UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NOAA Marine and Aviation Operations
Marine Operations Center
439 W. York Street
Norfolk, VA 23510-1114

JUN 16 2015

MEMORANDUM FOR: Master Donn Pratt, NOAA
Commanding Officer, NOAA Ship *Gordon Gunter*

FROM: Captain Anne K. Lynch, NOAA
Commanding Officer, NOAA Marine Operations Center-Atlantic

SUBJECT: Project Instruction for GU-15-04
ECOA-1

Attached is the final Project Instruction for GU-15-04, ECOA-1, which is scheduled aboard NOAA Ship *Gordon Gunter* during the period of June 17 to July 24, 2015. Of the 34 DAS scheduled for this project, 34 DAS are funded by a Line Office allocation. This project is estimated to exhibit a Medium Operational Tempo. Acknowledge receipt of these instructions via e-mail to **OpsMgr.MOA@noaa.gov** at Marine Operations Center-Atlantic.

cc:
Joseph Salisbury

FINAL Project Instructions

Date Submitted: June 3, 2015

Platform: NOAA Ship *Gordon Gunter*

Project Number: GU-15-04 (OMAO)

Project Title: ECOA-1 (Previously GOMECC)

Project Dates: June 17, 2015 to July 24, 2015

Prepared by: Dated: June 3, 2015

Chief Scientist: Joseph E. Salisbury
Joseph E. Salisbury
Ocean Processes Analysis Lab, University of New Hampshire

Approved by: Dated: 6/5/2015

Dwight K Gledhill
Program Deputy Director
NOAA OAR Ocean Acidification Program

Approved by: Digitally signed by JEWETT.ELIZABETH.B.1366747008 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=JEWETT.ELIZABETH.B.1366747008 Date: 2015.06.10 20:19:41 -04'00' Dated: ______________

Lab Director Name
Title
Affiliation (Program or Lab)

Approved by: Dated: 6/15/2015

Captain Anne K. Lynch, NOAA
Commanding Officer
Marine Operations Center - Atlantic

JUN 16 2015

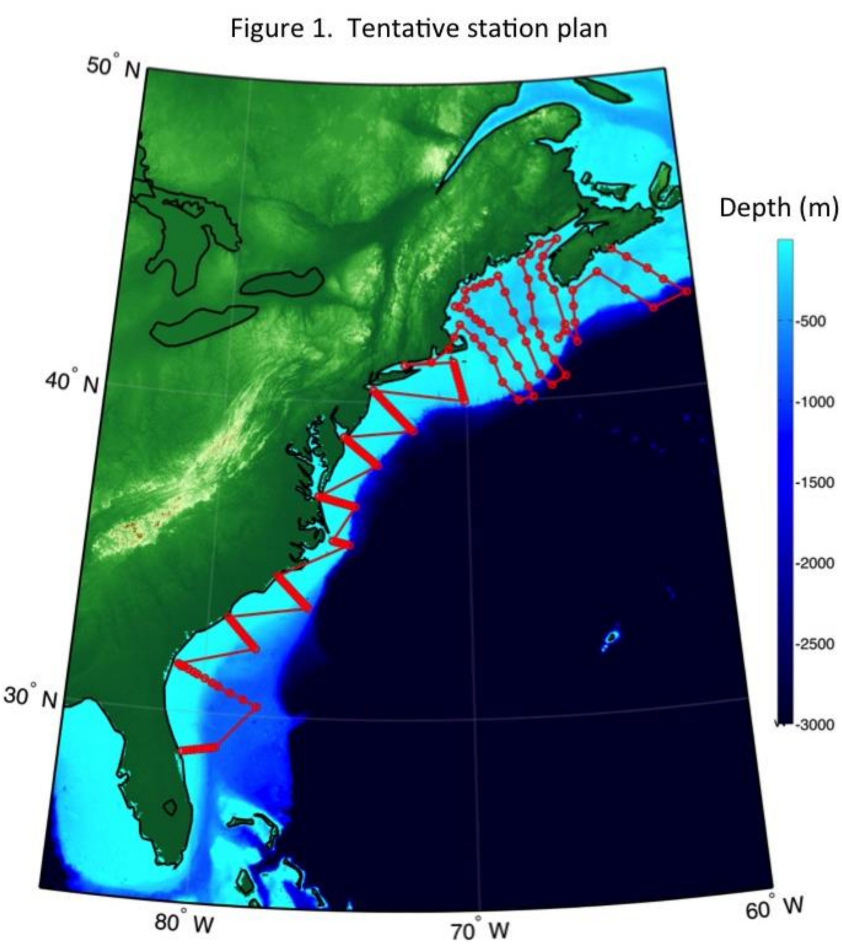
Preliminary project instructions for the NOAA OAP East Coast Ocean Acidification (ECOA) cruise

I. Overview

A. Brief Summary and Project Period

The ECOA-1 (formally designated as GOMECC 3) cruise is currently scheduled to commence in Newport, RI on Jun 17 and end in Miami, Florida on July 24, 2015. 15 scientists from seven different institutions will be engaged in surface water, water column and shipboard experiments en route. The cruise plan involves ~16 cross-shelf transects of 3-12 stations each from the coast to the ~1000-m isobath. At the stations CTD/Rosette operations will occur 24 hours per day using 24, 10-L bottles that will be filled consecutively over the water column from 1 to 2 m from the bottom to the surface. Extensive measurements will be taken from the scientific seawater line during the entire cruise. Air sampling from the bow will occur continuously in conjunction with meteorological measurements. A hyperspectral radiometer will be mounted on or near the bow rail to provide continuous measurements of surface reflectance.

B. Days at Sea (DAS)



Of the _34_ DAS scheduled for this project, _0_ DAS are funded by an OMAO allocation, _34_ DAS are funded by a Line Office Allocation, _0_ DAS are Program Funded, and _0_DAS are Other Agency funded. This project is estimated to exhibit a _Medium__ Operational Tempo.

C. Operating Area (include optional map/figure showing op area)

The operating area is on the East Coast of the US and Maritime Canada with a schematic of the cruise track (approximate at this point) shown in Figure 1.

Figure 1: Cartoon of cruise track. The ship will depart Massachusetts and return to Florida. The cruise will be 34 days. A preliminary station plan

schedule is listed in Table 2. Note that several stations have been reordered.

D. Summary of Objectives

The ECOA 1 cruise is the third (previously GOMECC 1 and GOMECC 2) comprehensive survey of inorganic carbon, nutrients and other biogeochemical parameters along the East coast of the USA. The effort is in support of the NOAA/OAR Ocean Acidification Program (OAP) that has as a major objective to monitor changes in inorganic carbon dynamics, due to anthropogenic carbon input and natural changes in the coastal regions. These processes are often referred to as ocean acidification. The project will increase our understanding of the controls of ocean acidification and its impacts on ocean ecosystems. Additionally the ECOA cruise seeks to better understand a unique set of processes such as freshwater discharge and intense net production known to affect the coastal carbonate cycle.

E. Participating Institutions

Primary:

UNH	University of New Hampshire

Additional information:

RSMAS	Rosenstiel School of Marine and Atmospheric Science/University of Miami
UDel	University of Delaware
AOML	Atlantic Oceanographic and Meteorological Laboratory (NOAA/AOML)
ODU	Old Dominion University
GSFC	Goddard Space Flight Center
NOAA NESDIS	National Environmental Satellite, Data, and Information Service

F. Personnel/Science Party: name, title, gender, affiliation, and nationality (Table 1)

Name (First, Last)	Title	Date Aboard	Date Disembark	Gender	Affiliation	Nationality
Joseph Salisbury	**Co-Chief Scientist CTD/Watch**	**6/17/2015**	**7/24/2015**	**M**	**UNH**	**USA**
Janet Reimer	~~**Co-Chief**~~ Post **Scientist** Doc ~~**CTD/Watch**~~	**7/8/2015**	**7/24/2015**	**F**	**UDel**	**USA**
Bror Jonsson	**O2/Ar; 13DIC / triple O2 isotopes**	**6/17/2015**	**7/24/2015**	**M**	**Princeton**	**Sweden**
Shawn Shellito	**Respiration/ Continuous instruments**	**6/17/2015**	**7/24/2015**	**M**	**UNH**	**USA**
Marc Emond	**CTD/Watch**	**6/17/2015**	**7/24/2015**	**M**	**UNH**	**USA**
Melissa Melendez	**Filtration for DOC/ CDOM/ Chlorophyll**	**6/17/2015**	**7/24/2015**	**F**	**UNH**	**USA (Puerto Rico)**
Carlisle Withers	**O2**	**6/17/2015**	**7/24/2015**	**F**	**RSMAS**	**USA**

Peter Bernhardt	**13C and 15N NPP**	**6/17/2015**	**7/3/2015**	**M**	**ODU**	**USA**
Lin, Junfang	**AOP**	**6/17/2015**	**7/3/2015**	**M**	**NESDIS/UMASS**	**P.R. China (PRC)**
Michael Ondrusek	**AOP**	**7/8/2015**	**7/24/2015**	**M**	**NESDIS**	**USA**
Lynn Price	**13C and 15N NPP**	**7/8/2015**	**7/24/2015**	**F**	**ODU**	**USA**
Najid Hussain	**TALK/pH**	**6/17/2015**	**7/24/2015**	**M**	**UDel**	**USA**
Charles Featherstone	**DIC**	**6/17/2015**	**7/24/2015**	**M**	**AOML**	**USA**
Yuanyuan Xu	**DIC/Nutrient Sample**	**6/17/2015**	**7/24/2015**	**F**	**UDel**	**PRC**
Yafeng Zhang	**TALK/pH**	**6/17/2015**	**7/24/2015**	**M**	**UDel**	**PRC**
Stephen Gonski	**pH/water sampling**	**6/17/2015**	**7/24/2015**	**M**	**UDel**	**USA**
Yonghui Gao	**TAlk/Water Sampling**	**6/17/2015**	**7/3/2015**	**F**	**UDel**	**PRC**
Boashan Chen	**pH/TAlk**	**7/8/2015**	**7/24/2015**	**M**	**UDel**	**PRC**
Andrew Joesoef	**TAlk**	**7/8/2015**	**7/24/2015**	**M**	**UDel**	**USA**
Andrew Collin	**pH/TAlk**	**6/17/2015**	**7/24/2015**	**M**	**UDel**	**USA**

G. Administrative

1. Points of Contacts:

Chief Scientist: Dr. Joseph Salisbury
142 Morse Hall
University of New Hampshire
Durham, NH 03824
603-862-0849
joe.salisbury@unh.edu

Chief Scientist: Wei-Jun Cai
School of Marine Science and Policy
014 Lammot DuPont Lab
Newark, DE 19716
wcai@udel.edu

Project Leads: J. Salisbury (UNH) and W-J Cai (UDel)

Data Manager: L. Barbero (AOML)
Leticia.Barbero@noaa.gov

2. Diplomatic Clearances

This project involves Marine Scientific Research in Canadian waters. Diplomatic clearance has been initiated with the help of Nathan Keith on January 26, 2015 and will proceed through the RATS system.

3. Licenses and Permits

None necessary

II. Operations

A. Project Itinerary

NOAA Ship *Gordon Gunter* will depart Newport, RI on June 17, 2015 to begin scientific operations. The cruise will end in Miami, Florida, on July 24, 2015. The operational goals of the cruise are to sample along ~17 hydrographic sections (see Figure 1, and Table 1 for preliminary station locations) and continuous measurements of surface water from the uncontaminated scientific seawater supply, while steaming close to the coast (50-m isobaths). The actual hydrographic stations sampling plan may deviate from this proposed plan in both number of stations and their locations.

B. Staging and Destaging

Staging of all equipment for the cruise will be conducted at Newport Naval Station in Newport, RI June 14. We request access to the ship three days prior to steaming for loading and equipment set-up. We plan to send to the ship a container that includes the CTD/rosette package that will be loaded with the shipboard crane. The CTD may be delivered to Pascagoula prior to the Right Whale cruise on 4/13/2015. Scientific personnel will be present for the purposes of scoping and securing the craned equipment. A list of equipment to be brought aboard is shown in the FACILITIES section of the Project Instructions and in Appendix B.

The members of the science party that do not reside in the area will arrive in Newport two to three days prior to sailing for final staging prior to the cruise (June 14-16). The science party requests permission to stay onboard the ship the night prior to sailing to facilitate maximum time for setup of the scientific gear. We understand the galley may not be available for science party meals before sailing. We will require the assistance of the shipboard ET and Survey Technician for 4 hours two-days prior to sailing and 8 hours the day before sailing to help install computer systems, terminations for the CTD and other science equipment. ECOA-1 is scheduled to take place on two consecutive legs, with a stop of several days in between them. The science party members that will conduct both legs request permission to remain on their assigned berthing during the stay in port. We are aware that the galley may not be serving meals during that time.

C. Operations to be conducted

1. CTD/O2, fluorescence, attenuation and downwelling irradiance (PAR) profiles of depth along hydrographic transects on the East Coast of the US and Maritime Canada. Approximately 160 stations will be completed to full water depth of maximum 1500 m, but nearly all stations will be less than 1000 m. CTD casts will proceed 24 hours/day. **NOTE:** We request the assistance of Science Technical Personnel to assist in CTD operations when necessary and a Survey Technician to operate the winch.

2. Water samples collected in rosette bottles for chemical measurements. **NOTE**: We require the assistance of a Survey Tech to help prepare bottles for deployment and CTD recovery.
3. Continuous recording ship mounted ADCP, with inertial/GPS navigation system that can provide accurate ship's speed and heading to within + 1 degree.
4. Inorganic carbon of the water samples collected with the bottles and analyzed onboard.
5. Dissolved oxygen concentration in the water samples collected with the bottles.
6. Nutrients samples will be taken from Niskin bottles, frozen and analyzed at AOML.
7. Chlorophyll, DOM and CDOM will be collected with the bottles at three depths within the euphotic depth. These samples require filtration.
8. 2-3 times per day between 10AM and 2PM local, we will deploy the UNH optical profiler from the auxiliary winch. No powered cable is necessary. It is necessary to maneuver the ship so that it does not cast a shadow on the operation. The profiler will only go to a maximum depth of 100 meters. We request the assistance of a Survey Technician to operate the winch.
9. Simultaneous to the optical profiler operations above (2-3x/ day) we will deploy a hand held irradiance profiler off of the aft deck away from the optical profiler operations. It is necessary to maneuver the ship so that it does not cast a shadow on the operation.
10. Respiration measurements will be taken once or twice daily. One set of daily measurements will always take place during the station closest in time to dawn and the other will be taken during a convenient PM station. Respiration chambers are constructed from modified Niskin bottles and will require three positions on the rosette each time they are deployed. These will be taken within the 1st euphotic depth only.
11. Near dawn each day we will also carry out productivity measurements. This will also require 3 Niskin bottles per cast. NOTE: If we have a 12-position rosette, it may be necessary to do two casts at dawn to accommodate the productivity and respiration measurements.

11. Continuous recording of thermosalinograph (TSG), oxygen, chlorophyll fluorescence, CDOM fluorescence and beam attenuation at 660nm. UNH will supply the CDOM fluorometers and the beam attenuation equipment that will be plumbed in –line with the Gunter TSG and recorded on the SCS data system.
12. Measurements of CO_2, from the uncontaminated scientific seawater supply line spigots in main lab and hydro lab.

D. Dive Plan

Dives are not planned for this project.

E. Applicable Restrictions

CTD/Rosette deployments will be curtailed **if** weather conditions are such to create unsafe operating conditions.

There shall be no smoking, no painting, and no use of solvents in the area near the equilibrators and other underway equipment, or near the Niskin bottles at any time during the cruise.

III. Equipment

I. Equipment and Capabilities provided by the ship (itemized)

The following communications devices are currently on board *Gordon Gunter* and are expected to be in working order. The chief scientist should be apprised at earliest possibility of malfunction of equipment.

1. High Frequency SSB (SEA 330): SEA Inc. 300-watt high frequency transceiver. The transceiver covers a frequency range from 1.6 to 29.9 MHz (or similar)
2. Furuno (or similar) Global Maritime Distress and Safety System (GMDSS)
3. Satellite communication system (INMARSAT -A, -B, -M)
4. Three fixed VHF radios with eight channels pre programmed with a selection of marine band and NOAA frequencies.
5. Cell phones
6. Internet communication capability

Navigational equipment:

7. GPS
8. Commercial Gyro Compass
9. Marine Radar
10. Dynamic Positioning System
11. Doppler Speed/distance log
12. NAVTEX receiving and printing the international automated medium frequency (518 KHz) weather warnings
13. Weather maps: Medium frequency/high frequency

Equipment and Capabilities provided by the scientists (itemized) 1. ***Providing CTD/Rosette/Carousel/Niskin support***. The key operations revolve around taking ~ 140-180 CTD/ bottle casts and all components of this effort need to be in optimal condition, and tested prior to cruise. AOML will provide the following items for the CTD/Rosette package: a 24-bottle CTD frame, 30 10-L Niskin-type bottles in working order with spare parts (repair kits with o-rings, springs, etc.), an altimeter and a 24 position carousel.

I. Technical: ET with knowledge of terminations of wire, troubleshooting, interfacing and operation of CTD package (including carousel, fish, etc).

II. Science technical help with operation of CTD computer, bottle firing and data acquisition in the SCS system

III. Survey technical help with CTD deck operations when necessary (e.g. bottle prep)

IV. Operational:

a. A fully tested winch with a minimum of 2500 m of conducting cable, capable of deploying a 24-bottle frame package weighing 1 metric ton, is required.

b. A back-up spool of conducting cable mounted on a winch drum, or the ability to use the back up winch for CTD operations should the main CTD fail.

c. A 24-bottle frame/carousel/CTD capable of handling 10-L Niskin bottles (both provided by AOML) and the following provided by other NOAA entities:

i. Dual channel (two) Seabird 9-11 CTD. NOTE: each to be calibrated prior to the cruise.

ii. Seabird seawater pumps capable of servicing pumped instruments on the rosette (CTD, O2, f-chl)

iii. Seabird SBE-43 oxygen sensor (calibrated prior to the cruise)

iv. Wetlabs or similar beam attenuation meter (e.g. SeaStar transmissometer)

v. Wetlabs or similar chlorophyll fluorometer.

d. Back up 12-bottle frame/carousel/CDT/bottles (the present Gunter unit is acceptable)

e. 30, 10-L Niskins with end caps/O-rings/spigots that have been checked and fully operational (no leaks), or (second choice) (provided by AOML)
f. Bottles should have lanyards and attachments to fit on frame and connect to carousel
g. A spare 911 CTD (the Gunter's spare CTD is adequate)

2. Echo Sounder (Ocean Data Equipment Corporation (ODEC) Bathy 2000 or the Knudsen system) used in12 kHz mode (to track CTD package to within 10 meters of the bottom) to be used while on CTD station. This will be resolved ETs prior to cruise
3. Barometer logged in the SCS data system
4. Hydrographic Winch system and readouts (Markey DESH-5 using 0.322 conducting cable for CTD operations).
5. A-Frame Winch system (Marco-WT-252) for the UNH IOP profiler
6. Hull mounted acoustic Doppler current profiler (RD Instruments (RDI), 75 kHz Ocean Surveyor acoustic Doppler current profiler) with gyro input.
7. Gyro system for acquisition of heading data
8. ***Increasing counter space in ship's laboratory is necessary for the mission's success.*** Removal of cabinets in small wet lab if necessary and modifying the large fish sorting table (e.g. covering with plywood) in main wet lab would be implemented.
9. ***We request that the science clean water flow line be thoroughly cleaned and bleached prior to the cruise***

A. Equipment and Capabilities provided by the scientists (itemized) Wei-Jun: list what you know that is not in appendix C

In addition to the suite of oceanographic and meteorological instruments on board *Gordon Gunter,* the science party will bring the following instruments and materials on board (see appendix for full specifications):

1. Inherent optical property profiling unit. (UNH)
2. Apparent optical property profiling unit (from NESDIS)
3. Wetlabs wetstar cdom fluorometer for continuous seawater (logged in ships SCS); wetlabs c-star attenuation sensor for continuous seawater (logged in ships SCS) (UNH);
4. Biospherical QSP-2300 Scalar irradiance and Seapoint UV Fluorometer sensors to be coupled to the CTD. (UNH)
5. Instrumentation to measure a variety of biogeochemical parameters in ocean water and atmosphere as detailed in the summary of projects in Appendix C.
6. Deionized water generator (NESDIS)

IV. Hazardous Materials

A. Policy and Compliance

The Chief Scientist is responsible for complying with FEC 07 Hazardous Materials and Hazardous Waste Management Requirements for Visiting Scientific Parties (or the OMAO procedure that supersedes it). By Federal regulations and NOAA Marine and Aviation Operations policy, the ship may not sail without a complete inventory of all hazardous materials by name and the anticipated quantity brought aboard, MSDS and appropriate neutralizing agents, buffers, or absorbents in amounts adequate to address spills of a size equal to the amount of chemical brought aboard, and a chemical hygiene plan. Documentation regarding those requirements will be provided by the Chief of Operations, Marine Operations Center, upon request.

Per OMAO procedure, the scientific party will include with their project instructions and provide to the CO of the respective ship 30 days before departure:

- List of chemicals by name with anticipated quantity
- List of spill response materials, including neutralizing agents, buffers, and absorbents
- Chemical safety and spill response procedures, such as excerpts of the program's Chemical Hygiene Plan or SOPs relevant for shipboard laboratories
- For bulk quantities of chemicals in excess of 50 gallons total or in containers larger than 10 gallons each, notify ship's Operations Officer regarding quantity, packaging and chemical to verify safe stowage is available as soon as chemical quantities are known.

Upon embarkation and prior to loading hazardous materials aboard the vessel, the scientific party will provide to the CO or their designee:

- An inventory list showing actual amount of hazardous material brought aboard
- An MSDS for each material
- Confirmation that neutralizing agents and spill equipment were brought aboard sufficient to contain and cleanup all of the hazardous material brought aboard by the program
- Confirmation that chemical safety and spill response procedures were brought aboard

Upon departure from the ship, scientific parties will provide the CO or their designee an inventory showing that all chemicals were removed from the vessel. The CO's designee will maintain a log to track scientific party hazardous materials. MSDS will be made available to the ship's complement, in compliance with Hazard Communication Laws.

Scientific parties are expected to manage and respond to spills of scientific hazardous materials. Overboard discharge of hazardous materials is not permitted aboard NOAA ships.

B. Inventory: See chemical inventory and accompanying MSDS sheets.

C. Chemical safety and spill response procedures

A: ACID

- Wear appropriate protective equipment and clothing during clean-up. Keep upwind. Keep out of low areas.
- Ventilate closed spaces before entering them.
- Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.
- **Large Spills**: Dike far ahead of spill for later disposal. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal.
- **Small Spills**: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.
- Never return spills in original containers for re-use.
- Neutralize spill area and washings with soda ash or lime. Collect in a non-combustible container for prompt disposal.
- J. T. Baker NEUTRASORB® acid neutralizers are recommended for spills of this product.

M: Mercury

- Spills: Pick up and place in a suitable container for reclamation or disposal in a method that does not generate dust. Sprinkle area with sulfur or calcium polysulfide to suppress mercury. Use Mercury Spill Kit if need be.

F: Formalin/Formaldehyde

- Ventilate area of leak or spill. Remove all sources of ignition.
- Wear appropriate personal protective equipment.
- Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible.
- Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container.
- Do not use combustible materials, such as saw dust.

Inventory of Spill Kit supplies

Spills will be diluted with DI or seawater, then cleaned with a clay adsorbant.

D. Radioactive Materials

No Radioactive Isotopes are planned for this project. (Replaces all below under IV. D-E) OR

A. Supplementary ("Piggyback") Projects

Underway Measurements in support of Global Carbon Cycle Research

The underway sensors on *Gordon Gunter* will be used in support of the objectives of the Global Carbon Cycle Research (GCC) to quantify the uptake of carbon by the world's ocean and to understand the bio-geochemical mechanisms responsible for variations of partial pressure of CO_2 in surface water (pCO_2). This work is a collaborative effort between the CO_2 groups at AOML and PMEL.

Principal investigators:
Dr. Rik Wanninkhof, AOML 305-361-4379 rik.wanninkhof@noaa.gov
Contact person:
Dr. Denis Pierrot, AOML 305-361-4443 denis.pierrot@noaa.gov

The semi-automated instruments are installed on a permanent basis on the Gordon Gunter. All work is performed on a not-to-interfere basis and does not introduce any added ship logistic requirements other than the continuous operation of the bow water pump and thermosalinograph. The chief scientist assumes responsibility of the hazardous materials aboard the Gunter for this project. A list of the HAZMAT associated with this project is provided in Appendix A.

B. NOAA Fleet Ancillary Projects

Any additional work will be subordinate to the primary project and will be accomplished only with the concurrence of the Commanding Officer and the Chief Scientist(s).

The following projects may be conducted by ship's personnel in accordance with the general instructions contained in the MOC Directives, and conducted on a not-to-interfere basis with the primary project:

a. SEAS Data Collection and Transmission
b. Marine Mammal Reporting
c. Bathymetric Track line
d. Weather Forecast Monitoring
e. Sea Turtle Observations
f. Automated Sounding Aerological Program

VI. Disposition of Data and Reports

A. Data Responsibilities

The Chief Scientists will be responsible for the disposition, feedback on data quality, and archiving of data collected on board the ship for the primary project. The Chief Scientists will also be responsible for the dissemination of copies of these data to participants in the cruise, to any other requesters, and to NESDIS in accordance with NDM 16-11 (ROSCOP within 3 months of cruise completion). The ship's personnel are requested to assist in copying data and reports insofar as facilities allow. A data file will be sent daily to the overall data manager for the cruise, L. Barbero (AOML) for initial en-route QCing of the CTD casts. The file will at least contain location, date and time of the CTD casts, tripping depth of the Niskin bottles and CTD temperature and salinity at tripping depth. A scanned copy of the master sample sheet will be helpful to flag leaking Niskins. Niskin bottles will be flagged according to WOCE QC flags and files will be sent back to the chief scientists. By the end of the cruise, but ideally as soon as practical, all data from samples analyzed on board will also be submitted to the data manager to build a preliminary dataset.

The Chief Scientists will receive all original data gathered by the ship for the primary project, and this data transfer will be documented on NOAA Form 61-29 "Letter Transmitting Data". The Chief Scientist in turn will furnish the ship with a complete inventory listing all data gathered by the scientific party detailing types and quantities of data.

Individuals in charge of piggyback projects conducted during the cruise have the same responsibilities for their project's data as the Chief Scientist has for primary project data. All requests for data should be made through the Chief Scientist.

VII. Meetings, Vessel Familiarization, and Project Evaluations

<u>Pre-Project Meeting</u>: The Chief Scientist and Commanding Officer will conduct a meeting of pertinent members of the scientific party and ship's crew to discuss required equipment, planned operations, concerns, and establish mitigation strategies for all concerns. This meeting shall be conducted before the beginning of the project with sufficient time to allow for preparation of the ship and project personnel. The ship's Operations Officer usually is delegated to assist the Chief Scientist in arranging this meeting.

A. Vessel Familiarization Meeting: The Commanding Officer is responsible for ensuring scientific personnel are familiarized with applicable sections of the standing orders and vessel protocols, e.g., meals, watches, etiquette, drills, etc. A vessel familiarization meeting shall be conducted in the first 24 hours of the project's start and is normally presented by the ship's Operations Officer.

B. Post-Project Meeting: The Commanding Officer is responsible for conducted a meeting no earlier than 24 hrs before or 7 days after the completion of a project to discuss the overall success and short comings of the project. Concerns regarding safety, efficiency, and suggestions for future improvements shall be discussed and mitigations for future projects will be documented for future use. This meeting shall be attended by the ship's officers, applicable crew, the Chief Scientist, and members of the scientific party and is normally arranged by the Operations Officer and Chief Scientist.

C. Project Evaluation Report

Within seven days of the completion of the project, a Customer Satisfaction Survey is to be completed by the Chief Scientist. The form is available at http://www.omao.noaa.gov/fleeteval.html and provides a "Submit" button at the end of the form. Submitted form data is deposited into a spreadsheet used by OMAO management to analyze the information. Though the complete form is not shared with the ships', specific concerns and praises are followed up on while not divulging the identity of the evaluator.

VIII. Miscellaneous

A. Meals and Berthing

The ship will provide meals for the scientists listed above. Meals will be served 3 times daily beginning one hour before scheduled departure, extending throughout the project, and ending two hours after the termination of the project. Since the watch schedule is split between day and night, the night watch may often miss daytime meals and will require adequate food and beverages (for example a variety of sandwich items, cheeses, fruit, milk, juices) during what are not typically meal hours. Special dietary requirements for scientific participants will be made available to the ship's command at least seven days prior to the project.

Berthing requirements, including number and gender of the scientific party, will be provided to the ship by the Chief Scientist. The Chief Scientist and Commanding Officer will work together on a detailed berthing plan to accommodate the gender mix of the scientific party taking into consideration the current make-up of the ship's complement. The Chief Scientist is responsible for ensuring the scientific berthing spaces are left in the condition in which they were received; for stripping bedding and linen return; and for the return of any room keys which were issued. The Chief Scientist is also responsible for the cleanliness of the laboratory spaces and the storage areas utilized by the scientific party, both during the project and at its conclusion prior to departing the ship.

All NOAA scientists will have proper travel orders when assigned to any NOAA ship. The Chief Scientist will ensure that all non NOAA or non Federal scientists aboard also have proper orders. It is the responsibility of the Chief Scientist to ensure that the entire scientific party has a mechanism in place to provide lodging and food and to be reimbursed for these costs in the event that the ship becomes uninhabitable and/or the galley is closed during any part of the scheduled project.

All persons boarding NOAA vessels give implied consent to comply with all safety and security policies and regulations which are administered by the Commanding Officer. All spaces and equipment on the vessel are subject to inspection or search at any time. All personnel must comply with OMAO's Drug and Alcohol Policy dated May 17, 2000 which forbids the possession and/or use of illegal drugs and alcohol aboard NOAA Vessels.

B. Medical Forms and Emergency Contacts

The NOAA Health Services Questionnaire (NHSQ, NF 57-10-01 (3-14)) must be completed in advance by each participating scientist. The NHSQ can be obtained from the Chief Scientist or the NOAA website http://www.corporateservices.noaa.gov/noaaforms/eforms/nf57-10-01.pdf.

All NHSQs submitted after March 1, 2014 must be accompanied by NOAA Form (NF) 57-10-02 - Tuberculosis Screening Document in compliance with OMAO Policy 1008 (Tuberculosis Protection Program).

The completed forms should be sent to the Regional Director of Health Services at the applicable Marine Operations Center. The NHSQ and Tuberculosis Screening Document should reach the Health Services Office no later than 4 weeks prior to the start of the project to allow time for the participant to obtain and submit additional information should health services require it, before clearance to sail can be granted. Please contact MOC Health Services with any questions regarding eligibility or completion of either form. Ensure to fully complete each form and indicate the ship or ships the participant will be sailing on. The participant will receive an email notice when medically cleared to sail if a legible email address is provided on the NHSQ.

The participant can mail, fax, or email the forms to the contact information below. Participants should take precautions to protect their Personally Identifiable Information (PII) and medical information and ensure all correspondence adheres to DOC guidance (http://ocio.os.doc.gov/ITPolicyandPrograms/IT_Privacy/PROD01_008240).

The only secure email process approved by NOAA is Accellion Secure File Transfer which requires the sender to setup an account. Accellion's Web Users Guide is a valuable aid in using this service, however to reduce cost the DOC contract doesn't provide for automatically issuing full functioning accounts. To receive access to a "Send Tab", after your Accellion account has been established send an email from the associated email account to accellionAlerts@doc.gov requesting access to the "Send Tab" function. They will notify you via email usually within 1 business day of your approval. The 'Send Tab" function will be accessible for 30 days.

Regional Director of Health Services
Marine Operations Center – Atlantic
439 W. York Street
Norfolk, VA 23510
Telephone 757-441-6320
Fax 757-441-3760
Email MOA.Health.Services@noaa.gov

Prior to departure, the Chief Scientist must provide an electronic listing of emergency contacts to the Executive Officer for all members of the scientific party, with the following information: contact name, address, relationship to member, and telephone number.

C. Shipboard Safety

Hard hats are required when working with suspended loads. Work vests are required when working near open railings and during small boat launch and recovery operations. Hard hats and work vests will be provided by the ship when required.

Wearing open-toed footwear or shoes that do not completely enclose the foot (such as sandals or clogs) outside of private berthing areas is not permitted. At the discretion of the ship CO, safety shoes (i.e. steel or composite toe protection) may be required to participate in any work dealing with suspended loads, including CTD deployment and recovery. The ship does not provide safety-toed shoes/boots. The ship's Operations Officer should be consulted by the Chief Scientist to ensure members of the scientific party report aboard with the proper attire.

D. Communications

A progress report on operations prepared by the Chief Scientist may be relayed to the program office. Sometimes it is necessary for the Chief Scientist to communicate with another vessel, aircraft, or shore facility. Through various means of communications, the ship can usually accommodate the Chief Scientist. Special radio voice communications requirements should be listed in the project instructions. The ship's primary means of communication with the Marine Operations Center is via email and the Very Small Aperture Terminal (VSAT) link. Standard VSAT bandwidth at 128kbs is shared by all vessels staff and the science team at no charge. Increased bandwidth in 30 day increments is available on the VSAT systems at increased cost to the scientific party. If increased bandwidth is being considered, program accounting is required and it must be arranged through the ship's Commanding Officer at least 30 days in advance.

E. IT Security

Any computer that will be hooked into the ship's network must comply with the *OMAO Fleet IT Security Policy* 1.1 (November 4, 2005) prior to establishing a direct connection to the NOAA WAN. Requirements include, but are not limited to:

(1) Installation of the latest virus definition (.DAT) file on all systems and performance of a virus scan on each system.
(2) Installation of the latest critical operating system security patches.
(3) No external public Internet Service Provider (ISP) connections.

Completion of the above requirements prior to boarding the ship is required.

Non-NOAA personnel using the ship's computers or connecting their own computers to the ship's network must complete NOAA's IT Security Awareness Course within 3 days of embarking.

F. Foreign National Guests Access to OMAO Facilities and Platforms

All foreign national access to the vessel shall be in accordance with NAO 207-12 and RADM De Bow's March 16, 2006 memo (http://deemedexports.noaa.gov). National Marine Fisheries Service personnel will use the Foreign National Registration System (FNRS) to submit requests for access to NOAA facilities and ships. The Departmental Sponsor/NOAA (DSN) is responsible for obtaining clearances and export licenses and for providing escorts required by the NAO. DSNs should consult with their designated Line Office Deemed Export point of contact to assist with the process.

Foreign National access must be sought not only for access to the ship involved in the project but also for any Federal Facility access (NOAA Marine Operations Centers, NOAA port offices, USCG Bases) that foreign nationals might have to traverse to gain access to and from the ship. The following are basic requirements.

Full compliance with NAO 207-12 is required.

Responsibilities of the Chief Scientist:

1. Provide the Commanding Officer with the email generated by the Servicing Security Office granting approval for the foreign national guest's visit. (For NMFS-sponsored guests, this email will be transmitted by FNRS.) This email will identify the guest's DSN and will serve as evidence that the requirements of NAO 207-12 have been complied with.
2. Escorts – The Chief Scientist is responsible to provide escorts to comply with NAO 207-12 Section 5.10, or as required by the vessel's DOC/OSY Regional Security Officer.
3. Ensure all non-foreign national members of the scientific party receive the briefing on Espionage Indicators (NAO 207-12 Appendix A) at least annually or as required by the Servicing Security Office.
4. Export Control - Ensure that approved controls are in place for any technologies that are subject to Export Administration Regulations (EAR).

The Commanding Officer and the Chief Scientist will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.

Responsibilities of the Commanding Officer:

1. Ensure only those foreign nationals with DOC/OSY clearance are granted access.
2. Deny access to OMAO platforms and facilities by foreign nationals from countries controlled for anti-terrorism (AT) reasons and individuals from Cuba or Iran without written approval from the Director of the Office of Marine and Aviation Operations and compliance with export and sanction regulations.

3. Ensure foreign national access is permitted only if unlicensed deemed export is not likely to occur.
4. Ensure receipt from the Chief Scientist or the DSN of the FNRS or Servicing Security Office email granting approval for the foreign national guest's visit.
5. Ensure Foreign Port Officials, e.g., Pilots, immigration officials, receive escorted access in accordance with maritime custom to facilitate the vessel's visit to foreign ports.
6. Export Control - 8 weeks in advance of the project, provide the Chief Scientist with a current inventory of OMAO controlled technology onboard the vessel and a copy of the vessel Technology Access Control Plan (TACP). Also notify the Chief Scientist of any OMAO-sponsored foreign nationals that will be onboard while program equipment is aboard so that the Chief Scientist can take steps to prevent unlicensed export of Program controlled technology. The Commanding Officer and the Chief Scientist will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.
7. Ensure all OMAO personnel onboard receive the briefing on Espionage Indicators (NAO 207-12 Appendix A) at least annually or as required by the Servicing Security Office.

Responsibilities of the Foreign National Sponsor:

1. Export Control - The foreign national's sponsor is responsible for obtaining any required export licenses and complying with any conditions of those licenses prior to the foreign national being provided access to the controlled technology onboard regardless of the technology's ownership.
2. The DSN of the foreign national shall assign an on-board Program individual, who will be responsible for the foreign national while on board. The identified individual must be a U.S. citizen and a NOAA or DOC employee. According to DOC/OSY, this requirement cannot be altered.
3. Ensure completion and submission of Appendix C (Certification of Conditions and Responsibilities for a Foreign National

APPENDICES

Table 2. Preliminary station locations in attached excel spreadsheet

Appendix O

Station Operations (Typical)

CTD casts will occur at all times during the day. They will include the CTD/O2 unit, a Biospherical QSP-2300 Scalar irradiance sensor, a Seapoint UV fluorometer, a chlorophyll fluorometer, a "beam-c" transmissometer, a Rosette sampler and 24, 10-L Niskin-type bottles on the Rosette frame. Approximately 140-160 casts will be conducted to full water column depth, maximum estimated at 1500 meters. The majority of stations will be less than 1000m. We will require an altimeter, a package tracking system and display for the CTD operations. We recommend that the ship carry a back-up CTD conducting cable for this cruise and a functioning spare winch. Technical assistance will be needed for bottle preparation, crane operations, deployment and recovery of the CTD/rosette package and computer operations. Approximate station locations are listed in Table 1. During these stations we will fire bottles through the water column. The Niskin bottles will be sampled for oxygen, carbonate parameters, nutrients and other parameters.

Station Operations (near dawn)
At or near dawn each day we will collect water for productivity and respiration measurements.

AOP and IOP profile casts NOAA/NESDIS/STAR and UNH personnel will be conducting in situ optical measurements 2-3 times per day. These will consist of instrument casts. The IOP case will be conducted using the auxiliary winch, while the AOP is a hand held profiling instrument. It is expected that these can occur simultaneously and that one will not interfere with the other. When possible, these casts will be performed on “typical” station.

Additional Respiration
We convenient (i.e occurring in the afternoon during a typical cast), we will use 3 positions on the Niskin to sample for additional respiration measurements.

Appendix A. List of Chemicals (a full list is still to come)

I. CHEMICAL REAGENTS USED FOR THE
DETERMINATION OF **DISSOLVED OXYGEN** IN SEA WATER

NAME OF CHEMICAL	AMOUNT OF CHEMICAL	COMMENTS
Manganese Chloride	2 Liters, (600gr/Liter)	Solution
Alkaline Sodium Iodide	2 Liters, (320gr. Sodium Hydroxide + 600gr. Sodium Iodide, in each liter).	Solution
Sulfuric Acid	2 Liters, 280ml/liter	Dilute Solution
Sodium Thiosulfate	3 Liters, 10gr/Liter	Very Dilute Solution
	3 vials of 10gr. Thiosulfate	Granular Salt
Potassium Iodate	1 Liter, (0.3567gr/Liter) Std.	Very Dilute Solution Primary Standard
Triton(R) X-100	1 Liter (Polyethylene Glycol Octylphenyl Ether)	Solution

NAME OF CHEMICAL	bottles	AMOUNT OF CHEMICAL	COMMENTS

II. CHEMICAL REAGENTS USED FOR THE
DETERMINATION OF TOTAL **DISSOLVED INORGANIC CARBO**N **(DIC)**

NAME OF CHEMICAL	AMOUNT OF CHEMICAL	COMMENTS
Magnesium Perchlorate	2 bottles, 500 g each	Granular Salt
Soda Lime	2 bottle, 500 g each	Granular Salt
Potassium Iodate	2 bottles, 500 g	Granular Salt
Silica gel (ORBO tubes)	700 tubes 0.75 g	Granular Salt
Isopropanol	4 Liters (1 x 4 L bottle)	Solvent

Acetone	7.5 Liters (15 x 0.5L bottle)	Solvent
Coulometer solution (cathode)	24 L (6 x 4L bottle)	Liquid
Coulometer solution (anode)	3 L (10 x 0.3L bottle) Liquid	
Phosphoric Acid	1 L(2 X 500 ml bottles)	LIQUID
Nitrogen, compressed	5 steel cylinders Carrier Grade	Compressed Gas
Air, compressed	8 aluminum cylinders (size a)	Compressed Gas
Carbon Dioxide (99.99%)	12 cylinders (0.8 kg each)	Compressed Gas
$HgCl_2$	3, 300 ml of saturated solution	Liquid for sample preservation

III. CHEMICAL REAGENTS USED FOR THE DETERMINATION OF **OPTICAL PROPERTIES** IN SEAWATER (HPLC, CDOM, DOC and POC preservation)

NAME OF CHEMICAL	AMOUNT OF CHEMICAL	COMMENTS
Methanol	500 mL	Solution
Liquid Nitrogen	20L	In Dewar Flask in Starboard wetlab.

IV. OTHER (Please fill out)

Appendix B. Individual project needs NOTE: this does not yet include final space apportions or locations

Wei-Jun Please fill out what you can on these and I will fill work on this some more as well. We can merge docs.

1. Oxygen (AOML/RSMAS) SITE: Starboard Wet Lab 01 deck

WT: 200 kg

SIZE: Small miscellaneous equipment tools, & laptops

Oxygen Equipment:

1. Sample bottles- 10 blue plastic cases, 24 x 16 x 12, 20 lbs. each.
2. Reagents- 2 blue plastic cases, 24 x 18 x 14, 50 lbs. each.
3. Titration Equipment- 1 aluminum box, 24 x 24 x 16, 70 lbs.
4. Misc. supplies- 2 cardboard boxes, 16 x 15 x 14, 30 lbs. each.

Misc. Equipment

1. Instruction manuals
2. 2 computers, 16x16x10, 20 lbs. total
3. 2 laptops, 14x2x9, 10 lbs. total
4. 2 LCD monitors, 16x12x2, 4 lbs. total
5. 2 tool boxes, 30”x16”x30”, 200 lbs. total
6. 2 boxes misc. supplies, 16”x16”x36”, 150 lbs. total

2. CTD Rosette with console to be supplied by NOAA (UNH/UDel) SITE: Dry Lab/ O1 Deck (CTD/Niskins)

WT: 1 ton

SIZE: 4'L x 4'W x 6'H ‘ – in Storage van 8 W x 8 Hx 16 L

SITE: Standard CTD Location

1. 3- Seabird 9 CTDs, 8”x8”x36”, 90 lbs. total

2. 2 – CTD frame, underwater sampling package, 6.5'x48"diameter, 1300 lbs./each
3. 2 boxes CTD sensors, 16"x18"16, 30 lbs. total
4. 30, 10 L Niskin Bottles

3. TAlk and pH equipment (UGa) SITE: Starboard Wet Lab 01 deck

The TAlk titrator has a small size of less than 0.3x0.3x0.3 m. The DIC analyzer has a small size of less than 0.5x0.3x0.3 m. We need a bench space of 3-m. We are expecting a total size of 1x1x1 of sample bottle volume for Ca^{2+}. We will bring a small N_2 gas (99.999%) tank (~80 ft^3) for DIC measurement.

4. CDOM/ DOC/ HPLC/ POC (UNH/ Goddard) SITE: Starboard Wetlab 01 deck aft

Bottles are stored in 5 or 6 coolers until collection and then need refrigeration while on the ship (50 lbs. empty, 150 lbs. full). 3'W x2'H x2'D with adjacent bench-space needed for a notebook computer. The deck-box and notebook computer for the optical gear are small and light (deck-box smaller footprint than notebook). No special power requirement other than normal 120 AC for any equipment. We also will require about 4 feet of table space for equipment related to filtration. We also need a GPS feed.

5. Total dissolved inorganic carbon (DIC) (AOML) Wet Lab

The DIC analytical equipment will be set up in the assigned lab space. The analysis will be done by coulometry with two analytical systems (AOML3 and AOML4) used simultaneously on the cruise. Each system consists of a coulometer (UIC, Inc.) coupled with a Dissolved Inorganic Carbon Extractor (DICE) inlet system.

The weight of equipment, supplies, and sample bottles is approximately 1000 lbs.

6. Nutrients (AOML/ UDEL) (sampling only)

7. IOP and AOP Measurements (UNH/ NESDIS) NOAA/NESDIS/STAR will be conducting in situ optical measurements during the ECOA-1 summer 2015 cruise aboard the NOAA Ship Gordon Gunther. These optical measurements will be conducted in direct support of the GOMECC project and provide NESDIS ocean color validation measurements to support the JPSS VIIRS project. Will be bringing a Satlantic Hyperpro radiometer (21 ft^3) and potentially, a Hypersas autonomous system (20 ft^3). We requite 16 squared feet on back deck and 2 feet of bench space in lab for laptop and power supply.

8. O2/ Argon

Wen Jun Cai and B. Jonsson (Princeton U.) will deploy an underway Equilibrium Inlet Mass Spectrometry (EIMS; Cassar et al., 2009) to measure DO2/Ar ratio, a proxy for Net Community Production (NCP). 9 linear feet of lab space in a dry part of the wet lab. Access to running seawater (<1 liter/minute) for instruments that aren't splash proof. I will set up a small tank/bucket (~10 liters) that needs to drain. Desk Mounting of one 45cm *95cm*120cm heavy box and a Pfeiffer quadrupole about one meter from a sink or tank. Power needs are 110 volt, 2000 watts clean power supply.Deck space is required for three large cases with bottles. Need to be accessible when on station. GPS and met data from flow-though feeds are also required.

9. ^{13}DIC

Jonsson will also operate a newly developed system to measure Dissolved Inorganic Carbon (DIC) underway, based on two Picarro Cavity Ring-Down Spectroscopy (CRDS) instruments. This system is developed by Michael Bender and Kuan Huang at Princeton University and has a comparable precision as discrete methods (0.1%) with 8 min temporal resolution. This instrument space and water requirements are included in the O2/ Argon system above

10. ^{13}C/ ^{15}N Productivity

We will measure primary productivity and dinitrogen fixation using stable isotopes ($H^{13}CO_3^-$ and $^{15}N_2$, respectively) as tracers at least 1 station per day. For comparison, we will measure N uptake (nitrate, nitrite, ammonium and urea) to determine the dominant form of N supporting productivity. In addition, we will measure particulate nitrogen and carbon concentrations. We require bench space for two 6-seater filter rigs (these ideally will be separated so that the PN/PC samples can also give us an estimate of natural abundance). We will also need space to store and prepare incubation bottles. Ideally about 6 feet of counter space in 2 places and near sinks is ideal for our filtering. Storage space for pipettes (which can be kept in trunks), filters and other supplies are required.

Approximately 2m^2 are required for incubations. These must be done in a space that is open to the sun's rays and experiences minimal shading from ship structures. We require a raw water flow of about 10L/ min to the incubators and a way to drain the cooling water overboard. About 0.5m^2 of freezer space are required to hold samples.

11. **Triple Isotopes.** This is measurement intended to give a measure of gross productivity. It requires sampling from the Niskins and we will take approximately 200 samples above the first euphotic depth. We will require about 1m^3 for bottle storage.

12. **Respiration** At or near dawn of each cruise day, 3 positions on the Rosette will be used to sample water near the surface, at the base of the mixed layer and at the 1% light level. This water will be taken to the wetlab and incubated in water baths. When convenient, we will also take samples at a station during the afternoon.

Appendix C (Water Budgets in ml)

a. **BOTTLE**

i.	**Nutrients**	**250**
ii.	**DIC**	**800**
iii.	**O2**	**500**
iv.	**TA**	**600**
v.	**pH**	**300**
vi.	**f-chl/ HPLC**	**1200 (varies)**
vii.	**DOC**	**700**
viii.	**Absorption (lambda)**	**700**
ix.	**Ca++**	**300**
x.	**Other WeiJun**	**300**
xi.	**Triple isotopes**	**800**

xii. **Respiration** **3 Niskin positions 2x/day**
xiii. **13C/15N NPP** **4 Niskin Positions 1x/Day**

b. **Science flow (in L)**
   i. **O2/Ar 0.5L/min**
   ii. **13DIC 0.25L/min**
   iii. **SeaPhox pH 0.25L/min**
   iv. **pCO_2 [permanent installation onboard] 4L/min**

c. **Raw flow for cooling**
   i. **Salisbury (respiration)** **10 L/min**
   ii. **Mulholland (NPP)** **10 L/min**

Appendix C: Synopses of Individual Projects.

A. Project name: Total Alkalinity (TAlk) and pH
Responsible investigator: Wei-Jun Cai
Cruise participants: Wei Jun Cai (UDel post-doc researcher) and Andrew Joeoef (UDel undergraduate student)

Summary of scientific objectives:

1) Measuring Total Alkalinity (TAlk) on all water samples;
2) Take water samples on a subset of Niskin bottle samples and bring sample home for analysis of DIC. Will compare UGA DIC analysis (based on 0.75 mL sample and a Li-Cor CO_2 analyzer) with the AOML DIC analysis (SOMMA). Such comparison was very favorable in summer 2007.
3) Taking water samples home for Ca^{2+} analysis to examine the role of $CaCO_3$ dissolution and its contribution to TAlk export.
4) Synthesis of TAlk distribution pattern and export flux.

Sampling and Analysis:

1) All hydrocast water samples will be titrated for TAlk on board ship. TAlk samples will be collected from the 10-L Niskin bottles into 250 ml glass-stoppered bottles (no $HgCl_2$ added) and analyzed within 24 hours.
2) A subset of samples will be taken home for analysis. Sample bottle volume is 250-mL. The DIC sample should be taken from the same Niskin bottle that AOML group takes their DIC sample and will be preserved by adding HgCl.
3) On selected transects and stations, we will take water samples for Ca^{2+} analysis. Sample bottle volume is 120-mL.

Location of setup :Starboard wetlab 01 deck

Size/weight of equipment:
The TAlk titrator has a small size of less than 0.3x0.3x0.3 m. We need a bench space of 2-m. We are expecting a total size of 1x1x1m of sample bottle volume for Ca^{2+}.

B. Project name: Ocean color, DOC, POC, HPLC, AOP and IOP
Principal investigators: Joe Salisbury (UNH)
Cruise participants: Marc Emond (UNH), Melissa Melendez (UNH), Shawn Shellito (UNH), NESDIS 1 and NESDIS 2.
Summary of scientific objectives: Ongoing research at UNH seeks to quantify relationships that relate ocean color data to salinity and organic & inorganic carbon parameters. The ultimate objective is space-based algorithms for salinity, organic carbon and the biological parameters related to inorganic carbon perturbations. NESDIS seeks high quality AOP and IOP data for validation of the NPP-VIIRS Sensor
Sampling and Analysis:

1. DOC (50 ml. freeze @ 0C), CDOM (100ml, refrigerate); for DOC and CDOM. These samples will be taken at 2-3 depths within the euphotic layer, filtered and placed in the freezer (DOC) or refrigerator (CDOM).
2. Continuous: surface scattering @660nm, f-chl, f-dom, salinity (Logged on SCS)
3. HPLC*:* Water from the CTD cast will be filtered for pigment analysis using HPLC. As much as 2 liters/sample will be filtered using GF/F filters, which will be cryogenically stored for subsequent HPLC analysis at Goddard.
4. Profiling equipment: Seapoint f-CDOM, and a Wetlabs f-chl fluorometer (each with 6000m endurance) on the Main CTD. A Biospherical scalar irradiance sensor QSP2300 (with a depth

capacity of 1000m) on the Main CTD. NOTE: The QSP2300 must be removed for casts >1000m (estimated removal time is <10 minutes*).*

Location of setup: about 3 m^2 of wet lab space needed for filtration rig; additional space needed to tie down Dewar filled with Liquid N. 10 liter m^{-1} debubbled seawater). ~20 liters of DI water every 3 days for calibration of optical equipment*:*

Size/weight of equipment: <120kg.

C. Project name: Measurement of total dissolved inorganic carbon (DIC) on bottle samples

Principal investigator: Rik Wanninkhof (AOML)

Cruise participants: Charles Featherstone (AOML), Yuanyuan Xu (UDel)

Summary of scientific objectives: DIC is one of the four inorganic carbon system parameters that are used to characterize the oceanic carbon system. Together with the TAlk, pH and inorganic nutrient measurements, the observations will be used to estimate the effect of riverine input, air-sea CO_2 gas exchange, biological productivity and lateral carbon exchange on the coastal carbon dynamics.

Sampling and Analyses: The chemistry group from AOML will measure DIC at the hydrocast stations. DIC samples will be collected from the 10-L Niskin bottles into 250 ml glass-stoppered bottles containing 0.025 mL of a saturated solution of $HgCl_2$ to retard bacterial oxidation of organic matter prior to analysis. DIC samples will be measured by the coulometric titration method and will be done in assigned space 3-4 meters in the wet lab.

D. Project name: Oxygen (O_2) measurements

Principal investigator: Chris Langdon (RSMAS)

Cruise participants: Carlisle Withers (RSMAS)

The AOML amperometric titration equipment will be used. They will be sampling every Niskin from every cast. Including rinses and overflow they will require approximately 500 ml of water.

Summary of scientific objectives: The O_2 measurements are core measurements that will be taken on all bottles of all CTD casts. The main purpose is to elucidate the biogeochemical controls of these parameters in coastal waters. *Sampling and Analysis:* Oxygen samples will be taken in standard volumetric iodine flasks from all Niskin bottles as the first aliquot after the Niskin bottle is opened. Draw temperatures will be taken for all samples.

Location of setup: Starboard Wet Lab 01 deck

E. Project name: Measurement of nutrients (NO_3, NO_2, NH_4, PO_3 and $Si(OH)_4$) on bottle samples

Principal investigator: Jia-Zhong Zhang

Cruise participant: Yuanyuan Xu (UDel)

Summary of scientific objectives: Nitrate, Nitrite, ammonium, phosphate and silicate are major inorganic nutrients that control oceanic primary production and carbon exports. Together with the measurements of inorganic carbon parameters, the observations will be used to estimate the effect of riverine input, air-sea CO_2 gas exchange, biological productivity and lateral carbon exchange on the coastal carbon dynamics.

Sampling and Analyses: A cruise member from UDel will sample and freeze NO_3, NO_2, NH_4, PO_3 and $Si(OH)_4$ concentrations at the hydrocast stations. Nutrient samples will be collected from the 10-L Niskin bottles into 50 ml plastic sampling bottles. Water samples will be equilibrated to room temperature prior to analysis. Nutrient samples will be measured on land at AOML

G. Project name: Apparent optical properties, inherent optical properties and above water reflectance.

Principal investigator: Mike Ondrusek (NESDIS), Joe Salisbury *(UNH)*

Cruise participants: Marc Emond (UNH), Joe Salisbury (UNH), NESDIS1, NESDIS 2

Summary of scientific objectives: Hyperspectral remote sensing reflectance measurements will be collected during daylight hours while on station for regular hydrographic measurements (CTD casts, etc.). This work is being done in support of the calibration and validation of the VIIRS sensor on the new National Polar Orbiting Satellite (http://www.ioccg.org/sensors/viirs.html) and as a complement to data on apparent and inherent optical properties being collected as part of the flow-through sampling system and on the CTD package. The above-water measurements are made with a stand-alone hand-held instrument and require the ability to direct the instrument toward the sky and the water without interference from ship's shadow. Collection of the fifteen spectra needed for each individual measurement takes less than fifteen minutes, often less than five minutes, although some additional time may be required for repeat measurements if optical conditions change during the series (e.g. cloud cover changes, etc). The AOP measurements are from a hand held profiler that must be deployed on the sunny side of the ship. The IOP package will be deployed with the auxiliary winch simultaneous to the AOP measurements. This will take less than 30 minutes per cast.

Location of setup and timing of sampling: Sampling is done from deck in an unshaded area while the ship is stopped. It will 3x/ day from 10AM-2PM local, preferably coincident to CTD stations. The NPP satellite will make one pass per day and, on days when there is clear sky, and a daytime pass, a request might be made to slow or stop the ship to make it possible to collect data for matchup with the satellite observation. The priority for approving such a request is low relative to other mission requirements, but, when possible, is desirable.