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Project Plan No. 8-69

for

FASOR III CRUISE (U)

10 February 1969 – 1 September 1969.

Naval Undersea Warfare Center San Diego, California 92132

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DEPARTMENT OF THE NAVY
NAVAL UNDERSEA WARFARE CENTER
SAN DIEGO DIVISION
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SAN DIEGO, CALIFORNIA 92152

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IN REPLY REFER TO:
60:CRH:mb
SF 11 552 001
Task 11290
(NUWC L108)
Ser 60-015

2 JAN 1969

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From: Commander, Naval Undersea Warfare Center
To: Distribution List

Subj: Project Plan for FASOR III, "Forward Area Sonar Research III" (CNO Project F/R 108); forwarding of

Encl: (1) NUWC Project Plan No. 8-69 for FASOR III Cruise

1. The Project Plan for the conduct of the FASOR III under CNO project F/R 108 is forwarded as enclosure (1). The detailed operations schedule (Annex A) is preliminary and will be modified as final details become known.

2. Distribution list addressees are invited to review the subject test plan and comments are welcomed. These should be forwarded to: Dr. C. R. Haupt (Code 60), Naval Undersea Warfare Center, San Diego, California 92132 prior to 15 January 1969.

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NAVAL UNDERSEA WARFARE CENTER

FASOR III PROJECT PLAN

CNO PROJECT F/R 108

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LIST OF KEY WORDS AND ABBREVIATIONS

FASOR	Forward Area Sonar Research
F/R	Fleet Research Project
NUWC	Naval Undersea Warfare Center, San Diego, California
RANEL	Royal Australian Navy Experimental Laboratory, Sydney, Australia
BAYA	USS BAYA (AGSS-318) attached to COMSUBDEVGRU ONE, San Diego, California
DAVIS	USNS CHARLES H. DAVIS (AGOR-5) attached to MSTSPAC in San Francisco, California
DIAMANTINA	HMAS DIAMANTINA attached to Royal Australian Navy
OTWAY	HMAS OTWAY attached to Royal Australian Navy
OCE	Officer Conducting the Exercise (C.O., USS BAYA)
SIC	Scientist-in-Charge - The SIC aboard BAYA has overall responsibility for the conduct of the scientific program.

NAVAL UNDERSEA WARFARE CENTER

FASOR III PROJECT PLAN

CNO PROJECT F/R 108

Section 1

PURPOSE

1. The principal purpose of this project is to extend the ocean investigations pertinent to long range active sonars using convergence zone and bottom reflected paths to additional ocean areas in Southeast Asia that are of importance. These investigations will include:

a. Compiling of noise and propagation data applicable to both active and passive systems, and the obtaining of all necessary supporting environmental and oceanographic data including bottom structure and bottom loss measurements.

b. Continuation of the collection of data for classification studies.

c. Compiling of reverberation data.

d. Obtaining ambient noise measurements.

e. Operation of a low frequency source for special acoustic transmission tests.

2. CNO Confidential letter Ser 060871 of 18 June 1968 fully discusses the background and goals to be achieved during the FASOR III cruise.

Section 2

PREVIOUS WORK AND BACKGROUND

1. FASOR III tests and procedures are a continuation of and similar to those conducted during FASOR I and II. Some modifications have been made to take advantage of improved equipment and instrumentation which has become available. Additionally, the FASOR III effort has been expanded to include units of the Australian Navy. This cooperative enterprise will provide for joint submarine/surface ship operations and will be advantageous to both countries.

2. FASOR III is scheduled to begin 10 February 1969 and will require approximately seven months for completion. Geographic areas are chosen for their operational and acoustic significance. These areas will include regions of deep, intermediate, and shallow water. The FASOR III at sea operations should be completed about 25 August 1969.

Section 3

DESCRIPTION OF EQUIPMENT

1. The equipment on BAYA is essentially as described in NEL Confidential letter SF 101 03 06, Task 8016 (NEL E1-3) Ser 3110-031 of 20 May 1964 and in NEL Report 1060. Supplemental changes in the equipment are described in NEL Confidential letter SF 101 03 15, Task 11290 (NEL L10851) Ser 3110-06 of 2 March 1965 and in NEL Confidential letter SF 11 121 100, Task 11197 (NUWC E119) Ser 603-028 of 29 August 1968. More recent changes include: An Active Signal Processor (ASP) installed in November 1968. It replaces the existing AN/BQS-5 equipment between the beamformer and the computer, including the Bearing Data Encoder presently used for signal level measurement. It utilizes the capability of the BAYA transmitter, now proven, to handle signal bandwidths as great as 300 Hz centered at 1500 Hz. For additional details of equipment aboard BAYA see CNO Confidential letter Ser 060871 of 18 June 1968.

2. The CHARLES H. DAVIS carries a modern and complete suit of oceanographic equipments with computer-aided facilities for data analysis. She will again carry NUWC (SD) manufactured echo repeaters and transponders which BAYA will use as standard targets in echo ranging tests and as acoustic sources of known strength for reciprocal transmission measurements. The Laboratory has designed and will have available for use on FASOR III a greatly improved Echo Repeater - Transponder combination which will operate in both the lower frequency (1500 Hz) and the higher frequency (4300 Hz - BRASS-II) regions. The echo repeater will provide greater linearity of response, controllable levels of simulated target strength and the time saving advantages of having to deploy only a single device overside for use in both frequency regions.

A standard 100-inch sonar dome containing two 1.5 KHz sources, two 4.3 KHz sources, and a UQC transducer is installed on the bottom of the DAVIS at frame No. 32. The projectors in this dome will be used for one-way signal measurements, for rough weather stations, and for direct comparison with explosive sources.

Section 4

PARTICIPATING ACTIVITIES AND UNITS

1. Commander, Naval Undersea Warfare Center is responsible for the prosecution of this project. The SIC aboard BAYA is designated as his representative in the operating area and is authorized to modify or alter test details, procedures, etc., as necessary to fulfill test objectives, keeping NUWC and other pertinent commands informed. Specifically, SIC is responsible for:

a. Overall supervision and conduct of the tests.

b. Detailed scheduling of project operations.

c. Keeping OCE fully informed of status of tests, problem areas etc. All changes to this plan which effect safety or movement of ships must be discussed with OCE and concurrence obtained from him.

d. Submission of Summary Reports as directed in the Reports Section of this plan.

e. Briefing of all supporting personnel prior to commencement of project operations.

f. Status and optimum adjustment of the equipments associated with the tests.

g. Collection, reduction, and forwarding of data for further analysis.

2. The following ships will participate in the test operations:

Ships	ETD/Ports	Area	ETA/Ports
USS BAYA (AGSS-318)	100900UFeb (San Diego)	MID, SO & WESTPAC and INDIAN OCEAN	29 Aug 1969 (San Diego)
USNS CHARLES H. DAVIS (AGOR-5)	111200UFeb (San Diego)	MID, SO & WESTPAC and INDIAN OCEAN	3 Oct 1969 (San Diego)
HMAS OTWAY	02-30 Apr 130800Apr (Sydney)	(Sta. ECHO FOUR through Sta. HOTEL)	6 May (Sydney)
HMAS DIAMANTINA	29 Mar - 6 May (Sydney)	(Sta. ECHO TWO through Sta. MIKE)	6 Jun (Djakarta)

Loading Schedule:

	BAYA	DAVIS	OTWAY	DIAMANTINA
Location:	San Diego	San Diego	Sydney	Sydney
Dates:	3-7 Feb 1969	3-7 Feb 1969	2-13 Apr 1969	28 Mar 1969

Unloading Schedule:

Location:	San Diego	San Diego	Sydney	Djakarta
Dates:	2-18 Sep 1969	6-10 Oct 1969	6-8 May 1969	6 June

3. The Commanding Officer of each ship participating in this project is responsible for:

a. Conducting operations in accordance with this plan.

b. Assigning a liaison officer to assist SIC in all shipboard matters affecting the project.

c. Ensuring that all supporting equipment associated with the tests is operating at maximum efficiency throughout the test period.

d. Submission of a completion report to NUWC following termination of project operations. This report should be general in nature and will be used in planning for future FASOR operations.

4. Nothing in this project plan shall be construed to interfer with the inherent responsibilities of the Commanding Officers of the participating ships for maintaining safety of their ships and personnel.

5. In view of the fact that the participating units are of various types (SS, AGOR), have different nationalities (U.S., Australian), and have personnel of different status (military, civilian) aboard, it is necessary to establish command relationships and responsibilities. The following command structure shall be observed for the conduct of the project operation:

SHIP CHAIN OF COMMAND

a. C.O. BAYA is OCE for the Task Group consisting of BAYA, DAVIS, OTWAY, and DIAMANTINA.

b. C.O. BAYA is OCE for joint operations of BAYA and DAVIS only.

c. C.O. BAYA is OCE for joint operations of BAYA and OTWAY only.

d. C.O. BAYA is OCE for joint operations of BAYA, OTWAY, and DAVIS only.

e. C.O. DAVIS is OCE for joint operations of DAVIS and DIAMANTINA only.

SCIENTIFIC CHAIN

The SIC aboard BAYA has overall responsibility for NUWC in the conduct of the project operations and for direction of the scientific work aboard BAYA. The SIC aboard DAVIS is responsible for direction of the scientific work aboard DAVIS, for coordination with SIC BAYA, and for coordination with scientific work aboard DIAMANTINA when she is participating. The SIC aboard OTWAY (NUWC personnel) is responsible for the scientific work aboard OTWAY and for coordination with SIC BAYA.

6. A Movement Report will be issued by COMSUBPAC/COMSUBFLOT ONE covering BAYA participation in FASOR III.

7. MSTSPAC has assigned DAVIS to participate in FASOR III.

8. RAN has assigned DIAMANTINA and OTWAY to participate in FASOR III

Section 5

OPERATIONS SCHEDULE

1. The operations required by this plan will be conducted in accordance with the general schedule given below. Detail scheduling is given in Annex A.

* (Port arrival and depart Local Time)
(Stations based on GMT Time)

OPERATING SCHEDULE

STATION	LAT	LONG	MILES DIST	BAYA ARR	BAYA DEP	DAVIS ARR	DAVIS DEP	OTWAY ARR	OTWAY DEP	DIAMANTINA ARR	DIAMANTINA DEP	REMARKS
*SAN DIEGO					10 Feb		11 Feb					
*PEARL HARBOR			2400	21 Feb	24 Feb	20 Feb	24 Feb					
ALFA	11°00N	160°00W	615	27 Feb	01 Mar	27 Feb	01 Mar					
BRAVO	03°00S	166°00W	940	06 Mar	07 Mar	05 Mar	07 Mar					
*SAMOA			700	10 Mar	15 Mar	10 Mar	15 Mar					
CHARLIE	22°35S	172°30W	510	18 Mar	19 Mar	18 Mar	20 Mar					
DELTA	26°10S	174°35E	790	23 Mar	25 Mar	23 Mar	25 Mar					
ECHO-ONE	34°00S	151°50E								28 Mar	29 Mar	
ECHO-TWO	34°00S	153°20E	1185			30 Mar	01 Apr			29 Mar	01 Apr	DIAMANTINA arrive sta 20 hrs prior to DAVIS
*SYDNEY			1320	01 Apr	13 Apr	02 Apr	13 Apr		15 Apr	02 Apr	12 Apr	
ECHO-THREE	33°45S	151°35E	30 From Sydney									
ECHO-FOUR	33°00E	153°20	120	13 Apr	15 Apr	14 Apr	15 Apr	13 Apr	16 Apr	12 Apr	14 Apr	
*BRISBANE			380 Fr.E4							15 Apr	17 Apr	
FOXTROT	16°40S	160°00E	1030	20 Apr	21 Apr	20 Apr	22 Apr	20 Apr	21 Apr	20 Apr	21 Apr	
GOLF	08°21S	152°55E	660	25 Apr	26 Apr	25 Apr	26 Apr	25 Apr	26 Apr	25 Apr	26 Apr	

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* (Port arrival and depart Local Time)
(Stations based on GMT Time)

OPERATING SCHEDULE (Cont'd)

STATION	LAT	LONG	MILES DIST	BAYA ARR	BAYA DEP	DAVIS ARR	DAVIS DEP	OTWAY ARR	OTWAY DEP	DIAMANTINA ARR	DIAMANTINA DEP	REMARKS
HOTEL	14°05S	151°00E	375	28 Apr	30 Apr	28 Apr	30 Apr	28 Apr	30 Apr	28 Apr	30 Apr	OTWAY returns to SYDNEY
*SYDNEY			1220					5 May				
*PORT MORESBY			350	03 May	07 May	03 May	07 May			03 May	07 May	
INDIA	10°00S	139°00E	490	09 May	10 May	08 May	11 May			08 May	10 May	
JULIETTE	11°30S	129°00E	590	13 May	15 May	13 May	15 May			13 May	15 May	
*DARWIN			130	16 May	22 May	16 May	22 May			16 May	22 May	
KILO-ONE	10°30S	125°30E	360							23 May	23 May	
KILO-TWO	11°00S	124°00E	120 Fm DAR							24 May	24 May	
KILO-THREE	11°30S	121°30E	570	24 May	26 May	24 May	26 May			25 May	26 May	
LIMA-ONE	13°08S	116°26E	325	27 May	29 May	27 May	29 May			27 May	28 May	
LIMA-TWO	11°00S	113°00E	200 Fm K1							29 May	30 May	
MIKE	10°00S	107°38E	560	01 Jun	02 Jun	01 Jun	03 Jun			01 May	02 May	
*DJAKARTA			390	05 Jun	09 Jun	05 Jun	09 Jun			04 Jun		DIAMANTINA leaves Cruise
NOVEMBER	02°00N	93°00E	1050	14 Jun	15 Jun	13 Jun	16 Jun					
OSCAR	03°00N	84°00E	550	18 Jun	20 Jun	18 Jun	20 Jun					

* (Port arrival and depart Local Time)
(Stations based on GMT Time)

OPERATING SCHEDULE (Cont'd)

STATION	LAT	LONG	MILES DIST	BAYA ARR	BAYA DEP	DAVIS ARR	DAVIS DEP		DIAMANTINA ARR	DIAMANTINA DEP	REMARKS
*COLOMBO			360	22 Jun	26 Jun	22 Jun	26 Jun				
PAPA	13°00N	84°00E	520	28 Jun	30 Jun	28 Jun	30 Jun				
QUEBEC	11°20N	95°00E	630	03 Jul	04 Jul	03 Jul	05 Jul				
ROMEO	06°00N	98°15E	370	06 Jul	08 Jul	06 Jul	08 Jul				
*SINGAPORE			460	11 Jul	16 Jul	11 Jul	16 Jul				BAYA Return to S.D. via Hong Kong, Yokosuka
ROMEO	06°00N	98°15E	460			18 Jul	20 Jul				DAVIS conduct ambient noise measurements
*QUEBEC	11°20N	95°00E	370			22 Jul	24 Jul				
SIERRA	11°00N	90°00E	320			25 Jul	27 Jul				
PAPA	13°00N	84°00E	400			29 Jul	31 Jul				
*COLOMBO			520			2 Aug	5 Aug				
OSCAR	03°00N	84°00E	360			6 Aug	8 Aug				
NOVEMBER	02°00N	93°00E	550			11 Aug	13 Aug				
*SINGAPORE			900			19 Aug	20 Aug				

Section 6

EVENTS AND OPERATIONAL PROCEDURES

1. The objectives of this cruise are as follows:

a. To measure those properties of ocean areas, including ambient noise, reverberation and those bottom characteristics which directly affect passive detection to 200 mile range and echo-ranging to ranges of 35 miles.

b. To perform echo-ranging tests using both a repeater/transponder buoy, and a submarine target.

c. To measure signal coherence and to make the results available for echo ranging and sonar communication design studies and for performance predictions.

2. Auxiliary acoustic information and data on environmental characteristics of the area will be obtained by personnel aboard DAVIS and DIAMANTINA. DIAMANTINA will carry a scientific group from the RANEL (Royal Australian Navy Experimental Laboratory). Data obtained by DAVIS and/or DIAMANTINA should include for each area:

a. Sea surface information

b. Bathythermograms

c. Volume surface and bottom back-scattering

d. Normal incidence acoustic bottom reflections

e. Nansen casts

f. Sediment samples with cores

g. Stereo and photogrammetric records of the bottom

h. Net hauls

i. Velocimeter, or velocity-temperature-depth probes

j. Sparker records of bottom sub-layers

k. Ambient noise

l. Towed array noise and S/N ratios

m. Bottom profiles (gross and precision)

n. Signal coherence and/or sonar communications

o. Continuous overall position plots relating times and locations of data obtained.

These and other tests will be scheduled by the SIC aboard DAVIS and DIAMANTINA to fit into time available at each station and for minimum interference with inter-ship measurements.

3. Stations to be occupied during this cruise include deep, medium and shallow water depths. Appropriate events for various combinations of ships and submarines are described in this plan. Appendix I to this Project Plan contains the Preliminary Master Schedule of Events for each station. This schedule will be adjusted appropriately as additional information becomes available. Scientists aboard each ship will be provided with a separate Area Folder for each station. These will contain sonar predictions and other information for use in the planning of data collection. The area folders will be available at each port for use in reviewing the schedule of events to be conducted at each station to be taken prior to arrival at the next port. Further on-station adjustments to these schedules will be made as necessary to best accomplish the test objectives within the instrumentation status and environmental conditions actually encountered. Selection of all events, sequence of events, ship and target positioning, times for COMEX, and duration of events will be the responsibility of SIC aboard BAYA with concurrence of OCE. Surface ships may conduct independent operations during submarine events which do not involve them. Planning and coordination of independent surface ship operations will be accomplished during pre-sailing conferences in port and by separate communications between the surface ships at sea.

It is expected that BAYA will spend an average of about 38 hours at each station and DAVIS approximately 54 hours. Wherever possible, DAVIS will arrive on station 6-8 hours prior to BAYA's arrival. DAVIS may use this extra time to obtain a Nansen cast at the rendezvous point, and make other environmental measurements as time permits. DAVIS will calibrate and launch an echo repeater/transponder buoy prior to echo ranging events and retrieve it following these events as requested by SIC on BAYA. High differential drift between DAVIS and the echo repeater/transponder buoy may require compromises on priority of DAVIS measurements or requests that DIAMANTINA assist.

DIAMANTINA will participate on Stations ECHO ONE to MIKE inclusive and may occupy several additional stations not indicated here. The Australian submarine OTWAY, will serve as target for both active and passive detection trials on Stations E4, F, G, and H, and will also transmit signals and record data using equipments manned by NUWC personnel on board.

Ship movements at shallow-water stations will be similar to those for deep-water stations and the same event descriptions are used. Essential differences will be:

a. Pre-selected range for shot run will be a best estimate of the maximum echo-ranging range for the area. After first echo-ranging trials, SIC may select longer or shorter ranges for the additional runs.

b. Tilted transducers will not be used, unless required by SIC for limited sampling in special cases.

c. Echo repeater/transponder buoy may be anchored if position is critical.

Initial positioning of ships for echo-ranging events will be accomplished with submarines surfaced. The following aids are available:

a. Radar: Best for short range, but not available at the ranges normally required for deep water stations.

b. Satellite Navigation: Receivers will be installed on BAYA and DAVIS. Provides precise positions, but is dependent upon satellite schedules. DAVIS will give her location to BAYA via radio to make range and bearing information available to SIC. OTWAY, when involved, may be requested to take initial position relative to DAVIS, using radar, to make use of the satellite navigation capability.

c. RARIE: Radio ranging equipment which includes a master station aboard BAYA and a transponding station aboard DAVIS or OTWAY, provides accurate range but no bearing information.

4. EVENTS or experiments which involve or are of interest to more than one ship are described below. These events are grouped with the first group consisting of events involving BAYA, DAVIS and echo repeater/transponder buoy. The following groups include events involving BAYA and OTWAY; BAYA, OTWAY and buoy; DIAMANTINA and DAVIS; and MISCELLANEOUS EVENTS.

5. The following events involve BAYA and DAVIS only:

EVENT I: Shot Run and Area Search (7-hour duration)

BAYA dive, rig booms and take proposed heading for explosive run. BAYA will transmit signals and obtain acoustic returns indicating clear path or possible uncharted sea mounts. When both ships indicate ready by underwater telephone, DAVIS drop 3 deep charges at 20-sec intervals. DAVIS run at 5 K. First shot should detonate on an even 3-minute interval of thw WWV hour. Shots will be detonated on schedule so as to produce 6 single shot signals on 2-minute spacing, 6 on 4-minute spacing and 20 shots on 6-minute spacing. All subsequent shots at 12-minute intervals. Three deeper shots at 30 second intervals will signify end of run. During the 6 and 12-minute interval spaced shots, one minute after the shot, BAYA will transmit 1.5 and 0.5 sec pulses every 10 sec until a total of ten signals are sent. BAYA will hover, maintain requested headings, and will record all explosive signals, for duration of shot run. BAYA may remain submerged after the Shot Run continue DRT and measure bottom reverberation while DAVIS calibrates and deploys repeater/transponder.

EVENT II. BAYA and BUOY: Convergence Zone; Two Frequencies: (5-hour duration)

BAYA take two or more headings as requested for bottom reverberation measurements. BAYA return to heading toward buoy and commence echo-ranging run at about 2 knots. A small down angle is requested to clear the bow from the BRASS II beam. DAVIS conduct independent measurements.

EVENT III. BAYA and BUOY: Convergence Zone, Coded Signal: (6-hour duration)

At designated position, BAYA dive to requested depth and take heading toward target. At COMEX, BAYA commence closing slowly. PRN and FM echo-ranging will be conducted using a pre-arranged schedule and shared time on the lower frequency bands. Sampling at 4.3 kHz may be considered by SIC on a not-to-interfere basis. After closing through the convergence zone, BAYA will be requested to back down or otherwise maneuver to re-cross the zone from duration of run. DAVIS maintain station within $\pm$ 10 degrees of buoy from BAYA to provide for reception of transponder (TRACER) signals from DAVIS.

EVENT IV. BAYA and BUOY: Bottom Bounce, 2 Frequencies: (5-hour duration)

BAYA at pre-selected range and depth approach buoy. On request of SIC and when 1.5 kHz is near optimum, BAYA either back, or retrace, or modify original course while 4.3 kHz band is tested. Resume closing run at 1.5 kHz. Log course and frequency changes with times on DRT.

EVENT V. BAYA and BUOY: Bottom Bounce, Coded Signal: (6-hour duration)

At designated position, BAYA dive to requested depth and take heading toward target. At COMEX, BAYA commence closing slowly. PRN and FM echo-ranging will be conducted using pre-selected tilts of the transducers. When best range is determined, BAYA will be requested to maintain position. DAVIS maintain station within $\pm$ 10 degrees of buoy from BAYA to provide reception of transponder (TRACER) signals from DAVIS.

6. The following events involve BAYA and OTWAY:

EVENT VI. BAYA and OTWAY; 2 Frequencies (3-hour duration)

OTWAY dive to requested depth and present beam aspect to BAYA after opening range according to pre-arranged plan. OTWAY hover or make minimum speed so as to maintain stable situation. Event terminates 5 hours after dive.

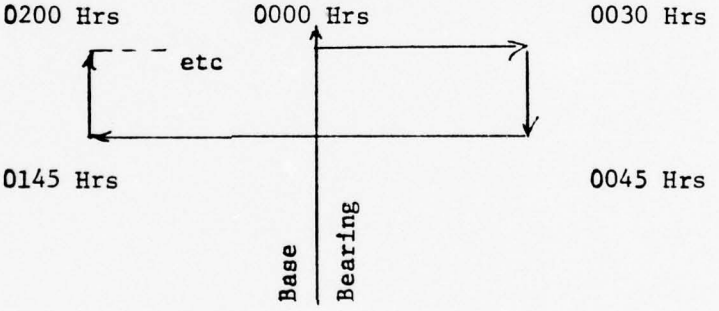
EVENT VII. BAYA and OTWAY; Coded Signal: (6-hour duration)

OTWAY take station at a range (on the order of 15 to 35 miles) from BAYA and on a base bearing as specified by Scientist-in-Charge on BAYA. Range and base bearing will depend on area where this event is conducted. Both submarines dive, BAYA to 150 feet and OTWAY to periscope depth. OTWAY present 090 degree aspect and hold position (minimum turns) while BAYA rigs receiving

array. BAYA maintain heading and close range at minimum turns. COMEX will be 30 minutes after dive. OTWAY commence following snorkel run at six knots starting at COMEX:

RELATIVE TIME	OTWAY COURSE (Relative to base bearing)
0000	090°R
0030	180°R
0045	270°R
0145	000°R
0200	090°R
0300	180°R
0315	270°R
0415	000°R
0430	090°R
0530	Surface

OTWAY TRACK



OTWAY is requested to maintain DRT plot on scale 1" - 2000 yards with entries every 5 minutes for duration of dive.

EVENT VIII: BAYA, OTWAY; BRASS-II Only: (5-hour duration)

With OTWAY at a range of 10,000 yards on BAYA's starboard beam, both submarines dive at designated time to pre-arranged depth and proceed at 2 knots on pre-arranged base course. Both submarines requested to make DRT plots during run on scale of 1" - 2000 yards, showing own and best estimates

of other submarines track. BAYA will operate only BRASS-II equipment during this run. Fifteen minutes after dive COMEX following run:

RELATIVE TIME	BAYA COURSE (Relative Bearing)	TARGET COURSE (Relative Bearing)
0000	000°	000°
0100	330°	030°
0120	000°	000°
0200	330°	045°
0220	000°	000°
0300	330°	060°
0320	000°	000°
0400	330°	060°
0420	000°	000°
0500	Surface	Surface

7. The following events involve BAYA, OTWAY, and DAVIS.

EVENT IX: BAYA, OTWAY & BUOY: 2 Frequencies (5-hour duration)

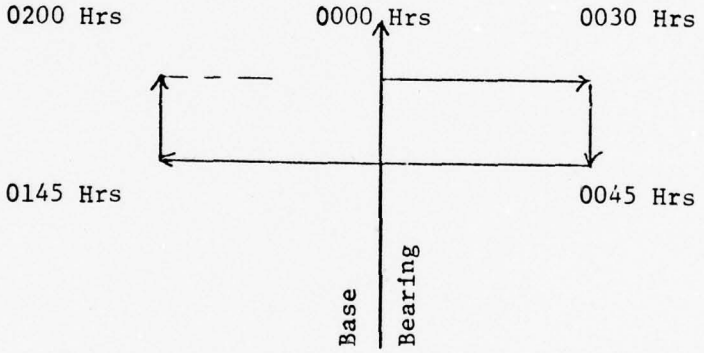
DAVIS deploy echo repeater/transponder buoy with Kytoon and stand clear. At a pre-arranged depth not less than 200 feet, OTWAY circle buoy at 3 knots at 1000 yard range held constant ± 200 yards. OTWAY maintain DRT log and a separate log at 5 minute intervals of echo repeater/transponder buoy true bearing. Run terminates 5 hours after dive. DAVIS stand clear by at least 3 miles during this operation, and approach buoy only after OTWAY surfaces.

EVENT X: BAYA, OTWAY and BUOY: Coded Signal: (6-hour duration)

BAYA take station at range from the buoy (on the order of 18 to 35 miles depending on local propagation conditions) requested by the Scientist-in-Charge. OTWAY take station 5000 yards from buoy on base line between BAYA and buoy. At designated time, both submarines dive to a depth of 150 feet and hover. BAYA take heading toward buoy (on base bearing) and OTWAY take heading such that buoy is on port beam and BAYA on starboard beam (090° Relative to base bearing). COMEX will be one hour after dive. Upon COMEX, OTWAY commence following run at 3 knots:

RELATIVE TIME	OTWAY COURSE (Relative to base bearing)
0000	090°R
0030	180°R
0045	270°R
0145	000°R
0200	090°R
0300	180°R
0315	270°R
0415	000°R
0430	090°R
0500	Surface

OTWAY TRACK



OTWAY is requested to maintain DRT plot on scale 1" - 2000 yards with entries every 5 minutes for duration of dive.

8. The following events involve DIAMANTINA and DAVIS:

EVENT XI: DAVIS Closes DIAMANTINA and Commences Station Tests (24-hour duration)

DIAMANTINA occupy station 18 to 20 hours prior to DAVIS arrival and acquire VLF propagation data. DAVIS transmit 3 frequencies the first 20 minutes every six hours starting precisely on the hour. Two SUS (one 800 ft. shot and one 60 ft. shot) conclude the transmission. Exact shot times will be passed by radio. A close approach run by DIAMANTINA should be made when DAVIS arrives on station to provide a source level check. Lloyd ranges $\left(\frac{4Z_sZ_r}{\lambda}\right.$ where Z_s = source depth and Z_r = receiver depth) are recommended for close approaches. DIAMANTINA will normally remain on station until EVENT I (Shot-run) is completed. If course for EVENT I is altered, DAVIS notify

DIAMANTINA so that she can stand clear. DIAMANTINA may lay-to or maneuver with TOWFLEX during EVENT I and will normally depart station soon thereafter.

EVENT XII: DIAMANTINA Departs: DAVIS On-Station VLF Transmissions (Duration Depends on Departure of DIAMANTINA from Station)

After DAVIS concludes Shot Run and any required buoy deployment, DIAMANTINA may pass close aboard for short-range check of DAVIS VLF source at 3 frequencies. DIAMANTINA departs and DAVIS transmits VLF the first 20 minutes every six hours starting precisely on the hour. Two SUS (one 800 ft. shot and one 60 ft. shot) conclude the transmission. Exact Shot times will be passed by radio. This event terminates when DAVIS completes station. Last transmission from the station will be identified by a longer time period between the 3 frequency samples. These longer quiet periods will be exactly 5 minutes, and the total transmission will continue 5 to 10 minutes longer than the ordinary, nominal 20-minute, samples.

EVENT XIII: DIAMANTINA Towflex: DAVIS Sparker and VLF Runs (Duration not more than 6 hours)

Sparker transmissions for sub-bottom profiling are required DAVIS measurements but must be scheduled with consideration of DAVIS VLF transmissions to DIAMANTINA so as to minimize incompatibility. Use of sparker and subsequent interruption of VLF may be as follows: Sub-bottom profiling (18,000 Joule sparks every 4 seconds at 20 ft. depth) will commence at an opportune time on station and continue for about 5 hours. VLF schedules will normally occupy a 20 minute period every 6 hours. Hence, the scheduling of this EVENT XIII will indicate a probable cancellation of one VLF transmission under EVENT XII.

EVENT XIV: DIAMANTINA Towflex Monitoring Other Ships on Parallel Run (4-1/2 hour duration)

This event may be conducted between FASOR stations. A message confirming the plan will be originated by BAYA at least 24 hours before completion of the prior station. BAYA may be limited for participation in this event by condition of battery charge.

DIAMANTINA and DAVIS depart prior station so as to take up parallel courses with 20 n. mi. separation for this EVENT. At COMEX and at 30 minute intervals DAVIS will transmit three frequency samples on VLF overside transducer while DIAMANTINA records on TOWFLEX.

If BAYA can dive for 3 hours or longer, she should take position halfway between and somewhat astern of surface ships so that DIAMANTINA and/or DAVIS bear about 060 and 300 degrees relative. At time 45 mimutes, and 1 hour 15 minutes, 1 hour 45 minutes and 2 hours 15 minutes after COMEX BAYA transmit 3 frequency samples on VLF transducer.

If OTWAY participates, she should take position ahead of surface ships with range approximately 10 miles and relative bearing to DIAMANTINA about 30° abaft the beam. OTWAY snorts throughout this event.

EVENT XV: Shot Run by DIAMANTINA (4-hour duration)

This event should be scheduled to follow DAVIS Shot Run in areas where there is reason to believe that propagation along a second course would be of interest. Examples might be up-slope or down-slope bottoms as compared with a constant depth course. DIAMANTINA open along this "second" course and drop charges as scheduled for EVENT I.

9. MISCELLANEOUS EVENTS (Used primarily for inter ship-calibrations and Special Activities)

EVENT XVI: Submarine Battery Charge (8-hour duration)

BAYA and/or OTWAY charge batteries and choose courses so as to arrive in position for next event. Current estimates of time for this event will be of interest to other ships.

EVENT XVII: BAYA Check Source Levels vs DAVIS (2-hour duration)

BAYA dive to make a run directly under DAVIS. Receiving booms need not be rigged. BAYA log best estimate of relative position every 5 minutes. BAYA's sources will be triggered by an acoustic transmission from DAVIS. UQC may be used in positioning but should not be operated during last 750 yards of run. Time availability for this event is contingent on scheduling of other runs and on prompt or early arrival on station.

Section 7

COMMUNICATION

1. Communication frequencies assigned each unit are as listed below:

TYPE	FREQUENCY	VESSEL	CALL SIGN
Primary (AM)	2558 kHz	USS BAYA	FLORIDA 10
		USNS DAVIS	FLORIDA 14
		HMAS OTWAY	FLORIDA 15
		HMAS DIAMANTINA	FLORIDA 16
Secondary &	3510 kHz	Same	Same
Back up (AM)	2670 kHz	Same	Same
UHF (AM)	312.12 MHz	USS BAYA	FLORIDA 10
		USNS DAVIS	FLORIDA 14
UHF (FM)	140.34 MHz	USS BAYA	FLORIDA 10
		USNS DAVIS	FLORIDA 14

2. All shipboard communication will be submitted to appropriate authority for release, as designated by the Commanding Officer.

3. BAYA will handle all classified traffic for DAVIS.

Section 8

REPORTS

1. SIC will prepare a summary report of results obtained for each station. These reports will be mailed, by registered mail, upon arrival at the next port to Commander, Naval Undersea Warfare Center, Attention Dr. C. R. Haupt, Code 60. A copy of the station report will be furnished to OCE. SIC will originate a brief report of work at each station for transmission by radio message upon completion of work at that station.

2. A preliminary summary report on FASOR III will be submitted to Commander, Naval Ship Systems Command, Code OOV1, within 30 days following completion of the FASOR III trip.

3. The C.O. of each ship is requested to submit a summary letter report, including comments on any aspect of FASOR III which would be helpful in the planning of future FASOR trips. These reports should be addressed to Commander, NUWC, attention Dr. C. R.Haupt, Code 60, and are desired within 30 days following completion of their participation in the FASOR III project.

Activity/Address	Name	Function
NUWC, San Diego Code 60	Dr. C. R. Haupt	Project Liaison Officer
NUWC, San Diego Code 15102	LCDR W. W. Mac Kenzie	Assistant Technical Officer
NUWC, San Diego Code 603	R. B. Wheeler	Scientist-in-Charge, BAYA and Overall, 20 Feb - 11 July
NUWC, San Diego Code 603	K. E. Rogers	Scientist-in-Charge, OTWAY, 14 Apr - 6 May
NUWC, San Diego Code 503	M. A. Pederson	Observer aboard DIAMANTINA, 28 Mar - 3 May
NUWC, San Diego Code 503	W. E. Batzler	Scientist-in-Charge, DAVIS 20 Feb - 7 Apr
NUWC, San Diego Code 503	J. Cummins	Scientist-in-Charge, DAVIS, 8 Apr - 7 June
NUWC, San Diego Code 503	J. Percy	Scientist-in-Charge, DAVIS, 8 June - 11 July
NUWC, San Diego Code 605	G. Wenz	Scientist-in-Charge, DAVIS 12 July - 25 Aug
RANEL, Sydney, Australia	R. Wyber	Project Liaison Officer
RANEL, Sydney, Australia	Dr. W. Hunter	Scientist-in-Charge, DIAMANTINA

CONFIDENTIAL

P R E L I M I N A R Y

ANNEX A

to

NUWC FASOR III PROJECT PLAN

DETAILED OPERATIONS SCHEDULE

PRELIMINARY

Detailed Operations Schedule

1. This schedule will be reviewed at each port during pre-sailing conferences by the SIC and representatives of each ship to confirm or modify the schedules for stations to be taken prior to arrival at the next port. Adjustments on station may also be made to accommodate special requirements and to best accomplish goals within the environmental and instrumentation situation actually encountered. Such adjustments to the schedule of events are the responsibility of the SIC aboard BAYA subject to concurrence by OCE. Times shown are approximate. COMEX for events will be established on station.

Station ALFA Rendezvous: Lat 11°00N Long 160°00W Time zone +11 X

271200ZFeb	DAVIS arrive on station
271200Z - 272000ZFeb	DAVIS make environmental measurements including Nansen Cast.
272000ZFeb	BAYA arrive on station.
272000Z - 2200Z	Event XVII (BAYA Source Level Measurements)
272200Z - 280500Z	Event I: (Shot Run and Area Search)
280500Z - 281100Z	Event III: (Convergence Zone; Coded Signal) (DAVIS conduct independent tests including TRACER recording)
281100Z - 281200Z	BAYA reposition (Surface)
281200Z - 281600Z	Event II (Convergence Zone, 2 Frequencies) DAVIS measure volume reverberation and make net hauls.
281600Z - 010000Z	Event XVI (Battery Charge) DAVIS continue with coring, sediment sampling, etc.
010000Z - 010500ZMar	Event V (Bottom Bounce, Coded Signal)
010500Z - 010600Z	BAYA Reposition (Surface)
010600Z - 01200Z	Event IV, (Bottom Bounce, 2 Frequencies)
012000ZMar	BAYA depart. DAVIS recover buoy and complete measurements.
011800ZMar	DAVIS depart station.

Station BRAVO Time Zone +11 X Rendezvous: Lat 03°00S Long 166°00W

051600ZMar	DAVIS arrive on station, commence measurements including Nansen Casts.
060000ZMar	BAYA arrive on station.
060000Z - 060700Z	Event I
060700Z - 061300Z	Event III
061300Z - 061400Z	BAYA surface and reposition
061400Z - 061900Z	Event II
061900Z - 070300Z	Event XVI (Battery Charge)
070300Z - 070900Z	Event V
070900Z - 071000Z	BAYA surface and reposition
071000Z - 071500Z	Event IV
071500Z	BAYA depart area
072200ZMar	DAVIS depart area

Station CHARLIE Time zone +12 Y Rendezvous: Lat 22°35S Long 172°30W

172300ZMar	DAVIS arrive on station
180800ZMar	BAYA arrive on station
180800Z - 181000Z	Event XVII
181000Z - 181700Z	Event I
181700Z - 182300Z	Event III
182300Z - 182400Z	BAYA reposition (surface)
190000Z - 190400Z	Event II
190400Z - 191200Z	Event XVI
191200Z - 191800Z	Event V
191800Z - 191900Z	BAYA surface and reposition
191900Z - 192300Z	Event IV
192300ZMar	BAYA depart
200600ZMar	DAVIS depart

Station DELTA Time zone -12 M Rendezvous: Lat 26°10S Long 174°35E

231100ZMar	DAVIS arrive on station
231900ZMar	BAYA arrive on station
231900Z - 240200Z	Event I
240200Z - 240800Z	Event III
240800Z - 240900Z	BAYA reposition
240900Z - 241300Z	Event II
241300Z - 242100Z	Event XVI
242100Z - 250300Z	Event V
250300Z - 250400Z	BAYA reposition
250400Z - 250900Z	Event IV
250900ZMar	BAYA depart
251700ZMar	DAVIS depart

Station ECHO-ONE Rendezvous: Lat 34°00S Long 151°50E

28-29 March	DIAMANTINA make independent measurements

Station ECHO-TWO Time zone -10 K Rendezvous: Lat 34°00S Long 153°20E

291900ZMar	Event XI - DIAMANTINA on station; DAVIS commence VLF acoustic transmissions. DAVIS will transmit at 291900Z; 300100Z; 300700Z; commencing exactly on the hour. Time will be set by WWV. DAVIS will drop 2 SUS charges at the conclusion of each transmission period. First drop to detonate at 800 foot depth and the second drop at 60 feet. Exact shot times will be passed to DIAMANTINA by radio.
301500ZMar	DAVIS arrive on station.
301500Z - 302300Z	Event XI continues, modified as necessary. DIAMANTINA make close approach to DAVIS to calibrate VLF signal. Continue TOWFLEX run. DAVIS will transmit on 6 hour schedule or as requested during run.

302300Z - 010600Z	DIAMANTINA departs area. DAVIS make environmental measurements, including Sparker runs; and/or explosive shots which may be monitored by DIAMANTINA.
010600ZApr	DAVIS depart area

Station ECHO-FOUR Time zone -10 K Rendezvous: Lat 33°00S Long 153°20E

121900ZApr	DIAMANTINA arrive on station. Event XI commence at 122300Z.
131000ZApr	DAVIS arrive on station.
131200ZApr	BAYA and OTWAY arrive on station.
131200Z - 131700Z	Event I - OTWAY open range with DAVIS. DAVIS does not launch buoy. DIAMANTINA stand clear and monitor shot run. Continue Event XI.
131700Z	BAYA surface to establish range to OTWAY.
131800Z - 132300Z	Event VI - DAVIS conduct independent measurements. DIAMANTINA commence Event XII.
132300Z - 132400Z	BAYA and OTWAY surface and reposition.
140000Z - 140600Z	Event VII.
140600Z - 141400Z	Event XVI (Battery Charge)
141400Z - 142000Z	Event VII
142000Z - 142100Z	BAYA and OTWAY surface and reposition
142100Z - 150200Z	Event VIII
150200ZApr	BAYA and OTWAY depart station.
151000Z Apr	DAVIS depart station Event XII FINEX

Station FOXTROT Time zone -10 K Rendezvous: Lat 16°40S Long 160°00E

190700ZApr	DIAMANTINA arrives. Event XI
200100ZApr	DAVIS arrive on station
200900ZApr	BAYA and OTWAY arrive on station.

200900Z - 201400Z	Event I OTWAY take station on DAVIS. DIAMANTINA stand clear and monitor shots Event XI FINEX
201400Z - 201500Z	BAYA establish range to OTWAY
201500Z - 201900Z	Event VI, Event XII COMEX 201500Z
201900Z - 202000Z	BAYA and OTWAY surface and reposition
202000Z - 210200Z	Event VII
210200Z - 211000Z	Event XVI
211000Z - 211500Z	Event VIII
211500Z - 211700Z	BAYA, OTWAY surface and reposition
211700Z - 212300Z	Event VII
212300ZApr	BAYA and OTWAY depart station
220700ZApr	DAVIS depart station Event XIII

Station GOLF Time zone -10 K Rendezvous: Lat $08^{o}21$S Long $152^{o}55$E

240700Z	DIAMANTINA arrive Event XI
250100ZApr	DAVIS arrive on station
250500ZApr	BAYA and OTWAY arrive on station
250500Z - 251000Z	Event I OTWAY open range, DIAMANTINA monitor
251000Z - 251100Z	BAYA establish range to OTWAY
251100Z - 251600Z	Event VI, COMEX Event XII 251100Z
251600Z - 251700Z	BAYA and OTWAY reposition
251700Z - 252300Z	Event VII, Event XII continued
252300 - 260700Z	Event XVI, FINEX Event XII 260700Z
260700Z - 261200Z	Event VIII
261200Z - 261300Z	BAYA and OTWAY reposition
261300Z - 261900Z	Event VII
261900ZApr	BAYA and OTWAY depart station
262000ZApr	DAVIS depart Event XIII

Station HOTEL Time zone -10 K Rendezvous: Lat 14°05S Long 150°00E

271300ZApr	DIAMANTINA arrive Event XI
280900ZApr	DAVIS arrive on station
281500ZApr	BAYA, OTWAY arrive on station
281500Z - 282200Z	Event I DAVIS deploys buoy, FINEX Event XI
282200Z - 290300Z	Event IX
290300Z - 290400Z	BAYA, OTWAY reposition, COMEX Event XII 290300Z
290400Z - 291000Z	Event X
291000Z - 291800Z	Event XVI
291800Z - 292300Z	Event IX
292300Z - 300100Z	BAYA, OTWAY reposition
300100Z - 300700Z	Event X, DIAMANTINA independent exercises
300700ZApr	BAYA and OTWAY depart area. DAVIS retrieve buoy. FINEX Event XII 300700Z
301500ZApr	DAVIS depart area. Event XIII

Station INDIA Time zone -9 I Rendezvous: Lat 10°00S Long 139°ooE

080300ZMay	DIAMANTINA arrive Event XI
082300ZMay	DAVIS, arrive on station
090700ZMay	BAYA arrive on station
090700Z - 091400Z	Event I
091400Z - 092000Z	Event V DIAMANTINA departs, operates independently
092000Z - 092100Z	BAYA reposition
092100Z - 100200Z	Event IV
100200Z - 101000Z	Event XVI
101000Z - 101600Z	Event V
101600Z - 101700Z	BAYA reposition
101700Z - 102200Z	Event IV

102100ZMay	BAYA depart
110500ZMay	DAVIS depart station

Station JULIETTE Time zone -9 I Rendezvous: Lat 11°30S Long 129°00E

131000ZMay	DAVIS arrive on station
131800ZMay	BAYA and DIAMANTINA arrive
131800Z - 132400Z	Event I, DIAMANTINA monitor
140000Z - 140600Z	Event V, DIAMANTINA independent tests and depart area
140600Z - 140700Z	BAYA reposition
140700Z - 141200Z	Event IV
141200Z - 142000Z	Event XVI
142000Z - 150200Z	Event V
150200Z - 150300Z	BAYA reposition
150300Z - 150800Z	Event IV
150800ZMay	BAYA depart
151600ZMay	DAVIS depart

Station KILO-ONE Time zone -8 H Rendezvous: Lat 10°30S Long 125°30E

Station KILO-TWO Rendezvous: Lat 11°00S Long 124°00E

DIAMANTINA only will occupy these two stations and will conduct tests as per RANEL instructions.

Station KILO-THREE Time zone -8 H Rendezvous: Lat 11°30S Long 121°30E

241100ZMay	DAVIS arrive on station
241900ZMay	BAYA arrive on station
241900Z - 242100Z	Event XVII Check source levels. DIAMANTINA arrive
242100Z - 250200Z	Event I DIAMANTINA monitor shots
250200Z - 250800Z	Event V DIAMANTINA make independent tests
250800Z - 250900Z	BAYA reposition COMEX Event XII 250800Z

250900Z - 251400Z	Event IV
251400Z - 252200Z	Event XVI
252200Z - 260400Z	Event V
260400Z - 260900Z	Event IV
260900ZMay	BAYA departs
261500ZMay	DAVIS departs FINEX Event XII
Station LIMA-ONE Time zone -8 H	Rendezvous: Lat 13°08S Long 116°26E
271100ZMay	DIAMANTINA on station COMEX Event XI
272100ZMay	DAVIS arrive on station
272300ZMay	BAYA arrive on station
272300Z - 280600Z	Event I DIAMANTINA monitor shots FINEX Event XI 280600Z
280600Z - 281200Z	Event III
281200Z - 281300Z	BAYA reposition, COMEX Event XII 281200Z
281300Z - 281800Z	Event II
281800Z - 290200Z	Event XVI
290200Z - 290800Z	Event V
290800Z - 290900Z	BAYA reposition
290900Z - 291300Z	Event IV
291300ZMay	BAYA depart station
292100ZMay	DAVIS depart station FINEX Event XII
Station MIKE Time zone -7 G	Rendezvous: Lat 10°00S Long 107°38E
310400ZMay	DIAMANTINA arrive and COMEX Event XI 311400Z
010000ZJun	DAVIS arrive on station
010700ZJun	BAYA arrive on station
010700Z - 011400Z	Event I

011400Z - 012000Z	Event III
012000Z - 012100Z	BAYA reposition
012100Z - 020200Z	Event II
020200Z - 021000Z	Event XVI
021000Z - 021600Z	Event V
021600Z - 021700Z	BAYA reposition
021700Z - 022100Z	Event IV
022100ZJun	BAYA depart
030500ZJun	DAVIS depart Continue VLF until rendezvous with DIAMANTINA

Station NOVEMBER Time zone -6 F Rendezvous: Lat 02°00N Long 93°00E

132000ZJun	DAVIS arrive
140400ZJun	BAYA arrive
140400Z - 140600Z	Event XVII
140600Z - 141200Z	Event I
141200Z - 141700Z	Event III
141700Z - 141800Z	BAYA reposition
141800Z - 142300Z	Event II
142300Z - 150700Z	Event XVI
150700Z - 151300Z	Event V
151300Z - 151400Z	BAYA reposition
151400Z - 151900Z	Event IV
151900ZJun	BAYA depart
160200ZJun	DAVIS depart

Station OSCAR Time zone -6 F Rendezvous: Lat 03°00N Long 84°00E

180400ZJun	DAVIS arrive
181100ZJun	BAYA arrive
181100Z - 181800Z	Event I
181800Z - 182400Z	Event III

190000Z - 190100Z	BAYA reposition
190100Z - 190600Z	Event II
190600Z - 191400Z	Event XVI
191400Z - 192000Z	Event V
192000Z - 192100Z	BAYA reposition
192100Z - 200200Z	Event IV
200200ZJun	BAYA depart
200900ZJun	DAVIS depart

Station PAPA Time zone -6 F Rendezvous: Lat 13°00N Long 84°00E

280700ZJun	DAVIS arrive
281500ZJun	BAYA arrive
281500Z - 281700Z	Event XVII
281700Z - 282300Z	Event I
282300Z - 290500Z	Event III
290500Z - 290600Z	BAYA surface and reposition
290600Z - 291100Z	Event II
291100Z - 291900Z	Event XVI
291900Z - 300100Z	Event V
300100Z - 300200Z	BAYA reposition
300200Z - 300700Z	Event IV
300700ZJun	BAYA depart
301300ZJun	DAVIS depart

Station QUEBEC Time zone -6 F Rendezvous: Lat 11°20N Long 95°00E

030000ZJul	DAVIS arrive
030700Z	BAYA arrive
030700Z - 031400Z	Event I

031400Z - 032000Z	Event III
032000Z - 032100Z	BAYA reposition
032100Z - 040200Z	Event II
040200Z - 041000Z	Event XVI
041000Z - 041600Z	Event V
041600Z - 041700Z	BAYA reposition
041700Z - 042200Z	Event IV
042200ZJul	BAYA depart
050400ZJul	DAVIS depart

Station ROMEO Time zone -7 G Rendezvous: Lat 06°00N Long 98°15E

061600ZJul	DAVIS
061600ZJul	BAYA arrive
061600Z - 062100Z	Event I
062100Z - 070300Z	Event III
070300Z - 070400Z	BAYA reposition
070400Z - 070900Z	Event II
070900Z - 071700Z	Event XVI
071700Z - 072300Z	Event V
072300Z - 072400Z	BAYA reposition
080000Z - 080600Z	Event IV
080600ZJul	BAYA depart
081400ZJul	DAVIS depart