

DRAFT CRUISE INSTRUCTIONS

FOCI

NOAA Ship *MILLER FREEMAN*, MF-02-06
May 12 – May 21, 2002
Chief Scientist: Morgan Busby

1.0 DRAFT CRUISE INSTRUCTIONS

1.1 Cruise Title – Fisheries-Oceanography Coordinated Investigations (FOCI).

1.2 Cruise Numbers:

1.2.1 Cruise Number – MF-02-06

1.2.2 FOCI Number – 3MF02

1.3 Cruise Dates:

1.3.1 Departure – Depart Dutch Harbor, Alaska, at 1500 on May 12, 2002.

1.3.2 Arrival – Arrive Dutch Harbor, Alaska, at 0800 on May 21, 2002

2.0 CRUISE OVERVIEW

2.1 Cruise Objectives – We will be conducting an ichthyoplankton survey in the Bering Sea in the vicinity of Unimak Island, Alaska. This work is needed to describe larval fish assemblages in the Bering Sea (slope, outer shelf, and middle shelf) in spring. Zooplankton data and data on physical characteristics of the water column will also be collected.

2.2 Applicability – These instructions, with ***FOCI Standard Operating Instructions for NOAA Ship MILLER FREEMAN***, dated February 4, 2002, present complete information for this cruise.

2.3 Operating Area –Southeastern Bering Sea

2.4 Participating Organizations

NOAA – Alaska Fisheries Science Center (AFSC)
7600 Sand Point Way N.E., Seattle, Washington 98115-0070

2.5 Personnel

2.5.1 Chief Scientist

| Name | Gender | Affiliation | E-mail Address |
|--------------------------------|---------------|--------------------|--|
| Morgan Busby (206) 526-4113 | Male | AFSC | Morgan.Busby@noaa.gov |

2.5.2 Participating Scientists

| Name | Gender | Affiliation | E-mail Address |
|------------------------|---------------|--------------------|--|
| Morgan Busby | Male | AFSC | Morgan.Busby@noaa.gov |
| Debbie Blood | Female | AFSC | Debbie.Blood@noaa.gov |
| Christina Deliyianides | Female | AFSC | Christina.Deliyanides@noaa.gov |
| Ann Matarese | Female | AFSC | Ann.Matarese@noaa.gov |
| Kathy Mier | Female | AFSC | Kathy.Mier@noaa.gov |
| Susan Picquelle | Female | AFSC | Susan.Picquelle@noaa.gov |

2.6 Administrative

2.6.1 Ship Operations

Marine Operations Center, Pacific
1801 Fairview Avenue East, Seattle, Washington 98102-3767
Telephone: (206) 553-4548, Fax: (206) 553-1109

Commander Timothy B. Wright, NOAA
Chief, Operations Division (MOP1)
Telephone: (206) 553-8705, Cellular: (206) 390-7527
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2.6.2 Scientific Operations

Dr. Phyllis J. Stabeno, PMEL
Telephone: (206) 526-6453
E-mail: Phyllis.Stabeno@noaa.gov

Dr. Jeffrey Napp, AFSC
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3.0 OPERATIONS

3.1 Data To Be Collected – A goal of the FOCI program is to identify the physical and biological factors that underlie ecosystem change and to understand how those factors interact. One focus is the effects of perturbations at lower trophic levels. To this end, we will collect ichthyoplankton and zooplankton data using 60-cm Bongo nets (60BON) and 20-cm Bongo

nets (20BON), a Neuston net, and CalVET nets. Rough counts from 60BON Net 2 will be used to provide immediate estimates of larval walleye pollock distribution and abundance in the survey area. We will collect data on the physical environment using the Sea-Bird Electronics SBE 19 SEACAT Profiler to relate larval assemblage structure to environmental variables (temperature, salinity). Sea-Bird Electronics SBE 911*plus* CTD casts will collect physical data as well as data on nutrients, microzooplankton, and chlorophyll. This cruise will provide new information on larval fish assemblages on the Bering Sea shelf in the spring. Samples will be collected from a grid of approximately 75 stations.

Note: It is possible that not all stations from this grid will be occupied.

- 3.1.1 Scientific Computer System (SCS)** – The ship's SCS shall operate throughout the cruise, acquiring and logging data from navigation, meteorological, oceanographic, and fisheries sensors. See *FOCI Standard Operating Instructions for NOAA Ship MILLER FREEMAN* (SOI 5.2) for specific requirements.
- 3.2 Staging Plan** – The majority of the equipment necessary for the cruise will be loaded onto the NOAA ship *MILLER FREEMAN* before the ship's departure from Seattle, Washington, on April 21, 2002. We will use the chemistry lab, the rough lab, and the slime lab for sample and equipment preparation and request as much counter and cabinet space as possible. We will use DataPlot for CTD and SEACAT operations.
- 3.3 De-staging Plan** – Samples and gear will remain on board the ship until the completion of cruise MF-02-07 where the samples will be offloaded in Kodiak, Alaska, on June 1, 2002. Sampling equipment will remain on board, in the hold, for use during cruise MF-02-11.
- 3.4 Cruise Plan** – The cruise will depart from Dutch Harbor, Alaska, at 1500 on May 12, 2002, and occupy a series of approximately 75 stations on the Bering Sea FOCI grid. The first station is located immediately outside of Dutch Harbor, Alaska. Station positions and a chartlet of the working area are located in sections **9.2 Tables** and **9.3 Figures**, respectively.

At every station, a Neuston net will be deployed first to collect fish larvae in the surface layer. Samples from the Neuston net gear will be preserved in 1.8% buffered Formaldehyde.

Following completion of the neuston tow, a MARMAP Bongo tow (SOI 3.2.2) will be conducted. The SBE 19 SEACAT, the 20-cm Bongo net with 0.150-mm mesh netting and the 60-cm Bongo net with 0.333-mm mesh netting will all be mounted together for this tow. Bongo tows will be to a depth of 300 meters, or to 10 meters off bottom, whichever is deeper. The sample from 60BON Net 1 will be preserved in its entirety in 1.8% buffered Formaldehyde, and the sample from Net 2 will be sorted for walleye pollock and other ichthyoplankton and the stored fraction will be preserved in 95% Ethanol. The sample from 20BON Net 1 will be preserved in its entirety in 1.8% buffered Formaldehyde; the sample from Net 2 will be discarded.

Selected stations have been chosen for CTD casts to collect water samples for microzooplankton, chlorophyll, and nutrient data (SOI 3.2.1). At these stations, the CTD cast will precede the MARMAP Bongo tow. CTD casts will be made to 300 meters, or to 10 meters off bottom, whichever is deeper.

Selected stations have also been chosen for CalVET tows (SOI 3.2.6). At these stations, the CalVET tow with 0.053-mm mesh netting will follow the MARMAP Bongo tow. The CalVET tows, both nets combined, will be preserved in 1.8% buffered Formaldehyde.

3.5 Station Locations – See section **9.2 Tables**.

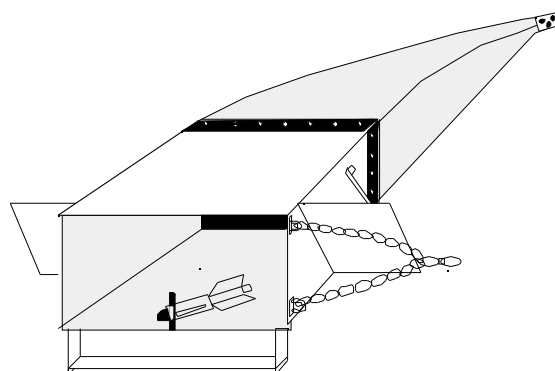
3.6 Station Operations – The following are operations to be conducted on this cruise. The procedures for these operations are listed in the ***FOCI Standard Operating Instructions for NOAA Ship MILLER FREEMAN*** (SOI). Operations not addressed in the SOI are addressed below.

- CTD/Water Samples Operations (SOI 3.2.1),
- MARMAP Bongo Tows (SOI 3.2.2),
- CalVET Net Tows (SOI 3.2.6), and
- Chlorophyll Sampling Operations (SOI 3.2.10).

3.6.1 Neuston Net Tows

3.6.1.1 Description –

Neuston nets are used for sampling the upper few centimeters of the water column. There are many frame styles that may be used; however, we use a Sameoto sampler made of stainless steel. The mouth opening is 30-cm x 50-cm and is designed to fish half in and half out of the water.



Sameoto Neuston Sampler

3.6.1.2 Assembly – If the frame is not already put together, some assembly will be required. There are two wings that need to be matched up to the holes on the frame and bolted on. Then bolt on the struts that reinforce the wings. There are a series of holes on the aft end of the frame that the net attaches to with metal straps and bolts. If the net does not already have holes, make them. Slide the net over the frame in the position to be used and use a marking pen to indicate where holes are to be made. Remove and cut holes using scissors, reattach the net, and secure with the metal straps and bolts. The Sameoto sampler is designed to be towed from the side to provide an unobstructed mouth opening. Make sure the towing chain (bridle) is connected to the proper side of the frame, depending on which side of the ship you are sampling from. Some repositioning of the swivel on the tow chain may be required to provide a proper attitude of the frame, ideally it should fish half in and half out of the water. The flow meter is attached with a special bolt to

the bottom of the frame, just back from the mouth opening. Remove the lanyard pin from behind the nosecone of the flow meter by unscrewing the nosecone and backing off the screw that is holding the pin in place. Place flow meter on pin, making sure the window for reading the revolutions is facing up, and attach.

Note – It may prove helpful, and safer, to attach a long tagline to the frame to assist in getting the frame on board. In heavy winds, the sampler tends to act as a kite.

3.6.1.3 Rates/Fishing – The vessel should be moving ahead slowly, about 1.5 to 2.0 knots so that the net is fishing half in and half out of the water. The exact speed is a learning process and may vary with sea conditions. Lower the Neuston net to the surface and pay out 10-15 meters of wire. It may be necessary to adjust the ship's speed to maintain the proper skimming action. Start the stopwatch when the net starts to fish and tow the net for ten minutes, unless otherwise instructed. Advise winch operator when time is nearly up and retrieve when ready. Read and record flow meter revolutions, time of tow, and any comments.

3.6.1.4 Preservation – The Neuston sample should be preserved immediately, as specified in the **FOCI Field Manual** or sample collection request forms.

3.6.1.5 Maintenance – Check net for holes and fill flow meter with water.

3.7 Underway Operations – The following underway operations are to be conducted during this cruise. The procedures for these operations are listed in the **FOCI Standard Operating Instructions for NOAA Ship MILLER FREEMAN** (SOI).

- Scientific Computer System (SCS) data acquisition (SOI 5.2),
- Fluorometer monitoring (SOI 5.3), and
- Thermosalinograph monitoring (SOI 5.3).

3.8 Applicable Restrictions – None

3.9 Small Boat Operations – None

4.0 FACILITIES

Equipment and Capabilities Provided by Ship

- Oceanographic winch with slip rings and 3-conductor cable terminated for CTD,
- Manual wire angle indicator,
- Oceanographic winch with slip rings and 3-conductor cable terminated for the SBE SEACAT, for net tow operations,
- Sea-Bird Electronics' SBE 911*plus* CTD system with stand, each CTD system should include underwater CTD, weights, and pinger. There should be one deck unit and tape recorder for the two systems,
- 10-liter Niskin sampling bottles for use with rosette (10 plus 4 spares),
- AUTOSAL salinometer, for CTD field corrections,
- Sea-Bird Electronics' SBE-19 SEACAT system,

- Meter block for plankton tows,
- Wire speed indicators and readout for quarterdeck winches,
- For meteorological observations: 2 anemometers (one R. M. Young system interfaced to the SCS), calibrated air thermometer (wet-and dry-bulb) and a calibrated barometer and/or barograph,
- Freezer space for storage of biological and chemical samples (blast freezer -20°C),
- Bench space in DataPlot for PCs, monitor, printer,
- Use of Pentium PC in DataPlot for data analysis,
- Scientific Computer System (SCS),
- Removable stern platform in place,
- Laboratory space with exhaust hood, sink, lab tables, and storage space,
- Sea-water hoses and nozzles to wash nets on quarterdeck and aft deck,
- Adequate deck lighting for night-time operations,
- Navigational equipment including GPS and radar,
- Safety harnesses for working on quarterdeck and fantail, and
- Ship's crane(s) used for loading and/or deploying.

4.1 Equipment and Capabilities Provided by Scientists

- Sea-Bird Electronics' SBE 911*plus* CTD system to be used with PMEL stand (**primary system**),
- Sea-Bird Electronics' SBE-19 SEACAT system (**primary system**),
- PMEL PC with SEASOFT software for CTD data collection and processing,
- Fluorometer and light meter to be mounted on CTD,
- CTD stand modified for attachment of fluorometer
- Conductivity and temperature sensor package to provide dual sensors on the primary CTD,
- CTD rosette sampler,
- IAPSO standard water,
- 60-cm Bongo sampling arrays,
- 20-cm Bongo arrays,
- Neuston net array
- CalVET net array,
- Spare wire angle indicator,
- Scientific ultra-cold freezer (-80°C),
- Miscellaneous sampling processing equipment, and
- Cruise Operations Database (COD) and forms.

5.0 DISPOSITION OF DATA AND REPORTS

5.1 The following data products will be included in the cruise data package:

- **NOAA Form 77-13d – Deck Log – Weather Observation Sheets,**
- Electronic Marine Operations Abstracts,
- SCS backup (SCS, TSGF, and ASCII) – recordable compact diskette (CD-RW),
- Calibration Sheets for all ship's instruments used,
- CTD Cast Information/Rosette Log,
- CTD VHS videocassettes
- Autosalinometer logs,
- Electronic Navigation suite's export files on diskette, and
- Ultra-cold Freezer Temperature Daily Log (SOI 5.4).

5.2 Pre- and Post-cruise Meetings – Cruise meetings may be held in accordance with **FOCI Standard Operating Instructions for NOAA Ship MILLER FREEMAN** (SOI 5.5).

6.0 ADDITIONAL PROJECTS

6.1 Definition – Ancillary and piggyback projects are secondary to the objectives of the cruise and should be treated as additional investigations. The difference between the two types of secondary projects is that an ancillary project does not have representation aboard and is accomplished by the ship's force.

6.2 Ancillary Projects – Any ancillary work done during this project will be accomplished with the concurrence of the Chief Scientist and on a not-to-interfere basis with the programs described in these instructions and in accordance with the **NOAA Fleet Standing Ancillary Instructions**.

6.3 Piggyback Projects – None

7.0 HAZARDOUS MATERIALS – All scientific staff on board **NOAA Ship MILLER FREEMAN** for this cruise have been properly trained for spill response and may be contacted in the event of an accidental spill.

7.1 Inventory

| Chemical | Amount | Neutralizer | Contact |
|----------------------------------|----------------------|--------------------|----------------|
| 37 % Formaldehyde | 3 x 20-Liter Buckets | Spill Kit | Busby |
| Sodium Borate | 500-g | Dust Pan/Water | Busby |
| 95% Reagent Alcohol | 1 x 20-Liter Carboy | 3-M Sorbent Pads | Busby |
| Saturated Sodium Borate Solution | 1 x 20-Liter Carboy | See Note | Busby |

Note – Saturated Sodium Borate Solution is a non-regulated substance by the Department of Transportation (DOT) and does not have Material Data Safety Sheets (MSDS).

7.2 Material Safety Data Sheet (MSDS) – Submitted separately.

8.0 MISCELLANEOUS

8.1 Communications – Specific information on how to contact the **NOAA Ship MILLER FREEMAN** and all other fleet vessels can be found at:

<http://www.pmc.noaa.gov/phone.htm>

8.2 Important Telephone and Facsimile Numbers and E-mail Addresses

8.2.1 Pacific Marine Environmental Laboratory (PMEL):

FOCI – Ocean Environmental Research Division (OERD2):

- (206) 526-4700 (voice)
- (206) 526-6485 (fax)

Administration:

- (206) 526-6810 (voice)
- (206) 526-6815 (fax)

E-Mail: FirstName.LastName@noaa.gov

8.2.2 Alaska Fisheries Science Center (AFSC):

FOCI – Resource Assessment and Conservation Engineering (RACE):

- (206) 526-4171 (voice)
- (206) 526-6723 (fax)

E-Mail: FirstName.LastName@noaa.gov

8.2.3 NOAA Ship *MILLER FREEMAN* – Telephone methods listed in order of increasing expense:

Homeport – Seattle, Washington:

- (206) 553-4589
- (206) 553-4581
- (206) 553-8344

United States Coast Guard – Kodiak, Alaska

- (907) 487-9752
- (907) 487-9753
- (907) 487-4397
- (907) 487-4398

Cellular:

- (206) 660-7167

INMARSAT Mini-M

- 011-872-761-267-346 (voice/PBX)
- 011-872-761-267-347 (voice)
- 011-872-761-267-348 (fax)

INMARSAT B

- 011-872-330-394-113 (voice)
- 011-872-330-394-114 (fax)

E-Mail: NOAA.Ship.Miller.Freeman@noaa.gov (mention the person's name in SUBJECT field)

8.2.4 Marine Operations Center, Pacific (MOP):

Operations Division (MOP1)

- (206) 553-4548 (voice)
- (206) 553-1109 (facsimile)

E-Mail: FirstName.LastName@noaa.gov

E-Mail to Radio Room: Radio.Room@noaa.gov

9.0 APPENDICES

9.1 Equipment Inventory

| Equipment | Quantity | Dimension | Weight |
|--------------------------------|--------------|-----------------|-------------|
| Larval Supply Trunks | 1 | 20" x 22" x 36" | 80-lbs |
| Microzooplankton Supply Trunks | 2 | 20" x 22" x 36" | 90-lbs (ea) |
| Formaldehyde Containers | 3 x 20-Liter | | 40-lbs (ea) |
| Carboy, 95% Reagent Alcohol | 1 x 20-Liter | | 40-lbs |
| Miscellaneous Gear Trunks | 4 | 20" x 22" x 36" | 80-lbs (ea) |
| 60-cm Bongo Frame | 1 | 8" x 26" x 60" | |
| 20-cm Bongo Frame | 1 | 8" x 14" x 16" | |
| CalVET Frame | 1 | 24" x 18" x 18" | 5-lbs |
| Cases, Glass Jars, 32-oz | 30 cases | 8" x 12" x 15" | 50-lbs |
| Cases, Glass Jars, 8-oz | 10 cases | 4" x 6" x 8" | 8-lbs |

9.2 Tables

Table 1 – MF-02-06 Station Locations

| Grid Designation | Station | Lat (Deg) | Lat (Min) | Lon (Deg) | Lon (Min) | Lat (dd) | Lon (dd) |
|-------------------------|---------|-----------|-----------|-----------|-----------|----------|-----------|
| Depart Dutch Harbor, AK | 0 | 53 | 54.498 | 166 | 30.900 | 53.9083 | -166.5150 |
| BM1 | 1 | 54 | 0.660 | 166 | 35.418 | 54.0110 | -166.5903 |
| BM4 | 2 | 54 | 13.848 | 166 | 47.634 | 54.2308 | -166.7939 |
| BP4 | 3 | 54 | 6.690 | 167 | 10.320 | 54.1115 | -167.1720 |
| BP7 | 4 | 54 | 19.878 | 167 | 22.572 | 54.3313 | -167.3762 |
| BM7 | 5 | 54 | 27.042 | 166 | 59.916 | 54.4507 | -166.9986 |
| BJ7 | 6 | 54 | 34.200 | 166 | 37.200 | 54.5700 | -166.6200 |
| BG7 | 7 | 54 | 41.364 | 166 | 14.412 | 54.6894 | -166.2402 |
| BD7 | 8 | 54 | 48.522 | 165 | 51.564 | 54.8087 | -165.8594 |
| BA7 | 9 | 54 | 55.686 | 165 | 28.644 | 54.9281 | -165.4774 |
| AX7 | 10 | 55 | 2.844 | 165 | 5.658 | 55.0474 | -165.0943 |

| Grid Designation | Station | Lat (Deg) | Lat (Min) | Lon (Deg) | Lon (Min) | Lat (dd) | Lon (dd) |
|-------------------------|----------------|------------------|------------------|------------------|------------------|-----------------|-----------------|
| AU7 | 11 | 55 | 10.008 | 164 | 42.600 | 55.1668 | -164.7100 |
| AR7 | 12 | 55 | 17.166 | 164 | 19.476 | 55.2861 | -164.3246 |
| AO7 | 13 | 55 | 24.330 | 163 | 56.280 | 55.4055 | -163.9380 |
| AL7 | 14 | 55 | 31.488 | 163 | 33.018 | 55.5248 | -163.5503 |
| AI7 | 15 | 55 | 38.652 | 163 | 9.678 | 55.6442 | -163.1613 |
| AF7 | 16 | 55 | 45.810 | 162 | 46.272 | 55.7635 | -162.7712 |
| AF10 | 17 | 55 | 58.998 | 162 | 59.034 | 55.9833 | -162.9839 |
| AI10 | 18 | 55 | 51.840 | 163 | 22.404 | 55.8640 | -163.3734 |
| AL10 | 19 | 55 | 44.676 | 163 | 45.702 | 55.7446 | -163.7617 |
| AO10 | 20 | 55 | 37.518 | 164 | 8.928 | 55.6253 | -164.1488 |
| AR10 | 21 | 55 | 30.354 | 164 | 32.088 | 55.5059 | -164.5348 |
| AU10 | 22 | 55 | 23.196 | 164 | 55.176 | 55.3866 | -164.9196 |
| AX10 | 23 | 55 | 16.032 | 165 | 18.192 | 55.2672 | -165.3032 |
| BA10 | 24 | 55 | 8.874 | 165 | 41.142 | 55.1479 | -165.6857 |
| BD10 | 25 | 55 | 1.710 | 166 | 4.020 | 55.0285 | -166.0670 |
| BG10 | 26 | 54 | 54.552 | 166 | 26.838 | 54.9092 | -166.4473 |
| BJ10 | 27 | 54 | 47.388 | 166 | 49.584 | 54.7898 | -166.8264 |
| BM10 | 28 | 54 | 40.230 | 167 | 12.270 | 54.6705 | -167.2045 |
| BP10 | 29 | 54 | 33.066 | 167 | 34.884 | 54.5511 | -167.5814 |
| BP13 | 30 | 54 | 46.254 | 167 | 47.262 | 54.7709 | -167.7877 |
| BM13 | 31 | 54 | 53.418 | 167 | 24.684 | 54.8903 | -167.4114 |
| BJ13 | 32 | 55 | 0.576 | 167 | 2.040 | 55.0096 | -167.0340 |
| BG13 | 33 | 55 | 7.740 | 166 | 39.330 | 55.1290 | -166.6555 |
| BD13 | 34 | 55 | 14.898 | 166 | 16.548 | 55.2483 | -166.2758 |
| BA13 | 35 | 55 | 22.062 | 165 | 53.706 | 55.3677 | -165.8951 |
| AX13 | 36 | 55 | 29.220 | 165 | 30.798 | 55.4870 | -165.5133 |
| AU13 | 37 | 55 | 36.384 | 165 | 7.812 | 55.6064 | -165.1302 |
| AR13 | 38 | 55 | 43.542 | 164 | 44.766 | 55.7257 | -164.7461 |
| AO13 | 39 | 55 | 50.706 | 164 | 21.648 | 55.8451 | -164.3608 |
| AL13 | 40 | 55 | 57.864 | 163 | 58.458 | 55.9644 | -163.9743 |
| AI13 | 41 | 56 | 5.028 | 163 | 35.202 | 56.0838 | -163.5867 |
| AF13 | 42 | 56 | 12.186 | 163 | 11.874 | 56.2031 | -163.1979 |
| AF16 | 43 | 56 | 25.380 | 163 | 24.786 | 56.4230 | -163.4131 |
| AL16 | 44 | 56 | 11.058 | 164 | 11.058 | 56.1843 | -164.1843 |
| AR16 | 45 | 55 | 56.736 | 164 | 57.516 | 55.9456 | -164.9586 |
| AX16 | 46 | 55 | 42.414 | 165 | 43.470 | 55.7069 | -165.7245 |
| AU19 | 47 | 56 | 2.760 | 165 | 33.312 | 56.0460 | -165.5552 |
| AO19 | 48 | 56 | 17.082 | 164 | 47.304 | 56.2847 | -164.7884 |
| AI19 | 49 | 56 | 31.404 | 164 | 1.020 | 56.5234 | -164.0170 |

| Grid Designation | Station | Lat (Deg) | Lat (Min) | Lon (Deg) | Lon (Min) | Lat (dd) | Lon (dd) |
|----------------------------|----------------|------------------|------------------|------------------|------------------|-----------------|-----------------|
| AC19 | 50 | 56 | 45.726 | 163 | 14.454 | 56.7621 | -163.2409 |
| AC16 | 51 | 56 | 32.538 | 163 | 1.428 | 56.5423 | -163.0238 |
| AC13 | 52 | 56 | 19.350 | 162 | 48.474 | 56.3225 | -162.8079 |
| AC10 | 53 | 56 | 6.162 | 162 | 35.598 | 56.1027 | -162.5933 |
| AC7 | 54 | 55 | 52.974 | 162 | 22.794 | 55.8829 | -162.3799 |
| AF4 | 55 | 55 | 32.622 | 162 | 33.582 | 55.5437 | -162.5597 |
| AI4 | 56 | 55 | 25.458 | 162 | 57.024 | 55.4243 | -162.9504 |
| AL4 | 57 | 55 | 18.300 | 163 | 20.400 | 55.3050 | -163.3400 |
| AO4 | 58 | 55 | 11.136 | 163 | 43.704 | 55.1856 | -163.7284 |
| AR4 | 59 | 55 | 3.978 | 164 | 6.936 | 55.0663 | -164.1156 |
| AU4 | 60 | 54 | 56.814 | 164 | 30.096 | 54.9469 | -164.5016 |
| AX4 | 61 | 54 | 49.656 | 164 | 53.190 | 54.8276 | -164.8865 |
| BA4 | 62 | 54 | 42.492 | 165 | 16.218 | 54.7082 | -165.2703 |
| BA1 | 63 | 54 | 29.304 | 165 | 3.852 | 54.4884 | -165.0642 |
| Unimak Pass G | 64 | 54 | 27.642 | 165 | 0.828 | 54.4607 | -165.0138 |
| Unimak Pass F | 65 | 54 | 26.142 | 165 | 5.292 | 54.4357 | -165.0882 |
| Unimak Pass E | 66 | 54 | 24.900 | 165 | 9.012 | 54.4150 | -165.1502 |
| Unimak Pass D | 67 | 54 | 23.778 | 165 | 13.122 | 54.3963 | -165.2187 |
| Unimak Pass C | 68 | 54 | 22.290 | 165 | 17.058 | 54.3715 | -165.2843 |
| Unimak Pass B | 69 | 54 | 20.952 | 165 | 20.952 | 54.3492 | -165.3492 |
| Unimak Pass A | 70 | 54 | 19.782 | 165 | 24.432 | 54.3297 | -165.4072 |
| BD1 | 71 | 54 | 22.146 | 165 | 26.844 | 54.3691 | -165.4474 |
| BD4 | 72 | 54 | 35.334 | 165 | 39.174 | 54.5889 | -165.6529 |
| BG4 | 73 | 54 | 28.170 | 166 | 2.058 | 54.4695 | -166.0343 |
| BG1 | 74 | 54 | 14.982 | 165 | 49.770 | 54.2497 | -165.8295 |
| BJ1 | 75 | 54 | 7.824 | 166 | 12.624 | 54.1304 | -166.2104 |
| BJ4 | 76 | 54 | 21.012 | 166 | 24.882 | 54.3502 | -166.4147 |
| BM1 | 1 | 54 | 0.660 | 166 | 35.418 | 54.0110 | -166.5903 |
| Arrive Dutch Harbor, AK | 0 | 53 | 54.498 | 166 | 30.900 | 53.9083 | -166.5150 |

9.3 Figures

Figure 1 – MF-02-06 Station Locations

