Plateau Mapping 2 (Mapping)

Blake Plateau, Southeastern United States

Port Canaveral, Florida to Charleston, SC

September 5 - September 28, 2021

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March 2, 2022

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Introduction

NOAA Ocean Exploration is the only federal program dedicated to exploring our deep ocean, closing prominent gaps in our basic understanding of U.S. deep waters and the seafloor and delivering the ocean information needed to strengthen the economy, health, and security of our nation.

Using the latest tools and technology, NOAA Ocean Exploration explores previously unknown areas of our deep ocean, making discoveries of scientific, economic, and cultural value. Through live video streams, online coverage, training opportunities, and real-time events, NOAA Ocean Exploration allows scientists, resource managers, students, members of the general public, and others to actively experience ocean exploration, expanding available expertise, cultivating the next generation of ocean explorers, and engaging the public in exploration activities. From this exploration, NOAA Ocean Exploration makes the collected data needed to understand our ocean publicly available, so we can maintain the health of our ocean, sustainably manage our marine resources, accelerate our national economy, and build a better appreciation of the value and importance of the ocean in our everyday lives.

Report Purpose

The purpose of this report is to briefly describe the acoustic seafloor, water column, and subseafloor mapping data collection and processing methods used by NOAA Ocean Exploration on NOAA Ship *Okeanos Explorer* during EX-21-06: 2021 U.S. Blake Plateau Mapping 2, and to present a summary of mapping results and mapping-related expedition activities.

A detailed description of Okeanos Explorer's mapping equipment and capabilities is available in the "NOAA Ship *Okeanos Explorer* Mapping Systems Readiness Report 2021," which is archived in the NOAA Central Library.[1]

For further information about general equipment calibration procedures, data acquisition, processing, reporting, and archiving, see the "NOAA Ocean Exploration Deepwater Exploration Mapping Procedures Manual V1," which is archived in the NOAA Central Library[2] and also available from the website.[3]

[1] https://doi.org/10.25923/qbjz-m470

[2] https://doi.org/10.25923/jw71-ga98

[3] https://oceanexplorer.noaa.gov/data/publications/mapping-procedures.html

Expedition Objectives

EX-21-06 consisted of a transit from Port Canaveral, Florida to the primary mapping grounds on the Blake Plateau, and focused on systematic ocean mapping operations on the Blake Plateau region in U.S. waters deeper than 200 meters, providing high-resolution imagery of the seafloor and acoustic backscatter information about the seabed and water column. This region is home to the most extensive continuous cold-water coral mound reef ecosystem yet discovered, and closing the gaps in understanding within this region is of great national importance. This is the second of two expeditions in 2021 aimed at focused mapping operations on the Blake Plateau.

Atlantic U.S. deep-sea exploration contributes to NOAA's Atlantic Seafloor Partnership for Integrated Research and Exploration (ASPIRE), a major multi-year, multi-national, collaborative ocean exploration campaign focused on raising our collective knowledge and understanding of the North Atlantic Ocean. Building on previous work in the North Atlantic, including the 2011-2014 Atlantic Canyons Undersea Mapping Expeditions (ACUMEN), NOAA's ASPIRE campaign will provide data to inform research planning and management decisions in the region, by broadening both the geographic focus to include more of the U.S. Atlantic and Canada, and the scope of partnerships to include U.S. federal agencies, such as U.S. Geological Survey (USGS) and Bureau of Ocean Energy Management (BOEM), as well as international partners from Canada and Europe. ASPIRE will also support the National Strategy for Mapping, Exploring, and Characterizing the United States Economic Zone[4] and Seabed 2030.

This expedition also aimed to further evaluate the efficacy of using a shore-based team of seafloor mapping experts for multibeam sonar data processing via internet-based cloud services. Shore-based personnel worked closely with the at-sea mission team to streamline these processes and enhance current telemapping capabilities.

The complete objectives for this expedition are detailed in "Project Instructions: EX-21-06 U.S. Blake Plateau Mapping 2 (Mapping)," which is archived in the NOAA Central Library.[5]

Operational Personnel

EX-21-06 included onboard operational personnel, inclusive of ship's force and mission team, who participated in operational execution (see **Table 1**), and shore-based personnel who participated remotely via telepresence (see **Table 2**).

[4] https://oeab.noaa.gov/wp-content/uploads/2021/01/2020-national-strategy.pdf

[5] https://doi.org/10.25923/pzs5-tq72

Table 1. EX-21-06 Onboard Personnel.

Name	Role	Affiliation	Dates Aboard
Sam Candio	Expedition Coordinator	NOAA Ocean Exploration (CNSP)	9/3 - 9/28
Amanda Bittinger	Mapping Watch Lead	UCAR[1]	8/13 - 9/28
Madelyn Cook	Explorer-in-Training	UCAR[1]	9/3 - 9/28
Edward Kim	Explorer-in-Training	UCAR[1]	9/3 - 9/28
Rebekah Hernandez	Explorer-in-Training	UCAR[1]	9/3 - 9/28
SST Charlie Wilkins	Senior Survey Tech	OMAO[2]	8/13 - 9/28
ENS Abigail Letts	Operations Officer (in training)	OMAO[2]	8/13 - 9/28
ENS Thomas Cervone	Operations Officer (in training)	OMAO[2]	8/13 - 9/28
Jim Meyers	GFOE Team Lead	GFOE[3]	8/13 - 9/28
Chris Wright	GFOE Engineer	GFOE[3]	8/13 - 9/28
Roland Brian	GFOE Engineer	GFOE[3]	9/3 - 9/28
Andy Lister	GFOE Engineer	GFOE[3]	9/3 - 9/28
Caitlin Bailey	GFOE Engineer	GFOE[3]	9/3 - 9/28

[1]University Corporation for Atmospheric Research
[2]NOAA Office of Marine and Aviation Operations
[3]The Global Foundation for Ocean Exploration

Table 2. EX-21-06 Shore-based personnel.

Name	Role	Affiliation

Meme Lobecker	Cloud Coordinator	NOAA Ocean Exploration(CNSP)
Neah Baechler	Cloud Contractor	UCAR
Marcel Peliks	Cloud Intern	UCAR
Treyson Gillespie	Cloud Intern	UCAR
Anna Takagi-Berry	Cloud Intern	UCAR

Summary of Mapping Operations

NOAA Ocean Exploration mapped 25,579 square kilometers (sq km) of seafloor during the 23 days at sea for EX-21-06. Of the 25,579 sq km mapped, 25,516 sq km were deeper than 200 meters (m) and within the U.S. Exclusive Economic Zone and Territorial Sea. Multibeam bathymetry data coverage is shown in **Figure 1**.

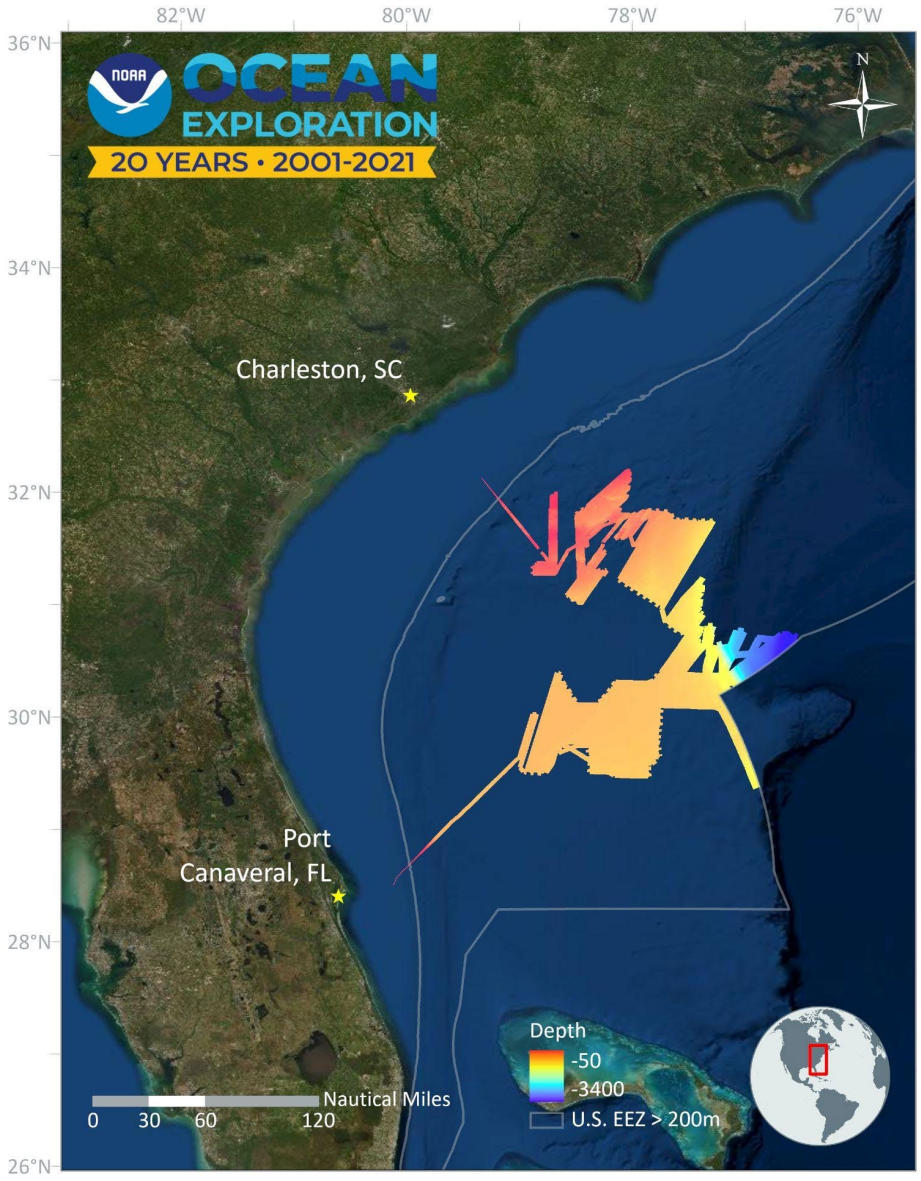

Figure 1. Overview of bathymetric mapping coverage completed during U.S. Blake Plateau Mapping 2 (EX-21-06).

Mapping Statistics

Table 3 provides summary statistics of ocean mapping work conducted during EX-21-06 from August 15 - September 2, 2021 (UTC).

Table 3. Summary statistics of ocean mapping work during EX-21-06.

Statistic	Value
Ship's draft*: Start of expedition (08/15/2021) End of expedition (09/02/2021)	Fore: 16' 4.5''; Aft STBD: 15' 7"; Aft Port: 15' 7" Fore: 16' 6.5"; Aft STBD: 15' 7.5"; Aft Port: 15' 5.5"
Linear kilometers of survey with EM 304	8 ,518.5
Square kilometers mapped with EM 304	25,579
Square kilometers mapped with EM 304 within U.S. waters deeper than 200 m	25,516
Number/data volume of EM 304 raw multibeam files (.kmall)	912 files/152.0 GB
Number/data volume of EM 304 water column multibeam files (.kmwcd)	907 files/460.0 GB
Number/data volume of EK60/EK80 water column split-beam files (.raw)	1,593/128.0 GB
Number/data volume of sub-bottom sonar files (.segy, .kea, .keb)	1096/2.92 GB
Number of expendable bathythermograph (XBT) casts	277
Number of conductivity, temperature, depth profiler (CTD) casts (including test casts)	1

*Prior to EX-21-01, and as a result of the full marine survey completed during the 2020/2021 drydock, it was discovered that the draft markers on the bow are referenced to the bottom of the original hull, not the sonar blister, which is 16.5" lower than the hull bottom, requiring that a +16.5" offset be applied to the draft measurements. The measurements listed in Table 3 include the +16.5" offset.

Mapping Sonar Setup

Kongsberg EM 304 Multibeam Sonar

NOAA Ship *Okeanos Explorer* is equipped with a 26 kilohertz (kHz) Kongsberg EM 304 MKII multibeam sonar, capable of detecting the seafloor in up to 10,000 meters of water and conducting productive mapping operations in up to 8,000 meters of water. The nominal transmit (TX) alongtrack beamwidth is 0.5°, and the nominal receive (RX) acrosstrack beamwidth is 1.0°. The system generates a 140° beam fan (70° port/70° starboard maximum angles), containing 512 beams with up to 800 soundings per ping cycle when in high-density mode. In waters shallower than approximately 3,300 m the system is able to operate in dual-swath mode, where one nominal ping cycle includes two swaths, resulting in up to 1,600 soundings. The multibeam sonar is used to collect seafloor bathymetry, seafloor backscatter, and water column backscatter.

Simrad EK60/EK80 Split-Beam Sonars

The ship is equipped with a suite of Simrad EK60/EK80 split-beam fisheries sonars: 18 kHz (EK60), 38 kHz (EK80), 70 kHz (EK80), 120 kHz (EK60), and 200 kHz (EK60). These systems are quantitative scientific echosounders calibrated to identify the target strength of water column acoustic reflectors, typically biological scattering layers, fish, or gas bubbles, providing additional information about water column characteristics and anomalies. In 2019, the 38 and 70 kHz transceivers were replaced with broadband units (WBTs). WBTs use frequency modulation to acquire higher resolution water column data allowing for the detection of finer features, improved depth capability without loss of range resolution, and support of broadband frequency response of targets.

These sonars were calibrated during EX-21-01, and calibration values from that expedition were applied to the EK sonars for EX-21-06 and will continue to be applied until the next calibration scheduled for early in 2022. The “2021 EK60/EK80 Calibration Report” is available in the NOAA Central Library and the calibration files are included with the dataset of each cruise to which they are relevant.[6]

Knudsen 3260 Sub-Bottom Profiler

The ship is equipped with a Knudsen 3260 sub-bottom profiler (SBP) that produces a frequency-modulated chirp signal with a central frequency of 3.5 kHz. This sonar is used to provide echogram images of shallow geological layers underneath the seafloor to a maximum depth of

[6] https://doi.org/10.25923/v5kz-ge28

approximately 80 meters below the seafloor. The sub-bottom profiler is operated to provide information about sub-seafloor stratigraphy and features.

Teledyne Acoustic Doppler Current Profilers

Two acoustic Doppler current profilers (ADCPs), a Teledyne Workhorse Mariner (300 kHz) and a Teledyne Ocean Surveyor (38 kHz), are installed on the ship. Depending on environmental conditions, the 300 kHz system provides ocean current data to approximately 70 m deep, and the 38 kHz system provides data to approximately 1,200 m deep. The 38 kHz system is capable of collecting data in narrowband and broadband frequency ranges. The ADCPs gather data prior to remotely operated vehicle (ROV) and conductivity, temperature, depth profiler (CTD) deployments in order to assess currents in support of safe operations. The ADCPs are typically not run concurrently with the other sonars during mapping operations due to issues of interference.

During EX-21-01 the 38 kHz transducer experienced temperature spikes, and at the beginning of EX-21-03, the 38 kHz ADCP permanently failed and was not operational for the duration of the cruise. The 38 kHz will not be operational until the transducer is replaced.

Data Acquisition Summary

Following port departure, data are typically collected with the ADCPs until the sea buoy is reached, at which point the ADCPs are secured. Then, data acquisition begins with the EM 304, EK60/EK80 (18, 38, 70, 120, and 200 kHz), and the Knudsen 3260 sub-bottom profiler, with these sonars running concurrently using a Kongsberg Synchronization Unit (K-Sync).

Multibeam survey lines are planned to maximize either edge-matching of existing bathymetric data or data gap filling in areas with existing bathymetric coverage. In regions with no existing data, lines are planned to optimize potential discoveries and to complete relatively large contiguous areas to support interpretation of features from bathymetry and backscatter.

Throughout the expedition, multibeam data quality was monitored in real time by acquisition watchstanders. Ship speed was adjusted to maintain data quality and sounding density as necessary, and line spacing was planned to ensure one-quarter to one-third swath-width overlap between lines, depending on the environmental conditions and impact on the quality of the outer swath regions. Angles in the SIS were generally left open (70°/70°) during transits to maximize data collection and were adjusted on both the port and starboard sides to ensure the best data quality and coverage. If outer beams were returning obviously spurious soundings (e.g., due to attenuation or low grazing angle), beam angles were gradually reduced and monitored closely until a high-quality swath was obtained.

Real-time corrections to the data upon acquisition included: continuous application of surface sound speed obtained with a hull-mounted Reson SV-70 probe, application of water column sound speed profiles obtained with Sippican Deep Blue Expendable Bathythermographs (XBTs) and/or Seabird CTD 9/11, application of roll, pitch, and heave motion corrections obtained with POS MV 320 version 5 inertial motion unit. No tidal corrections were applied to the raw or processed data. Sound speed profiles were conducted every four hours or more frequently as dictated by local oceanographic conditions (typically every two hours when operating near currents). Reson sound speed values were constantly compared against secondarily derived sound speed values from the ship's onboard thermosalinograph flow-through system as a quality assurance measure.

Simrad EK60/EK80 split-beam water column sonar data were collected throughout the majority of the expedition. Data were monitored in real time for quality, but were not post-processed. **Figure 2** shows the EK60/EK80 data collected during EX-21-06.

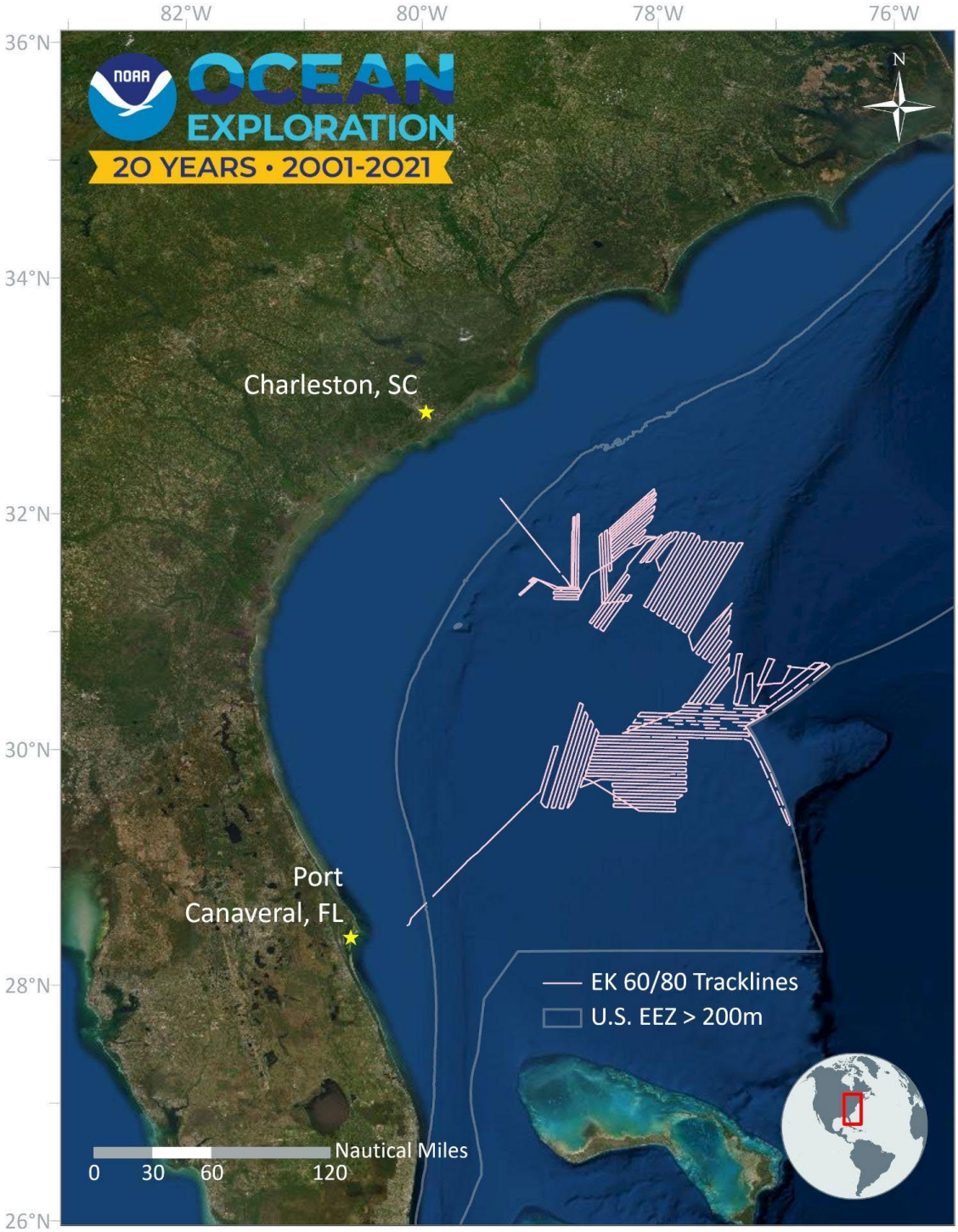

Figure 2. Simrad EK60/EK80 split-beam sonar data collection tracklines (in pink) collected during EX-21-06.

Knudsen 3260 sub-bottom profiler data were also collected during the majority of the expedition. **Figure 3** shows where sub-bottom data were collected during EX-21-06.

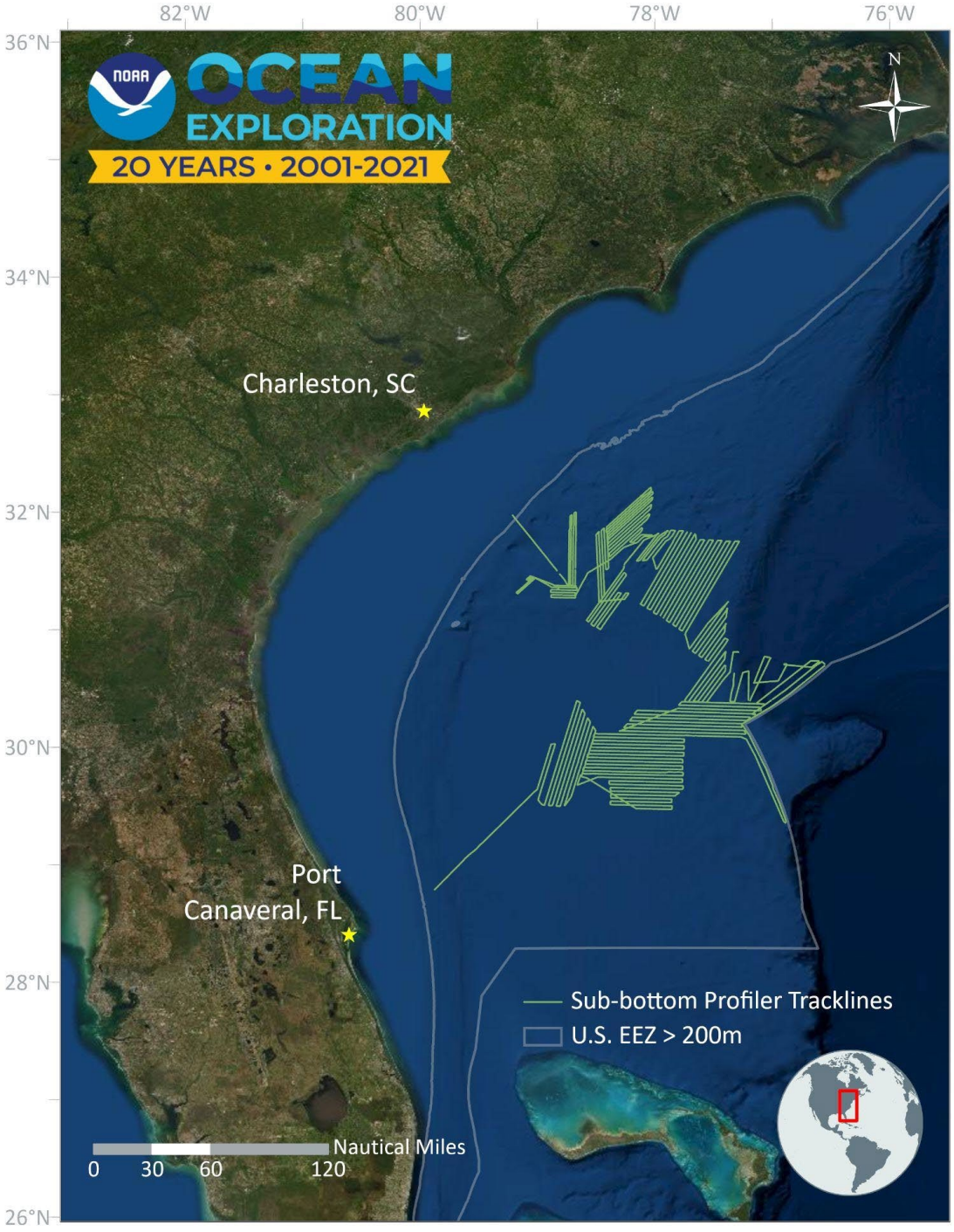

Figure 3. Sub-bottom profiler data collection tracklines (in green) collected during EX-21-06.

Multibeam Sonar Bathymetric Data Processing and Quality Assessment

The bathymetry data were generated using a Kongsberg EM 304 MKII multibeam system, and recorded using Kongsberg's Seafloor Information System (SIS) software as *.kmall files. Collocated to the bathymetric data, bottom backscatter data were collected and stored within the *.kmall files, both as beam averaged backscatter values, and as full time series values (snippets) within each beam. Water column backscatter data were recorded separately within *.kmwcd files.

The full-resolution multibeam .kmall files (Level-00 data) were imported into QPS Qimera, and then processed and cleaned of noise and artifacts. Outlier soundings were removed using multiple methods including automatic filtering and/or manual cleaning with the swath and subset editing tools. The default sound speed scheduling method used was "Nearest-in-Time." If another method was implemented, it will be noted in the associated log. Gridded digital terrain models were created using the weighted moving average algorithm and were exported in multiple formats using QPS Fledermaus software. Daily bathymetric surfaces were created and sent to shore. **Figure 4** shows the onboard multibeam data processing workflow.

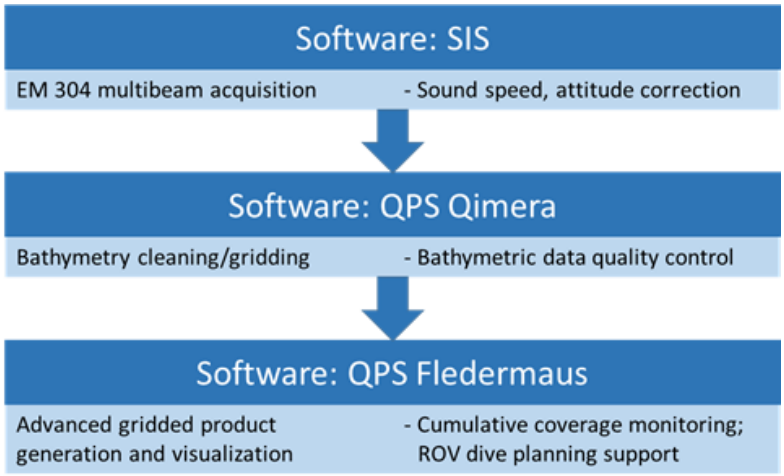

Figure 4. Shipboard multibeam data processing workflow.

On shore, the Mapping Team performed a final quality check of the data using QPS Qimera and Fledermaus software. This involved additional fine cleaning of soundings and minimization of residual artifacts from sound speed biases and field-cleaning errors. Depth values were compared from orthogonal lines (crosslines) to evaluate the consistency of the multibeam sonar data collected during the expedition.

A crossline analysis was completed using the Crosscheck Tool in QPS Qimera software to evaluate the data against the Order 1 S-44 standards set by the International Hydrographic Organization (IHO, 2008).

Each line of cleaned full resolution data was exported to a *.gsf file (Level-01 data). The processed and cleaned files were used to create a static surface in QPS Qimera. This final surface was re-projected into the field geographic WGS84 reference frame in QPS Fledermaus software and saved as a .sd file for archiving. Using QPS Fledermaus, this *.sd bathymetric grid file was then exported into ASCII XYZ text file (*.xyz), color *.tif, floating point *.tif, and Google Earth *.kmz file formats. The *.gsf files were used to create daily backscatter mosaics using QPS FMGT. All products maintain horizontal referencing to WGS84 (G1762) and vertical referencing to the assumed mean waterline. There is a complete accounting of each individually archived multibeam data file and of each bathymetric surface product in the multibeam data acquisition and processing logs archived with the dataset.

Crossline Analysis

A crossline was run on September 15, 2021, as shown in **Figure 5**, and the results are presented in **Table 4**.

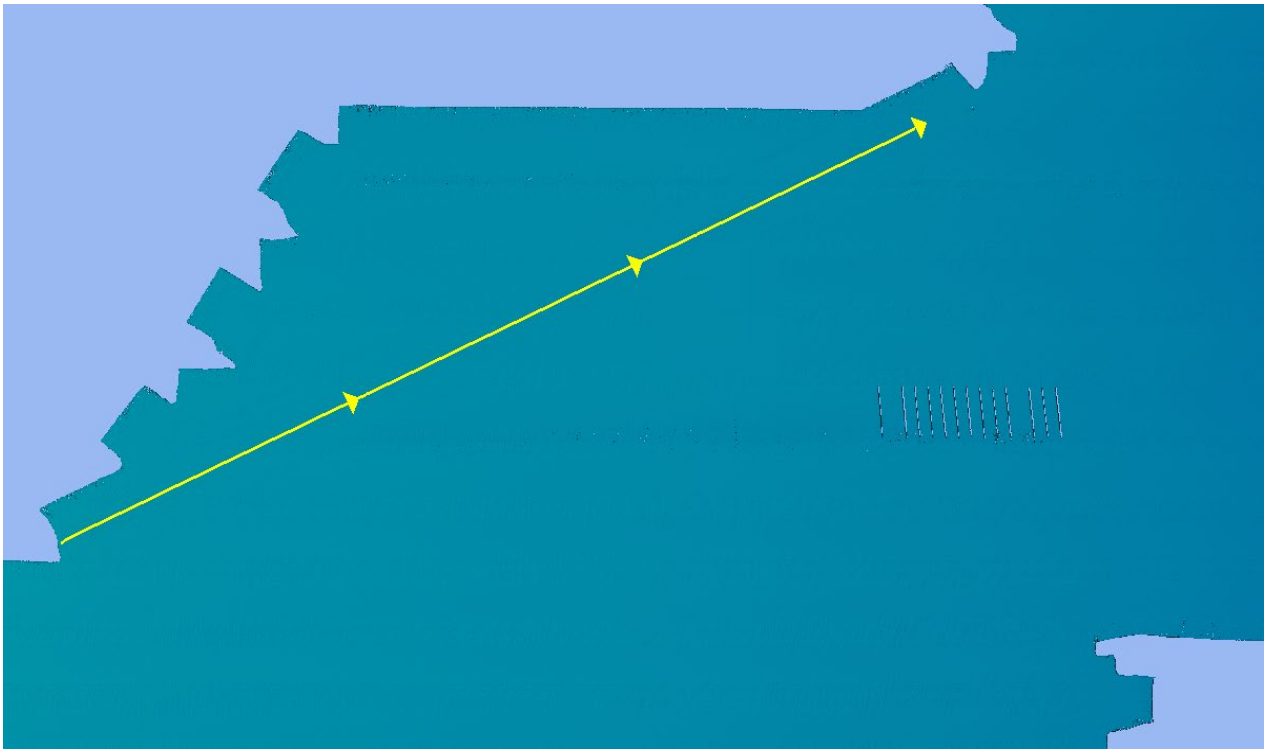

Figure 5. EX-21-06 crossline (shown in yellow) used for comparison against the bathymetric grid generated via orthogonal multibeam survey lines.

Crossline files:

0372_20210915_112257_EX2106_MB.kmall

0373_20210915_122257_EX2106_MB.kmall

0374_20210915_132257_EX2106_MB.kmall

Mainscheme line files:

0319_20210913_233405_EX2106_MB.kmall

0351_20210914_213120_EX2106_MB.kmall

0337_20210914_110437_EX2106_MB.kmall

0352_20210914_221610_EX2106_MB.kmall

0354_20210914_222958_EX2106_MB.kmall

Table 4. Crosscheck results.

Statistic	Value
Number of points of comparison	936093
Grid cell size (m)	20.00
Difference mean (m)	0.568177
Difference median (m)	0.525259
Difference standard deviation (m)	1.831188
Difference range (m)	[-6.90, 8.46]
Mean + 2* standard deviation (m)	4.230554
Median + 2* standard deviation (m)	4.187636
Data mean (m)	-808.833452
Reference mean (m)	-809.401630
Data z-range (m)	[-816.06, -800.97]
Reference z-range (m)	[-815.92, -802.57]
Order 1 error limit (m)	10.534094
Order 1 # rejected	0
Order 1 p-statistic	0

Order 1 survey	ACCEPTED

These results confirm that the data collected meet International Hydrographic Organization Order 1 specifications for data quality.

Acquisition and Processing Software

Table 5 provides a list of the acquisition and processing software versions that were used during EX-21-06.

Table 5. Versions of acquisition and processing software used during EX-21-01.

Software	Purpose	Version
SIS	EM 304	5.7.0
EK80	EK suite	2.0.1
EchoControl	Knudsen	4.09
UHDAS	ADCPs	14.04
AMVERSEAS	Autolaunch XBT	9.3
WinMK21	XBT	3.0.2
K-Sync	Synchronization	1.9.0
Qimera	Bathymetry	2.4.0
FMGT	Backscatter	7.9.7
FMMidwater	Water Column	7.9.3
Sound Speed Manager	Sound Velocity Profiles	2021.2.0
NRCan (SegJp2)	Sub-bottom	1.0

Fledermaus 7	Visualization/Data Analysis	7.8.11

Data Archiving Procedures

All mapping data collected by NOAA Ocean Exploration on *Okeanos Explorer* are archived and publicly available within 90 days of the end of each expedition via the National Centers for Environmental Information (NCEI) online archives. The complete data management plan (which describes the raw and processed data formats produced for this expedition) is available as an appendix in the "Project Instructions: EX-21-06, 2021 U.S. Blake Plateau Mapping 2 (Mapping)", which is archived in the NOAA Central Library. For each data type, raw data (Level 00), processed data (Level 01), derived products (Level 02), and ancillary files may be available, depending on the dataset and the level of staffing for the expedition. **Tables 6-10** describe the data archived for each dataset. For further information about proprietary software and freeware that can handle the varying data types, refer to the "NOAA OER Deepwater Exploration Mapping Procedures Manual."

Table 6. EM 304 bathymetry and seabed backscatter dataset.

Level	Description	File Type
Level 00	Raw multibeam files (in native sonar format) that include both raw bathymetry and backscatter (horizontal referencing = WGS84)	.kmall
Level 01	Processed multibeam files in generic sensor format that include bathymetry and backscatter (horizontal referencing = WGS84)	.gsf
Level 02	Gridded multibeam data and backscatter mosaics (horizontal referencing = WGS84)	.xyz, .tif, .tif (floating point GeoTIFF, .kmz, .sd, .scene
Ancillary files	Mapping watchstander log, weather log, sound speed profile log, multibeam acquisition and processing log, backscatter correction file, built-in self test logs, processing unit parameters, telnet session records	.xlsm, .xlsx, .txt

Table 7. EM 304 water column backscatter dataset.

Level	Description	File Type
Level 00	Raw multibeam files (in native sonar format) that include water column backscatter (horizontal referencing = WGS84)	.kmwcd
Level 01	n/a	n/a
Level 02	QPS Fledermaus objects such as beam fan, beam line, volume and/or track line; produced if time and staffing allows (horizontal referencing = WGS84)	.sd, .scene
Ancillary files	Mapping watchstander log, weather log, sound speed profile log, multibeam acquisition and processing log, water column data log, built-in self test logs, processing unit parameters, recorded telnet sessions	.xlsm, .xlsx, .txt

Table 8. EK60/EK80 split-beam echosounder dataset.

Level	Description	File Type
Level 00	Raw water column files provided in native sensor format (horizontal referencing = WGS84)	.raw, .idx
Level 01	n/a	n/a
Level 02	n/a	n/a
Ancillary files	Mapping watchstander log, weather log, EK data log, EK calibration report, calibration files and the raw files used for calibration	.xlsm, .xlsx, .txt, .pdf, .xml, .raw, .idx

Table 9. Knudsen 3260 sub-bottom profiler dataset

Level	Description	File Type
Level 00	Raw sub-bottom files provided in native sonar format (horizontal referencing = WGS84)	.sgy, .kea, .keb
Level 01	Raw sub-bottom files converted to images and shapefiles of the tracklines; produced as time and staffing levels allow	.jpg, .shp
Level 02	n/a	n/a
Ancillary files	Mapping watchstander log, weather log, sub-bottom profiler data log	.xlsm, .xlsx

Table 10. Sound speed profiles dataset.

Level	Description	File Type
Level 00	Raw profile data for any XBT or CTD cast	.txt, .hex, .cnv
Level 01	Processed sound speed profiles created for multibeam data acquisition	.asvp
Level 02	n/a	n/a
Ancillary Files	Mapping watchstander log, sound speed profile log, profile locations as a shapefile and in Google Earth format, any associated calibration files	.xlsm, .xlsx, .shp, .kml, .cal, .xml, .pdf

All sonar data is permanently discoverable within the NCEI archives[7] and searchable through the Ocean Exploration Digital Atlas,[8] which provides access to all of the data collected during an expedition. The locations for specific data types (at the time of writing this report) are detailed in **Table 11**. For any challenges accessing data, send an inquiry to NCEI,[9] or contact the Ocean Exploration Mapping Team.[10]

[7] https://www.ngdc.noaa.gov/

[8] https://www.ncei.noaa.gov/maps/oer-digital-atlas/mapsOE.htm

[9] ncei.info@noaa.gov

[10] oar.oer.exmappingteam@noaa.gov

Table 11. Locations of data collected during EX-21-06 (at the time of writing this report).

Data Type	Description	Location
EM 304 bathymetry and backscatter data	EM 304 bathymetric and backscatter data, supporting informational logs, and ancillary files are available through the NCEI Bathymetry Data Viewer	https://maps.ngdc.noaa.gov/viewers/bathymetry/
Water column data (EM 304 and EK60/EK80)	EM 304 and EK60/EK80 water column data, supporting data, and informational logs are available through the NCEI Water Column Sonar Data Viewer	https://www.ngdc.noaa.gov/maps/water_column_sonar/index.html
Knudsen 3260 sub-bottom profiler data	Sub-bottom data, supporting data, and informational logs are available in the NCEI data archives	May be requested directly from NCEI: https://www.ncei.noaa.gov/ National Centers for Environmental Information (NCEI) E/NE42 325 Broadway Boulder, Colorado USA 80305 ncei.info@noaa.gov (828) 271-4800
Sound speed profiles	Ancillary sound speed profiles are available along with all mapping data per expedition in the NCEI data archives, or within the oceanographic archive for the expedition.	https://maps.ngdc.noaa.gov/viewers/bathymetry/ or through the oceanographic archives at: https://www.ncei.noaa.gov/
Reports	Reports are archived in the NOAA Central Library's Ocean Exploration Program (OEP) institutional repository	NOAA Central Library home: https://library.noaa.gov/ OEP institutional repository: https://repository.library.noaa.gov/cbrowse?pid=noaa%3A4&parentId=noaa%3A4

Expedition Schedule

Table 12. EX-21-06 schedule.

Date (UTC)	Activity
09/03	Mission personnel joined the ship in Port Canaveral, FL. Mapping mobilization began.
09/04	Mobilization continued.
09/05	Departure from Port Canaveral, FL. Underway 09:30. Transit mapping to the Blake Plateau Priority 2 polygon.
09/06	Focused mapping operations on the Blake Plateau. Drills occurred.
09/07-09/25	Focused mapping operations on the Blake Plateau.
09/26	Focused mapping operations. CTD cast completed in 500m water depth. Survey operations occurred over a potential UCH target.
09/27	Continued mapping operations on the Blake Plateau. Began transit to Port Canaveral at 1900.
09/28	Sonars secured at 0030. Arrived to pier at 0900.

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Appendix A: Daily Log Entries

The following entries were excerpted from each of the daily expedition situation reports provided by the onboard team to the onshore support team, and therefore are somewhat informal in language. These are included to provide situational awareness for future users of the data collected during this cruise. All times are in local ship time (-4 hours from UTC).

September 3

The mission team that did not sail on EX2105 moved aboard following a seven day SIP period. A rapid COVID antigen test was taken by all arriving personnel prior to moving aboard. Planned departure is 9am Sunday, 09/05.

September 4

Alongside preparation day prior to tomorrow's anticipated departure. Pre-cruise operations meeting occurred.

Line plans were generated in HYPACK for the initial transit and the first mapping area. EiTs were introduced to the mission equipment and received an overview of the sonars, computers, and softwares. Watchbill was finalized for the mission team

September 5

The ship got underway at ~0930. Data quality on the transit looked relatively good, with seas 1-3 ft and light winds.

All sonars began pinging/logging data once the ship transited out to water depths exceeding 50m. All sonars started up normally, and all BISTs passed for the EM304. Some interference was identified in the EM304 from the EKs in the shallow water, but this was resolved relatively quickly.

September 6

Focused mapping operations continued on the Blake Plateau. Drills were conducted this afternoon. Monitoring Hurricane Larry for potential impacts to the survey area.

September 7

Focused mapping operations continued on the Blake Plateau. The data team has been troubleshooting some slight data management issues. Potential issues with the VSAT A/C unit. Monitoring Hurricane Larry for potential impacts to the survey area.

September 8

Data collection continued on the Blake Plateau in the Priority 2 polygon. The seas began to build throughout the day from 2-5ft. Data quality remains relatively high.

POS thrashing events occurred for ~30 minutes early this morning and ~90 minutes this afternoon around the same times as yesterday.

The SV-70 surface sound velocity probe began malfunctioning ~0630 ship time. It was the same drop that was observed towards the end of EX2105. The TSG is now the source of surface sound velocity, and is behaving normally. The CET plans on investigating the issue with the SV-70 while in drydock.

Testing began on Cloud access of EX-21-05 data aboard the ship. An Amazon Workspace client was downloaded onto MBPROC-2, and watch leads will be evaluating the utility of Cloud services while underway.

September 9

Continued mapping on the Blake Plateau. Effects from Larry/Mindy are being experienced on the ship with increasing winds/sea state. Catch-up effort occurred with sending EK files to shore.

September 10

Mapping operations continued on the Blake Plateau. Weather conditions have been improving following Larry/Mindy. All systems are operating normally.

September 11

Survey operations continued on the Blake Plateau. Weather conditions have continued to improve, with 3-4 foot seas and winds ~10kts.

The cloud team of three experienced EiTs and one contractor are confidently/efficiently communicating via Google Room chats and are moving through the bathy and EM 304 water column data at a good pace. Good communication with Mapping EC to determine how to break up Qimera projects to keep performance up.

September 12

Survey operations continued on the Blake Plateau. Weather conditions have continued to improve, with 2-3 foot seas and winds ~10kts. Lines were run along the eastern extent of the priority polygon to provide a turning buffer prior to the edge of the US EEZ.

The cloud team continued to keep up well with bathymetric and water column processing, as well as shoreside QC. Ship access to the cloud has been a little difficult due to internet limitations, but data cleaning has been possible so far.

September 13

Survey operations continued on the Blake Plateau. Weather is great, with 2-3 foot seas and winds ~10kts. Developed the northern extent of the Priority 2 polygon where it abuts to the EEZ of the Bahamas to provide a turning area for the remainder of data acquisition.

Team cloud is keeping up with bathy and EM water column data review. A weekly 'office hours' style meeting was led by the UCAR Data Lead Reviewer to review any technical or schedule issues the EiTs are having, and to take the pulse of the team. All is well, this weekly meeting is very useful to keep the team on the same page and fosters a cohort environment.

September 14

Survey operations continued on the Blake Plateau. Weather is great, with 2-3 foot seas and winds ~10kts. Some issues experienced with the XBT autolauncher throughout the afternoon were resolved with a little TLC from our favorite SST.

The cloud team is keeping up very well with incoming EX2106 EM 304 bathy and water column data review. Mosaicing has commenced on fully processed GSF files in the first mapping area.

The transfer of EX2105 projects to the new storage array created unexpected issues in Qimera, specifically with SVP post processing approaches not being maintained in the project structure and Qimera SVP files becoming unavailable. The issues have been reported to QPS.

September 15

Survey operations continued on the Blake Plateau. The seas have increased slightly, but conditions are still relatively good out here. Data quality remains high.

Two EX2105 projects were restored by OAR IT after they became corrupt after being moved from cloud storage array 1 (X:) to cloud storage array 2 (K:). OAR IT was very responsive and this capability proved yet another benefit of working in the cloud.

Cloud team is keeping up with bathy/kmwcd review. The first mosaic of exported final GSFs was produced by an EiT. Preliminary bathy grids of all data on EX2106 so far were provided to the EX2107 planning team.

September 16

Survey operations continued on the Blake Plateau. Seas 3-5ft, data quality still relatively high. Survey operations targeted data gaps in the northern part of the Priority 2 polygon, while leveraging existing data in the region.

Team Cumulus continued to keep up with multibeam bathy and water column review. 20 m grids of EX2106 cumulative bathy and mosaics of finalized bathy were provided to the EX2107 mapping lead for cruise planning.

September 17

Mapping operations continued on the Blake Plateau. All systems are normal.

Team cloud is keeping up with bathy and MBES water column review. Mosaics for EX2107 planning were provided to the EX2107 mapping lead. Feedback was given to remove turns from mosaics in the future.

September 18

Survey operations continued on the Blake Plateau. Finished Priority 2 polygon and moved on to Priority 1 polygon. Weather/data quality are both good. No issues to report.

Cloud team is keeping up nicely with incoming bathy/water column review. Cloud resources are performing well.

September 19

Survey operations continued on the Blake Plateau. The onboard team has been working on the EX2105 data in the cloud when possible.

Team cloud continues to keep up with MBES bathy/water column. One EiT reported he had to try several times to log into his Amazon workspace, and reported an error that 'not all updates were completed' when he was able to finally log in. It is suspected that Amazon cloud hardware receives regular updates, eg Windows updates, late on weekend nights. Google Room is working out very well for EiTs on different watches and time zones to communicate efficiently with each other and with cruise leadership.

September 20

Survey operations continued on the Blake Plateau. The bathymetry data has become much more interesting, with various seafloor features observed throughout the area. All systems are operating well.

The cloud EiTs are doing excellent job keeping up with bathy/water column and asking troubleshooting questions on QPS software and cloud software. Neah is doing excellent work answering their advanced questions as they gain experience and see new data artifacts/technical glitches.

September 21

Survey operations continued on the Blake Plateau. All systems are working normally, no issues to report.

The team continues to keep up with bathy/FMMW review. Small challenges are shared with each other for group troubleshooting. The team is in a great rhythm.

September 22

Survey operations continued on the Blake Plateau. Weather has deteriorated some with occasional blowouts observed in the data. Operations have begun in the axis of the Gulf Stream, and sound velocity challenges are being observed. All systems continue to work well.

The cloud team continues to keep up with bathy/FMMW. Interesting small coral mounds (likely) and depressions were noted and discussed, and shared with Derek as potential interest for EX2107.

September 23

Mapping operations continued on the Blake Plateau. Sound velocity remains challenging, and weather conditions aren't ideal. Data quality is still relatively high.

The team continues to keep up with bathy/FMMW review. The Cloud team are assessing SV processing strategies to alleviate the challenges presented by the Gulf Stream.

September 24

Mapping operations continued on the Blake Plateau. Data quality is relatively high.

September 25

Continued mapping operations on the Blake Plateau. Planning for an investigation of a potential UCH target tomorrow.

September 26

Continued mapping operations. A CTD cast was completed to a depth of 500 meters. An investigation of a potential UCH target was conducted, and a promising target was identified in the sonar data. Further investigation is planned for EX2107.

September 27

Focused apping operations continued until 1900, when the transit commenced towards Port Canaveral, FL.

September 28

All sonars were secured upon reaching 50 meter water depth at 0030. Arrived at the pier at 0900. All mission personnel departed.