

Cruise: AT34 / Mike Behrenfeld. "NAMES" (YR 2).

Dates: May 11 to June 5, 2016.

Vessel: RV Atlantis

## ***General Program Overview:***

### **1. Scientific objectives and activities:**

The North Atlantic Aerosols and Marine Ecosystems Study (NAAMES) is an interdisciplinary investigation addressing two primary science goals: (1) Define environmental and ecological controls on plankton communities and (2) Define linkages between ocean ecosystem properties and biogenic aerosols. Within these two broad goals, the NAAMES investigation focuses on identifying environment-ecosystem-aerosol interdependencies in the climate-sensitive **North Atlantic**. This ocean region hosts the largest annual plankton bloom in the global ocean and its impact on Earth's radiative balance is particularly sensitive to biogenic aerosol emissions. Specific baseline science objectives of NAAMES are to (1) Characterize plankton ecosystem properties during primary phases of the annual cycle in the North Atlantic and their dependence on environmental forcings, (2) Determine how primary phases of the North Atlantic annual plankton cycle interact to recreate each year the conditions for an annual bloom, and (3) Resolve how remote marine aerosols and boundary layer clouds are influenced by plankton ecosystems in the North Atlantic. These objectives are accomplished by coupling autonomous in situ and satellite measurements sustained throughout the NAAMES investigation with short-term, coordinated ship and airborne campaigns that target critical events in the annual plankton cycle and focus on detailed system characterization. These direct observations are integrated with climate-ecosystem modeling to create a process-based understanding that allows improved interpretation of historical data records and improved predictions of future change.

This is the second NAAMES cruise and will be operating in a similar area as the first NAAMES cruise. The goal of this second cruise is to occupy at least 7 sampling stations, although this is understood to be potentially compromised by weather. The exact location of these stations can not be identified at this time as they will likely be targeted on the location of drifters deployed during the first cruise (assuming these drifters are at a reachable distance).

### **Activities:**

The NAAMES investigation has a duration of 5 years and involves 4 field campaigns. This will be Year 2. For this campaign, ship-based measurements will be accompanied by aircraft measurements.

The aircraft will be a NASA C-130 stationed either from Saint John's Bay, Canada, or the Lajes Field in the Azores.

Foreward 02 deck space for four 20 foot atmospheric sampling vans. 01 deck space for a radioisotope van and aerosol storage van.

Station operations will include multiple CTD/Rosette casts, the first of which will be relatively shallow casts (~200 m), followed by a deep cast to ~2000 m.

Optical and other instruments mounted on the rosette for the shallow casts but with depth limits <2000 m will need to be removed before the deep cast.

Following the deep cast, an additional shallow cast will be conducted for final water sampling and underwater light measurements.

Also during station, measurements will be made of downwelling light properties and water leaving radiances.

In addition to daily station occupations, 2 stations will be chosen for long-term measurement series (36-48 h).

SeaSweep will be run off the port side as in 2015.

During the long-term stations, a **surface lagrangian drifter** will be deployed upon arrival at station and then measurements will be conducted over the following occupation while following the trajectory of the drifter.

Once the primary science transect is complete and the northern-most turning point is reached, the return transect will commence, with continuous in-line measurements conducted until the day before port arrival, but no additional station occupations anticipated.

In addition to water sampling and flow through seawater measurements, another key component of the NAAMES investigation is the measurement of aerosols. For this aspect, key measurements will be conducted from the Aerosols Van, located on the forward deck of the ship.

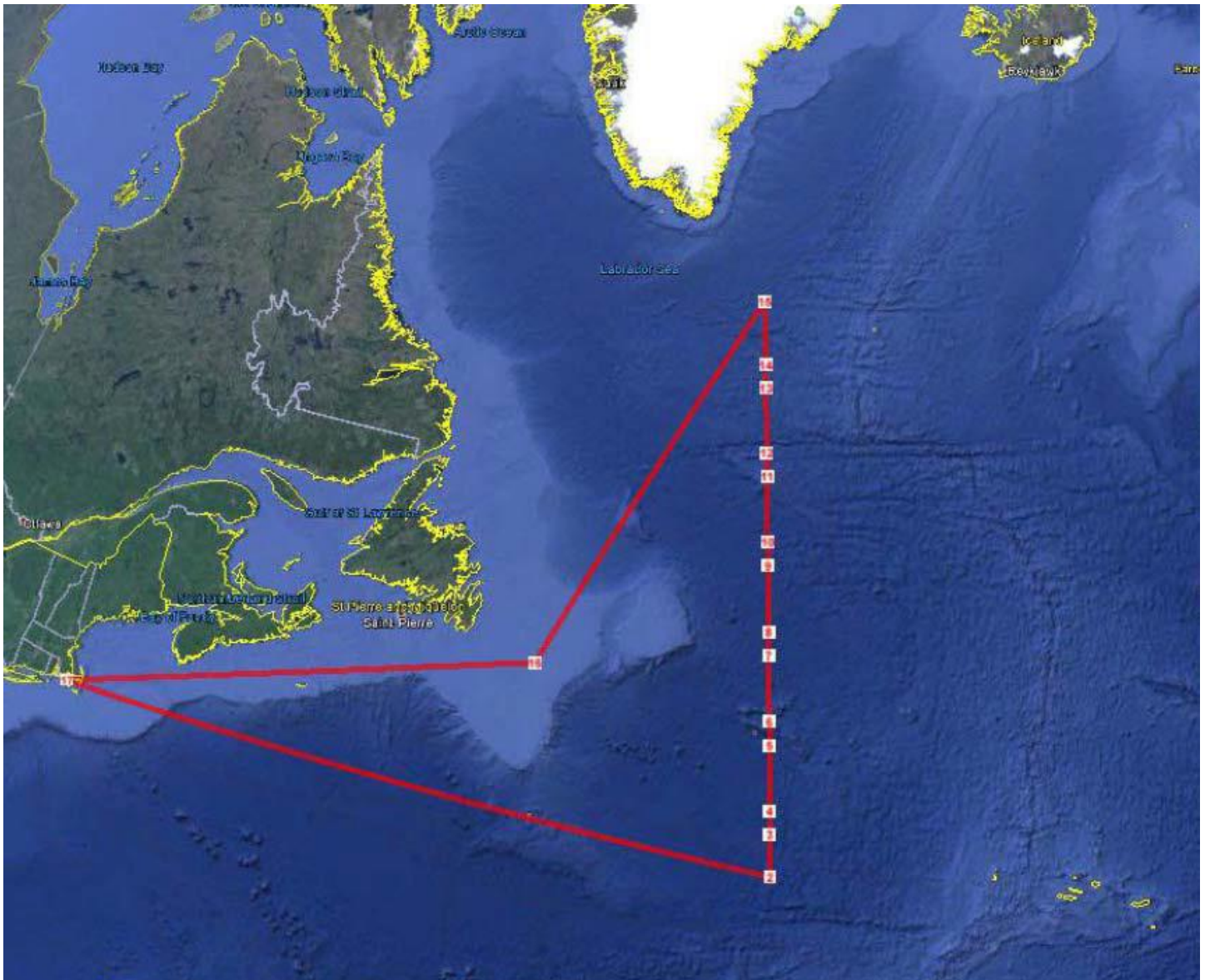
Aerosol measurements are conducted continuously while the wind is from the forward direction.

**Five autonomous profiling floats and surface drifters.** Deployments will occur along the N-S primary latitudinal science transect, with exact location dependent on station location and real-time information on regional mesoscale eddies. Surface drifter deployments will target mesoscale eddy centers and will provide water parcel tracking capabilities that inform flight patterns for the C-130.

Airborne deployments accompanying the ship measurements will focus on the primary N-S latitudinal transect. The airborne measurements include in situ aerosol sampling and remote sensing measurements with a hyperspectral ocean color sensor, a high resolution lidar, a polarimeter, and a downwelling irradiance sensor.

***Aircraft measurements need to be highly coordinated with the ship, so regular communications between the two platforms is essential.*** The NAAMES team gained considerable experience conducting successful ship-aircraft campaigns during the previous 2012 Azores campaign and the 2014 SABOR campaign. Aircraft measurements begin shortly after takeoff, and continue during the transect to the ship. Once arriving at the ship, a diversity of flight patterns are followed to characterize horizontal and vertical variability in ocean ecosystem and aerosol properties. The aircraft transect will also include fly-overs of regions previously sampled by the ship, as tracked by the surface drifters. These drifters essentially provide a 'bread crumb trail' that allows the aircraft to follow changes in system properties well after the ship has departed a given sampling station. Once the primary science measurements are complete along the ship transect, the aircraft returns to base.

2. **Identify other PIs participating in this cruise:**  
Mike Behrenfeld,
3. **Identify the at-sea Chief Scientist:**  
Mike Behrenfeld.
4. **Identify operating area (See cruise synopsis for details):**



Depth range;  
0 -2000 meters

5. **Voyage Dates and Leg #:** May 11 to June 5, 2016 // AT34  
Start Port: Woods Hole, MA.  
End Port: Woods Hole, MA.  
Mobe: May 6<sup>th</sup> = Crane operations  
May 7 & 8 set up but no crew support.  
May 9 & 10, full support and set up.  
Move aboard date is May 10  
Demobe June 6, 7 & 8.  
Science moves off June 6
  
6. **Science party (size) –**  
(32 bunks available for science party)

### ***Pre-cruise and Administrative:***

1. **Diplomatic clearance requirements for operations in EEZs:**  
Greenland and Canada (4 months lead time – Application submitted.)
2. **Financial responsibility:** NASA or NAMES Purchase Order for to be set up.  
(For shore crane, / mobe/demobe, science installation req. RAD and Chem waste disposal, and other cruise logistical expenses)
3. **Personnel forms (Passports, Driver's License, Visas, Entry Fees)**  
Personnel forms are req. 1 month prior to cruise.  
We will need list for foreign collaborators if any.
4. **Any Special Food Requirements (Gluten Free, Vegetarian, Kosher, etc.)**
5. **Berthing Plan - 1 week prior to mobilization;**  
<http://www.whoi.edu/page.do?pid=822>
6. **Lab Layout plan:**  
<http://www.whoi.edu/main/ships/atlantis/lab-science-spaces>

### ***RV ATLANTIS Instrumentation & Technician Support*** **[Shipboard Installed Scientific Equipment]**

1. **General Duties of Marine Technicians (SSSG techs)**  
Scheduled SSSG techs for this cruise are Allison Heater & Catie Graver

Each tech works a 12 hr shift. Techs will train science team w/ CTD deployments & recoveries.

## 2. WHOI general use equipment required for cruise [Installed Scientific Equipment]:

### A. CTD rosette w/ dual T/C Sensors – 24 x 10liter

Bio underwater Par 1000meter, SBE O2 sensor, Wet Labs Flurometer, Wet Labs FLNTURTD. ECO-AFL Flurometer, Seapoint STM Turbidity sensor -*{This is incorporated in the Wet Labs FLNTURTD}*. C\*Star Transmissometer and Wet Labs ECO-AFL flurometer.

Discussion – Science is requesting critical that any black o-rings on the Niskin bottles be replaced with the **orange silicone o-rings**, as the black versions are toxic and will have serious impacts on many of the sensitive biological measurements made during the cruise.

### B. Di H2O – how much / day?

### C. Science Underway Seawater Supply \* incorporate sci instrument inline?

### D. ADCP 75kHz

### E. O2 Titration Sys. – Who will operate this? w/ sample bottles

### F. High Seas Net

### G. Skype

### H. Transmit data to and from Shore on regular basis. SIZE of data?

### I. Communications with C130 Aircraft.

### J. Navigation position / heading readouts.

### K. Met Sensors – all.

### L. Sample storage - 3.2 c/ft 070 freezers, -70 25cu/ft. freezer.

### M. Walk in freezer

### N. Fume Hood

### O. Rad Van w/ scintillation counter.

### P. Electrical power and telephone for visiting lab van on 02 deck fwd (110VAC / 120 Amp).

## 3. Science Party Supplied Equipment:

### A. 2 Aerosol lab vans; 1 from Scripps, one from UNOLS

For the Scripps van, power requirements are 120 amps “clean” continuous power at 110 VAC. Lynn Russel will provide a 408 transformer. For the UNOLS supplied van, power requirements are 25 amps "clean" power and 14.1 amps dirty power at 110 VAC. The UCSC team has an additional 11 amp clean + 11 amp dirty power requirement for their mass spectrometer, but where this source is depends on where the instrument is located (i.e., either in the van or wet lab). A crane is required to load van (15000 lb) onto “feet” bolted to 02 deck. A

crane is again required to load inlet (300 lb) on top of van while it is secured. Two gas cylinders (dry air, standard size) need to be secured external to van (request a 2x2 rack be mounted on deck adjacent to back of van). We would also like to request, if possible, phone installation in the Scripps van (the use of radios is not advised as they interfere with the mass spectrometers in the van)

- B. Emmanuel Boss Seawater Pump (bow thruster room) SPARES
- C. Five Profiling floats / drifters – w/ wooden boxes.
- D. 6 outside incubators - 4 Incubators (Menden team) + 2 incubators (Bidle team(4'x4'x18"))
- E. 2 upright lab incubators (20c/ft @ 110V).?
- F. Gas Chromatograph – into lab van?
- G. Optical Instrument for Sci Seawater Supply line.
- H. Fog water collector (put on rail?)
- I. Titrator (Bidle team?)
- J. Small flow thru incubator (Bidle)
- K. Biospherical C-OPS spectroradiometer package – hand deploy and recover.
- L. BD-Influx Flow Cytometer in analytical lab (Behrenfeld team) w/ compressor and computers.
- M. Electrical cords, tie wraps and water hoses\* science must bring these.
- N. C130 Aircraft.
- O. “OTHER”

## ***Ship [Other Requirements] [Shipboard Equipment/Nav]***

### **1. Science / Ship Operations**

A. Instrument Deployment / Recovery Procedures:

**CTD ops, Glider Ops, float deployments “Bio-Spectro package” hand deployments.**

**SeaSweep, transducer pole, Plankton tow and net drifters**

B. Vans: Three total. 2 vans to 02 deck +1 ship Rad van.

C. Night Operations: **YES.**

D. Deck Safety – Safety Shoes ( X ), Experience ( X )

E. Science personnel have Training/Experience to operate/deploy gear.

F. Lab Safety – PPE ( **X** ), Lab Training ( **X** ) Spill Kits ( **X** )

G. Hazardous Material- Please Fill out HAZMAT INVENTORY FORM

[Weight, bulk, chemical, pres.] Types?

<http://www.who.edu/sbl/liteSite.do?litesiteid=7092&articleId=10875>

- Chemicals & Compressed Gases? **Yes**. See synopsis.
- Spill Kit
- Loading and waste removal logistics. **Load in WHOI / Remove WHOI.**

I. Isotope Use [Isotope Use Approval] – **none req.**

<http://ehs.who.edu/ehs/DesktopDefault.aspx?tabindex=2&tabid=5&itemID=543>

2. Policies: (speed, departure/arrival times, moving aboard, etc
3. Ship Navigation
4. Communication (voice, fax, e-mail)
5. Equipment
  - a. Cranes ( **X** )
  - b. Oceanographic winches: Hydro ( **X** ), Trawl ( ),
  - c. CTD ( **X** )
  - d. Electrical power ( **X** )

## ***Cruise Logistics***

1. Shipping gear to and from vessel. Shipping Address:

TO: Master RV ATLANTIS  
Attn: Eric Benway ***and Scientist Name*** – AT34  
Woods Hole Oceanographic Institution  
266 Woods Hole Road  
Woods Hole, MA. 02543

2. Agent Information:

Eric Benway  
Marine Operations Coordinator  
Woods Hole Oceanographic Institution

266 Woods Hole Road MS 37  
Woods Hole Ma. 02543

Email: [ebenway@whoi.edu](mailto:ebenway@whoi.edu)

Tel: 508-289-3770

Fax: 508-457-2185

<http://www.whoi.edu/main/cruise-planning>

**PLEASE COPY ERIC BENWAY ON ALL COMMUNICATIONS Re. Shipping.**

### ***Post-Cruise Responsibilities***

1. Actions departing ship.
  - a. **CLEAN** your work areas, cabins and heads before disembarking.
  - b. **LABEL** all items being shipped to WHOI and from WHOI.
  
2. UNOLS cruise evaluation [Chief Scientist & Master] – **UNOLS PCA.**
3. Reports to foreign government/State Department [required for work in EEZs]
  - **Preliminary Report for Canada 30 days after completion of cruise.**
4. Data delivery [shipboard underway data].
5. Data archiving policy:

All data on a WHOI Cruise Data Distribution (which includes all underway data) will, by default be considered publicly available once a copy of it has been delivered to the chief scientist at the end of the cruise. Please review the Cruise Assignment of Data Access Protection