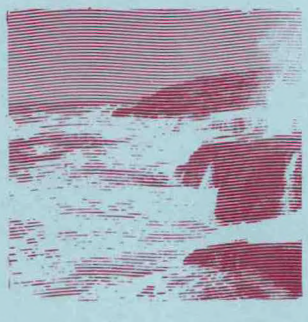
AEC-DEPARTMENT OF COMMERCE-DEPARTMENT OF DEFENSE-NASA-NSF
NCAR-DEPARTMENT OF INTERIOR-DEPARTMENT OF TRANSPORTATION



BOMEX BULLETIN NO. 3

JANUARY 27, 1969

Prepared by
THE BOMEX PROJECT OFFICE AN INTERAGENCY SCIENTIFIC PLANNING GROUP
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It is with deep regret that we must inform you that Dr. Benjamin Davidson, Scientific Director for BOMEX died on 20 December 1968. The BOMEX Project Office will not be the same without Ben Davidson. Under his strong and capable leadership the experimental design for BOMEX has evolved into a firm plan for the satisfaction of the primary scientific objectives. This would not have been accomplished without the broad background of knowledge and understanding which Dr. Davidson brought to bear upon the complex problems associated with the design of the experiment.

Dr. Joachim Kuettner, Director of Advanced Research Projects, ESSA Research Laboratories, has been named to be the new Director for BOMEX. Before joining the ESSA Research Laboratories, Dr. Kuettner was Chief Scientist of the National Environmental Satellite Center and played an important role in the United States manned space flight program, first as Director of the Mercury Project at NASA's Marshall Space Flight Center and later as Deputy Director of the Saturn Apollo Systems Office. He also spent a number of years with the Air Force Cambridge Research Laboratories conducting atmospheric research with jet aircraft and high altitude sailplanes.

Dr. Joshua Holland has also joined the BOMEX scientific staff, to serve as Chief Scientist for the Sea-Air Interaction Program. Dr. Holland is on leave from the Atomic Energy Commission where, for the past twelve years, he has directed major research programs on atmospheric transport and dispersion processes. Prior to this he was with the U.S. Weather Bureau where he was engaged in research on micrometeorology, turbulence and diffusion and in the application of meteorology in the environmental safety sector of the nuclear power reactor development program. During World War II, Dr. Holland was a weather officer in the U.S. Air Force.

1. Introduction

This Bulletin is intended to provide information concerning plans and schedules for the implementation of BOMEX and to continue the useful exchange between the BOMEX Project Office and interested members of the scientific community throughout the world and between the agencies or groups supporting such scientists. This issue of the Bulletin is concerned primarily with ship schedules and with schedules of observations which will be taken from the ship and buoy platforms. The overall management framework within which BOMEX will be conducted is briefly described, and an overall BOMEX milestone schedule is included. The Appendices include detailed information on a variety of subjects which are of importance on preparation for the conduct of the experiment in the field.

A large number of experiments will be conducted in support of overall BOMEX objectives. A summary of both the objectives and the experiments will be published in Bulletin No. 4, which will be issued on or about March 1, 1969. Bulletin No. 4 will also include more detailed information on participating aircraft, aircraft instrumentation and schedules for aircraft observations.

2. Project Management

The responsibility for the scientific and logistical planning and coordination for the experiment is in the BOMEX Project Office, 6010 Executive Boulevard, Rockville, Maryland, telephone 301-496-8416. This office was authorized by the Interagency Committee on International Meteorological Programs and is the focal point for planning, integrating and phasing government, university and industry participation in the experiment. Scientific guidance is provided by the BOMEX Advisory Panel of the U.S. GARP Committee, National Academy of Sciences. The primary functions of the BOMEX Project Office are:

(1) Coordinating the support which is being provided by the following agencies and groups which are participating in the overall experiment:

Department of Commerce
  ESSA

Department of Defense
  U.S. Army
  U.S. Navy
  U.S. Air Force
  National Guard Bureau

Department of the Interior
  Bureau of Commercial Fisheries

Department of Transportation
  U.S. Coast Guard

Atomic Energy Commission

National Aeronautics and Space Administration

National Science Foundation

National Academy of Sciences

National Oceanographic Data Center

National Center for Atmospheric Research

(2) Coordinating the scientific programs of the participating principal scientific investigators to insure achievement of the overall objectives.

The Barbados Oceanographic and Meteorological Experiment is a bilateral program to be conducted by the Government of the United States in cooperation with the Government of Barbados. Participation of the United States is conducted on an Interagency basis with ESSA as the lead Agency. The BOMEX Project Office was initially established with the endorsement of the Interagency Committee for International Programs. However, the provision of overall policy coordination and guidance has now been assumed by the Federal Committee for Meteorological Services and Supporting Research. Administrative support for the BOMEX Project Office is provided by ESSA, within the Office of World Weather Systems. Overall scientific direction and operational planning is provided by the BOMEX Director.

The Principal Investigators for the scientific experiments which will be conducted as a part of BOMEX coordinate their activities with the Director. It remains the responsibility of the Director to establish priorities and resolve problems which may arise as a result of conflicting requirements among the principal investigators, both during the planning stages and during the observational phases of BOMEX.

William S. Barney, as Project Manager for BOMEX, is responsible for the accomplishment of the planning, procurement, operations and administration necessary to support the approved experiments and for the execution of the program in the field.

A BOMEX Field Office will be established in Barbados on or about 20 April 1969. At that time control of BOMEX will be transferred to the Field Office; however, a BOMEX Coordinating Group will remain at Rockville, Maryland, during the observational phases.

NOTE: All participants in, and visitors to BOMEX, who are United States citizens and who expect to travel to Barbados during the Experiment, are advised that passports or visas are not required. It is necessary, however, to have some form of identification such as a uniformed service identification card or a birth certificate, to meet immigration requirements. Immunization certificates indicating vaccination for smallpox within the three years preceding the date of reentry to the United States are required.

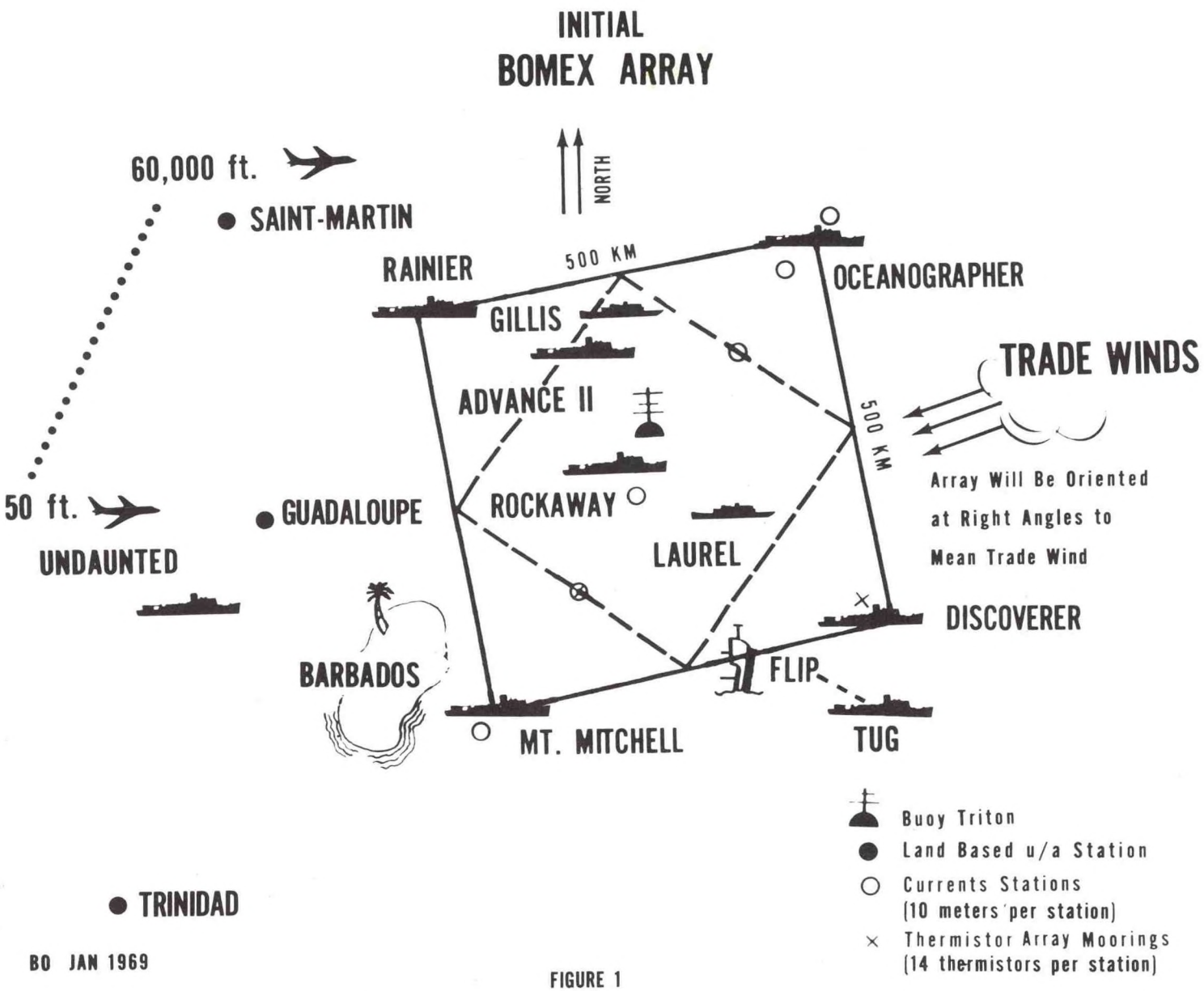
INITIAL
BOMEX ARRAY
60,000 ft.
SAINT-MARTIN
NORTH
RAINIER
500 KM
OCEANOGRAPHER
GILLIS
TRADE WINDS
ADVANCE II
500 KM
50 ft.
GUADALOUPE
ROCKAWAY
Array Will Be Oriented
at Right Angles to
Mean Trade Wind
UNDAUNTED
LAUREL
DISCOVERER
BARBADOS
FLIP
MT. MITCHELL
TUG
Buoy Triton
Land Based u/a Station
Currents Stations
(10 meters per station)
Thermistor Array Moorings
(14 thermistors per station)
TRINIDAD
BO JAN 1969

FIGURE 1

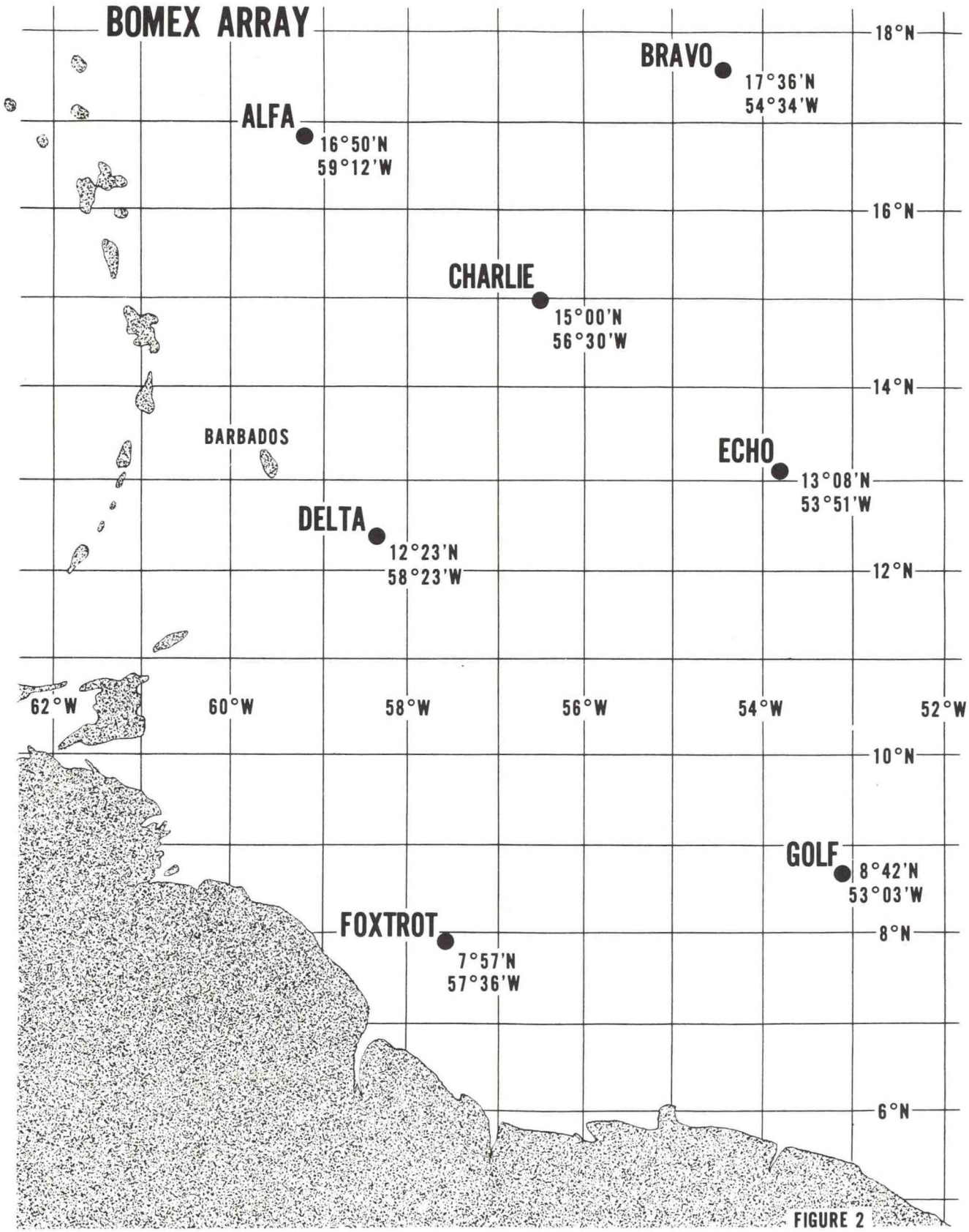
BOMEX ARRAY
BRAVO
17°36'N
54°34'W
ALFA
16°50'N
59°12'W
CHARLIE
15°00'N
56°30'W
BARBADOS
ECHO
13°08'N
53°51'W
DELTA
12°23'N
58°23'W
GOLF
8°42'N
53°03'W
FOXTROT
7°57'N
57°36'W
18°N
16°N
14°N
12°N
10°N
8°N
6°N
62°W
60°W
58°W
56°W
54°W
52°W

FIGURE 2

3. BOMEX Ship and Buoy Array

Observations and data collection for BOMEX are scheduled to take place, beginning May 1, 1969, through July 28, 1969, in the ocean area north and east of the Island of Barbados. The time for observations in the field has been divided into four phases as shown:

a.	Phase 1	May 3 - May 15
b.	Resupply	May 16 - May 23
c.	Phase 2	May 24 - June 10
d.	Resupply	June 11 - June 18
e.	Phase 3	June 19 - July 2
f.	Resupply	July 3 - July 10
g.	Phase 4	July 11 - July 28

The ships will return to Barbados for resupply, during which time a review of the data collected and preparations for the next phase will be accomplished.

The array of platforms and sensors for the first three data collection phases is shown in Figure 1. Figure 2 shows the geographic coordinates of the fixed stations. During the first three phases, ships RAINIER and OCEANOGRAPHER will be on stations ALFA and BRAVO, respectively. During the fourth experimental phase, these ships will move to the fixed stations FOXTROT and GOLF, with the ROCKAWAY, DISCOVERER and MT. MITCHELL remaining at their fixed stations. The GILLISS and the ADVANCE II have been committed as roving ships. The LAUREL will be utilized primarily for the implanation and servicing of buoys.

4. Organizations Participating with Aircraft

Organizations participating with aircraft are shown below. The aircraft will operate from Barbados during the periods reflected in Table 1, except, the Navy VW-121 will stage from Roosevelt Roads Naval Station, Puerto Rico, the NRL VW-121 will stage from Piarco, Trinidad, and the Air Weather Service aircraft (WC-130, WB-47, and RB-57F) will stage from Ramey AFBase, Puerto Rico. Table 2 lists the primary parameters which are observed and recorded.

ESSA RESEARCH FLIGHT FACILITY (RFF/ESSA)	
1 May - 30 July 1969	DC-4 & 2 DC-6
8-30 July 1969	B-57
AIR WEATHER SERVICE, USAF (AWS)	
1 May - 28 July 1969	WB-47
	RB-57F
	WC-130E
	WC-135
NAVY	
1 May - 28 July 1969 SQD 4	VW-121
22 May - 30 May & 16 - 22 June (ASWEPS)	VW-121
22 May - 30 May (NRL)	VW-121
NATIONAL CENTER FOR ATMOSPHERIC RESEARCH (NCAR)	
1 May - 28 July 1969	QUEEN AIR
15 June - 28 July 1969	BUFFALO
NASA	
8 - 20 July 1969	CONVAIR 990
1 - 20 June 1969	LOCKHEED P3V
WOODS HOLE OCEANOGRAPHIC INSTITUTE (WHOI)	
23 June - 28 July 1969	C-54
UNIVERSITY OF CALIFORNIA	
1 - 30 May 1969	DC-3
COLORADO STATE UNIVERSITY	
23 June - 28 July 1969	AERO COMMANDER

BOMEX AIRCRAFT PARTICIPATION

AIRCRAFT	1 MAY-15 MAY	24 MAY - 10 JUNE	19 JUNE-2 JULY	11 JULY-28 JULY	REMARKS
DC-6 ESSA 39	X	X	X	X	WATER VAPOR, TURB., VERT. FLUX
DC-6 ESSA 40	X	X	X	X	WATER VAPOR, HORIZONTAL FLUX
DC-4 ESSA	X	X	X	X	WATER VAPOR, HORIZONTAL FLUX
B-57 ESSA				X	TROPICAL DISTURB., WIND FIELD
VW-121 NAVY	X	X	X	X	GENERAL SUPPORT, WIND FIELD
VW-121 ASWEPS		23-29 MAY	17-21 JUNE		OCEANOGRAPHIC EXPERIMENTS
VW-121 NRL		23-29 MAY			OCEANOGRAPHIC EXPERIMENTS
C-130 AWS	X	X	X	X	SAMPLING, DROPSONDE
B-57F AWS	X	X	X	X	SAMPLING, CLOUD PHOTOS.
B-47 AWS	X	X	X	X	SAMPLING, RADAR
C 990 NASA				X	MULTIPLE EXP., SATELLITE GROUND TRUTH
P3A NASA		1-21 JUNE			MULTIPLE EXP., SATELLITE GROUND TRUTH
C-54 WHOI			23 JUNE-28 JULY	X	TURB. VERT. FLUX
AERO. CDR. COLO. ST. U.			23 JUNE-28 JULY	X	SUBCLOUD LAYER, OCEAN SURFACE
BUFFALO NCAR			X	X	TURB. VERT. FLUX
QUEEN AIR NCAR	X	X	X	X	MULTIPLE SUPPORT
DC-3 UNIV. OF CALIF.	1-30 MAY				VERT. TEMP. GROUND TRUTH OCEAN SURFACE

TABLE 1

METEOROLOGICAL OBSERVATION MATRIX FOR AIRCRAFT

X - OBSERVATION PERFORMED AND RECORDED

ELEMENT / AIRCRAFT	RFF DC-6	RFF DC-4	RFF B-57	AWS C-130	AWS B-47	AWS RB-57F	NAVY VW-121	WOODSHOLE DC-4	COL. ST. U. AERO COMM.	NASA 990	NASA NP3A	NCAR BUFFALO	NCAR QUEEN AIR	U. of CALIF. DC-3
Temperature	X	X	X	X	X		X	X	X	X	X	X	X	X
Abs. Humidity	X	X						X		X	X	X	X	
Dew Point Temperature	X						X	X	X		X	X	X	
Liquid Water Content	X										X	X	X	
Cloud Drop Temperature									X					X
Wind Direction (Doppler)	X	X	X	X	X	X	X			X	X	X	X	
Wind Speed (Doppler)	X	X	X	X	X	X	X			X	X	X	X	
Absolute Altitude	X	X	X	X	X		X	X			X	X	X	X
Pressure Altitude	X	X	X	X	X	X	X	X	X	X	X	X	X	
Ambient Pressure	X	X	X				X	X	X	X	X	X	X	
Sky Condition (Visual)	X	X	X	X	X	X	X							
Cloud Photo	X		X			X		X	X	X		X	X	
Sea State (Visual)	X	X	X	X			X							
Sea Sfc Temp. (IR)	X	X					X	X	X	X	X	X	X	X
Hor. Wx (Radar)	X	X		X	X	X	X	X		X	X			
Vert. Wx (Radar)	X		X				X							
Radar Photo	X	X	X	X	X	X	X	X		X	X			
Present Wx (Visual)	X	X	X	X	X	X	X	X	X	X	X	X	X	
Dropsonde				X										
Atm. Sampling	X			X	X	X								
Cloud Sample	X								X	X				
Nuclei Counter	X													
Vertical Wind	X							X				X		
Gust Probe	X											X		
Radiometer (Various Wave Lengths)	X	X					X	X	X	X	X	X	X	X
Pyronometers (short wave)	X									X		X		
Refractometer	X							X		X	X			
Time	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ind. Air Speed	X	X	X	X	X	X		X	X	X	X	X	X	
True Air Speed		X	X		X	X	X	X	X	X	X	X	X	
True Heading	X						X	X	X	X	X	X	X	
Mag. Heading	X	X	X					X	X	X	X	X	X	
Ground Speed	X	X	X			X	X	X	X	X	X	X	X	
Drift Angle	X	X	X				X	X	X	X	X	X	X	

TABLE 2

5. Data Management

NASA has assumed a significant role in support of BOMEX, particularly in the design of a Data Management System, which will be accomplished by utilization of the extensive capabilities of the Mississippi Test Facility of the Marshall Space Flight Center. The following are major tasks which will be accomplished by NASA/MTF:

a. Design, fabricate, and install a data recording system aboard five ship platforms to support the basic experiments defined by the BOMEX Director.

b. Provide field service support necessary to insure verification and performance of the NASA-installed data collection system.

c. Advise the BOMEX Project Office in data system verification and calibration as requested, within the limits of prescribed available manpower and resources.

d. Provide computer programs for data processing and scientific computation for the basic meteorological experiments as defined by the BOMEX Director.

e. Conduct data processing and post-experiment scientific computation for the basic meteorological experiments as defined by the BOMEX Director.

f. Provide a limited quick-look capability to assist the BOMEX Director in assessing the need for operational changes during the data collection periods.

6. Milestones and Schedules

The overall BOMEX Milestone Schedule is shown in Figures 3 and 4. The milestones which are shown on the schedule represent major events in the overall planning and execution of the experiment. The numbers beside the arrowheads indicate the day of the month toward which the arrow is directed. Solid arrows show that the indicated event has been accomplished, open arrows show the scheduled date for accomplishment.

APPROVED

PROJECT MANAGER

DATE

BOMEX MILESTONE SCHEDULE

CRITICAL EVENTS

LAST SCHEDULE CHANGE: DATE

LEVEL 1

MILESTONE	CY 19 68				CY 19 69			
	J F M	A M J	J A S	O N D	J F M	A M J	J A S	O N D
1 Data Reduction Software Ready						1 ⇧		
2 Data Analysis Software Ready						15 ⇧		
3 Support Systems Ready					24 ⇧			
4 Ships on Station						1 ⇧		
5 Buoys on Station						1 ⇧		
6 ACFT at Seawell						1 ⇧		
7 Start Data Collection								
8 Phase I						3 ⇧		
9 Phase II						24 ⇧		
10 Phase III						19 ⇧		
11 Phase IV							11 ⇧	
12 End Data Collection							28 ⇧	
13 Start Data Reduction						20 ⇧		
14 Start Data Analysis						28 ⇧		
15								
16								
17								

2 YEAR

FIGURE # 3

APPROVED

PROJECT MANAGER

DATE

BOMEX MILESTONE SCHEDULE

CRITICAL EVENTS

LAST SCHEDULE CHANGE: DATE

LEVEL 1

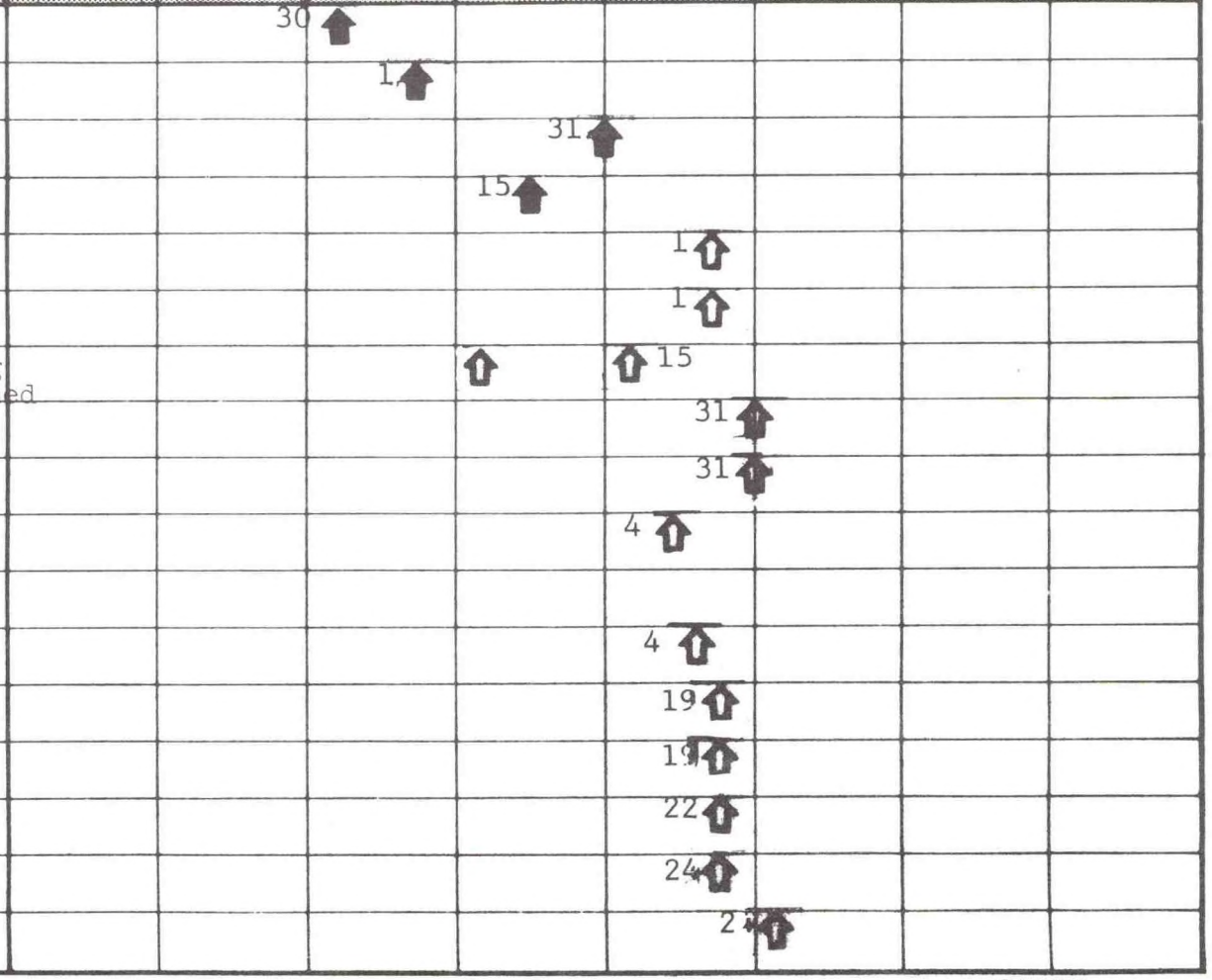

FIGURE # 4

2 YEAR

A P P E N D I C E S

APPENDIX 1

SCHEDULE FOR PARTICIPATING SHIPS

MT. MITCHELL (MSS22)

March 10	Arrive Miami
March 17	Depart Miami
March 19	Arrive Gulfport
March 20 - April 13	Gulfport Availability
April 14 - April 18	Sea Trials
April 19 - April 23	Gulfport (Corrective Action)
April 24	Depart Gulfport
April 24 - April 30	Enroute BOMEX Station DELTA
May 1 - May 15	On Station DELTA
May 16	Enroute Bridgetown
May 17 - May 22	In port Bridgetown
May 23	Enroute Station DELTA
May 24 - June 10	On Station DELTA
June 11	Enroute Bridgetown
June 12 - June 17	In port Bridgetown
June 18	Enroute Station DELTA
June 19 - July 2	On Station DELTA
July 3	Enroute Bridgetown
July 4 - July 9	In port Bridgetown
July 10	Enroute Station DELTA
July 11 - July 28	On Station DELTA
July 29	Enroute Bridgetown
July 30 - July 31	In port Bridgetown (Off-load necessary personnel and equipment)
August 1	Depart Bridgetown
August 1 - August 13	Enroute Norfolk

USNS GILLISS

May 22	Depart Norfolk
May 29	Arrive Bridgetown, Barbados (on-load scientists)
May 30 - May 31	Ops with FLIP)
June 1 - June 10	Ocean Station Ops) BOMEX area
June 11	Travel P.O.S. Trinidad
June 12 - June 15	In port P.O.S. Trinidad
June 16	Depart P.O.S. for BOMEX area
June 17 - June 24	Ocean Station Ops BOMEX area
June 25 - July 2	NUWRES Ops
July 3	Travel P.O.S. Trinidad
July 4 - July 6	In port Trinidad
July 7	Depart P.O.S. Trinidad
July 8 - July 23	Ocean Station Ops BOMEX area
July 24	Travel P.O.S. Trinidad
July 25 - July 27	In port Trinidad
July 28	Depart P.O.S. Trinidad
July 29 - August 5	Ocean Station Ops BOMEX area
August 5	Off-load scientists Bridgetown, Barbados; Depart for San Juan

DISCOVERER (OSS02)

March 17 - March 19	Enroute Gulfport
March 19	Arrive Gulfport
March 20 - April 9	Gulfport Availability
April 10 - April 16	Sea Trials & Corrective Action
April 17 - April 23	Miami or Gulfport
April 24	Depart Miami or Gulfport
April 24 - April 30	Enroute BOMEX Station ECHO
May 1 - May 15	On Station ECHO
May 16	Enroute Bridgetown
May 17 - May 22	In port Bridgetown
May 23	Enroute Station ECHO
May 24 - June 10	On Station ECHO
June 11	Enroute Bridgetown
June 12 - June 17	In port Bridgetown
June 18	Enroute Station ECHO
June 19 - July 2	On Station ECHO
July 3	Enroute Bridgetown
July 4 - July 9	In port Bridgetown
July 10	Enroute Station ECHO
July 11 - July 28	On Station ECHO
July 29	Enroute Bridgetown
July 30 - August 3	In port Bridgetown (Off-load necessary personnel and equipment)
August 4	Depart Bridgetown

OCEANOGRAPHER (OSS 01)

March 4	Depart for Gulfport
March 21	Arrive Gulfport
March 22 - April 13	Gulfport Availability
April 14 - April 18	Sea Trials
April 19 - April 23	Gulfport (Corrective Action)
April 24	Depart Gulfport
April 24 - April 30	Enroute BOMEX Station BRAVO
May 1 - May 15	On Station BRAVO
May 16	Enroute Bridgetown
May 17 - May 22	In port Bridgetown
May 23	Enroute Station BRAVO
May 24 -June 10	On Station BRAVO
June 11	Enroute Bridgetown
June 12 - June 17	In port Bridgetown
June 18	Enroute Station BRAVO
June 19 - July 2	On Station BRAVO
July 3	Enroute Bridgetown
July 4 - July 9	In port Bridgetown
July 10	Enroute Station GOLF
July 11 - July 28	On Station GOLF
July 29	Enroute Bridgetown
July 30 - July 31	In port Bridgetown (Off-load necessary personnel and equipment)
August 1	Depart Bridgetown
August 1 - August 19	Enroute Seattle

RAINIER (MSS21)

February 13	Depart Seattle
March 4	Arrive Gulfport
March 5 - March 30	Gulfport Availability
March 31 - April 4	Sea Trails
April 5 - April 13	Gulfport (Corrective Action)
April 14	Depart Gulfport
April 14 - April 20	Enroute Bridgetown, Barbados
April 21 - April 24	In port Bridgetown (Monitor Omega and test Triton
April 25 - April 28	In port Bridgetown
April 29	Depart Bridgetown
April 29 - April 30	Enroute BOMEX Station ALFA
May 1 - May 15	On Station ALFA
May 16	Enroute Bridgetown
May 17 - May 22	In port Bridgetown
May 23	Enroute Station AFLA
May 24 - June 10	On Station ALFA
June 11	Enroute Bridgetown
June 12- June 17	In port Bridgetown
June 18	Enroute Station ALFA
June 19 - July 2	On Station ALFA
July 3	Enroute Bridgetown
July 4 - July 9	In port Bridgetown
July 10	Enroute Station FOXTROT 50 miles off coast of British Guiana
July 11 - July 28	On Station FOXTROT (Anchored in 50 fms)
July 29	Enroute Bridgetown
July 30 - July 31	In port Bridgetown (Off-load necessary personnel and equipment)
August 1	Depart Bridgetown
August 1 - August 25	Enroute Seattle

CGC LAUREL

March 25	Arrive Washington Navy Yard (Load NAVOCEANO Arrays Aboard)
March 27	Depart Washington
April 9	Arrive San Juan, Puerto Rico
April 10	Depart San Juan, Puerto Rico - Implant NAVY's Six Current Meter Arrays and Two Temperature Arrays
April 22	Arrive Bridgetown, Barbados
April 25	Depart Bridgetown - Tow TRITON to Station CHARLIE
April 27	Arrive OP Area (15°N, 56.5°W) (Implant TRITON and Instrument - Transfer FSU Personnel to ROCKAWAY)
May 4	Depart OP Area
May 5	Arrive Bridgetown (Stay available for use until May 26)
May 26	Depart BOMEX
June 2	Arrive Bermuda (Navy OPS)
June 10	Depart Bermuda
June 15	Arrive Rockland, Maine (R&R and Ship Maintenance)
July 1	Depart Rockland
July 11	Rendezvous with ROCKAWAY (Available to assist in Buoy Servicing and Maintenance in BOMEX area)
July 28	FSU Personnel transfer from ROCKAWAY - Tow TRITON to Bridgetown
August 2	Arrive Bridgetown
August 3	Depart Bridgetown
August 4	Arrive OP Area (15°N, 56.5°W) (Retrieve Six Current Meter and Two Temperature Arrays)
August 10	Depart OP Area
August 11	Arrive Bridgetown
August 26	Depart Bridgetown - Reload TRITON Equipment for transit to Miami
September 1	Arrive Miami, Florida (Offload TRITON Equipment)
September 3	Depart Miami
September 7	Arrive Washington Navy Yard (Offload NAVOCEANO Equipment)
September 8	END BOMEX OPS

ROCKAWAY (W 377)

March 17	Depart New York
March 24	Arrive Gulfport
March 25 - April 14	Gulfport Availability
April 15 - April 24	Sea Trials and Corrective Action, Enroute to Bridgetown, Barbados.
April 25 - April 27	In port Bridgetown
April 27	Depart Bridgetown
April 28	Arrive BOMEX Station CHARLIE - help instrument TRITON - bring aboard FSU personnel.
May 1 - May 15	On Station CHARLIE
May 16	Enroute Bridgetown
May 17 - May 22	In port Bridgetown
May 23	Enroute Station CHARLIE
May 24 - June 10	On Station CHARLIE
June 11	Enroute Bridgetown
June 12 - June 17	In port Bridgetown
June 18	Enroute Station CHARLIE
June 19 - July 2	On Station CHARLIE
July 3	Enroute Bridgetown
July 4 - July 9	In port Bridgetown
July 10	Enroute Station CHARLIE
July 11 - July 28	On Station CHARLIE
July 28	Transfer FSU Personnel to LAUREL
July 29	Enroute Bridgetown
July 30 - July 31	In port Bridgetown (Off-load necessary personnel and equipment)
August 1	Depart Bridgetown

FLIP (SVCS) and TUG

March 29	Departs San Diego
April 25	Arrives Bridgetown, Barbados
April 30	FLIP on station
May 1 - May 29	Participate in BOMEX
May 13 - May 18	TUG on logistics run to Barbados and return
May 29	Depart BOMEX
June 1	Arrive Bridgetown, Barbados

*SCARD = Mag. Tape
Man. = Manual Record
P.P.T.= Punched Paper Tape
STRIP = STRIP Chart
SAMP. = Captured Sample

APPENDIX 2

BOMEX OBSERVATION SCHEDULE

SHIP	OBSERVATION	*PRIMARY RECORD MODE	START/END DATE OF OBS.	FREQUENCY OF OBSERVATION	OBS. START TIME	DEPTH OR HEIGHT (REL. TO SURFACE)
OCEANO.	1. Rawinsonde		5/3 - 5/15,	15/day	0300+1.5 hrs	to 400 MB.
	a. Temperature	Scard	5/24- 6/10		(000)	(To Burst)
	b. Humidity	Scard				
	c. Pressure	Scard	6/19- 7/2	4/day	0000+6 hrs.	To Burst
	d. Balloon Position (Scanwell)	Scard	7/11- 7/28	(8/day Periodically)		
	e. Radiation (Net)	Scard	5/3 - 5/15,	1/day	0000	To Burst
			5/24- 6/10	1/day	0000	To Burst
			5/19- 7/2	(1/day or more)	----	(On command for approx.
			7/11- 7/28	(1/day or more)	----	1/3 of test days)
	2. BLIP		5/3 - 5/15	Cont.	0000	200m, 400m, 600m
	a. Temp. (DB)	Scard	5/24- 6/10	(Except During		(3 levels)
	b. Temp.(WB)	Scard	6/19- 7/2	Servicing)		
	c. RH	Scard	7/11- 7/28			
	d. Wind Speed	Scard				
	e. Pressure	Scard				
	3. BOOM					
	a. Temp (DB)	Scard	All Experimental	Cont.	0000	Surface (10m)
	b. Temp (WB)	Scard	Periods			
	c. Wind Dir.	Scard				
	d. Wind Speed	Scard				
	e. RH	Scard				
	f. Sea Temp.	Scard				
	4. Surface Obs.					
	a. Baro. Press.	Scard	All Exp. Per.	Cont.	0000	Surface
	b. Baro. Press. (Aneroid)	Man.	"	15/day or 4/day	Rawin Sch.	Surface
	c. Baro. Press. Tend.	Man.	"	8/day	0000+3 hrs.	"
	d. Net Rad.	Strip	"	Cont.	0000	"
	e. Incident Rad.	Strip	"	"	"	"
	f. Rel. Wind Sp.	Scard	"	"	"	"
	g. Rel. Wind Dir.	Scard	"	"	"	"
	h. Temp (DB)	Man.	"	"	"	"

*SCARD = Mag. Tape
Man. = Manual Record
P.P.T.= Punched Paper Tape
STRIP = STRIP Chart
SAMP. = Captured Sample

BOMEX OBSERVATION SCHEDULE

SHIP	OBSERVATION	*PRIMARY RECORD MODE	START/END DATE OF OBS.	FREQUENCY OF OBSERVATION	OBS. START TIME	DEPTH OR HEIGHT (REL. TO SURFACE)
OCEANO.	i. Temp (WB)	Man.	All Exp. Per.	4/day	0300+6 hrs.	Surface
	j. Rainfall Amt.	Man.		----	----	When occurs, Sfc.
	k. Wave Conditions	Man.	"	15/day or 4/day	Rawin Sch.	Surface
	l. Sky Cover	Man.	"	"	"	"
	m. Cloud Types	Man.	"	"	"	"
	n. Visibility	Man.	"	"	"	"
	o. Weather Elem.	Man.	"	"	"	"
	p. Sea Temp.	Scard	"	Cont.	"	Sfc. (-6m)
	5. S. T. D.					
	a. Temp.	Scard	All Exp. Per.	8/day	0000+3 hrs.	Sfc. to 1000m
	b. Salinity	Scard				
	c. Depth 1	Scard				
	d. Depth 2	Scard				
	e. Sound Vel.	Scard				
	6. Aerosol Air Sample	Samp.	All Exp. Per.	Cont.	0000	1 level at Sfc.
	7. Rain Catchment	Samp.	"	Cont.	----	Surface
	8. Ocean Current Speed & Dir.	Scard	"	Cont.	0000	Sfc. & 150m profile every 3 hrs.
	9. Ship Oper.					
	a. Course	Scard	All Exp. Per.	Cont.	0000	Surface
	b. Speed	Man.	"	24/day	0000+1 hr.	----
	c. Position	Man.	"	24/day	0000+1 hr.	----

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P.P.T.= Punched Paper Tape
STRIP = STRIP Chart
SAMP. = Captured Sample

BOMEX OBSERVATION SCHEDULE

SHIP	OBSERVATION	*PRIMARY RECORD MODE	START/END DATE OF OBS.	FREQUENCY OF OBSERVATION	OBS. START TIME	DEPTH OR HEIGHT (REL. TO SURFACE)
DISCO.	1. Rawinsonde		5/3 - 5/15,	15/day	0300+1.5 hrs	to 400 MB.
	a. Temp.	Scard	5/24- 6/10		(0000)	(To Burst)
	b. Humidity	Scard				
	c. Pressure	Scard	6/19- 7/2,	4/day	0000+6 hrs.	To Burst
	d. Balloon Position (Selenia Radar)	P.P.T.	7/11- 7/28	(8/day Periodically)		
	e. Radiation (Net)	Scard	5/3 - 5/15	1/day	0000	To Burst
			5/24- 6/10	1/day	0000	To Burst
			6/19- 7/2	(1/day or more)	----	(On command for approx.
			7/11- 7/28	(1/day or more)	----	1/3 of test days)
	2. BLIP					
	a. Temp (DB)	Scard	All Periods	Cont.	0000	200m, 400m, 600m
	b. Temp (WB)	Scard	as above	(Except during		(3 levels)
	c. RH	Scard		servicing)		
	d. Wind Speed	Scard				
	e. Pressure	Scard				
	3. BOOM					
	a. Temp (DB)	Scard	All Exp. Per.	Cont.	0000	Surface (10m)
	b. Temp (WB)	Scard				
	c. RH	Scard				
	d. Wind Dir.	Scard				
	e. Wind Speed	Scard				
	f. Sea Temp.	Scard				
	4. Surf. Obs.					
	a. Baro. Press.	Scard	All Exp. Per.	Cont.	0000	Surface
	b. Baro. Press. (Aneroid)	Man.	"	15/day or 8/day	Rawin Sch	"
	c. Baro. Press. Tend.	Man.	"	8/day	0000+3 hrs.	"
	d. Net Rad.	Strip	"	Cont.	0000	"
	e. Incident Rad.	Strip	"	"	"	"
	f. Rel. Wind Dir.	Scard	"	"	"	"

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Man. = Manual Record
P.P.T.= Punched Paper Tape
STRIP = STRIP Chart
SAMP. = Captured Sample

BOMEX OBSERVATION SCHEDULE

SHIP	OBSERVATION	*PRIMARY RECORD MODE	START/END DATE OF OBS.	FREQUENCY OF OBSERVATION	OBS. START TIME	DEPTH OR HEIGHT (REL. TO SURFACE)
DISCO.	g. Rel. Wind Speed	Scard	All Exp. Per.	Cont.	0000	Surface
	h. Temp (DB)	Man.	"	4/day	0300+6 hrs.	"
	i. Temp (WB)	Man.	"	"	"	"
	j. Rainfall Amt.	Man.	"	Cont.	"	When occurs, Sfc.
	k. Wave Cond.	Man.	"	15/day or 8/day	Rawin Sch.	Surface
	1. Sky Cover	Man.	"	"	"	"
	m. Cloud Types	Man.	"	"	"	"
	n. Visibility	Man.	"	"	"	"
	o. Weather Elem.	Man.	"	"	"	"
	p. Sea Temp.	Scard	"	"	"	"
	5. S. T. D.					
	a. Temp.	Scard	All Exp. Per.	8/day	0000+3 hrs.	Surface to 1000m
	b. Salinity	Scard	"			
	c. Depth 1	Scard	"			
	d. Depth 2	Scard	"			
	e. Sound Vel.	Scard	"			
	6. Aerosol Air Sample	Samp.	All Exp. Per.	Cont.	0000	1 level at Sfc.
	7. Rain Catchment	Samp	"	"	"	Surface
	8. Ship Oper.					
	a. Course	Scard	All Exp. Per.	Cont.	0000	----
	b. Speed	Man.	"	"	0000+1 hr.	----
	c. Position	Man.	"	"	"	----

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Man. = Manual Record
P.P.T.= Punched Paper Tape
STRIP = STRIP Chart
SAMP. = Captured Sample

BOMEX OBSERVATION SCHEDULE

SHIP	OBSERVATION	*PRIMARY RECORD MODE	START/END DATE OF OBS.	FREQUENCY OF OBSERVATION	OBS. START TIME	DEPTH OR HEIGHT (REL. TO SURFACE)
ROCK.	1. Rawinsonde		5/3 - 5/15	15/day	0300+1.5 hrs	To 400 MB.
	a. Temp.	Scard	5/24- 6/10		(0000)	(To Burst)
	b. Humidity	Scard				
	c. Pressure	Scard	6/19- 7/2	4/day	0000+6 hrs.	To Burst
	d. Balloon Position (AW/SPs 29 Radar)	Man.	7/10- 7/28	(8/day Periodically)		
	2. BLIP					
	a. Temp (DB)	Scard	All Exp. Per.	Cont.	0000	200m, 400m, 600m
	b. Temp (WB)	Scard		(Except for		3 levels
	c. RH	Scard		servicing)		
	d. Wind Speed	Scard				
	e. Pressure	Scard				
	3. BOOM					
	a. Temp (DB)	Scard	All Exp. Per.	Cont.	0000	Surface (10m)
	b. Temp (WB)	Scard				
	c. Wind Dir.	Scard				
	d. Wind Speed	Scard				
	e. RH	Scard				
	f. Sea Temp.	Scard				
	4. Surface Obs.					
	a. Baro. Press.	Scard	All Exp. Per.	Cont.		Surface
	b. Baro Press.	Man.	"	15/day or 4/day	Rawin Sch.	"
	c. Baro. Press. Tend.	Man.	"	8/day	0000+ 3 hrs.	"
	d. Net Rad.	Strip	"	Cont.	0000	"
	e. Incident Rad.	Strip	"	"	"	"
	f. Rel. Wind Speed	Scard	"	"	"	"
	g. Rel. Wind Dir.	Scard	"	"	"	"
	h. Temp (DB)	Man.	"	4/day	0000+6 hrs.	"
	i. Temp (WB)	Man.	"	"	"	"

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Man. = Manual Record
P.P.T.= Punched Paper Tape
STRIP = STRIP Chart
SAMP. = Captured Sample

BOMEX OBSERVATION SCHEDULE

SHIP	OBSERVATION	*PRIMARY RECORD MODE	START/END DATE OF OBS.	FREQUENCY OF OBSERVATION	OBS. START TIME	DEPTH OR HEIGHT (REL. TO SURFACE)
ROCK,	j. Rainfall Amt.	Man.	All Exp. Per.	15/day or 8/day	Rawin Sch.	Surface
	k. Wave Cond.	Man.	"	"	"	"
	l. Sky Cover	Man.	"	"	"	"
	m. Cloud Types	Man.	"	"	"	"
	n. Visibility	Man.	"	"	"	"
	o. Weather Elem.	Man.	"	"	"	"
	p. Sea Temp.	Scard	"	"	"	"
	5. S. T. D.					
	a. Temp.	Scard	All Exp. Per.	8/day	0000+3 hrs.	Sfc to 1000m
	b. Salinity	Scard	"			
	c. Depth 2	Scard	"			
	6. Aerosol Air Sample	Samp.	All Exp. Per.	Cont.	0000	5 levels at Sfc.
	7. Rain Catchment	Samp.	"	"	"	Surface
	8. Water Sample (AEC)	Samp.	"	1/day	----	Profile to 150m.
	9. Water Sample (LAMONT)	Samp.	5/3 - 5/15 5/24- 6/10	1 per 2 days "	---- ----	10 levels to 200m. "
	10. Water Sample (Isotopes)	Samp.	6/19- 7/2	1/day	----	10 levels to 200m.
	11. Rain Drop Charge	Samp.	All Exp. Per.	----	----	----
	12. Rain Part. Size	Samp.	"	----	----	----
	13. Ship Ops.					
	a. Course	Scard	"	Cont.	0000	Surface
	b. Speed	Man.	"	24/day	0000+1 hr.	"
	c. Position	Man.	"	24/day	0000+1 hr.	"

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Man. = Manual Record
P.P.T.= Punched Paper Tape
STRIP = STRIP Chart
SAMP. = Captured Sample

BOMEX OBSERVATION SCHEDULE

SHIP	OBSERVATION	*PRIMARY RECORD MODE	START/END DATE OF OBS.	FREQUENCY OF OBSERVATION	OBS. START TIME	DEPTH OR HEIGHT (REL. TO SURFACE)
MT. MITCHELL	1. Rawinsonde		5/3 - 5/15	15/day	0300+1.5 hr	to 400 MB.
	a. Temp.	Scard	5/24- 6/10	"	(0000)	(To Burst)
	b. Humidity	Scard				
	c. Pressure	Scard	6/19- 7/2	4/day	0000+6 hrs.	To Burst
	d. Balloon Position (Scanwell)	Scard	7/11- 7/28	(8/day Periodically)		
	2. BLIP					
	a. Temp (DB)	Scard	All Exp. Per.	Cont.	0000	400m
	b. Temp (WB)	Scard		(Except for		(1 level)
	c. RH	Scard		Servicing)		
	d. Wind Speed	Scard				
	e. Pressure	Scard				
	3. BOOM					
	a. Temp (DB)	Scard	All Exp. Per.	Cont.	0000	Surface (10m)
	b. Temp (WB)	Scard				
	c. Wind Dir.	Scard				
	d. Wind Speed	Scard				
	e. RH	Scard				
	f. Sea Temp.	Scard				
	4. Surface Obs.					
	a. Baro. Press.	Scard	All Exp. Per.	Cont.	0000	Surface
	b. Baro. Press. (Aneroid)	Man.	"	15/day or 4/day	Rawin Sch.	"
	c. Baro. Press. Tend.	Man.	"	8/day	0000+3 hrs.	"
	d. Net Radiation	Strip	"	Cont.	0000	"
	e. Incident Rad.	Strip	"	"	"	"
	f. Rel. Wind Speed	Scard	"	"	"	"
	g. Rel. Wind Dir.	Scard	"	"	"	"

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Man. = Manual Record
P.P.T.= Punched Paper Tape
STRIP = STRIP Chart
SAMP. = Captured Sample

BOMEX OBSERVATION SCHEDULE

SHIP	OBSERVATION	*PRIMARY RECORD MODE	START/END DATE OF OBS.	FREQUENCY OF OBSERVATION	OBS. START TIME	DEPTH OR HEIGHT (REL. TO SURFACE)
MT. MITCHELL	h. Temp (DB)	Man.	All Exp. Per.	4/day	0000+6 hrs.	Surface
	i. Temp (WB)	Man.	"	"	"	"
	j. Rainfall Amt.	Man.	"	----	----	When occurs, Sfc.
	k. Wave Cond.	Man.	"	15/day or 4/day	Rawin Sch.	Surface
	1. Sky Cover	Man.	"	"	"	"
	m. Cloud Types	Man.	"	"	"	"
	n. Visibility	Man.	"	"	"	"
	o. Weather Elem.	Man.	"	"	"	"
	p. Sea Temp.	Man.	"	"	"	"
	5. S. T. D.					
	a. Temp.	Scard	All Exp. Per.	4/day	0000+6 hrs.	Surface to 1000m
	b. Salinity	Scard				
	c. Depth 2	Scard				
	6. Aerosol Air Sample	Samp.	All Exp. Per.	Cont.	0000	1 level at Sfc.
	7. Rain Catchment	Samp.	"	"	----	Surface
	8. Ship Ops.					
	a. Course	Scard	All Exp. Per.	Cont.	0000	Surface
	b. Speed	Man.	"	24/day	0000+1 hr.	----
	c. Position	Man.	"	24/day	0000+1 hr.	----

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Man. = Manual Record
P.P.T.= Punched Paper Tape
STRIP = STRIP Chart
SAMP. = Captured Sample

BOMEX OBSERVATION SCHEDULE

SHIP	OBSERVATION	*PRIMARY RECORD MODE	START/END DATE OF OBS.	FREQUENCY OF OBSERVATION	OBS. START TIME	DEPTH OR HEIGHT (REL. TO SURFACE)
RAINIER	1. Rawinsonde		5/3 - 5/15	15/day	0300+1.5 hr	to 400 MB
	a. Temp.	Scard	5/24- 6/10	"	(0000)	(To Burst)
	b. Humidity	Scard				
	c. Pressure	Scard	6/19- 7/2	4/day	0000+6 hrs.	To Burst
	d. Balloon Position (Scanwell)	Scard	7/11- 7/2	(8/day Periodically)		
	e. Radiation (Net)	Scard	5/3 - 5/15	1/day	0000	To Burst
			5/24- 6/10	1/day	0000	To Burst
			6/19- 7/2	(1/day or more)	----	(on command for approx.
			7/11- 7/28	(1/day or more	----	1/3 of test days)
	2. BLIP					
	a. Temp (DB)	Scard	All Exp. Per.	Cont.	0000	400m
	b. Temp (WB)	Scard		(Except for		(1 level)
	c. RH	Scard		Servicing)		
	d. Wind Speed	Scard				
	e. Pressure	Scard				
	3. BOOM					
	a. Temp (DB)	Scard	All Exp. Per.	Cont.	0000	Surface (10m)
	b. Temp (WB)	Scard				
	c. Wind Dir.	Scard				
	d. Wind Speed	Scard				
	e. Humidity	Scard				
	f. Sea Temp.	Scard				
	4. Surface Obs.					
	a. Baro. Press.	Scard	All Exp. Per.	Cont.	0000	Surface
	b. Baro. Press. (Aneroid)	Man.	"	15/day or 4/day	Rawin Sch.	"
	c. Baro. Press. Tend.	Man.	"	8/day	0000+3 hrs.	"

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Man. = Manual Record
P.P.T.= Punched Paper Tape
STRIP = STRIP Chart
SAMP. = Captured Sample

BOMEX OBSERVATION SCHEDULE

SHIP	OBSERVATION	*PRIMARY RECORD MODE	START/END DATE OF OBS.	FREQUENCY OF OBSERVATION	OBS. START TIME	DEPTH OR HEIGHT (REL. TO SURFACE)
RAINIER	d. Net. Rad.	Strip	All Exp. Per.	Cont.	0000	Surface
	e. Incident Rad.	Strip	"	"	"	"
	f. Rel. Wind Speed	Scard	"	"	"	"
	g. Rel. Wind Dir.	Scard	"	"	"	"
	h. Temp (DB)	Man.	"	4/day	0000+6 hrs.	"
	i. Temp (WB)	Man.	"	"	"	"
	j. Rainfall Amt.	Man.	"	15/day or 4/day	Rawin Sch.	"
	k. Wave Cond.	Man.	"	"	"	"
	1. Sky Cover	Man.	"	"	"	"
	m. Cloud Types	Man.	"	"	"	"
	n. Visibility	Man.	"	"	"	"
	o. Weather Elem.	Man.	"	"	"	"
	p. Sea Temp.	Man.	"	"	"	"
	5. S. T. D.					
	a. Temp	Scard	All Exp. Per.	4/day	0000+6 hrs.	Surface to 1000m
	b. Salinity	Scard	"			
	c. Depth 2	Scard	"			
	6. Aerosol Air Sample	Samp.	All Exp. Per.	Cont.	0000	1 level at Sfc.
	7. Rain Catchment	Samp.	"	"	"	Surface
	8. Ship Ops.					
	a. Course	Scard	All Exp. Per.	Cont.	0000	----
	b. Speed	Man.	"	24/day	0000+1 hr.	----
	c. Position	Man.	"	"	"	----

APPENDIX 3

BOMEX DATA SYSTEM PLAN

The three primary platforms from which BOMEX Basic Data are acquired are: Ships, Buoys and Aircraft. The goals of the Data Acquisition System on each of these platforms, at the central data reduction facility and archive facility break down as follows:

1) Ingestion of the Basic Core BOMEX Data in a form to facilitate machine or computer processing of the data and to minimize data system and human error.

2) Provide a data quick look facility at Barbados and at the Central Data Reduction Facility to quality control the incoming data.

3) Provide a Central Repository for the BOMEX Basic Core Data from which the various users may request data in the formats they require.

The flow of shipboard, buoy and aircraft data to the final repository for the data is shown in block diagram form in Figure 5.

In the shipboard case the data input falls into four discrete types, (1) Automatic Sensor Input (i.e., rawinsonde, boundary layer instrument package, STD etc.); (2) Manually Recorded Data (surface observations, etc); (3) Punched Paper Tape Data (radar data), and (4) Analog Strip Chart Data for Quality Control Input.

The automatic sensor input data is by far the greatest amount of shipboard data and is signal conditioned (amplified, etc.), multiplexed and recorded by a specialized NASA/GE Electronic Equipment System called SCARD, (Signal Conditioning And Recording Device).

One SCARD will be installed on each of five instrumentation ships participating in the experiment, although a total of six SCARD units will be fabricated. The additional SCARD will be employed at NASA/MTF in the data reduction cycle.

Each SCARD will consist of seven basic units as follows:

a. Magnetic Tape Unit

The Magnetic Tape Unit will be a seven-track magnetic tape recorder with the appropriate record, reproduce, and control electronics. The function of this unit will be to record the BOMEX data for automatic processing at a later data.

b. Voltage Controlled Oscillator (VCO) Calibration Unit

The VCO Calibration Unit will be used to provide five precision voltage steps into the SCARD Frequency Multiplex Unit (VCO's). These voltage steps will be used to calibrate the Frequency Multiplex Unit prior to data recording.

c. Local Data Distributor Unit

The Local Data Distributor Unit will perform the following functions:

- o Generate sync code for the Multiple Sample Unit.
- o Generate the data tape identification code.
- o Generate event marker data.

The composite sync, identification and event marker data from this unit will interface with the Multiple Sampling Unit.

d. Frequency Multiplex Unit

The Frequency Multiplex Unit consists of ten voltage controlled oscillator subunits and two summing amplifiers. The purpose of this unit is to frequency-multiplex radiosonde, radar tracked and shipboard data into the Magnetic Tape Unit.

e. Multiple Sampling Unit

The Multiple Sampling Unit will accept thirty sync, identification and data inputs for sequential sampling and output to the VCO located in the Frequency Multiplex Unit.

f. Power Supply Unit

The Power Supply Unit performs the following functions:

- o Supply excitation to the slide wire measurements aboard ship.
- o Provide DC excitation to the local data distributor.

g. Patch Panel Unit

The SCARD Patch Panel Unit provides a central interface for data inputs into the SCARD and a monitoring interface for the Frequency Multiplex Unit output and the Magnetic Tape Unit reproduce output.

After the data is recorded during each experiment period on SCARD, the tapes for that period will be flown to NASA/MTF for decommutating and digitizing. After this step is completed, the data will be smoothed, converted to Engineering Units and formatted. Quality Control "Quick Look" data will then be made available to the BOMEX Director to enable him to modify the the observation program as required.

After the basic validity of the data has been established by quality control checks, the data from the ships and the RFF aircraft will be transferred to the BOMEX Master Data File. This file will store all the BOMEX Basic Core Data taken and will be used as the data sources for computation of fluxes as soon as the observation phases of the experiment have been completed. Initial flux computations will proceed as other data are being digitized. Data collected on magnetic tape from the RFF daily flights will be monitored and smoothed using a small scale computer at Barbados. This will enable the scientists at the island to make minor observation adjustments as necessary. It is planned that all BOMEX Basic Core recorded data will be available to all interested parties not later than six months after the end of the observation periods. The data will be stored on magnetic tape and filed in its entirety at the National Weather Records Center at Asheville, North Carolina. Other data collected by aircraft and buoys will in general be processed by the individual investigators and then forwarded to the National Weather Records Center or the National Oceanographic Data Center as appropriate.

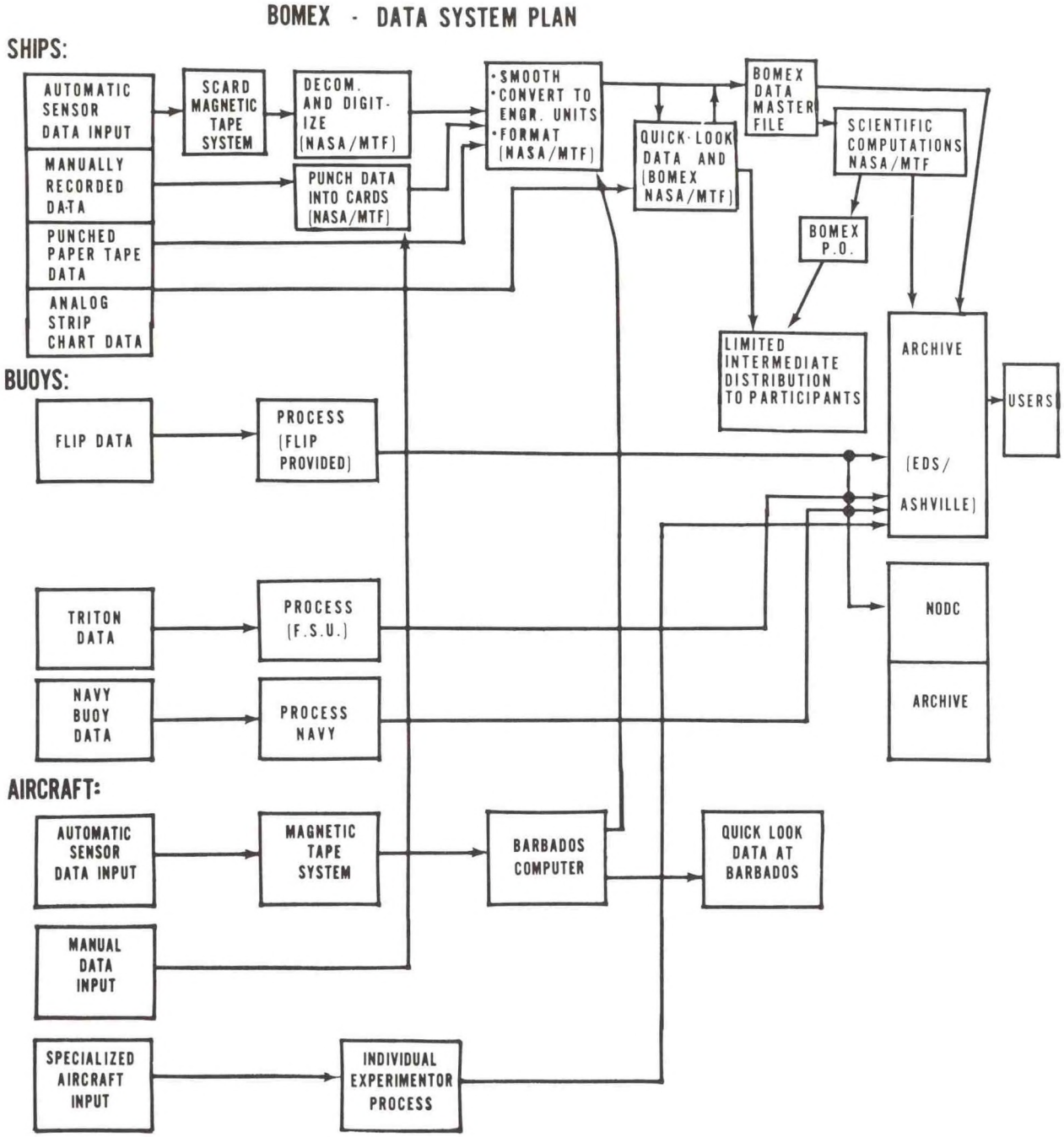
BOMEX - DATA SYSTEM PLAN
SHIPS:
AUTOMATIC SENSOR DATA INPUT
MANUALLY RECORDED DATA
PUNCHED PAPER TAPE DATA
ANALOG STRIP CHART DATA
SCARD MAGNETIC TAPE SYSTEM
DECOM. AND DIGIT-IZE (NASA/MTF)
PUNCH DATA INTO CARDS (NASA/MTF)
•SMOOTH
•CONVERT TO ENGR. UNITS
•FORMAT (NASA/MTF)
QUICK-LOOK DATA AND (BOMEX NASA/MTF)
BOMEX DATA MASTER FILE
SCIENTIFIC COMPUTATIONS NASA/MTF
BOMEX P.O.
LIMITED INTERMEDIATE DISTRIBUTION TO PARTICIPANTS
ARCHIVE
(EDS/
ASHVILLE)
USERS
BUOYS:
FLIP DATA
PROCESS (FLIP PROVIDED)
TRITON DATA
PROCESS (F.S.U.)
NAVY BUOY DATA
PROCESS NAVY
NODC
ARCHIVE
AIRCRAFT:
AUTOMATIC SENSOR DATA INPUT
MAGNETIC TAPE SYSTEM
BARBADOS COMPUTER
QUICK LOOK DATA AT BARBADOS
MANUAL DATA INPUT
SPECIALIZED AIRCRAFT INPUT
INDIVIDUAL EXPERIMENTOR PROCESS

FIGURE # 5

APPENDIX 4

LOGISTICS

A staging period has been scheduled for installation of equipment and loading of supplies aboard the five participating ships at Gulfport, Mississippi, from 3 March through 23 April 1969. Equipment installations will include the signal conditioning and recording devices and the sensor equipment by MTF personnel, installation of meteorological booms and BLIP equipment by SAIL personnel, and installation of the free-fall mooring systems by ESSA personnel in conjunction with engineers representing the contractor. Supplies to be loaded in Gulfport include meteorological expendables, helium gas, and miscellaneous items necessary to the Project. All receiving and warehousing of equipment and supplies in Gulfport is being handled by the U.S. Naval Construction Battalion Center. Port facilities are being provided by the State of Mississippi.

Some pre-staging installation work has been accomplished in the ships' respective home ports. This has included installation of meteorological radars and provision for stowage of the large amounts of helium which will be required by the Experiment.

Prior to commencement of BOMEX in May, the Air National Guard will provide airlift services for transportation of radar vans, computer vans, special buoy components, electronic equipment, and other items necessary for the Experiment on Barbados.

The BOMEX field office and control center in Barbados will be in the Paragon House, just south of Seawell Airport. Arrangements for mail handling, transportation, medical care, and fuel are in progress. Periodic logistics flights by the Air National Guard will be made throughout the Experiment. Resupply of the ships with helium will be accomplished as required in Barbados. Experiment data tapes will be collected from the ships during in port periods and transported by courier to Mississippi Test Facility for reduction.

The roll-up phase, to begin about 28 July 1969, will consist of returning BOMEX equipment to continental U. S. ports by ship and by airlift, and shipment within the U. S. to final destination.

APPENDIX 5

COMMUNICATIONS AND NAVIGATION

U. S. Coast Guard facilities will be established on Barbados to provide communications support for BOMEX. High frequency single side band voice and direct printing telegraph between ships, aircraft and Barbados, with relay back to the Coast Guard's radio station in New Orleans will be available for coordination and data relay for the experiment. Additionally, experimental satellite communications will be utilized to demonstrate the feasibility of this technique for such an experiment. Details of the communications plan will be published as Annex M to the BOMEX Operations Plan.

In addition to radio communications, the BOMEX Control Center will have access to the Barbados Telephone Company for intra-island service and long distance telephone and cable service. Dockside telephone service for ships in port will be provided for intra-island service.

Commercial telegraph service is available in Bridgetown, Barbados. Incoming telegrams will be held at the BOMEX Control Center and in the case of persons on ships at sea, may be relayed on a not-to-interfere basis over BOMEX radio circuits.

The OMEGA Navigation System Project Office will provide four OMEGA Navigation Sets for use on vessels participating in BOMEX, for installation during mid-April 1969 until 1 August 1969. Instruction on OMEGA installation, monitoring maintenance and operation will be provided while the appropriate ships are at Gulfport, Mississippi.

APPENDIX 6

METEOROLOGICAL RADAR FOR USC&GS SHIP DISCOVERER

A multi-purpose meteorological radar is currently being installed on the DISCOVERER. This radar, a METEOR 200 RMT-2S built by the Italian firm Selenia, will perform three important functions for BOMEX:

1. Upper-air wind observations.

2. Determination of location and extent of precipitation areas.

3. Analyses of individual rain cells for estimation of precipitation rate and duration.

The radar will be mounted high on the ship's center-line aft, affording an unobstructed view of the entire horizon except for a narrow arc directly forward where the masts interfere.

The output for wind observations is in three modes: punched paper tape, digital print-out, and dials which may be read to $\pm$ 0.1° and $\pm$ 25 meters. For meteorological purposes, the presentations are on CRT's with PPI, RHI, REI, and A/R scans. The set offers many options to an analyst since it incorporates such features as calibrated attenuation in a number of steps, iso-echo contouring at several selectable thresholds, STC (range normalization), linear and logarithmic receiver modes, a variable range marker, and a synchronized photographic attachment. Through connection to the ships' gyrocompass, the radar presents all data relative to true North regardless of ship heading. Height and angle presentations are almost unaffected by ship's motion because of the gyro-stablized platform included in the system. This platform removes up to $\pm$ 25° of roll and $\pm$ 10° of pitch.

Pertinent characteristics of the radar:

Wavelength	:	X-Band (3.2Cm)
Peak Power	:	200 KW
Beam Width	:	1.2 (2 meter diameter dish)
Pulse Lengths	:	0.5 and 3.0 microsecond
PRF	:	1200 pps and 240 pps
Ranges	:	10, 20, 50, 100 and 250 nm
Scan Modes	:	Continuous azimuth, azimuth sector, elevation sector, and manual with simple pencil beam; automatic tracking and manual with nutating conical scan beam.

APPENDIX 7

MT. MITCHELL TEST

During the period of November 18-22 an operational test of three basic data acquisition systems was conducted by the USC&GSS MT. MITCHELL offshore of the Virginia capes. The observation systems included:

- Rawinsonde program using the SCANWELL wind tracking system.
- Boundary Layer Instrument Program comparing three prospective instrumentation systems and two possible lifting vehicles.
- Instrumented boom for measuring surface meteorological parameters.

The test was conducted with all systems, including expected BOMEX communications, operating separately, by pair and in unison to ascertain crew requirements, radio frequency interference problems, ship handling solutions, on deck coordination, system positioning, expendable location and intravessel communications.

In some cases, solutions to known problems were determined during the cruise and similarly, new problems were made apparent for later solution.

The results of the test were extremely beneficial to the detailed planning necessary for the larger scale BOMEX exercise and will be reflected in the Operation Plan soon to be published.

APPENDIX 8

MOORING SYSTEMS

Systems have been ordered which are designed to permit the BOMEX ships to anchor at their array stations. These free-fall mooring systems are designed and built by AC Electronics Division of General Motors. They consist of six-ton clump anchors and wire bales in integral units. The bales contain about 23,000 feet of half-inch wire wound with a two-pi twist so that they will unspool neutrally. The surface end of the wire will be attached to a mooring buoy, after which the anchor and wire unit will be released to plummet to the bottom. Use of the systems will obviate the necessity for continuous maneuvering by the ships, and therefore will improve the quality of the data which will be collected during the three-month observation period. The five mooring systems are the first production models of the size required, so a test of a prototype moor was conducted in conjunction with the Navy and the Coast Guard during the fall of 1968. The test, in 15,000 feet of water, was entirely successful. Mooring of the BOMEX ships will be, to the best of our knowledge, the first time that ships of such size are anchored in 18,000 feet of water for such a length of time, so that there is some element of risk in the dependence on the mooring system. In the event of mooring failure, ships will resort to a "station keeping" mode.

APPENDIX 9

FLOATING INSTRUMENT PLATFORM

The Floating Instrument Platform (FLIP) which was developed by the Marine Physical Laboratory of the University of California, San Diego and Scripps Institution of Oceanography with financial assistance from the U. S. Navy will be available as a stable platform from which many experiments will be conducted in support of BOMEX. The FLIP will be on station during the period of 2 May to 29 May 1969.

FLIP has no motive power of her own. She is towed in the horizontal position to the area where she is to be "flipped." The FLIP crew then floods the ballast tanks that make up 85 percent of her length. Then as the tanks fill, the whole 50 feet of the prow abruptly lifts from the ocean surface. FLIP is now in the vertical position, her up-and-down motion limited to only a very small fraction of the wave height. Aboard, one can feel little or no vertical motion.

When she is fully vertical, 55 feet of the entire 355-foot length are above the water line, while the other 300 feet extend well down into the silent, motionless portion of the ocean, exerting a stabilizing influence on the entire structure.

While on prior observing stations, gale force winds and seas have offered ample opportunity to evaluate FLIP's capabilities. In 35-foot waves vertical oscillation averaged less than three inches.

A tug from the West Coast will tow the FLIP to the Panama Canal, where it will be met by the Navy tug which will tow the FLIP to Barbados and stand by to provide support during the experiment.

APPENDIX 10

EQUIPMENT TESTS ON USC&GS SHIP DISCOVERER

The DISCOVERER will sail from Miami, Florida, on January 28, 1969, for participation in the Atlantic Trade Winds Experiment (ATEX). The primary objectives of ATEX will be accomplished by a three week drift by four drifting ships in the fully developed north-east trade wind regime. Comprehensive aerological measurements are planned from all ships utilizing free-flight and captive balloons. The participation of the DISCOVERER in ATEX is highly desirable from the point of view of providing opportunities for test and evaluation for both the new meteorological radar which is expected to be operational and for continued evaluations of the Boundary Layer Instrument Package and the BOOM sensing system. NASA/MTF is rushing a SCARD (Signal Conditioning and Recording Device) unit to completion in order to place it aboard for use during the cruise. Such a shakedown cruise is considered to be valuable from the point of view of a complete equipment check out for the SCARD and for the isolation of radio frequency disturbances. Two SCARD engineers are scheduled to make the cruise and will accomplish the test and evaluation.

APPENDIX 11

PARTICIPATION OF THE S. S. ADVANCE II

The S. S. ADVANCE II, of The Cape Fear Technical Institute, Wilmington, North Carolina, will participate in BOMEX during the third observational period. The ADVANCE II will depart Wilmington, N. C., on June 5, 1969, arriving in Barbados on June 15. She will be on station near the USNS GILLISS from June 17 to July 2. Dr. J. R. Smith of the Triangle Research Institute will conduct studies of trace gases in the marine environment, other studies will be conducted under the sponsorship of NASA, NESC and NAVOCEANO. Details of the experiments and the names of the principal investigators will be published in the next BOMEX Bulletin.

The S. S. ADVANCE II is 185 feet long, beam is 33 feet and draft is 11 feet. She can cruise at 15 knots and has a cruising range of 2500 miles. The vessel can accommodate up to 70 students and instructors in addition to the crew. She has been well equipped for physical oceanographic and for marine biological research.

APPENDIX 12

ORGANIZATIONS CONDUCTING SCIENTIFIC EXPERIMENTS

There will be approximately 80 separate scientific experiments involved in BOMEX. These will be conducted by four major government agencies, eighteen universities, and seven private industries. Tables 3, 4 and 5 show the BOMEX scientific participation by government, university, and industry respectively. Each organization is shown with number of experiments involved noted in parentheses. The experiments have been sorted into Sea-Air Interaction, Tropical, Radiation, Satellite, Oceanographic and Meteorological experiments. Sea-Air Interaction has been broken down into core experiments and others. The core experiments will involve energy flux determinations by covariance, profile, energy dissipation, structure function, and geostrophic departure methods; as well as, energy and water budget computations. The major measurement platforms for the experiments are also noted.

The following abbreviations are utilized in the Tables:

AEC - Atomic Energy Commission

ESSA - Environmental Science Services Administration

BPO - BOMEX Project Office

ERL - Environmental Research Laboratories

NESC - National Environmental Satellite Center

WB - Weather Bureau

GSFC - Goddard Space Flight Center

MSC - Manned Spacecraft Center

NRL - Naval Research Laboratories

NAVOCEANO - Naval Oceanographic Office

NUWRES - Navy Underwater Research and Engineering Station

BOMEX SCIENTIFIC PARTICIPATION

GOVERNMENT ORGANIZATION	SEA-AIR INTER. CORE	SEA-AIR INTER. OTHERS	TROPICAL	RADIATION	SATELLITE	OCEAN-OGRAPHY	METEOR-OLOGY	MEASUREMENT PLATFORMS
AEC-ARGONNE (1)		X						BUOY
ESSA -BPO (8)	X							ALL PLATFORMS
ERL (5)	X	X		X		X	X	SHIP AIRCRAFT
NESC (1)					X			SHIP SATELLITE
WB (1)							X	SHIP
NASA-LANGLEY (1)							X	SHIP AIRCRAFT
GSFC (6)					X		X	AIRCRAFT SATELLITE
MSC (2)		X				(X)	X	AIRCRAFT
NAVY-NAVOCEANO(6)	X	X				X		SHIP, BUOY, AIR-CRAFT, FLIP
NRL (1)						X		AIRCRAFT
NUWR & ES (4)		X				X	X	SHIP BUOY

TABLE 3

BOMEX SCIENTIFIC PARTICIPATION

UNIVERSITY ORGANIZATION	SEA-AIR INTER		TROPICAL	RADIATION	SATELLITE	OCEAN-OGRAPHY	METEOR-OLOGY	MEASUREMENT PLATFORM
	CORE	OTHERS						
BRIT,COL.U.(5)	X					X	X	FLIP, AIRCRAFT
CHICAGO U. (1)					(X)		X	ISLAND, SATELLITE
COLO.S.U. (3)		X	X		X	(X)	X	AIRCRAFT, SATELLITE
FAIRFIELD U(1)					X			AIRCRAFT, SATELLITE
FLA. S.U. (2)	X			X			(X)	SHIP, BUOY
LAMONT OBS.(1)						X		SHIP
MIT (2)			X				X	AIRCRAFT, SHIP
MIAMI U. (1)			X					AIRCRAFT, SHIP
MICHIGAN U.(1)	X							FLIP
OREGON S.U.(1)	X							FLIP
RES.TRI. INST. (1)						X		SHIP
SCRIPPS (6)	X	X				X	X	FLIP,AIRCRAFT
STANFORD RES. I. (1)					(X)		X	SHIP, SATELLITE
TEXAS A&M (2)	X			X				FLIP
WASH.U. OF (3)	X	X		X		X		FLIP
WISC.U. OF (1)				X				SHIP, AIRCRAFT
WOODS HOLE (3)		X		X		X		SHIP, AIRCRAFT
YALE U. (2)						X		FLIP, AIRCRAFT

TABLE 4

BOMEX SCIENTIFIC PARTICIPATION

INDUSTRY ORGANIZATION	SEA-AIR INTER. CORE	SEA-AIR INTER. OTHERS	TROPICAL	RADIATION	SATELLITE	OCEANOGRAPHY	METEOROLOGY	MEASUREMENT PLATFORM
BATTELLE N.W.(1)		X					(X)	ALL PLATFORMS
EPPLEY LAB. (1)				X				AIRCRAFT
A.D.LITTLE INC (1)					X			AIRCRAFT, SATELLITE
McDONNELL-DOUGLAS INC. (1)							X	ISLAND
THORNTHWAITH ASSOC. (1)	X							FLIP
TRAVELERS (1)						X	X	ALL PLATFORMS
TELEDYNE INC.(1)						X		SHIP

TABLE 5