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HARRIS B. STEWART, JR.:

SCOR/IAMAP Operations Aboard DISCOVERER

1970

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US Department of Commerce

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Oceanic and Atmospheric Research
Atlantic Oceanographic and Meteorological Laboratory
Miami, FL

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M. J. Bello, A. Y. Cantillo and J. Gray

(Editors)

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Department of Commerce

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COVER PHOTO: NOAA Ship DISCOVERER.
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ACRONYMS AND ABREVIATIONS

AMC	Atlantic Marine Center
AMT	Atlantic mean Time
AOML	Atlantic Oceanographic and Meteorological Laboratory
BCF	Bureau of Commercial Fisheries
BOB	Beginning of building
BOMEX	Barbados Oceanographic and Meteorological Experiment
BT	Bathythermograph
C&GS	Coast and Geodetic Survey
CH	Chief
CICAR	Cooperative Investigation of the Caribbean and Adjacent Regions
CO	Commanding Office
DISCO	NOAA ship DISCOVERER
DR	Dead reckoning
DSL	Deep scattering layer
Ens	Ensign
ESSA	Environmental Science Services Administration
EXEC	Executive Officer
FAO	United Nations/Food and Agriculture Organization
fm(s)	Fathom(s)
FSU	Florida State University
GMD	Ground-based Midcourse Defense (GMD) radar
GMT	Greenwich Mean Time (also known as Zulu time)
HBS	Harris B. Stewart
HQTS	Headquarters
IA	International Affairs
IAMAP	International Association of Meteorology and Atmospheric Physics
Info	Information
IOC	Intergovernmental Oceanographic Commission
IR	Infrared
ITC	Intertropical convergence
LAT	Latitude
LONG	Longitude
LWOP	Leave without pay
m	Meter
Med	Mediterranean Sea
NMC	National Meteorological Center
Oceo	Oceanography
PC	Panama Canal
PDR	Precision depth recorder
POSREP	Position report
S/Sgt	Staff sergeant
SCOR	Scientific Committee for Ocean Research
STD	Salinity, temperature and depth
T	True (reference to compass bearing)
TGIF	Thank God it's Friday
TOS	The Oceanographic Society
US	United States
USA	United States of America
USAF	US Air Force
USSR	Union of Soviet Socialist Republics
WHOI	Woods Hole Oceanographic Institution
Z	Zulu time (also known as Greenwich Mean Time)

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ABSTRACT

The Scientific Committee on Oceanographic Research (SCOR) Working Group 15 on Photosynthetic Radiant Energy in the Sea conducted a cruise in May-June 1970 to the Caribbean and the Pacific Ocean to identify what measurement of radiant energy should be made in conjunction with determinations of ^{14}C uptake, and what instrumentation should be used to obtain the data. The experiments were carried out on board the US Coast and Geodetic Survey (C&GS) ship DISCOVERER by an international scientific complement representing nine countries. In addition, intercomparisons of various internationally used radiometersondes were conducted during the cruise as part of the effort of the Radiation Commission of the International Association of Meteorology and Atmospheric Physics (IAMAP) of the International Union of Geodesy and Geophysics. Dr. Harris B. Stewart, who eventually became the first director of the NOAA Atlantic Oceanographic and Meteorological Laboratory in Miami, FL, served as Coordinator and kept diaries recording daily scientific activities aboard. In addition, the diaries contain a description of the Rite of Passage of the Equator.

I. INTRODUCTION

The Scientific Committee on Oceanographic Research (SCOR) Working Group 15 on Photosynthetic Radiant Energy in the Sea was jointly sponsored by SCOR, the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Association for the Physical Sciences of the Oceans (IAPSO) for the purpose of identifying exactly what measurement of radiant energy should be made in conjunction with determinations of ^{14}C uptake, and what instrumentation should be used to obtain the data. The Working Group planned and carried out a series of experiments to collect essential data to support their recommendations and to demonstrate the feasibility of the instrumentation and incubation methods. The experiments were carried out on board the US Coast and Geodetic Survey (C&GS) ship DISCOVERER by an international scientific complement.

Primary objectives of the work at sea were the further testing and development of simple instrumentation for measuring the radiant energy available for photosynthesis and the collection of data to reveal any relationship between primary productivity and the radiant energy available for photosynthesis. A broad program including measurements of primary productivity, chlorophyll concentration, nutrient analysis, and light conditions was carried out. Twenty four stations were occupied along a track from about 25° N, 65° W to 8° S, 10° W (Figures 1 and 2).

The data collected during the cruise, including measurements of photosynthesis, available radiant flux and supporting oceanographic data, were published in Tyler (1973). A few copies of

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[Δ] NOAA (retired).

the SCOR DISCOVERER data report were made available to libraries and qualified scientists, and only a small number of those remain.

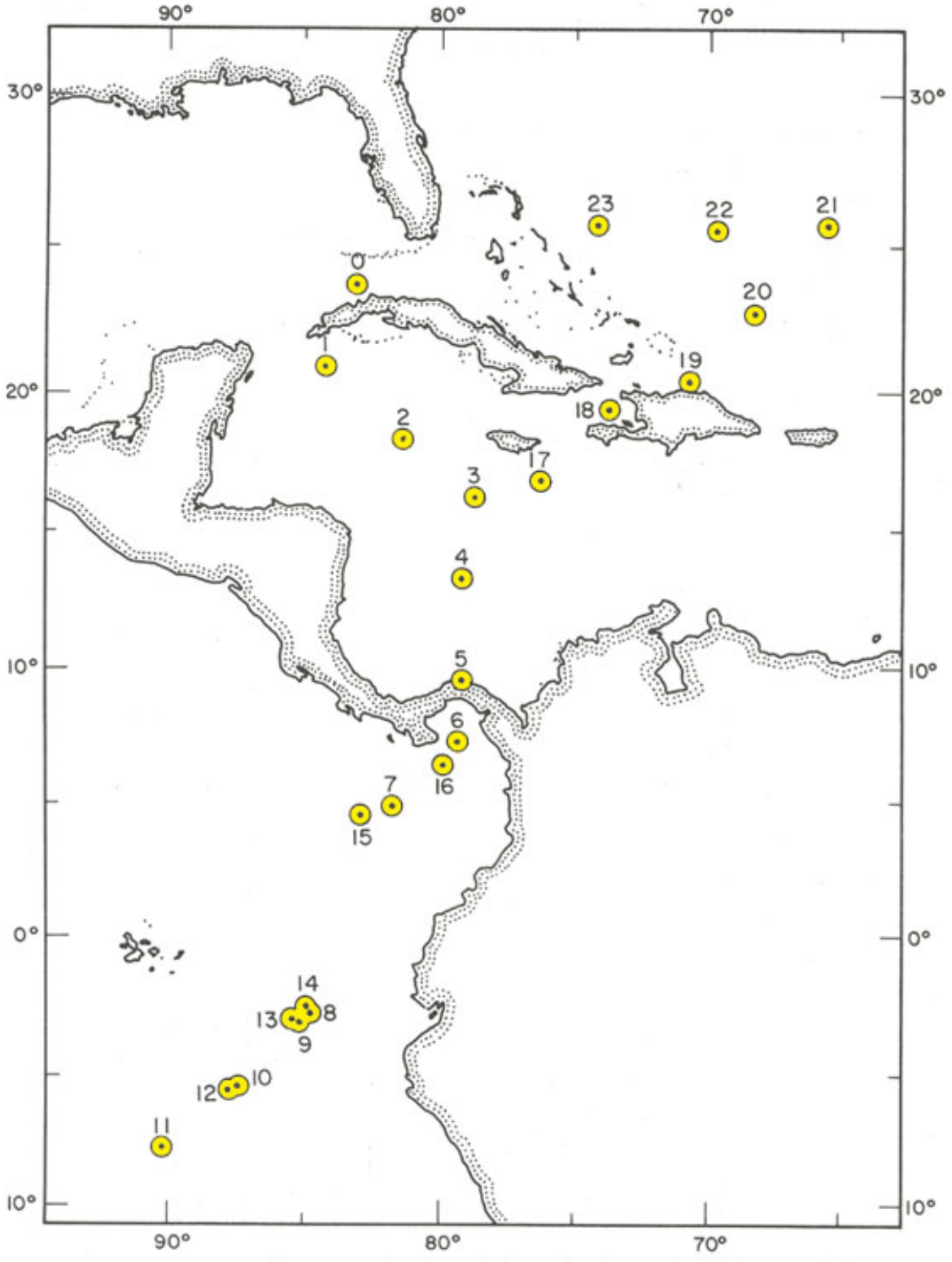

Figure 1. Sampling stations of the SCOR DISCOVERER cruise, May-June, 1970.

Figure 2. Cruise track of the SCOR DISCOVERER cruise, while H. B. Stewart was aboard.

Plate 1. Aerial view of the US Coast and Geodetic Survey ship DISCOVERER (NOAA Photo Library, NOAA Central Library, Silver Spring, MD).

Intercomparisons of various internationally used radiometersondes were conducted during the cruise as part of the effort of the Radiation Commission of the International Association of Meteorology and Atmospheric Physics (IAMAP) of the International Union of Geodesy and Geophysics.

As a result of the work on board the DISCOVERER, the Working Group recommended that in conjunction with determinations of ^{14}C uptake, measurements of total quantum available for photosynthesis at wavelengths from 250 to 700 nm should be made. The Tyler report included details of the “state of the art” instrumentation and procedures.

A. US C&GS ship DISCOVERER

The 303-foot research vessel DISCOVERER was commissioned in 1967 as part of the US Coast and Geodetic Survey (C&GS), the predecessor of the Environmental Science Services Administration (ESSA), and eventually of the National Oceanic and Atmospheric Administration (NOAA) (NOAA, 1996) (Plates 1 and 2). At that time, the ship, affectionally known as the “DISCO”, and her sister ship the OCEANOGRAPHER, were considered the most advanced vessels of their kind and the largest ever constructed by the United States exclusively for oceanographic work. The DISCO was decommissioned in 1996 after 30 years of oceanographic work.

After delays due to late arrival of equipment, the DISCOVERER departed Miami on May 2. The ship schedule was as follows:

May 2	Depart Miami
May 8	Arrive Panama Canal for westward passage

May 14	Arrive vicinity of Galapagos Islands

Plate 2. The US Coast and Geodetic Survey ship DISCOVERER (NOAA Photo Library, NOAA Central Library; Silver Spring, MD).

May 22	Arrive Balboa
May 22-25	In port
May 26	Depart Balboa for eastward passage
June 3	Arrive Miami

A news conference was held April 29, 1970 at 10 AM aboard the DISCOVERER at Dodge Island, Miami, FL, prior to departure April 30. Articles about the cruise appeared in newspapers (for example Blakeslee, 1970).

B. Scientific Complement

Twenty five scientists from nine nations took part in the SCOR/IAMAP DISCOVERER cruise. They were:

John E. Tyler Chairman SCOR Working Group 15 Chief Scientist	United States
Dr. Harris B. Stewart Project Coordinator	United States

SCOR Project

Dr. Harry R. Jitts	Australia
David J. Carpenter	Australia
Dr. Kjell Nygaard	Denmark
Niels Hojerslev	Denmark
Dr. André Morel	France
Dr. Jean-Pierre Bethoux	France
Dr. Yatsuka Saijo	Japan
Dr. Nobutada Nakamoto	Japan
Ian Baird	United Kingdom
Dr. Raymond C. Smith	United States
Roswell Austin	United States

James Albers	United States
Thomas C. Malone	United States
Dr. Yulen Ochakovsky	USSR
Anatol Susliaev	USSR

IAMAP Project

Prof. Dr. Hans G. Müller	Fed. Rep. of Germany
Hans Fimpel	Fed. Rep. of Germany
Dr. Masayoshi Shimizu	Japan
Akira Yata	Japan
Dr. Peter M. Kuhn	United States
Monte Poindexter	United States
Air Force Technician	United States

During the cruise, "Shorty" Grief, the ship's carpenter, colored and framed a cartoon showing all the scientists working on deck (Plate 3). The cartoon was signed by the scientists and is now part of the collection of NOAA Atlantic Oceanographic and Meteorological Laboratory (AOML).

An embroidered cloth patch featuring the flags of the participating scientists was designed for the cruise (Plate 4).

Harris B. Stewart, who eventually became the first director of the NOAA/AOML in Miami, FL, served as Coordinator and kept field diaries recording daily activities aboard including the rites associated with passage across the Equator.

Stewart left the ship at Balboa on May 23rd and returned to Miami. He was replaced by Jack Kofoed.

C. Planned Work

The SCOR work consisted of daily on-station periods of about 10 hours duration during which physical, chemical, and biological parameters were observed using deck mounted instrumentation, instrumentation suspended from tethered and free drifting buoys, and instrumentation lowered into the water with the ship's winches. An aircraft from Scripps Institution of Oceanography overflew the ship at selected times to determine chlorophyll concentrations using an airborne sensor. Ground-truth measurements for the airborne sensor were provided by chlorophyll data collected aboard the ship. Plane-ship communications were used to relay data and other information.

As part of the SCOR work, a salinity temperature and depth (STD) instrument was lowered daily. Total available quanta were measured in *situ* using French and Danish quanta meters. Color was measured using a Danish meter. Narrow band radiance was measured using an Australian instrument. Deck irradiance was measured using a deck thermopile supplied by the USSR. Simulated *in situ* productivity using natural light was measured using equipment supplied by Australia. *In situ* productivity was measured using equipment supplied by Japan that was suspended from a marker buoy. This required that the ship be (hove to) from noon to sunset. Nutrients were measured by Florida State University. Identification of plankton was done by SCOR biologists. Optical measurements were made to determine horizontal stratification.

The IAMAP work consisted of a series of three daily balloon releases scheduled to occur after SCOR activities. The first sounding was done using a small balloon and took approximately 35 min. The second sounding using a 1200-gram balloon carrying two radiometersondes. The third sounding was done using a 600-gram balloon carrying two radiometersondes. The second and third soundings took about two hours each.

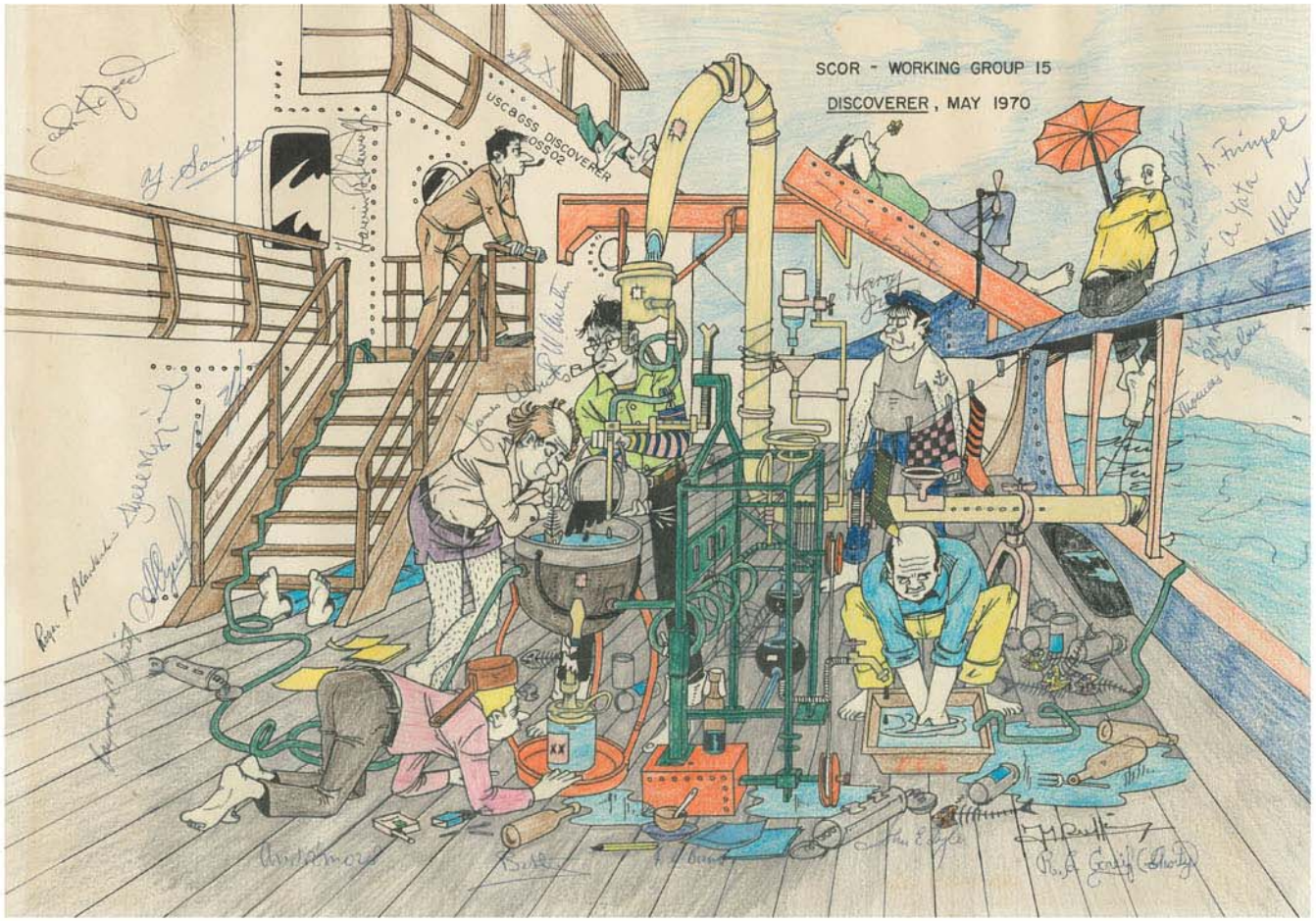

Plate 3. SCOR - WORKING GROUP 15 DISCOVERER, MAY 1970 Cartoon. Signed by members of the scientific party aboard the DISCOVERER during the SCOR/IAMAP trip May - Jun 1970. Coloring and framing was done aboard by "Shorty " Grief, the Chief Carpenter of the DISCOVERER.

Plate 4. Cloth patch of the SCOR 1970 Cruise on the US Coast and Geodetic Survey ship DISCOVERER. (4-in diameter) on cover of Harris B. Stewart blue-bound transcription. NOAA Atlantic Oceanographic and Meteorological Laboratory, Miami, FL.

In addition to the SCOR and IAMAP work, the Marine Geology and Geophysics Laboratory and Physical Oceanographic Laboratory of NOAA AOML, the International Cooperative Investigation of the Caribbean and Adjacent Regions (CICAR), and the ESSA National Meteorological Center Program requested the following:

> The Marine Geology and Geophysics Laboratory requested bathymetric, magnetic and gravity measurements in the eastern Tropical Pacific to complement data collected by the US C&GS ship OCEANOGRAPHER in 1969 and 1970.
>
> The Physical Oceanographic Laboratory requested on-deck measurements of sea surface temperatures at times coincident with ESSA and NASA satellite passages to provide ground truth data.
>
> CICAR requested hourly bathythermograph observations between Miami and the first two SCOR stations to contribute to the synoptic investigation of the eastern Gulf of Mexico.
>
> The National Meteorological Center Program work included three surface weather observations per day. The information was to be transmitted as soon as possible by best available means.

II. DIARIES AND TRANSCRIPTION

The Stewart family donated the papers of Dr. Stewart to NOAA's Atlantic Oceanographic and Meteorological Laboratory upon his passing on April 25, 2000. Among the Stewart material are

13 field diaries written over several decades, during a time of great ocean exploration. The diaries are being transcribed and published as a series.

The SCOR DISCOVERER field diaries are two bound notebooks with green covers, measuring 5 by 8 inches (Plate 5). Entries were made in ink and pencil. The diaries were transcribed by Dr. Stewart and a copy of this transcription, measuring 8.5 x 11 inches, was bound in royal blue. An embroidered cloth patch of the SCOR DISCOVERER cruise was glued to the cover. Photographs taken during the cruise were included in the blue-bound transcription. Loose material was found in the blue-bound transcription including cruise instructions, letters, and cables associated with the program.

For this work, the diaries were transcribed by hand from the original green diaries. Minor editorial changes were made as needed. Editorial comments are noted in brackets and capital letters. The diary and ancillary material were scanned and the graphics files, in JPG or pdf format, are stored on the CD. Numbers in brackets in the transcribed text are the page numbers of the original green dairies and are active links to the scanned image of each page. Documents related to the cruise are also stored on the CD.

III. ACKNOWLEDGMENTS

It was particularly pleasing to the editors of the diaries to see the names of many members of the crew of the DISCO, such as Eddie Hannon, Bill Stoney, Tom Lindsay, Bill Guthrie, and Robert (Hoppy) Hopkins, men who eventually transferred to the NOAA ship RESEARCHER and served aboard that vessel until it was decommissioned. The crew of these vessels was invaluable to the scientists aboard, providing assistance with equipment and instrumentation. We would like to dedicate this work to their memory and to the crews of US C&GS and NOAA vessels. God speed to you all.

The editors wish to thank A. Lorenzo and G. Berberian for their comments and assistance. Initial transcription of the diaries was funded through grant no. 02-432R from Environmental Services Data and Information Management (ESDIM), NOAA/NESDIS/GeoSpatial Data and Climate Services.

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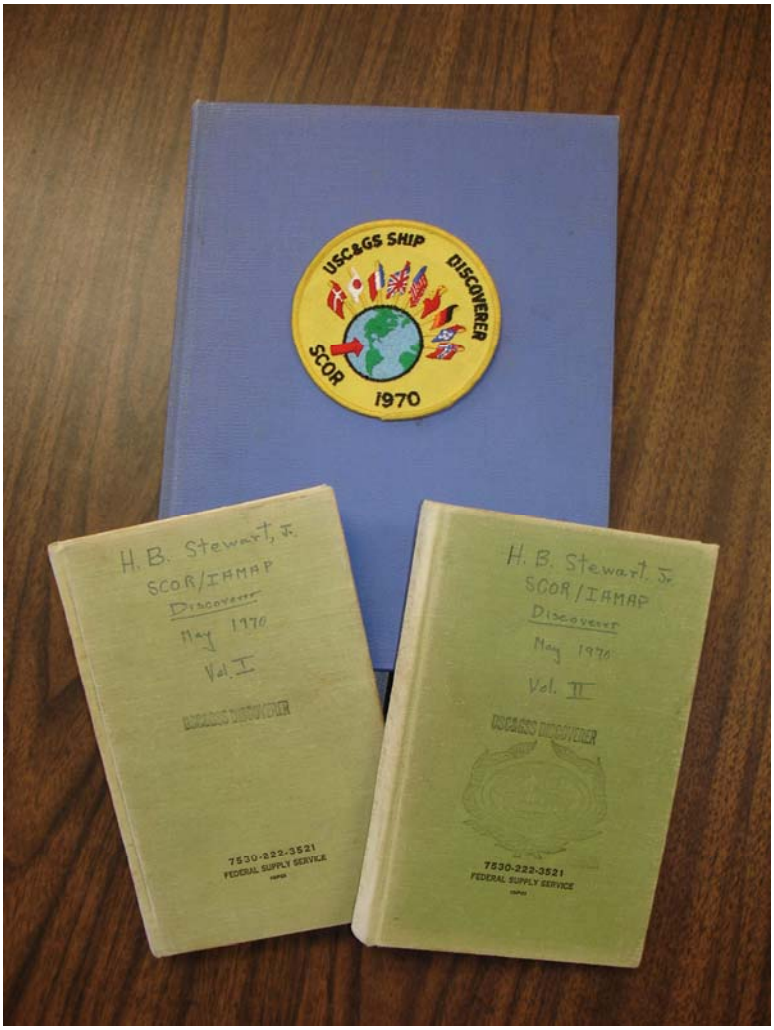

Plate 5. Stewart green field diaries and blue-bound transcription.

H. B. Stewart, Jr.

SCOR/IAMAP

Discoverer

May 1970

Vol. I

0

JOURNAL - H. B. Stewart, Jr.

SCOR/IAMAP Operations Aboard DISCOVERER, May 1970

May 3, 1970 - SW of Key West

Somehow we slipped the lines at Dodge Island at 1600 yesterday - Saturday - as advertised. To anyone watching it was smooth, routine, and on time. But to Jack Kofoed, Arch Patrick, John Tyler, Pete Kuhn, and me, it was a miracle. The Danish gear came in that morning on the GREBYDYKE and Jack had the agent shipping company and US Customs all steamed up to get it off, cleared, and aboard. It was aboard by 1000. About 1130, Jitts of Australia called me at home to say that the American chemist (Jim Alberts of FSU) could not use the UK spectrophotometer and could I get one locally - 5 hours before sailing on a Saturday. It was Carl Sindermann and John Vander Linden at BCF who bailed us out of that one and we had a Beckman aboard by 1300.

When I boarded about 1330, the first problem was that a drawer slid open and the 7-cm cell [1] for the spectrophotometer jumped out and smashed on the deck. I talked with Jack on the telephone and he will try to get two spares to Balboa to meet us. Next was the news that we had no 5-gal. cans for the carbon-14 waste material. After much telephoning, we located some, and Ensign Mangis used our car to collect these and got back literally minutes before the gangway went up.

Dietz, Feo, Egland, Everhard, Giff Ewing, assorted wives and children including mine, TV cameras, and hangers - on were all there to see us off and were still there on the bare wharf talking in small knots as the Dodge Island Passenger Terminal slid between us and them and we were headed out Government Cut.

Last evening the SCOR group had a long session in the Wardroom trying to set up a workable [2] schedule for the daily 10 - hour station. Briefly what we are trying to do is to schedule the following operations:

On deck we will have the Soviet actinometer and Amici prism equipment, and the Australian quanta meter and deck incubator for C-14 uptake. From the newly mounted 30 - foot boom out over the fantail we will run various equipment in and out and up and down including the French spectral irradiance meter, the Danish quanta meter, the Soviet Amici prism meter, and the US spectral irradiance meter. The big crane will be used for the launching and recovery of the Japanese buoy from which they will measure in-situ productivity. From the oceanographic winches, we will run an STD cast, a Nansen bottle cast to 1000 m, the French fluorescence meter, both Japanese and Australian special biological sampling gear, and special deep samples for the Japanese. Even the BT [3] winch is pressed

into service not only for BT's but for the US transmissivity meter, the Australian quanta meter, the Danish scatter meter, and the Norwegian plankton tows. The days will be busy.

My own role seems to be as a problem solver, and I trust today's batch will be atypical. So far they run like this:

How do we get the chill box in the photo lab up into oceo lab so that chemicals that react to heat can be kept chilled?

Can we get plates welded to the port and starboard kingposts so that upward - looking instruments can be mounted there.

The SCOR group wants hourly sun elevation angles recorded.

Can someone rig up a fairlead system so the BT cable on the winch on the starboard quarter can run out the new stern boom.

Ochakovsky (USSR) needs a piece of bar stock machined and drilled for his gear, and since one [4] of the two radiomen men never came back in time to sail, it will cost the Weather Bureau (or someone) some $15 per day ($450 for the trip) in overtime if they want the weather obs sent in to NMC from the 0000, 0600, and 1800 GMT observations. The 1200 GMT can be done on Tom Johnson's regular 8-hour watch, but the others will have to be on overtime. I‘ ve sent a message to AMC to check this out.

We had a fire drill and an abandon ship drill this morning about 0900 and then stopped the ship to try to have at least a dry run to see where all the bugs are and there are a good many, too. As predicted, this first station is primarily a run - through to see what problems there are. About that time, the Scripps research aircraft came over, and Kuhn and Monte got both hand - held IR gun measurements of surface water temperature (24.9 °C) and a [5] bucket temperature (27.1 °C). I gave the data to Johnson to give to Giff Ewing from Woods Hole on the Scripps plane if he called in for them. The plane will be working out of Cozumel and Grand Cayman, and we will expect an overflight daily.

The IAMAP radiometersonde group had its biggest problems before we sailed - I hope! First the Japanese gear came and needed special gear to track the balloons. Thanks to Monte Poindexter, Dick Hallgren at Rockville, and a slew of others, a GMD radar unit was located at Tinker Air Force Base at Oklahoma City, and the Air National Guard plane under Col. Wurtz that was picking up the Australian's 3 tons of strikebound gear in Long Beach detoured to collect that and Sgt. Blankenheim and got them to Miami. Then two days before sailing ~~a boffo in Bldg. # 5 in Rockville got the soviets annoyed and~~ [SIC] Academician Fedorov cancelled [6] out the participation of V. I. Shlyakhov and A. F. Kuzenkov. White has since cabled him in hopes they can join us at Balboa, but aboard we have heard no answer.

About 1245 the Scripps plane left after having dropped a few expendable bathyphotometers that transmit back to the aircraft for a while then sink.

I worked up our first position report (POSREP) to CICAR CURAÇAO this morning. That is the cablese name for the Curaçao Operations Center for the IOC-sponsored Cooperative Investigation of the Caribbean and Adjacent Regions (CICAR) of which our present work in the Gulf of Mexico and Caribbean is part. At 1200 GMT we were at 28° 56' N, 82° 46' W running 14 knots on 233°, and other than hourly BTs we were doing nothing at the time of interest to CICAR. I will continue to send out daily POSREPS until we hit the Canal this weekend.

Enough of the scientific party preferred to have bag lunches and to keep working so that we had only one [7] sitting needed for lunch in the Wardroom. I have given up lunch completely and hope to knock off some ten office pounds by the time I get back.

It was a long day and we are again underway at 1600. We put the Roberts buoy over - the one that Dr. Saijo of Japan will be using for his in - situ incubations. Someone had chalked Saijo Maru on the side and from here on it will be known as the Saijo Maru.

We spent a lot of time rigging the BT wire over the stern boom and testing it with a weight. We ran the Scripps spectral irradiance meter through its paces and did the water sampling for the Australians. We ran what we thought was a good STD lowering, but there seems to be some problem with the salinity data. At 1630 Lake said he may have fixed it. [8]

We will know tomorrow.

Jitts (Australia) wants to run several different lowerings from the A-frame at the port stern quarter using the dredge and trawl winch. He expects us just to cut 250 m from our 30,000 ft. hydro cable and put it on the dredge and trawl winch. I am against it, for once cut off, it can' t be put back - nor can it be used for anything else. The CO goes along with me on this, and we will try to fairlead it from the hydro winch, but it will mean that the winch operator won't be able to see where the cable enters the water. I will break the news to him tonight.

The first radiometersonde went off at sunset - about 2000. The Japanese and US on one balloon, the German gear on a second one. The GMD tracked beautifully, but the German receiver did not work properly. At 2200 Fimpel was [9] still in the met lab working away on his mini circuit board and wishing his fingers were smaller.

But who are all these people?

From Australia, it's Dr. Harry R. Jitts, Senior Research Scientist and David J. Carpenter, Experimental Officer, both of the Commonwealth Scientific Industrial Research Organization (CSIRO) in Sydney with SCOR Working Group - 15.

From Denmark, it's Dr. Kjell Nygaard, Chief Engineer, and Niels Højerslev, Research Associate, both of the University of Copenhagen (SCOR).

From France, it's Dr. André Morel, Mâitre Assistant from the University of Paris, and Dr. Jean-Pierre Bethoux, Attaché de Researche, National Center for Scientific Research, Paris (SCOR).

From Germany, it's Professor Dr. Hans G. Muller, Director, and Hans Fimpel, [10] Technical Assistant, both of the Institute for Atmospheric Physics of the German Research and Experimental Institute for Air and Space, Post Wessling/Oberbayern, West Germany. They are with the Radiation Commission of the International Association of Meteorology and Atmospheric Physics (IAMAP).

From Japan, it's Professor Yatsuka Saijo of Nagoya University and Nobutada Nakamoto, Doctoral Student at Tokyo Metropolitan University both with SCOR and Masayoshi Shimizu and Akira Yata both scientists with the Japan Meteorological Agency in Tokyo with IAMAP.

From Norway, it's Dr. Jahn Throndsen of the University of Oslo with SCOR.

From Scotland, it's Ian E. Baird, Senior Scientist with the Aberdeen Laboratory of the Department of Agriculture and Fisheries.

VIA OVERNIGHT MAILOchokovsky called it today.

Last evening's double balloon release was a roaring success. The German receiver worked perfectly - now that the "earth problem" has been solved by Fimple and the combined US-Japanese radiometersonde rig - looking like a miniature TOS satellite - [22] was released by Monte Poindexter an old pro at this - only seconds after the German balloon cleared the rail. The air was still and both balloons went straight up with their loads gyrating madly below them. Once in the prevailing westerlies aloft, they headed east, and the GMD radar tracker stopped looking straight up and nodded a bit to follow them.

The papers Giff Ewing dropped were Sunday and Monday's Miami Herald plus such others as he had collected on Grand Cayman. That's pretty good service, even though a week - old New Orleans Times-Picayune and a five-day old Sarasota paper offered little of immediate interest.

AMC replied to our request for overtime for the radio operator in a clever way. Since the second radio operator missed the ship, they will carry him in leave status until his leave is used up and then put him on leave without pay. Figuring how much leave he has on the books resulted in the ship being about $500 ahead [23] by having him on LWOP. This will just cover Tom Johnson's overtime needed to get out the additional weather observations to NMC for the rest of the trip. That's cutting it pretty close, but the bucks are tight. We will now send out daily weather observations at 0000, 0600, 1200, and 1800 Z.

Tyler decided this afternoon that we would make the Thursday station (04) rather, than run Thursday and making the Canal by 0800 Friday the 8th. This mean we will arrive at the Caribbean end about 1530 hours on Friday and - hopefully will be able to go through immediately - an 8- or 9-hour passage. This is the preferable way - even though our time in the Pacific may be somewhat less - for this weather is just fine, and there is no telling what it will be like when we get back to the Caribbean later in the month. [24]

Today was a complete station with the single exception of incubation of phytoplankton under artificial light, Ian Baird (Scotland) has been filtering 6-liter samples from 10, 51, and 101 meters through his milipore filters. The 10-m sample went through in about 20 minutes indicating light concentration of organic material, the one at 101 m took longer and the one at 51 m took several hours to filter suggesting a higher concentration of suspended material. This ties in with Giff Ewing's observation that the upward scattering (turbidity) was greatest below the surface waters which appeared clearer. Ian will have actual numbers for this variation later.

The scientific party is especially anxious to make a shore visit to the Galápagos Islands - Darwin's Islands, and Tyler is willing to give up a day of their observations to do it. This way we can get most of the [25] crew ashore too - the Captain's one condition. The Exec and I worked up a message to IA so that a proper request could go from State to Equador. Lying just on the equator at 90° W, the three main islands are Isabela, Santa Cruz, and San Cristóbal.

We hauled everything aboard in mid - afternoon and took off upwind to relocate the Saijo Maru with its string of in - situ incubation bottles. Once we had it in sight we adjusted our own position far enough upwind of her that we hoped to drift to her while we worked our gear up and down while continuing our on - station operations. Hopefully we will wind up right at her at sunset, recover all over board gear and the buoy at the same time. Actually it worked fairly well, but in the end we had to put a boat over and take a line to the Saijo Maru and winch her on to the ship [26]

May 6, 1970 - off Pedro Bank

In case we do get an official OK to go ashore on the Galápagos Islands, it seemed like a good idea to do some homework, so I spent the first hour after breakfast in the ship's library.

There are 13 large islands and many smaller ones. The largest is Isabella (called Albemarle by the English), which is 75 miles long and contains over half of the islands' land area. Isabella, Santa Cruz (Indefatigable), San Cristóbal, and Santa María are the only inhabited ones, and the town of San Cristóbal on San Cristóbal I. (Chatham I.) is the administrative seat. The name comes from galapago, the Spanish for the land tortoise which has evolved there to giant size (up to 560 lbs.).

Charles Darwin spent 5 weeks on the islands in 1835 when he was a naturalist aboard the HMS BEAGLE, and it was here at age 26 that he first began to formulate his theory of organic evolution. The islands are of volcanic [27] origin with most islands having one central single high crater. Isabella, however, has five large volcanoes, the highest of which is about

5000 feet above sea level. One of these five erupted in 1925, and the volcano on Fernandina has been active since then.

Although on the equator, the climate is not tropical and there are no palms. The Humbolt Current gives a mean temperature of about 70 °F. The lower coastal levels of the islands have the cactus, mesquite, acacia, and spined plant common to a desert environment, while a thick screen of mangroves usually grows around the edges of the islands. Above 800 feet, there is heavy rain on the volcanic mountains which are covered with dense jungles of large trees, tree ferns, orchids, and lianas, and a heavy mist called garua bathes the earth.

Animals vary from island to island, with the birds and reptiles as the most striking forms of wildlife. Some of the giant tortoises are as much as 400 years old and are considered the [28] world's oldest living animals.

There are two species of iguana, one the 4-foot long marine species which lives on seaweed, the other is a purely land species which lives off the cactus pads. There are no poisonous snakes. There are none of the gaily-colored tropical birds, but lots of flamingoes, cranes, hawks, finches, and flycatchers. All the wildlife is amazingly tame due to the virtual absence of man on these islands. There are the rare flightless cormorants, penguins, gulls, frigate birds, and boobies. In 1936, Ecuador made the Galápagos a national park to save its rare wildlife from extinction, and no explorers are allowed on the islands without official permission. Let's hope that those on the DISCOVERER get theirs.

About 1000, we used the bow thruster to put the sun off our stern while the French spectral irradiance meter was lowered from the stern boom. We now have up to five swallows that have adopted us, and they swoop [29] and glide about the ship with effortless grace. We are a good many miles from the nearest land, and these birds rested a good deal when they first showed up.

In talking with Ian Baird of Scotland, it developed that his first estimate yesterday of chlorophyll variation with depth was modified considerably when he had run his samples in a quantitative way. It turned out that at 10-m he got 0.026 mg/m^3, at 51-m it was 0.062 mg/m^3, and at 101-m it was 0.163 mg/m^3, Samples from the Nansen cast were also run last night, and it appears that the maximum falls somewhere between 75 and 125-m depth.

Commander Patrick is working most closely with the SCOR group aft and maintaining a continuous dialogue with the bridge as to what is up and what is down and when the Saijo Maru is to be launched, when we will be getting under way, when we need the bow thruster to kick the [30] stern around or an electrician to replace a blown fuse, or a carpenter to fix up a rack for the Australian water bottles, or a machinist to machine a part for the Soviet gear, etc. He is doing a fine job, and mine is easier because of him. A good executive is a man with a worried look on the face of his deputy, so I interpret this to my own benefit and am enjoying

myself. No 5:30 PM panic telephone calls, no memos, no daily crisis, and I sometimes go for as six or eight hours without even thinking about the new building on Virginia Key.

Just before noon the ship's PA system blared out, "Now hear this, Dr. Stewart lay up to the radio shack, Dr. Stewart lay up to the radio shack immediately - - ah - - please." It turned out to be Giff Ewing overhead again, and I gave him the various water temperature and weather data he wanted, gave him our present planned Canal schedule, and our best estimate of our [31] station location tomorrow (13° 34' N, 78° 55' W). He was interested in Ian Baird's chlorophyll results, and I gave him the numbers I had which he said correlated well with the data from his airdropped bathyphotometers "when they work." I thanked him for the paper dropped to us yesterday, and when he asked if there was anything we needed aboard that he could locate in Kingston, I said, yes, but I doubted if she'd be willing to jump out of an airplane so far from land. He finished his measurements and headed back to Jamaica.

Today's transmission from the Curaçao Operations Center for CICAR (Cooperative Investigations of the Caribbean and Adjacent Regions - an international effort under the Intergovermental Oceanographic Commission) reported - again - only the DISCO and the USSR ship ASKOLD in the CICAR area. The Soviet ship is now or was yesterday - at 18° 20' N, 75° 47' W, a bit southwest of her last reported position. I am [32] keeping a plot on the bulkhead in the lab to show where they are and where we are each day. A message from Jack Kofoed at AOML informs us that three opticells for the BCF spectrophotometer, used by an FSU graduate student aboard an ESSA ship to provide nutrient concentration data to scientist from nine different countries had been airmailed to ESSA's man in Balboa - a Mr. Metivier - for delivery to the DISCO during our Canal transit Friday - a good man. These are replacements and spares for the one broken just before we sailed.

We can all tell at any instant what the local time is, what the Greenwich Mean Time is - the time in which all our data records are logged - and what the date is, for all have very real meaning for us. But ask anyone what day of the week it is and you will see a confused look as he suddenly realizes that he doesn't really know - then maybe "It is Wednesday or Thursday, I think" - but [33] few if any know for sure, and most of us don't care. It is an interesting marine phenomenon, for the day of the week has absolutely no relevance to our life aboard. There is no Monday staff meeting, no TGIF, no weekend to look forward to. One day after another marches by with only a number to differentiate it from all of those before and those that follow. In a way this daylessness typifies our almost total removal from the world of land and our complete immersion in a completely different - and in many ways a more relaxing less confusing - world of sea and humming generators and pulsing engines and good men doing a job they like. It is a change of pace a new challenge, a different spatial scale to one's existence And it is good therapy.

To get a better feel for the pace of our operations back on the fantail, this is the way our [34] schedule looked yesterday:

0815 Lower Australian quanta meter from A-frame aft
0820 Norwegian plankton net over starboard
0823 Australian quanta meter back aboard
0827 Start lowering of STD to 1000 m from starboard with Oceo winch
0836 Obtain water samples (3 m) for US
0838 US water samples aboard
0843 Lower Australian quanta meter again
0852 Australian quanta meter aboard
0854 STD cast completed, sensor aboard
0859 Norwegian plankton net recovered
0905 Calibration lowering of Danish quanta meter starts from stern boom
0913 USA surface temperature measurement
0915 Complete USA temperature measurements
0920 Start lowering USA transmissometer from starboard boom
0924 Danish quanta meter back aboard
0927 USA transmissometer back aboard
0928 Scripps aircraft arrives overhead and starts dropping expendable bathyphotometer and that is only a bit over an [35] hour's worth. This went on all day ending up with:
1615 Start lowering of French quanta meter spectro-irradiance meter
1623 Recover USA transmissometer on starboard boom with Oceo winch
1637 Start relowering USA transmissometer
1643 Recover French quanta meter and spectro - irradiance meter
1644 Recover USA transmissometer
1652 Start lowering of Danish quanta meter using port Oceo winch and stern boom
1715 Recover Danish quanta meter
1720 Underway to recover Japanese in situ incubation gear below the free-drifting buoy
1820 Boat over to attach line to Japanese buoy
1835 Japanese in-situ gear and Robert buoy aboard
1840 Boat back aboard
1842 Underway
1900 Release both German and USA/Japanese radiometersondes

…and so it goes with variations on this same theme each day. [36]

Today's variation was that the Danes lowered a color meter that came up flooded out. Nygaard and Hojerslev opened her up, cleaned and dried it as well as they could, found the problem - a loose plate, fixed it, and hope for a more successful run tomorrow.

International scientific discussions are always good sport, and tonight we lingered long over coffee after dinner - Nygaard of Denmark, Morel of France, Commander Patrick, Saijo of Japan, Jitts of Australia, Ochakovsky of the Soviet Union, Pete Kuhn, Commander Alderman, John, and I. The mess boys were trying to wind up, so we all raised our coffee cups and the ash trays while the tablecloth was whipped off, then we all put our cups down on the plastic table cover and went on with our discussion. It had started with my talking of Walter Drost - Hansen's work at the University of Miami where he describes numerous observations of the sound-scattering layer at depth that is recorded on the echo sounder and coincides with the depth of the [37] 15 °C isotherm. He has determined that the scattering layer is associated with the presence of particulate matter of 1 to 10 microns and that these particles can also be detected by optical scattering. This layer, however, does not exhibit the diurnal vertical migrations of the shallower deep scattering layer, and he believes that this acoustic scattering is due to actual changes in the structure of water near 15 °C - especially in the water directly adjacent to the particulate matter. Jitts gave a summary of what's known and not known - of DSL to date, and André Morel told of the work he had done on Cousteau's CALYPSO with Harold Edgerton and George Clark in the Med where they had lowered cameras with strobe lights into and through a strong deep scattering layer and had watched as the returns on the PDR suggested the layer actually thinned around their gear - as though actively avoiding it - and the pictures showed nothing. All very similar to our 1964 work with [38] the three-part deep scattering layer investigated from the PIONEER off the east coast of Ceylon. Nygaard spoke of similar experiences off the Scandinavian coast, and Harry Jitts told of a 4-hour tow through a very heavy deep scattering layer in the Antarctic using a big Isaacs-Kidd midwater trawl with a fine-mesh net and recovering only 5 Crill [sic, Krill] "and assorted junk" but not the mass of life one might expect.

We talked awhile of how the unique collection of talent and optical, biological, chemical, and physical equipment aboard might be capitalized upon to tackle some problem that could only be solved with this once-in-a-lifetime assemblage of capabilities, and somehow got back to Drost-Hansen-Hansen's hypothesis. It seemed to me that about half would like to prove the idea is right and half would like to prove it wrong - primarily a Physics - Biology split, I think. At any rate we all felt it might be fun to look at if the [39] 15° - isotherm scatter showed up on our track. The narrow-beam echo sounder was repaired today, but it is still not functioning. This is too bad, for that is the ideal gear for looking at these scattering layers. I had looked

this morning at our STD lowering record, and the 15° isotherm is at 372 m - too deep for all of the optical gear aboard - i.e., their cables are not that long. We decided, though, that if the PDR shows a scattering layer at the depth of the 15° isotherm as revealed by the morning STD cast, and if the layer is still apparent that night, we would steal a few hours, stop, run a new STD or XBT to be sure the scattering layer still coincided with the depth of the 15° isotherm, then get some water samples which Nygaard says he will be willing to run in the lab for measurements of the particulate matter. We'd try to get samples above, in, and below the layer.

I think it was Morel who said we should be very careful not to solve the deep-scattering layer problem; for if we did, then the [40] oceanographers of the world would no longer be able to use this problem as one of our best levers to pry funds from the world's navies to do our work at sea, which we justify by saying we are working on the deep scattering layer - a problem of operational importance to any navy. We will look anyway, even at the risk of killing the proverbial goose that has laid the golden eggs for so long.

The evening balloons went off in good style, but the USA clock stopped before the end of the run. They were up some 45,000 feet and above the moist layer, so the run was still a good one. [41]

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By the time we had stopped on station # 04 at 0800 (local time) the PDR was on and recording, and I was looking for scattering layers. Even toying with the gain, gating, and switching scales, there was nothing I could spot as an identifiable scattering layer. The LODARr gear on the bridge, however, gave a different picture. That equipment showed scattering layer at 90 fms, 135 fms, a fat one at 215 to about 255 fms with a darker thin one in the middle at 240 fms and another thin faint one in at 300 fms. This instrument though, is not a precision survey tool but german fish-finding gear. I will let it run for a while on this station to see what we get. It will be interesting at sunset to see which - if not all - of these layers migrate upward with approaching darkness. [42]

Checking the morning's STD cast showed the 15 °C isotherm to be at just 300 m - that's 165 fms and right in the blank spot between the layers at 135 fms and 215 fms. The LODAR vertical scale can't be 30 or 50 fms off, but there is no way to calibrate it - it just is not designed for the sort of accuracy we need here. I infer from all this that there are several scattering layers but none of them coincides with the depth of the 15° isotherm this morning. We will try it again on our first station in the Pacific on the 9th - probably the 9th.

And this brings up another problem. I can't get John Tyler to give us even a tentative plan. The biologists want to get south into the highly productive waters of the Peru Current,

but Tyler says "water is water" - and indeed it is for his optical work. He would just as soon stay in the Caribbean anyway. I will try to get this one straightened out so [43] the Captain will have at least some idea of where he is going. The firm date is Balboa by noon on the 22nd. This means we can go some 1200 miles SSW with a daily station and still get back to Balboa on time even with the stop at Galápagos in lieu of one station. Or we can - if the weather is overcast or bad otherwise - head further south with no stations in the Gulf of Panama and get the more southerly stations first with the rest on the run back. The Captain made up an interesting graph of days (9 - 22 May) on the abscissa and distance from Balboa on the ordinate. We could run with no stations at all as much as 2200 miles from Balboa turning around on the 15th of May and running back with no stations. That is one boundary. The other is making a station every day except for one day at Galápagos, and this way we can get some 1200 miles from Balboa. Any combination of running and stations can be made [44] within this envelope on the graph, and on any day you can tell by a glance at the graph just how many stations you can still make prior to a 1200 arrival at Balboa on the 22nd.

The Scripps plane came over again this noon, and I again passed on the usual information to Giff Ewing. He plans a newspaper drop again, but from what I hear of college riots, I am not at all sure I want that much knowledge of the mess that the “other world” seems to be in. It is much more peaceful aboard. He did ask, however, if we would take a shallow sample for a chlorophyll "ground truth" for his airborne sensor if we did not make a regular station on the 9th. George Clark takes over from Giff at Panama but the plane can only go out some 250 miles. He did say that the plane's request for clearance into Ecuador was denied. I trust this bodes no ill for us [45]

We sent a message to AMC today asking for 250 m of hydrographic wire and saying the alternative is to cut 250 m from the port winch. I have talked to Bill Guthrie about that cable, and he tells me it has been on since the ship was delivered in 1967. The starboard winch has newer cable and I wouldn't touch that, but this is so old that I would be leery of running a really deep cast from it anyway. The telegram was so worded that AMC would find it very easy to tell us to take the alternative of cutting off the 250 meters. This we could then use as a help in justifying the expense of the new 30,000 ft reel I think we will need anyway. The possibility of locating 250 m of 5/32^{nds} cable and getting it to the ship in Panama in less than 36 hours is a pretty thin one anyway.

A big old white tip shark followed the French gear up to the surface [46] this morning and then stayed close to the ship waiting for a more edible looking piece of equipment. Ens. Chuck Langdon baited a big BIG hook and tossed it in. The shark smelled it once or twice on slow passes, swiped it once with his tail, and then came in like a freight train and took it. Fortunately the line was heavy and the bitter end secured to the rail, or all would have gone - Ensign Langdon included. The shark got to the end of the line and was fetched up rudely in a

churning froth of water and shark. They played him a bit and then hauled him up nearly clear of the water where he is still hanging. It takes a long time for these fellows to die, and Chuck wants that big jaw and teeth.

Shorty, the carpenter, and Mason, the Survey Tech, have been hard at it down in the shop making cutlasses, pistols, cat-o-nine-tails, the works, for the Equator Ceremony next week. Shorty called me to come on down and proudly presented me [47] [The original diary skips page 48] with a fine replica of an old flint-lock pistol. "The others all have wooden barrels, yours is metal and you can keep yours, while we'll need the other ones back for our next time" I'll add it to the museum collection in the new building on Virginia Key. He is a thoughtful guy.

Today's ups and downs and their associated samplings and measurements go well. Much of the confusion of the first several days has given way to a relatively smooth - though very busy - operation. The bombing run by the Scripps plane was a good one, and the two cannisters fell about 50 yards off the starboard beam, hitting the water even as the whaler bumped and slammed her way over to recover them. Once aboard, the cannisters contained the - appropriately enough - airlift editions of the Miami Herald for the 4th, 5th, and 6th of May. A Time magazine, and a small gift-wrapped package addressed to the Scripps Institution of Oceanography from the Woods Hole Oceanographic [49] Institution - actually it said "To Scripps from W.H.O.I. for the homesick and lovelorn," and inside was a small female doll. Evidentially, Giff had taken my request seriously, and the ship did indeed get a girl.

A message from AMC today says the two Soviet meteorologists "unable to come," so at least that is settled. It would have been good to have their gear compared with the German, Japanese, and American radiometersonde gear, but we would have had some bunk reshuffling to do and additional modifications to make to the presently configured radiometer sondes, and an interruption to what is now a smoothly running intercomparison. Still - it will be a less complete intercomparison with the USSR not taking part.

The CICAR Operations Center at Curaçao reports the ASKOLD yesterday at 18° 20' N, 75° 47' W, just where she was on the 5th. Evidently a hove-to operation of some sort. [50]

Since the Saijo Maru did not go over today, SCOR Working Group 15 finished early, and were underway at 1640 on route to Colon, but we will save that extra time and use it tomorrow at a station not too far from the Caribbean entrance to the Canal.

Ochakovsky had minor leakage problems with his underwater amici prism, but said this evening that he thought it would be OK.

The biological work aboard is all based on the lowering of the Australian quanta meter that measures percent of surface light versus depth. Then the bottles below the Saijo Maru are placed at depths with known light levels, and the biological samples are taken from these same light - depths. For example, if 25% of the light available is found at 100 m, 10% at 150

m, and 1% at 200 m, then these might be the sampling depths for that particular day. These light-depths [51] vary, of course, with such things as amount of cloud cover, angle of the sun, sea-surface roughness, and suspended material or turbidity. Hence the Australian gear (quanta meter) must go over first thing in the morning to determine what we are now calling the "Jitts numbers" for that day.

Jitts' quanta meter is an interesting device. In a regular old innertube he has one meter mounted on gimbles and looking upward to measure the incoming radiation at the surface of the sea. Below this is another gimble-mounted upward-looking meter that, with a release signal from the ship, is released and settles slowly to the end of the available line - about 250 m or so - and is then hauled up. This way he can record aboard, as the device free - drops, the variation in light intensity versus depth. By releasing it from a float some distance the ship itself, he nicely avoids the problem of having it pass through the ship's shadow [52] at depth - as that would foul up his readings.

Today, however, on three tries the darn thing came up wrong side up each time Somehow it was fouling. Thus with no "Jitts numbers" for this station, there was no sense in attempting any biological sampling - including the Saijo Maru incubation. And that is why we wound up the station at 1630 instead of going on for another 4 or 5 hours today.

About 3/4 of an hour before sunset this evening, I went back up to the bridge and switched the gear to the 0 - 330 fm scale, adjusted the gain to 8.75 where I got my best signal density this morning, and stood back to watch the deep scattering layers - three of them - all rise to the surface. I marked the time of sunset, 2335 (GMT), on the record and let it run for an hour or so until the layers leveled off for the night. I left [53] a call for 0530 in the morning, and I will try for a similar record of their return to depth after sunrise.

Yulen Ochakovsky told me today that he expects to be in Miami this December or January when the USSR Research Ship ACADAMICIAN MENDELÉEV of the Institute of Oceanology visits Miami en route to the Pacific. He will be the number two scientist aboard with Monin as Chief Scientist. This would be a fun visit - if State lets a Soviet ship visit the land of Castro's ex-patriots. If they do come in, it should indeed be festive! [54]

May 8, 1970 - Canal Transit Day Thursday ?? Friday ??

When I got to the bridge about 0545, dawn was well along and the hills of Panama were dead ahead - big cumulus clouds along the horizon but clear overhead. I set the again on the 0 - 300 fm scales and had four good scattering layers. As the skies became lighter (sunrise was at 0557) only one of the layers started down. I had good non - moving layers at 40 fms (72 m), at 80 - 90 fms (144 - 162 m) and one at 150 - 160 fms. (270 - 295 m). The moving layer came down from about 90 fms (162 m) at 0545 (1045 GMT) to 140 fms (252 m) at 0630

or going down at a rate of better than twelve feet a minute. The others stayed essentially at the same level with the moving one going down through the stationary ones. Once the record was long enough I could see a thin (2 fm) but distinct layer right at 100 fms (80 m). Last night through sunset though, the three migrating layers rose some 130 fms in 15 minutes or over 100 feet per minute. [55]

At 0800 we started a mini - station within sight of the cloud - topped hills of Panama. Still having some trouble with the Australian quanta meter, and two out of three attempts were no good. Chief Engineer Ralph Johnson has been working with Jitts, but it is apparently not solved yet.

Norfolk found the 250 m of cable somehow, and a message today said it was airfreighted by United leaving Norfolk, Virginia, at 4:30 yesterday afternoon. It might just make it.

A new hazard developed today - trees! Great trees up to 100 feet and more in length with bare branches and tangled roots sticking out above the trunks that are awash have been drifting down on us - or rather we onto them all morning. Either there has been a flood somewhere or abnormally high tides and surf, for there is quite a collection of [56] trees, limbs, hatchcovers, coconuts, branches, lightbulbs, and clorox bottles - the works. As the saying goes: if you want some flotsam; I gotsome [SIC]; if you want some jetsom, I can getsome [SIC]!.

At 1300 on the button Jitts' quanta meter came aboard - still not right, and seconds later the screws started turning, the ship vibrated briefly as though stretching after a nap and we were soon up to 14 knots and churning along for Colon and the Caribbean end of the Panama Canal.

The men who come aboard to handle lines during the Canal transit have a reputation for being something less than scrupulously honest. All our gear that can be lifted by two men has been moved into the Oceo Lab which will be locked. Everything else that is not welded down has been stowed away, and we have [57] a strangely unfamiliar uncluttered look. Usually the after working area on E deck around the deep-sea winch and the stern platform - “the balcony" as John Tyler calls it - as well as the whole of F deck aft of the balloon inflation shelter is full of gear. That is the nice way to put it. Cluttered with oceanographic equipment is another way. "My God, what a shambles" is the more normal way. It is special wooden boxes with hinged tops and snap catches and tailored padding for holding optical equipment, or it is the long Japanese lines for their buoy, and hundreds of feet of rubber conductor cable- the American cable on a self powered winch, the French cable coiled by hand into a wire basket, the Soviet cable - all light blue - flaked out in a long narrow coffin-like wooden box, the Japanese cable laid out in long 30 - foot loops on the deck, and the Danish cable in neat coils tied with marlin. Then there is always some box or coil [58] of cabl,e or exotic looking instrument or recorder, or sample bottles, or something right in the middle of where people

want to walk. But it always belongs to somebody else, so everyone walks around it or over it. This afternoon, however, all is uncommonly neat, and we have taken on the appearance of an all - male cruise ship with no gear in evidence to reflect the mad activity that was going on only an hour ago.

Right on the dot of 1530 - our advertised arrival time, the DISCOVERER slid through the mole at Colon and picked her way through the more than 15 ships moving in or out or at anchor there. The sun was bright and reflected off the relatively calm water inside the breakwater. A neat small launch flying the blue PC flag of the Panama Canal Company came up and nudged along our starboard side where the jacobs ladder was waiting for him and [59] our canal pilot climbed aboard. We nosed in behind a big tanker, and it looked as though we were headed through. Then we eased off to the side, and the starboard anchor was let go with a ship - shaking rattle, and clouds of red rust - dust billowed out of the exit from the chain locker, and we were anchored. This did not bode well for an early transit of the Canal.

Directly ahead of us and lying directly across our bow a sleek clean - looking tanker was anchored. The word spread like on oil slick that the Angelo Petrie was a wine tanker as indeed she is, and the men lining our rail looked with love in their eyes, and there was talk of suggesting a formal exchange of crews and scientists between our two ships.

All 25 of the scientific party and some five officers were on [60] the flying bridge, and there were at least 34 cameras - the Japanese each had two. If one - tenth of the pictures taken aboard come out we will have enough for a five-foot shelf of photo albums. Hopefully some of the negatives will eventually find their way back to the ship or to John Smiles in Rockville so that the photo record of a really unique cruise will somewhere be on file for the historians of the future who will work through the archives to find out what ESSA actually did with those big research ships she had back in the 1960's and '70's.

It is now almost 1700, and we are still swinging slowly on our anchor with no indication that we are any closer to starting our transit than when we dropped anchor over an hour ago. The ranks of photographers have thinned to three or four still [61] on the the flying bridge, and we are now resigned to waiting.

Where we describe the difference between an optimist and a pessimist as one saying his glass is half full while the other says it is half empty, Yulen Ochakovsky told me this afternoon - on the flying bridge - that in Russia the optimist studies Russian while the pessimist studies Chinese - a nice touch!

Just after 1700 the hook creaked up. We slowly swung around and fell in line behind the German ship BERNARD HOWADT headed for Gatun Locks - the set of three that lifts us some 85 or so feet up into Gutan Lake. Nose to tail like two puppies getting acquainted we were in the first lock with our two locomotives in front and two astern with their lines taut holding us in just the right spot as the great gates swung shut behind us, water boiled in, and

really quite quickly [62] we were lifted up to the level of the next one. Cameras were clicking all over the ship, and I am sure my Eastman Kodak stock went up a point or two. I remember wondering if this lifting of the ship would be recorded on the several barometers aboard. I am sure it is and will check in the morning to see. The first lift was completed just at sunset, and the electric locomotives quite effortlessly, apparently, eased us forward nose to tail again - into the second lock.

Since a decision was needed soon on what course we would leave the Canal on in the morning - about 0500, Tyler, Jitts, Nygaard, Austin, Patrick, Alderman, and I met in the ship's library with the charts and the Captain's plot of days between Balboas versus distance from Balboa and we had at it. The final decision was that we would head about 170 ° T until we got past the 100-fm line and have [63] our first station in the Pacific there. Time should be about 1000 if we get away by 0500. The next one would be some 210 nm farther along (at 0800 the next day). Then we would run SW headed for the offings of the Gulf of Guayaquil. All this presupposes that Ecuador does come through with our permission. Otherwise we will stay outside their silly 200 miles territorial sea and make some three stations in the Peru Current where it leaves the 200-mile limit. We will then work SW and back north getting to the Galápagos Islands. We would make stations the 19th, 20th, and 21st en route Galápagos to Panama getting to Balboa again by noon on the 22nd.

Somebody goofed at the Ships' Base in Miami, and there was no mail for us on arrival - that could have been [64] avoided. ESSA's man in Panama - Bill Metivier - came aboard with the pilot boat. Jack had sent two letters for Ian Baird and our two 7-cm cells for the spectrophotometer to Metivier, and these we got. One crew member - not the radio operator - who had stayed in Miami to take an exam also came aboard. He had been sent with no passport, no visa, no seaman's papers, only a letter saying if he ran into any trouble to contact Captain Stark at the Miami Ships' Base. Metivier said that it took the better part of a day to get the Panamanian authorities - not the US Canal Zone people, but the officials in the Republic of Panama where the planes land - to let him go. Without Metivier, our man would have been in the Panamanian pokey.

It is now 2315 and we are well along in the Canal. An occasional ship slips by close to our port side, [65] one was filled with what the old novels call" revelers." This was a swinging bunch, and a full - scale party was in session. Some who earlier had envied those assigned to the wine tanker now had a better idea, but it was soon astern of us and disappearing down the long road of lights we had just covered ourselves.

No cable in evidence - our 250 meters and no mail, but maybe we will get something in exchange for the big bag of mail that leaves the ship about 0400 tomorrow morning.

9 May, 1970 - Saturday, Gulf of Panama

We got out of the Canal earlier than expected and were past the 100-fm contour before 0900, and stopped in a bit over 200 fms at 0900. Because of the trouble with the Australian quanta meter, we will use the French and the Danish [66] instruments today to get essentially the same data and will then go ahead with the Japanese and Australian incubations. We now have a strong thermocline showing an 11-degree drop from 27.5° at the surface to 16° at 33 m.

A veritable flurry of messages came in this morning - some good, some bad. The good one first - "Pass to Stewart - Request for funds approved per ESSA Hqts." That means we will have the $660 required for the overtime to get our job done - good for Bob White! Now the bad: "Clearance to conduct research in Ecuadorian territorial waters not - repeat - not approved. This was backed up with another saying "American Embassy in Panama has traffic concerning clearance." Although the wording is a bit ambiguous, i.e., does "not approved" mean not approved yet, or does it mean officially disapproved? I suspect it means the latter and we are acting accordingly even while trying to get a phone patch through to our Embassy in Panama City. [67]

This is a big disappointment aboard, as we really need to get into that Peru Current water off southern Ecuador. I held a small session with Tyler, Jitts, and Commander Alderman all jammed in the 5x8 Executive Officer's Office, and we just must plan to do all we can staying at least 200 miles off South America. "It's bloody damned outrageous" is the way Harry Hitts of Australia put it, and I agree.

This, it seems to me, is real grist for the Intergovernmental Oceanographic Commission (IOC) mill, and I plan to see that it gets there. Although the last session is the first IOC meeting I have missed since 1960, the report indicated that the discussions on the point of freedom to do research at sea were more in terms of how much can the coastal state do to the researchers keep out rather than how can researchers do more in territorial waters. This is what comes of having the IOC delegations increasingly populated with governmental [68] bureaucrats and less with working oceanographers. The concern switches from developing improved means for facilitating research to strengthening the imposition of governmental jurisdiction over their own territorial seas. Messages of concern coupled with requests for assistance in reversing Ecuador's decision have been worked up to go to Warren Wooster, President of SCOR and now at FAO in Rome and to Sidney Holt at the IOC in Paris. We will sit on these, though, until we have some word from the US Embassy at Panama - a sorry damn situation!!.

All outgoing mail left with the pilot boat at 0400 hours this morning, and there was no mail for the DISCOVERER there. This is a relatively easy task - getting mail to a ship especially

when 1) the date (and even the hour) and place of arrival are known weeks in advance, 2) when ESSA has a local man at the foreign port, and 3) when C&GS has a [69] full Captain as a Ship Base Commander with little else to do. Maybe AOML should take over this function for the ship, for the only stuff we got was what Jack Kofoed sent - so it can be done when capable and concerned people are involved - end of grouse.

The Scripps plane called in about 1000, and I gave Giff our on-station position as 07° 36' N, 79° 21' W plus the regular surface temperature data and weather info that he wanted. He will make another bombing run today and drop the daily weather map plus the satellite cloud coverage picture from yesterday. These he got from the weather Air Force base. He also reported that the Intertropical Convergence (ITC) is now centered at about 5° N and is 4° wide - or some 240 miles across. It has been sitting there for over a month, and the [70] forecast is for slow movement north. So we can expect increasing cloudiness between here and the equator and increasingly better weather from there south. He reported further that the ITC is about 2/8^{ths} thunderstorms and 6/8^{ths} altocumulus and altostratus.

George Clark will be aboard the plane tomorrow, as Giff has to head back north, and that will be their last over flight. They have been most helpful and cooperative and the ship - plane joint effort has been most successful. George was aboard the CALYPSO with André Morel in the Med a few years ago, and they may talk tomorrow. The plane then heads north to the Costa Rica Dome - a magnificent upwelling area that we worked over on the EXPLORER during the 1960 transfer expedition.

Just before noon and after a full [71] hour of trying to get a good frequency ("frigancy," Tom Johnson calls it), we finally got through Mission Radio at Panama to the Duty Officer at the U.S. Embassy. It developed that he knew of the fact that a message had come in, but "the action was assigned to the Economic Officer." He will try to find out where the Economic Officer spends his Saturday afternoons and will ask him to call us back later.

He did call back about 1330 - a Mr. Jorgenson, and most helpful. He went to the Embassy, broke out the messages on the subject, and gave us an unclassified version. Briefly, the situation is this: In response to the U.S. request to work within their territorial waters which included an invitation for Ecuadorian observers to be aboard, Ecuador replied that Ecuadorian law required that their observers be aboard, and further they required that the USA pay all travel and other expenses entailed in getting the Ecuadorians from Ecuador to Balboa and back. The [72] State Department replied "nuts" or whatever the diplomatic verbiage is that amounts to the same thing. In this one, I am with State, and they therefore cancelled our request. I do feel that this specific incident must be brought before the IOC at the next meeting of the Commission, Bureau, Group of Experts, or Working Group that considers in any way the question of the freedom to carry out pure research at sea. In this instance, State was correct in refusing to be blackmailed. As someone in the Lab said on

hearing the news, "We'll fix ‘em - we just won’t learn about their damn current." It does seem quite unnecessary, and it is indeed frustrating.

No quantitative data on it yet, but there certainly is more marine life in evidence here than in the Caribbean. Two porpoises were working our bow wave this morning as we came on station, and there have been several mahi mahi or dolphin fish [73] circling the ship on station and pointedly avoiding the several lures and baited hooks that the crew has put out for them. They are good looking fish with a pug nose and brilliant yellows and blues. This morning early several big manta rays were leaping high out of the water and falling back with a great slap. The biologists claim that these great twisting leaps and uncontrolled crashes back into the sea are either some sort of courtship activity or are an attempt to rid themselves of parasites. My own theory is much nicer and is that the rays are just expressing sheer exuberance and are leaping just for the joy of it all. Why not?

Ray Smith from Scripps has suggested that we collect all the pirate costumes and wooden pistol and swords planned for Neptune's visit on the 11th when we cross the equator, and then arm us all for an invasion of Ecuador. Dave Carpenter from Australia [74] suggested instead that with all the cigarettes we have aboard, we could probably bribe our way into Ecuador. At any rate, Ecuador is now out. We have adjusted our track - again and will keep outside, their 200-mile limit. No news specifically on Galápagos, but I suspect that is out too. I am glad Darwin didn't encounter all of this in 1835 or he never would have gotten ashore, and I would never have known I had monkeys for ancestors.

George Clark takes over from Giff Ewing on the Scripps plane tomorrow, and he will want some numbers for surface chlorophyll determinations made aboard. I talked with Ian Baird in the lab this evening, and the numbers as fluorometric determinations (in mg/m^3) look like this to date:

Sta. #	Date	Surface Chlorophyll
01	5/4	0.06
02	5/5	0.03
03	5/6	0.04
04	5/7	0.07
05	5/8	0.17
06	5/9	0.23

[75]

Today's station - with the bottom of the mixed layer at about 30 m - looked like this for chlorophyll, again in mg/m^3

Depth	mg/m^3
0	0.23
30	0.70
50	0.16
75	0.69
100	0.015
125	0.01
150	0.00

After dark this evening, and before leaving Station # 06, Roz Austin and Ray Smith made a lowering with the Scripps scatter meter. This is a lowered device that has its own light source and measures the light scattering properties of the water at various depths. At depth, the instrument's narrow - beam light source swings through a semicircle and the pickup measures the forward scatter, back scatter, and all scatters in [76] between. As with the chlorophyll measurements, there was a marked increase at the bottom of the mixed layer at about 30 m.

The magnetometer fish went over as we left this station, the gravity meter was fired up, and we have started running track line hydrography to try to fill in some of the holiday areas in the work Paul Grim of AOML has been doing from the OCEANOGRAPHER. We would have liked to be tonight on his top priority north - south line along 79° W, but it runs inside that miserable 200-mile no-no. Right now we are angling off on 220°, but I hope the data will still be of use to him.

This is the DISCOVER's first time in the Pacific. I have spent considerably more time in the Pacific than in the Atlantic, and it does seem like seeing your college sweetheart long after your marriage [77] to another woman. The Southern Cross is still there, and we are now far enough south so she is well up. Tonight the sea is good. There is a comfortable roll, and somewhere deep within the ship a door bangs on every swell. In my own cabin, the bunk is not tight against the bulkhead, and it gives out a pleasant squeek as it recovers from each roll. It is a comfortable and familiar sound, and I will not try to wedge something in to stop it. I like it. It is a sea sound and it is good.

10 May 1970 - Sunday

I am sorry now that at the November SCOR Working Group 15 meeting at AOML I gave my address as the one to which all their gear should be sent. A name and address was needed, and mine and ESSA - AOML seemed at the time the logical ones to use. Lashed down on the foredeck, the starboard weatherdeck, all over F - deck aft, and fantail are these

gigantic boxes all [78] labeled in great stenciled letters, Dr. Harris B. Stewart, Jr. (SCOR), ESSA - Atlantic Oceanographic and Meteorological Laboratories, 901 South Miami Avenue, Miami, Florida, USA.

I can't get away from me, and it is doing things to my psyche.

Late yesterday while bringing up the Scripps transmissometer with the Scripps winch, a keeper in the gear box broke and the parts fell down into the gear train. Actually, we didn't know what had happened until Ralph Johnson opened it up. All Ray Smith and Roz Austin knew was that there had been some minor clanking followed by a horrendous metallic grinding noise, and the winch stopped just as the instrument got clear of the water. Ralph's people have been working with it down in the machine shop all morning making some new parts, and he said this noon that it should be back in operation this afternoon. On nine out of ten oceanographic ships in [79] the US, a breakdown like this would have meant the end of the programs that used that winch. On the DISCO, however, we are big enough to have the complete machine shop and good machinists needed to make such major repairs - another valid justification for the larger ships.

Lying due south of us and stretching from horizon to horizon is the heavy cloud bank with thunderstorms that marks the northern edge of the ITC. We should be well into it during our run south tonight.

Some minor juggling of schedule today to fit in a fire drill and man-over-board drill so that our observation schedule is not fouled up too badly. I talked first with Tyler and then with Captain Keith, and the Skipper suggested we hold it while the ship is underway about 1430 to chase the Saijo Maru. We [80] have a 14-kt wind today, and the buoy and ship separated fast once it was let go.

There were communication problems in talking with the aircraft today. The trouble apparently was ours, and we kept cutting out while transmitting. Johnson was giving them a signal to vector in on, and I was standing by to talk to George Clark, but we just never made it. The last word we got from them was that they were "returning to base." I don't know what the problem was.

With the need now to stay outside the 200 - mile limits of Ecuador - as well as 200 miles from the Galápagos - Tyler and the SCOR group would like to run south across the Ecuador to about 3° South, then move about 220° or so as far as we can get before we have to turn around in order to run north going west of the [81] Galápagos to the Costa Rica Dome at about 8 or 9° N, 90° W. This is an interesting and highly productive area where currents flowing in opposite directions meet to cause a strong vertical movement of outflow at the surface. We investigated this at some length on the EXPLORER during her 1960 Seattle to-Norfolk trip, and I well remember the long hours spent running a BT survey across this feature. It is easily spotted as the air is cooler, the water is 4-5° cooler, fish and birds are

more common, and the thermocline rises rapidly to the surface as you approach the area. I had written this all up and had made vertical temperature profiles across the Costa Rica Dome, but we couldn't locate a copy of my 1960 report of that trip aboard. The Captain finally found one in the Cabin, and it has proved most useful to the SCOR group. [82]

I have waited until now to tell what we really are trying to accomplish on this trip, because I felt I could explain it a bit better after we had been at it for a while. Briefly, the idea is that if the Soviets, the Japanese, the Australians, the Americans, and the rest are each making independent measurements of property X on their own ships using different equipment and different techniques, then there is a chance of getting all their results together to derive a meaningful picture of the global distribution and variation of property X in the ocean. Property X in this case is several things: primary phytoplankton productivity, radiant energy at and below the sea surface, and optical properties of seawater. All of these are being measured and the techniques intercalebrated among the members of SCOR Working Group 15. Property X is also the variations in incoming and reflected radiation as measured by radiometers carried aloft by helium - filled meteorological balloons released daily at sunset. [83]. Nutrient concentrations are also important so that we can tell if and when the productivity is limited by the amount of nutrients - primarily nitrates, phosphates, and silicates - available in the water. Thus Jim Alberts of FSU is running these analyses on samples collected both by the daily Nansen bottle cast and by the various water samplers used to get water for their productivity measurements. The various optical measurements record the horizontal stratification of suspended light - scattering matter in the water to assist in the interpretation of the other results.

More specifically, what do we hope to gain or learn from all this mixture of gear, techniques, and nationalities? Here are some of the hoped - for results:

1. We will get data on primary productivity - the ability of the floating microscopic plants in the sea to produce, even as the leaves of the green plants on land do. We will also get data on the available radiant energy - The main [84] energy source for this process of photosynthesis. With these data, SCOR working Group 15 hopes to demonstrate the validity of their earlier conclusions regarding those directional properties of the light field that are most important in primary productivity. [84]
2. We will obtain these data in a wide variety of water types with a wide range of chlorophyll concentrations to demonstrate the applicability of the Working Group's recommendations to various water types.
3. We will have for the first time a complete record of the performance of various detectors for measuring radiant energy that are used in productivity work. This

record will be with reference to the US Bureau of Standards standard of spectral irradiance.

4. This will permit daily intercalibration and correction of the several devices being used to detect radiant energy. This trip will be the first time ever that oceanic primary productivity has been determined under fully documented [85] radiometry.
5. Using the standard of spectral irradiance, we will compare all radiometers aboard quantitatively and under field conditions.
6. Optical measurements will reveal temporal and spatial variations in suspended particle concentrations in the photic zone - data necessary in the interpretation of the results of the measurements of primary productivity.
7. We will be able to specify and recommend in considerable detail a simple instrument that can be used by biologists to measure the radiant energy available for photosynthesis, and will be able to state the expected accuracy of the radiant energy measurement in different types of water.
8. We should also have enough data to specify the applicability of [86] a thermopile type of radiometer to measure the photosynthetic radiant energy as a function of depth and in different types of water.
9. We will be able to compare productivity measurements made by the *in-situ* technique (the Saijo Maru bottles) and the simulated *in-situ* technique (Jitts, Saijo, and Malone) on the same ocean water samples under the same daylight conditions in conjunction with carefully controlled radiometric measurements. Doing it this way, the real variability of the technique, or of the productivity itself, should be evident.
10. We will try to determine the importance of using color filters (rather than neutral screens) in the incubator used for simulated *in-situ* primary productivity determinations.
11. We will have an opportunity to compare the productivity per day [87] as a function of depth by three independent means: by the *in-situ* Carbon-14 incubation method, by the simulated *in-situ* method under the appropriate optical filters, and by calculation from our measurements of the integrated available radiant energy at various depths during the day, and the productivity per hour obtained in an incubator under constant artificial light.
12. New data for the optical classification of sea water and for developing an instrument which will permit biologists to determine "water type" from the deck of a ship and from this they will be able to estimate the probable spectral energy available for photosynthesis.

13. We will have measurements of the ratio of radiant energy at two wavelengths obtained by several instruments, including a prototype "color meter" (Nygaard's). These measurements can then be compared with complete spectral [88] data to determine the validity of identifying water types by this relatively simple instrumental approach.
14. We will be able to make new comparisons of chlorophyll concentrations at various depths with others such as productivity, total available radiant energy concentration of particulate matter, and nutrient concentrations.
15. We will have data on the spectral signature of various types of ocean water - data of importance in remote sensing and estimating surface chlorophyll concentrations.
16. We will also have the standard oceanographic measurements of salinity, temperature, oxygen, nutrients, etc. necessary to identify the water oceanographically. We will also by net tows have identification of the major plankton species at each station. [89]
17. Tyler hopes to have enough data to have the group prepare and publish a monograph of the results of the work of SCOR Working Group 15.

These are what we hope to accomplish, and in talking today with John Tyler I learned that he is extremely pleased with the way it has all gone to date and had nothing but praise for ESSA and for the DISCOVER.

We tried this afternoon to raise the plane or to get a message through to Howard Air Force Base in the Canal Zone to transmit to them, but no luck at all. So it looks as though we will not be able to get a position from them as to where the Costa Rica Dome is located when they fly over it, nor will they know we plan to be there the 18th in case they wanted to modify their schedule to overfly us again. [90]

The ITC is now on us, and it poured buckets this afternoon - the first rain we have had since leaving Miami over a week ago. The ship is a lot cleaner, but all gear outside is really soaked. All our upward - looking gear will have to be cleaned off before we can trust any of their measurements.

The fire-drill and abandon ship drills came off about 1430 as we got underway to catch up with the Saiju Maru, and afterwards the Captain came on the speaker system to announce that all hands except those on watch were to muster aft of the balloon inflation shelter on F deck. Men were in the whaler, on the crane base, on the winches and the rail, even on top of the port winch house. It was the first time everyone had been in the same place at the same time, and we were all surprised to see how many of us there are - about 100. The Captain gave a quick talk about the [91] equator crossing tomorrow - and he is a pollywog, too, and

then Davey Jones and two rough looking pirates showed up and announced that all slimey pollywogs were to prepare to meet Neptunus Rex tomorrow, and he had supoenas for all 56 who had not yet been inducted into the equatorial realms of Father Neptune - and that's when the rains began. It was the first time we had had everyone out on deck at the same time, so the law of the perversity of inanimate objects is still in effect, and that is the moment the ITC declares its presence quite forecefully, and the ceremonies were adjourned to reconvene immediately in the Oceo lab below. Each pollywog got his papers served, and each had a personally tailored set of specific charges of heinous crimes against the ocean. It really was extremely well done. Junior Gray, the Chief Steward, made a fine black Davey Jones in cocaded [92] tricorn, a blue greatcoat, white knickers, and with a great cat-o-nine-tails in his hand and a long pistol in his wide black belt. Mason, the Survey Tech chief was a pirate replete with gold earrings and eye patch and toting a long rifle, while Don Cassino was his henchman. They did a fine job and set a good scene for the shinannigans [SIC] tomorrow morning.

All this has been arranged so that we can have our fun and games while we are still steaming south to get to Station No. 08 south of the equator at 0800 the day after tomorrow.

The rain this afternoon completely fouled up all optical measurements, but the biological ones came off well. Ralph Johnson finished fixing the gears on the Scripps winch, and the survey techs were folding up fathometer and gravity meter records from the run last night [93]

With no stars tonight, we are starting a 37-hour run with no control other than a DR position at the end of an eleven - hour drift period. This will not be what Paul Grim would have liked for his hydrography - magnetics - gravity run we are now on, but it could not be helped. The satellite gear is badly needed, and we will all feel better when it is installed and-hopefully-operational in June and ready for Peter Rona's Trans Atlantic Geophysical Traverse starting in July.

The navigation plot got a shot of verification about 2130 when the bridge picked up Malpelo Island with its 846-foot peak on the radar and was able to get a series of ranges and bearings from the ship. We were a bit east of our DR track but not much, and the revision gave us firm anchor to this long line. As the Captain said, “Paul Grim will be happier now" and we set a new course of 212° to head for our turning point just south of the equator. [94]

H.B. Stewart Jr.

SCOR WG - 15/IAMAP Cruise

Miami - Panama Canal - South Pacific - Balboa - Miami

May 1970

Vol II

11 May 1970

Some time in the early hours of this evening we will cross the equator. However, we will have a station tomorrow, so this is the day that Father Neptune will board the DISCOVERER. By 0700 all hell had broken loose.

Last night at 2200, Captain Hook entered the Captain's cabin and presented him with the sword he is to surrender to Neptune on the morrow.

Breakfast was a shambles! The lowly Pollywog Officers were serving the Honorable Shellbacks in the crew's mess, and Alderman, Patrick, Durenberger, Langdon, Drake, Mangis, Childress, and Lake were in dress whites minus any insignia. The Captain served breakfast to his Shellback cabin boy, Marcel, music was provided - and I use the term "music" loosely - by the Pollywog Five, and a slop trough had been set up in which Pollywogs could dive for their breakfast. The bridge watch and the fathometer - magnetometer - [1] gravity meter watches continue - but just barely. I have Nakamoto all dressed up in foul weather gear at the peak of the bow with a five - foot spyglass looking for Father Neptune, and Ochakovsky and Kuhn on the bridge wings in foul weather gear looking for a mail buoy. Pirates are all over the ship - and a more motley crew has never been assembled.

At 0940 I brought up the Royal Party from the CPO lounge. Maynard Daniels from the engine room was Father Neptune and Chief Guthrie - with two hard hat helmets for breasts beneath his dress - was the Queen, Fimpel from Germany was the Grand Wizard, and Prof. Müeller was the Royal Princess, Chief Junior Gray was Davey Jones and Jimmy Jones was the Royal Baby, Chief Survey Tech Hopkins was the devil and had a pitchfork that was wired to give a shock that would start an airplane.

Each lowly Pollywog was brought before the Royal Judge (Chief Blackmon), his [2] charges were read while he knelt before the bench, and somehow there was not an innocent man aboard. Then followed a trip to the bloody stock where his head was securely locked, and the Royal Barber gave him a close cut.

Then to the chopping block for a catsup-blood facial, then through a canvas slop chute filled with right smelly garbage. Then a backward flip into a 4 x 8 foot water tank filled with salt water and topped with yesterday's garbage. As their final act each Pollywog went to his knees before the seated Royal Court, kissed the grease - smeared belly, was knighted by

King Neptune and congratulated as a full-fledged Shellback. All were good sports and enjoyed it.

Yata changed his mind and went through, but Tyler, [3] Nygaard, Shimizu, Saijo, Baird, Sgt. Blankenheim, and Malone declined and were not seen during the festivities. All others will get their really good - looking equator crossing certificate - or “deep-loam" - as Yulen Ochakovsky calls it. Coming out the end of the ceremony, a big bare patch of missing hair, catsup and grease all over his face, dripping wet with a piece of old lettuce still stuck behind his ear, the Soviet Union's top oceanographer at the Institute of Oceanology in Moscow grinned from grease to lettuce leaf and said "And now, Stewart, will I get my deep - loam?" And he wil.

The Captain had been hanged in effigy from the centerwell A-frame; and since the real Captain was bald as an egg he could hardly have a haircut. So in his case a special effort was made. The Royal Barber smeared his bald dome with spirit gum and applied great handfulls of the hair cut from others to the top of Keith's head. It isn't neat, and it isn't all the same color or texture, but it is hair.

By 1130 it was all over. The cleanup detail was hard at it trying to clean up the after deck. The Jolly Roger had been hauled down and [4] returned to the flag locker, and the costumes had all disappeared, as the ship struggled back to some semblance of order.

The 1330 sea surface infrared temperature showed a 5° drop to 22.7 °C. We are getting into the edge of the cooler water. An XBT was sent down, and we have a drop of nearly 6° to 17° at the bottom of the [5] thermocline at 30 m. On the basis of this, I started the Survey Dept. in on the four-hour schedule of XBT's, and we should have enough to do it all night.

The PDR hooked into the NMC, since the narrow beam echo sounder is inoperative, gives a nice scattering layer, and the Captain put the LODAR on the 0 - 660 fm scale, and there were a couple of layers. We will leave it on through sunset and see what happens to them.

The surface temperature is now (1530 hrs.) down to 21.7 °C and appears to have stabilized. The air is noticeably cooler and overhead are what Pete Kuhn calls "cold-water clouds", the altostratus and small altocumulus that are typical of cold waters areas. Ahead we can see what appears to be a fog bank or thick sea [6] smoke. All are typical of the effects of moist air moving in over colder water - a San Francisco or Monterey effect.

I was relaxing on the flying bridge talking with Müeller from Germany, Dave Carpenter from Australia, and Pete Kuhn when Chief Radioman, Tom Johnson, came up to give me a radiogram from Jack Kofoed. Tom had heard the story of AOML's building when we were trying to contact the Scripps plane last week, so he was grinning when he handed it to me.

R 11180OZ May 70
FM Atlantic Oceo and Met Labs
To USC&GS Discover
BT
UNCLAS
Pass to Stewart

Building off dead center. Nothing definite. Looks good for prior to your return. Will advise ASAP. [7]

Appears Andy rang bell at BOB with Reston job. I leave Miami May 21 at noon. Signed Kofoed.

TOR 11/1857Z/NMG/16 MHZ RATT/TS

Good for Jack and Andy; It would be hard to find two more like them. The continuing problem of AOML's new building on Virginia Key is already a three-volume story as recorded so far in official and totally unofficial documents at the office. I will not pursue it here except to note that the AOML Director's mood was one of barely controlled elation.

The same spate of messages also brought one from AMC saying that the Galápagos visit request was "not repeat not approved". We had assumed that this would be the case, and I,have passed the word on it. [8]

During the equator crossing ceremony we had one lowly pollywog stationed in the head and flushing the john every five minutes to see when we crossed the equator. Since, on flushing, the water in the northern hemisphere turns counterclockwise, it only stands to reason, that it will be clockwise in the southern hemisphere - all due to the Coriolis effect. He reported no change during the morning hours of pollywog survitude, but then we didn't actually cross the equator during that time, so it is still to be tested.

Just at 1900 (midnight GMT) the speaker system came alive and the bridge informed us that just at 0000 hrs. (AMT) the ship crossed the 00° 00’ 00" latitude line at 84° 24’ W. We are now officially in the South Pacific and in that fog bank. It was just then that the IAMAP balloons were released, and as Monte [9] Poindexter said later, "We'll be accused of fudging the records on this release. Who will believe that we got a balloon off right at 00h 00m GMT at 00° 00' latitude?" If that weren't enough, they had the ship swing so that the bow was into the north wind - heading? 00° 00', of course!

12 May 1970 Tuesday or Wednesdays

The foghorn went on and off all night as we rolled along at 14 knots for Station # 08. This morning the fog dissipated for several hours. The sea was calm but a goodly swell was running, and things that have been unmoved shift and slide about.

The waters around the DISCOVERER were alive with 8-to-10 inch reddish squid. They would dart toward the surface, and just short of breaking through would stop and squirt water up a foot or two into the air. This [10] was a new one on me and none of the several biologists aboard has seen it before. It is as though they resented us and spit to show their disgust with the whole operation.

As a matter of fact, I shared their view for a while this morning myself. Here we are some ten days out of Miami and Tyler still does not know where he wants to go. If new information, developed as we go along, necessitated changes in our cruise plan, that would be one thing; but other than Ecuador's refusal to allow us within their coastal waters, there is no constraint that has changed since our Miami meeting in November. Arch Patrick and I tried for five months to get even a proposed track out of SCOR but to no avail. We finally had to give a trackline to State to go along with our clearance request, and we made [11] that one up ourselves. During a one-hour session back in the lab this morning, we had at various times complete agreement to go south along Peru's outer limits, southwest into the more sterile waters, due west then north but west of the Galápagos to the Costa Rica Dome. I maintained that we are here for them to do their work, and it mattered not one whit what they did between now and noon on the 22nd when we get to Balboa. But we had to know in advance what their plan was - where they wanted to go and where they wanted to stop.

We finally settled on four stations ahead. We will run south tonight to about 5° S to get Station # 09 tomorrow. Then we'll run some 38 hrs. or so a bit north of due west to 4° 30' S, 94° 00' W. That will be Station # 10. We'd then go to 1° 30' S at the 200-mile line off [12] Galápagos at about 94° 45' W for Station # 11 on the 16th and Station # 12 on the 17th of May again on the outer edge of no-no country a night's run north. Tyler, Aldermen, Childress (the navigator) and I went over this with the Captain in the plotting room and he was agreeable with the one exception that he was adamant about not even transitory - no stations, just "innocent passage," as they say - the Galapagos territorial sea. We also figured when we could turn the clocks back next so as to gain the most advantage for the ship insofar as saving overtime costs for the crew is concerned. Since SCOR is working solely on sun time, with sunrise, local apparent noon, and sunset as their important times, it matters not a jot to them what time the ship is using. This makes at least three different time frames in use aboard: Greenwich Mean Time in which we keep all data records, local time at which meals and ships working hours are maintained, and local sun time [13] on which the SCOR

observations are scheduled so that their measurements are made at times determined by sun elevation angles - although recorded in GMT. If this isn't sufficiently confusing. Dave Carpenter still has his watch set on Sydney time, "So I'll know what's going on at my digs back home'. As someone said yesterday as he put a time mark on one of the records, "In five minutes it will be just five hours ago." It does get confusing.

Measurements are progressing even though we have been in fog all morning, and that lugubrious fog horn has reminded us of the fog at regular intervals, Dave Carpenter is still having problems with their dropped-from-the-innertube quanta meter, and again today it came back up hind-side-to. We will use the French and Danish quanta meters to get "pseudo Jitts numbers," and will keep going, but both Jitts and Carpenter are frustrated. They plan one more modification of the bridle and will try again tomorrow.[14]

Just as I left AOML, George Keller asked if I would get him one core in the Pacific - he didn't care where. Since we will have a relatively short run tonight, we will plan to arrive on station an hour early in the morning and drop a boomerang corer at our southernmost station.

I put the LODAR gear on in the late afternoon to see if we could follow scatterers up again tonight, and will put it back on tomorrow to see if we can get a Drost-Hansen layer at 15 °C. The swell is coming from about 135° at 11 seconds and gives us a comfortable roll.

The Saijo Maru was retrieved about 1830, and Prof. Müeller was holding the first balloon while Shimizu and Yata filled the balloon for the Japanese and American radiometers. Roz Austin and Ray Smith have spent all afternoon trying to [15] locate and fix a bum connection somewhere in their cable for the Scripps Transmissometer. They have two spares below, but this is the only cable they can use with the Scripps winch, and they prefer to use that rather than add one more piece of equipment to the winches already in heavy use all day. At 1900 the makeshift table in the wet lab was covered with the colored ends of conductor cables, electrical tape, resistance meter, test wires, wiring diagrams, pliers, knives, and two tired guys still hard at it. Roz suggested we bring our Chief Bos'n with his colorful vocabulary "to put my feelings into a few well chosen words as only Bill Guthrie can."

After dinner the SCOR nucleus of Tyler and Jitts met with Alderman, Patrick, Childress, and me in the plotting room to go over the plot Childress had made of our next four days. It [16] was a mistake. We never should have had them look again at a plan they had already approved in principle. They became embroiled in an argument - perhaps difference of opinion is a better phrase, and all bets were off. Jitts is still holding out for a long run southwest to get into South Pacific waters, we decided the others should be in on it, so John Tyler got Morel (France), Ochakovsky (USSR), Nygaard (Denmark), Baird (Scotland), and Saijo (Japan) to join Jitts (Australia) and us in a further discussion. This went on until after 2000, and the outcome was no Galápagos stations and no Costa Rica Dome, but on to the southwest, taking stations the 13th, 14th and 15th, then right back up the same line. It was fine with us

just so long as we were tied up in Balboa by the 22nd at noon. I'm getting leery of even recording these plans, for they seem to [17] change almost hourly. We have about run the full spectrum of possibilities so short of buying off Ecuador with our supply of cigarettes or invading it with our pirates, I think we may at last have settled on a plan that SCOR is willing to follow.

It was left that we would take an XBT every four hours during the night, and if it appeared we are getting out of the colder current, we will stop.

13 May, 1970

To my surprise - but not really! - when I awoke at 0700, we were stopped and rolling nicely. I pulled on shorts and shirt and padded sleepily up to the bridge. Lt. JG LeRoy had the watch, and the seaman and quartermaster were draped over the port bridge rail talking. All was quiet. I looked at the LODAR with its fine record of descending [18] scattering layers and asked Dick what had happened. "It didn't happen on my watch" he said, but he said it like a man who had just witnessed the crash of the flight he was supposed to have been on.

Evidently about 0100 this morning Jitts called Tyler that the surface temperature was up to 22 °C and he thought we should go back to make Station # 08 in the cooler water. Tyler said OK and called the OD to turn around and go back. The OD then called the Captain, and as Keith said this morning, "I dressed counted slowly - to 2,000, and went up to the bridge."

This business of constantly changing plans must, I am sure, do violence to the professional engineer's natural sense of the need for basic order and regularity to the progression of events. The Captain couldn't have been cheerier this morning when I [19] spoke with him on the bridge, but his night order for last night had a 0100 entry this morning that suggested he has not totally sympathetic to this mode of operation:

“Chapter 2. Proceed on course back to a position 60 miles from previous station. Stop and stand by. The scientists may want to go north or west or south or up. Under no circumstances go east or down".

Last night's balloon run ended up successfully, but not until they had worked at it. The USA transmitter had to be changed just before flight time, and then the German transmitter ran into modulator problems 13 minutes into the flight. They readied another and got it off. Both units got above 30 mb or some 29 km up. A good flight - finally. This IAMAP work is going extremely well, and Pete said this morning [20] that all three systems agree with less diversion than on the last intercomparison. The critical places are regions of sharp vertical gradients in radiation, and these appear to check well on all three systems.

A new radar reflector has been added to the Saijo Maru, and we can now see her well on the radar scope. It is now about two miles away and has a good solid blip that they can

follow. This helps a good deal as we don't have to pull up all lines and go chase it quite so often.

Navigation has been a real problem these last few days. The fog, the overcast, and no horizon have made star sights impossible, and with our doubling back and 10-hour drifts, the dead reckoning plot is probably getting further and further from the truth. The first day out of Panama if you went to the bridge and [21] asked where we were, out came the dividers with their needle points and one point was carefully placed on the exact spot on the chart, and the OD would say - with a note of pride in his voice "right there". I noticed a day or so later that he used the eraser end of a pencil instead of the dividers, and this evening he put down the saucer from his coffee cup and said "about there - I think". We do need that satellite navigation gear.

14 May - 1970

This morning dawned cool and overcast with - again no morning stars, Pete Kuhn has worked up a message to AMC to have them check with the Satellite Center to get a reading on the limits of this cloud bank. They will look at today's satellite pictures and we will then have some feel for when - and where - we might get out of this. Not only does it foul up the navigation, but [22] the SCOR gear that measures the light has problems on cloudy days.

Had a good talk with Jahn Throndsen from the University of Oslo. His role in the SCOR scheme is to provide qualitative data on planktonic organisms and some rough quantitative data on their abundance. His surface tows are to get species data for his own use, but he uses for SCOR the 100-L samples obtained at depth by the Japanese and Australian samplers. With these he concentrates the planktonic organisms by centrifuge, gets a rough volume measure, and then sets about the laborious job of actually counting the numbers present. He divides them into four groups of organisms: dinoflagellates, coccoliths, diatoms, and others. He counts what he feels is a representative portion and then an estimate of the total number of each group present. It is a long and an eye - straining job, and almost any [23] time day or night Throndsen can be seen in his yellow shirt, shorts, and sandals hunched over his Swiss microscope. The instrument is mounted on a thick block of spongex to reduce vibration and is secured with heavy bungee cord to keep it from sliding with the roll. I looked at some of his slides, and they were typical of the intricate shapes and beautiful patterns one usually finds in the plankton. Coccoliths and the collar-button like rabdoliths were abundant in today's samples together with some really beautiful radiolarians that looked like ornate chandeliers. Throndsen's own specialty is the flagellates and he was quite excited at finding in the Pacific several specimens from two new species that he had previously discovered and described from the Arctic waters north of Scandinavia.

Here we are some two weeks out of Miami and the Russians - still have their strong smelling [24] Russian Java cigarettes - "Yava", Ochakovsky calls them. Morel is still smoking French Gitannes, and the combination of the two gives a veritable aroma to the Oceo lab.

About noon the old cry of the whalers of the last century came over the speaker system, "Whales off the starboard beam." They were pilot whales or blackfish, and I counted 12 of them. They are not a big whale, the largest was only about 15-18 feet long, but they would come to the surface in unison, blow, and then roll back under. There was one cow with a calf rolling right along close beside her, and the whole pod came to within 20 feet of the fantail. We had the French quanta meter in the water, and its approach to the surface must have startled them, for the whole pod took off, and we could see them surfacing and blowing well to our stern. [25]

This area is singularly devoid of soundings on the N00 chart we are using, and the innate reaction of the hydrographer is to run trackline hydrography between stations. We talked of this at some length this morning. The last star sight we got was two days ago, and even that one showed that our dead reckoning track was 20 miles off. Soundings are of little use unless you know where they are, so we decided to forego this until we had some better idea of where we are. If we get stars this evening - and it looks very doubtful now, we will do trackline hydrography and magnetic to our next station and see that the data get cranked into the N00 system when we get back.

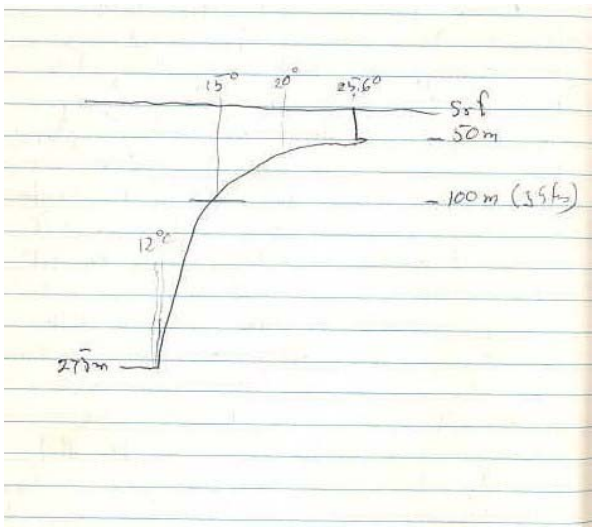
This morning's STD cast showed the 15 °C isotherm to be at 65 or 66 m depth or about 35 fms, The LODAR gear on the bridge shows the uppermost [26] scattering layer today at about 65 fms, with nothing definite anywhere near the 35-fm depth of the 15° isotherm.

Minor problems with the balloon launch this evening. The wind was a bit strong, and the first balloon, while Prof. Müeller was still holding it, began to whip and stretch and finally ruptured and collapsed. The USA/Japan balloon was just completing inflation in the shelter, so they finished that and carried it outside under a big green blanket while the second German one was being inflated in the inflation shelter. Monte in his croutched - release position ran it to the rail, the green cover slid off, and the balloon was released, Pete Kuhn raced for the Met. Lab to turn on the receiver shouting "it counts, it counts", He has been proudly keeping track of the successful launches, and this one once away did indeed count.

They ran a second set of balloons about 2300 with great success. They ran up to 6 mb or about [27] 120,000 feet, Actually they are not trying for altitude records, but this is a pretty good height, They discovered a problem in the sequencing gear in the USA equipment so contacts 125 to 130 were cut out. This means that the 125 readings have really been 130, this would have been caught in the processing anyway and is just a correction to be applied rather than an invalidation of the results.

15 May, 1970

The 1000 BT just as we came on station showed a very homogenous mixed layer at 25.6 °F down to 49 m. There was a sharp inversion of 0.5 °C for about 2 m just above a sharp thermocline which dropped to 15 °C at 95 m and to 1 °C at the bottom of the trace at 275 m. Checking the LODAR gear on the bridge for scattering layers showed the two fat ones that migrate had dropped at dawn and had stabilized at 190 fms and 235 fms. However, the thin non - migrating layer - about 1 or 2 fms thick - was at 50 fms or 90 m - just about at the depth of [28] the 15 °C isotherm. It might be fun this afternoon, or perhaps tomorrow afternoon when we will have more time, to lower Roz Austin's scatter meter down to sample through this layer at half - hourly intervals around sunset to see 1) if there is any scattering increase at the depth of the 15 °C isotherm, and 2) see if he can detect the migrating scattering layers coming up through it.



Last night from AMC we received a message put together by the National Environmental Satellite Center of ESSA which gave lats and longs for a whole series of points. When we joined these all up, like the sequentially numbered points the kids connect to make pictures on the Howard Johnson menus, we came out with a picture of the extent of the cloud cover - and of the holes - for some 500 miles in all directions from our present position. It looked as though we would be right at the southern edge of cloud cover at Station # 11 today, and indeed we were. There was [29] enough of a break in the clouds at dawn so Chief Wally Monsees and Lt. JG Bam Childress were able get two stars, but only two. The lines from two stars always give you a pinpoint fix. It is when you get the third one that the point becomes a triangle, quadrilateral or two triangles with a fourth star, and so on. So we had an indisputable two - star fix that was really only a very few miles off from our DR position. We have given up the saucer and are back to the pencil eraser for indicating our position. Today's station (No.

11) is at 07° 52' S, 90° 15’ W, our southernmost and westernmost station, some 700 miles due west of San Pedro, Peru.

If it was whales yesterday, it is dolphinfish today - not the mammal - Flipper - dolphin, but the fish, Mahi Mahi it is called in Hawaii. There were several around the fantail and Jerry Louder hooked one. He played it for some time [30] and the fish finally got the line snagged on the cable that the French quanta meter was coming up on. Once the gear was clear of the water, the line was freed, and the fight was on again. Jerry got down into the bucket off the stern and played that fish right up to the surface. "Sharks," someone shouted, and two dark brown sleek 10-footers slid effortlessly past within a few feet of the struggling dolphin on a preliminary inspection trip, Rudy Stevens had a gaff and hoisted the beautiful yellow and bluegreen fish from the sea just as two dark brown torpedoes streaked by where it had been just seconds before.

Today's STD lowering showed the inversion at 42 m, some 8 m of difference between the BT and the STD, but there was an hour's time difference too. The STD showed the 15 °C isotherm as lying at 90 m. We may have a Drost-Hansen [31] effect today afterall.

The contest with the critters of the South Pacific continued on the stern. Several more beautiful dolphin were brought aboard and cleaned, and their innards washed over the side. This brought more sharks, and Rudy Stevens hooked a big one. He would take another turn around the cleat every time the shark gave up a foot or so of line, and you had the feeling that the shark was really playing Rudy, Finally the shark tired of this play, gave a mighty wrench that straightened out the steel grappeling hook, and was off with the flip of his tail.

The sun has been out on and off all day, and several men are up on the flying bridge to try to get some of the tan they feel one should return with from a trip south of the equator. To date there has been little chance for sunbathing, and we all [32] look much as we did when we left Miami two weeks ago.

Ralph Johnson now has the bridle on the Australian quanta meter fixed, but on today's lowering the photocell was inoperative. Jitts and Carpenter feel the sea is against their efforts this trip.

I have finished the annual report of my Committee for the Miami Chamber of Commerce. I have completed the lists I was to compile for the Economic Society of South Florida, and I have read about a book every two days - the first ones I have been able to finish in less than a month since I was last at sea. This morning I collected six white envelopes from the ship’s office, typed in ten signature lines on the front and labeled them Australia, Denmark, France, Germany, Japan, Norway, UK, USA, and C.O. DISCOVERER. I will get Jitts, Nygaard, Morel, Mü, Saijo, Throndsen, Baird, [33] Tyler, Ochakovsky, and Keith to sign each one. When we land I will load them up with Canal Zones stamps, and I have six real collector's items. Not content with this, I fixed up one for the signature of all the scientific party aboard and the CO

This one will be framed for the AOML Museum to be a companion piece for my BOMEX one signed by the skippers of all five ships. All this may seem like veritable foolishness, but I happen to like this outfit I have thrown in with and feel we should be consciously developing a tangible history - if I have to do it myself.

It's a strange world. Jitts of Australia and I were back aft as the Saijo Maru was hoisted aboard, and the two of us began spooling the line as it came in bringing up the glass bottles. Saijo and Nakamoto were in the bucket pulling in line and removing bottles while Harry and I worked away getting the line on the big wooden spool. It suddenly occurred to [34] to me that just 25 years ago today both Jitts and I were in uniform doing all we could to exterminate the Japanese - and they us, yet here we were all working together as happy as clams at high tide. It is a strange world.

After it was all in and the gear removed from the buoy by Nakamoto, Saijo was dogging down the buoy hatch as I came up onto F deck. He stopped me and said, "Stewart, please to convey - to speak to men from boat - I thank very much. In my country the ship men not go out in boat in these seas for me." He was really impressed, and it was thoughtful of him. I relayed his thanks to both Jerry Louder and Mike Bellows, both of whom were sopping wet and tired. They grinned and waved their thanks to Saijo. It may be a strange world, but it is also basically a good world. [35]

16 May, 1970

Shorty Grief and Worth Mason (carpenter and survey tech) spent a long night in the photo lab developing and printing black and white photos. There are some good ones - including some of my instamatic shots - and they are building up a collection for the ship's files. I was with them in the photo lab for a while, and they have come a long way in fixing it up since I was last aboard. The great need now is for a big drum drier and some file cabinets.

Today is clear and sunny with occasional low clouds. The SCOR people like the sun but the wind is up to 16 knots out of 164° and the ship drifts so fast downwind that their cables soon develop pretty good wire angles. We have a good roll to us now, but everything has been well tied down, so the rattling and banging is less, even though the roll is more. [36]

It was whales two days ago and dolphin yesterday. It was both of them today plus a really big hammerhead shark that looked us over, stayed under the bucket for a time while Jim Alberts from FSU was putting on Nansen bottles, and then left. The rail aft was lined with fishing poles, and we looked more like the drift boat out of Miami than a research ship. It paid off too, for some two dozen dolphin were hooked and brought aboard. Fresh fish tonight.

This morning we almost reached the point where the operation is almost routine. The cameras are not even in sight and there are few tourists watching as the optical and

biological gear go up and down. They have all seen it all before. The machine shop rigged a new mast to carry the radar reflectors for the Saijo Maru, for the old one had been bent badly by all the rocking and was about to [37] break off. The buoy with its orange floats was hoisted overboard and released just at 1300 and we were drifting fast away from her. The bridge keeps regular ranges and bearings on her, so we can get back whenever we want to.

This morning's BT-showed the 15 °C isotherm to be at 71 m, and the STD printout showed it at about 65 m, The LODAR has the migrating layer now at 200-250 fms with a faint thin one at 72 fm (130 m) - no hint of Drost-Han sen layer today. We have a very dense and thick layer that shows some of the best diurnal migration I have ever seen. At least we are getting good records of that and of the occasional internal waves it reveals even if we are doing little of use to Drost-Hansen back at Miami; I put it back on at 1700, and will see how it behaves this evening.

Keith called me up to the cabin [38] after dinner, and when I went in the Exec, and Ship's Doctor were already there. Ens. Drake is sick with a mounting fever and a stiff neck. Doc feels there is a 50/50 chance it might be menengitis, and the Captain wanted me to know in advance. If his temperature is down tomorrow, it will probably be OK. If it is up, Doc will want a spinal tap, and this can't be done aboard. It may be that we will get into Ecuadorian waters yet, as Guayaquil will be our closest port from our estimated position tomorrow morning.

I guess I am finally relaxed, but it did take two full weeks. This afternoon I went up onto the flying bridge with "The Peter Principle" to read a bit. That was about 1530, and I never came to until 1700 - sound asleep. The ship was rolling, and Eddie Hannum was banging away replacing some dry-rotted wood on the bridge stand, and there [39] even was some trap-shooting going on from the boat deck, but I heard none of it.

I understood at dinner that when the speaker said that there would be "trap shooting on the boat deck at 1630," several men showed up with their own dice. You just have to enunciate clearly into that microphone on the bridge.

17 May, 1970

Had a good talk with John Tyler, and he is pleased with the way the SCOR work has gone to date. There have been instrumental problems, but as John says, "your people have been able to fix most of them." The Australian quanta meter is still not totally functional, but the other backup gear has filled in that hole. Saijo also told John, as he had told me, that in Japan he could not get this much cooperation from their ship people, and he is very grateful. [40]

The LODAR shows a faint layer at 50 fms (90 m), a thin but distinct layer at 150 fms (270 m), and the heavy migrating layer at 180 to 220 fms, An XBT showed the 15 °C layer at 108

m and the STD at 109 m. This is sufficiently close, considering both the poor resolution and the vertical variability of the LODAR layer at 90 m, to consider that we do have a 15 °C layer today.

Last evening the clouds were broken at star time, but Chief Wally Munsees and Lt. JG Boum Childress managed to catch three stars through the holes and their triangle was a small one, so at least we have a good position.

On the strength of this, the magnetometer fish went over,the gravity meter was turned on, and the PDR was fixed up for the run to today's station (#13) at 03° 03' S, 85° 25' W.

Ens. Don Drake feels better this morning, and his temperature is down, so the emergency run to Guayaquil has been cancelled - at least for this morning. [41]

Just as we came on station at 0900 sun time, the clouds dissipated, and it is a fine sunny day. The routine in the lab goes smoothly, and the various deck operations with winches, booms, and the big crane all go well. It has become old hat. The conversations on the sound - powered phones between the fantail and the winches are also heard on the bridge, so the watch will is in the water at any time. The winches have a whine to them that give the impression that they are straining their utmost even for the lightest of tasks. This creates much more of an air of hard labor than if they merely purred quietly. When they get improved winches aboard - which we need badly - I hope that they have not engineered out this strain - and - groan aspect. It is good for morale.

We stopped early on station one day last week for Keller's boomerang core sample, but the fog was too thick, and we were afraid we would not [42] see it come up. We have not had time since. Tonight, however, it is a short run from # 13 to # 14, and we will try first thing in the morning again.

On station we fly from the foremast yard the signals in the new code format that mean we are on station. The upper one of the two signal flags is yellow with a black central circle, the lower is red with a broad yellow vertical stripe down the middle and a similar one horizontally across the middle. I checked into this, and it develops that they are the new flags for I and R. The I flag means, "I am engaged in submarine survey work (underwater operations). Keep clear of me and go slow". The R flag says, "I have a diver down; keep well clear at slow speed". Even though neither one really applies here, the net effect is, "I am working, keep the hell away!" - and that's really what we want. For the past week, though, we have seen no other ship [43] at all, much less any close enough to read our flags. But the laws of the sea will be maintained, and those flags religiously go up at the minute we stop on station and are hauled down the minute leave.

Tonight, with only some 35 miles to the next station, is the night we will try to look at the scattering layers with some of the optical gear. It would be nice to work it right through sunset, but that is when we are collecting the Saijo Maru and hauling in the Japanese in situ

incubation bottles. I've talked with Roz Austin and Nygaard, and we will plan to put down an XBT first - for Drost-Hansen and to get a feel for the thermocline depth. I will be on the bridge monitoring the LODAR on the 0-165 scale while Roz puts down his transmissometer to try to locate levels of more intense suspended material (less transmissivity). Then with his scatter meter lowered from the starboard boom, he will check the scattering at specific depths, and [44] Nygaard will try the same thing but with a 10°-170° scatter meter. Hopefully the major scattering layer will come up through all of this while we are measuring. Sunset is at 1837 tonight, and we will probably have nearly an hour before the deep layer is all the way up.

At 1910 we took an XBT. At that time there was a very thin non - migrating layer at 20 fm (36 m), and the top of the migrating layer was at 45 fm (82 m). The upward migrating layers had become quite diffuse and indistinct by 1920. Hoppie fixed up the PDR, but it showed nothing. By 2145 the diffuse area had stabilized into layers at 36 m, 63 m, 99 m, and 117 m. At 2200 they were at 27 m, 65 m, 81 m, and 112 m, and at 2215, one had dropped out, and there were three at 27 m, 99 m, and 117 m. There are apparently internal waves at depth for a distinct wave pattern appears in these scattering layers with 8-10 minute periods on 10 to 20 fm height. At 2050, the Danish gear started up and layers were [45] at 62 fm (112 m), 52 fm (94 m), a thin faint one at 32 fm (58 m), and a 10-fm thick one with its top at 15 fm (27 m). The time tics on this LODAR gear are at intervals of 5.5 minutes - a strange number.

18 May, 1970

Today dawned cool (19.8 °C at the surface) and overcast with a steady light drizzle. Almost no wind, but a goodly swell keeps us in a steady slow roll that has us all walking as though drunk.

The boomerang corer had been broken out of the hold yesterday and was lashed down near the bucket aft of the lab. Promptly at 0800 Chief Hopkins was out with his crew, the improbable looking rig was carried to the bucket, hooked to the eye on the end of the winch cable, and hoisted outboard. Since this was an operation new to this trip, the cameras were out again. At 0819 with the rubber ball in place to prevent tripping as [46] the rig hit the water, Hoppie pulled the pin and the rig dropped into the sea. There was a splash, a boil of froth and bubbles, the rubber ball popped to the surface as it was supposed to do, and the corer was on its way to the bottom some 1730 fms (3166 m) below. Since the fall rate and ascent rate are known, we figure it could come back to the surface in 47 minutes. That would be 0906 when it was due back, and at 0910 it was spotted some 300 yds off the starboard beam. The boat was put over to recover it and bobbed its way over.

This seemed to the Captain and to Chief Quartermaster Wally Monsees to be a good time to try out the rocket-propelled line that had never been tested. This is a new device for

launching a light line for a long distance. A big bucket holds the line on rapid pay-out spools. Above it on the rail is mounted a 2-foot dish "launch pad" with a pistol grip at the back. A 16-inch long bright red rocket-looking device is placed in [47] the dish and over the end of the "pistol," and a packet of propellent is placed in the chamber of the "pistol." It was loaded and a 20-foot line was attached to the trigger so Wally Monsees could crouch down behind the flag locker to fire it cautiously. The speaker blared out, "All personnel could stay clear of the port for rocket launch," - much to the surprise of all but the few of us up on the flying bridge, and Wally pulled the string. There was a monsterous hissing, few great billows of bluish smoke, and the red "missile," minus line, took off in a great corkscrew course straight for the sea, and with a powerful-sounding "Chunk!" - dove beneath the surface. The whaler, with the core still aboard, came over and found nothing but bubbles. Total distance from the ship - 50 feet!

Undaunted by this dismal failure, they re-rigged to try again. This time the rocket went [48] almost straight up - even though the "dish" was pointed towards the horizon. Up and up it went out of the great cloud of smoke - a very Canaveraloid launch. But then it began to descend in a corkscrew pattern tumbling end over end and apparently headed straight for the boat bobbing some 50 yards off the bow. It landed near the boat, but again there was nothing to recover. As the smoke cleared where we were, we could see that the reason it had gone up rather than out was that the blast had also blown off both the dish and the pistol and the rig was wrecked. The bridge log records it this way, "Rocket line launcher tested unsuccessfully. Second test destroyed launcher." It was all straight out of an Alec Guinness movie.

STD today on Sta. # 14 showed the 15 °C isotherm at 133 m. The LODAR shows a fine, sharp, thin (3 fm) layer at 75 fms or 137 m - just where the 15 °C isotherm is. This appears to be a non-migrating [49] layer today. I checked with Tyler to see what gear they had that could go that deep. Only the French gear goes that deep. André Morel said that his lowerings today had a goodly wire angle so even his gear which has 140 m of cable didn't get to this 137 m layer. *C'est la vie*.

The core is about 20 inches of buff colored uniform texture fine silt. I looked at a smear under Throndsen's microscope, and there were some diatoms but mostly very finely com-minuted particles. Saw no forams. It has been sealed and labeled and will go to Keller on our return. Its position is 03° 05' S, 84° 48' W in 1730 fms.

Tyler, Archie Patrick, Childress and I had a session to see how we could best utilize our 38-hour run to the next station so that we could get there on time and still run some of the underway hydrography - magnetics - gravity lines that Paul Grim needs for his work. The lines that Paul most wants are all within that 200 - mile area, so we [50] are forced to go to his second priority lines. The plan is that from our present position at 84° 48' W, we'd run

west to 85° W, then run straight north along 85° to 3° N. There we would come right to 090° and go east to 83° W, and thence north to Station # 15 Paul wanted N-S and E-W lines at the even lat and longs, so this will get some 570 miles of track for him.

Jim Alberts of FSU - our chemist - put one of the ubiquitous styrofoam cups in a bag secured to the cast weight for this morning's Nansen cast, Even though it went only to 500 m, the cup came up somewhat less than one - half its normal size and the originally crisp plastic was spongy rubber. The pressure at 500 m is about 124 pounds per square inch, and all the air in the styrofoam bubbles was just squeezed out. He made a formal presentation of it to me for the AOML museum.

The ship is still chortling [51] over the abortive rocket launch this morning. They are now calling the DISCO a missile frigate, Talk of entering Ecuadorian waters has come up again now that we have such a formidable weapon. Mason has drawn an appropriate cartoon showing a mushroom cloud over the flying bridge, a corkscrew trail, and a potent IBM-looking missile about to land in the Boston whaler with Louder and Bellows diving overboard, Ralph Johnson said this noon that, "Monsees has been waiting two years to test that damn thing. Today was the day, and he blew it," It was decided, though, that if the Scripps plane came back, we could use it to get a line up so we could return their canisters.

The sharp thin scatterer at 75-80 fms stayed with us all day and appeared to peter out just before the heavy migrating layer came up through it [52] at 1830. By 1900 the migrating layer - only one of them tonight - had moved up to 50 fms, and the more stable layer (15 °C - still?) had reformed at about 95 fms 172 m) below it. The reformed layer, however, was much weaker looking on the record than it had been before the migrating layer passed through it. It is possible that having such a disruption dissipated non-migrating forms so that the layer is actually less dense, or it may be that having the considerably more dense layer now above it resulted in enough sound reflectance above that less came through to be reflected from the lower layer. In any case, this is the first instance I am aware of where there is a documented record of one layer migrating upward through another. It is too bad that our instrumentation is all cabled for 140 m or less and this tantalizing layer lives smugly at 172 m. Frustrating! [53]

19 May 1970

No station slated for today other than a brief stop planned about 1300 so Nygaard can get some mid - run measurements. This was to be my sleep morning, so I ignored the standard 0700 wake up call and went back to sleep. Since there is to be no winch work for the deck force, it is a good day to do some ship's work. At 0801 the electrical chipping hammer started on the bulkhead right outside my bunk, and not too far away the paint grinder that sounds like a high - powered dentist's drill went off at the same time. My sleep was

abruptly and horribly over. The Chinese could devise no more fiendish a torture - put a man in a small steel box tightly sealed, wait until he is asleep, and then beat on the outside with pneumatic hammers and electric grinders. It is an experience!

It is just as well I was up, for Keith called for me about 0830. [54]

There had been talk yesterday of a possible mid - day stop today for SCOR, and he wanted to know when and what the time requirements are. With no stars last night and none again this morning, and only a moon line with a very small angle of interception with our track, we are essentially running blind. We really wanted a good fix last evening to anchor this long line for Paul Grim, but it was not to be. Keith does want to get a noon sunline at local apparent noon at 1235, and it is much better to have a running fix than try it while drifting. Positioning for Paul's line is of lower priority this trip than getting the data SCOR needs, so if Nygaard's work is sun - related and necessitates that he be in the water at LAN, then that's that. I would find out - from Nygaard - if I could find him.

The Oceo lab was disserted except for Anatole who was seated amidst his recorders working with a Russian-English dictionary on [55] an Agatha Christie mystery. Saijo and Nakamoto wandered in to clean up their gear and finish running yesterday's filter samples, but otherwise the lab was deserted. No Nygaard.

Then came that signal on the general alarm and the continuous blast on the ship's whistle that means fire - or in this case, fortunately, fire drill. Now I would see Nygaard. Fire station for all the scientific party is the Wardroom. Pete Kuhn, Monte Poindexter, and I were the first three there. We complimented ourselves on what prompt and responsive fellows the only three ESSAites on the scientific party are, and then realized that the reason we were all there so soon was that we were all goofing off and had just come in for coffee when the signal went off. The others came in shortly afterwards - well, most of them. Chief Blackman had the list, and we were still short four: Blankenheim, Malone, Carpenter, and - yes - Nygaard. Pete went to get the [56] Sergeant, and then Dave Carpenter staggered in in his pajamas. "What idiot thought this one up on our one day off in three weeks?" Then Tom Malone came in tousled and sleepy and dropped into a chair. "Why today? Why today?" was all he could get out. Knowing they had no station today, many had stayed up long into the morning hours in one of the F-deck staterooms. I would like to be able to say that they were deep in scientific discussion throughout the night, but it was primarily dirty jokes and sea stories. Kjell Nygaard was the last to arrive, and he headed straight for the coffee urn amid a rising ovation from all the others. He did look like death warmed over, and could only grunt when someone shouted for him to tell another good Scandinavian story. I guess it had been quite a night, and watching the participants today, I am not at all sorry I missed it

When the drill was over, and Kjell [57] (pronounced Shell) had his second cup of coffee in front of him and a cigarette going, I asked him about his mid-day station. It turned out that his

ear did not have to be in the water through LAN, and any time around mid - day would be fine with him, Before I could get the word to the Captain that his noon sun line would be possible, the whistle and general alarm went off again. This time it was the short blasts of abandon ship. We all stood around our boat stations in our orange lifejackets and sipped our coffee and waited while our names were checked off and we got the course and distance to the nearest land.

Once that was over, I was able to tell the OD, Ens. Langdon this time, that they could get their sun lines and we would wait until they were through before we stopped on station. Sometimes the answering of a simple question can be a long and involved process. This one took [58] nearly two hours.

When sun-line time arrived, I was with Kjell on the flying bridge, Ray Smith and Doc Miller were in trunks stretched out in deck chairs sunning, and Kelly on lookout was smoking and squinting off at the horizon. I don't know why that lookout is maintained, we haven't seen a single ship since the 9th - some ten days ago. Kjell Nygaard needs a homogeneous sky - either all clear or all clouds. An occasional cloud fouls up his measurements, and although it is sunny, there are scattered strato - cumulus here and there and getting more so as the day wears on. Keith wanted to know if he was stopping at 1300. It entailed pulling in the mag - fish and switching men from paint chippers to winch operators, and he wanted to know. Kjell was by now also down to his shorts and flaked out in a lounge chair soaking up sun. He [59] opened one eye, saw the scattered clouds overhead, said, "Maybe we will have a good day for it in the Caribbean," and went back to sleep. I reported to Keith that after a careful scrutiny of the present sky conditions and a qualitative evaluation of the possibility of meaningful data being recovered from a lowering of the Danish gear under these conditions of varying incident radiation, Professor Nygaard had regretfully decided to forego the station tentatively planned for 1300. By the time I got up to the bridge and the last lounge chair, Nygaard was asleep and snoring quietly. It is thus that marine science advances.

At 1400 the scientists gave an hour and a half briefing to some 30 of the officers and crew, Dick Alderman started off, and I summarized how the DISCO became involved and ESSA's role in all this - the latter didn't take much time either. [60]

Pete Kuhn then gave a good summary of what the IAMAP Radiation Commission's radiometersonde group was trying to do with their balloons and why the results are important.

Then John Tyler gave a rundown on SCOR Working Group 15 and its aims and a summary of the optical measurements going on. Next Harry Jitts held forth on the biological program and what their work on primary productivity is all about and why. It was a good session, and I think the crew - at least those of them that were there - has a better idea of what we are up to. One of them said later that he didn't understand much of what was said

but that he did feel better knowing that the scientists apparently knew what they were up to even if he didn't. General consensus: it was a good thing to do.

The food aboard has been, without exception, great. Hibbs runs the Wardroom mess and does a good job of it - actually too good a job. I have had only one lunch since I have been aboard, and that was the dolphin one day [61] last week. Last night was the Captain's birthday, and he had been invited to the Wardroom for dinner. Hot *hors d'ouvres*, tomato juice, soup, curried chicken, vegetables, ice cream, and a monstrous birthday cake. To the cake was attached a pencil sketch portrait of Keith playing his bag pipes, done by I. W. Mason of the Survey Department. It as a good job, and the Captain seemed pleased.

Dick Alderman, the Exec, has read over volume 1 of this log and knows the nautical trivia it contains. Tonight we had mince pie for dessert, and as far as the old timers could remember it was the first time mince pie had ever been served on the DISCOVERER. “Be sure to record this in your log”, he said in all seriousness. So I do. Tonight we had mince pie for dessert. I will add gratuitously that I had vanilla ice cream on mine. [62]

We had our first colorful sunset tonight. It could be described in terms of great rows of pink altocumulus, higher white cirrocumulus, and a few unlighted low stratocumulus clouds, but Dave Carpenter summarized it best: “Damn pretty, that.” The Captain was walking his bag pipes on the deck forward of the Cabin and Scotland the Brave could be heard all over the ship. A few stars ducked in and out of the clouds, and Monsees and Childress were working on them at 1930 as we made our turn to 090° at 3° N. Having a good fix will make this line we have been on all day considerably more meaningful to Paul Grim.

Full moon, scattered clouds, cool breeze, a truly beautiful night, and the DISCO is the only ship on the sea. Our day off if finished, and we are back to a full station tomorrow. [63]

20 May, 1970

Dull leaden sea and overcast sky are reflected in the activity aboard. Everyone seems to be a bit slower, a bit less cheerful today. The mag fish took longer to come in this morning, and the usual split second timing on which one operation follows another just seemed to be off. Normally free - running lines were snarled and everything stopped while the tangles were worked out. The box of Washington State apples in the lab is going bad - you throw away 3 soft ones for each good one you find. The computer is acting up and Lahe and Mangis are trying to find out what's wrong. It is just one of those days.

I put the LODAR on at 1040. The big migrating layer had stabilized at 220 fms (396 m), and a strong thin layer came in at 35 fms (63 m) with a fainter one at about 45 fms (81 m). The 15 °C isotherm from this morning's BT was at 40 fms (73 m). Either one of these may be the layer [64] relating to the 15° isotherm. The upper one at 63 m appears more comparable

to the previous ones than does the less distinct one at 81 m. Roz Austin's transmissometer went down at 1015 and showed no marked change at either of these depths (63 m or 81 m). Nothing at all in his records to indicate anything out of the ordinary at these depths. It is quite possible that sound scatterers are not also light or optical scatterers, but this seems hard to believe. It may be that the organisms causing the sound scattering are sufficiently mobile that they avoid the transmissometer as it is lowered. If so, there would be no indication on the transmissometer record that these layers even existed.

The French gear seemed to bear this out. André Morel had various pieces of equipment in the water today including his spectroirradiance meter, the French quanta meter, and a thermopile which includes the infrared end of the spectrum. His results showed turbid water from 25 - 50 m, relatively clear from 50 - 60 m and very clear from 90 m to the limit of his cables at 130 m. Again, this seems to bear little relation to the observed sound scatterers.

Although the overcast had broken up some by noon, it's still one of those days Jim Alberts was putting down the Nansen cast just after noon. He had just finished attaching the 9th bottle, and as he told the winchman to lower away, he gave a final test tug to the messenger hanging below the bottle - and the nylon line holding it to the bottle broke. [65]

In trying to unhook the messenger from the now - moving wire, it slipped from his hand and down it went to trip the other eight bottles. Murphy's Law says that anything that can go wrong will go wrong and at the worst possible moment. Evidently Murphy's Law was not fully operational; or this would have happened while he was attaching the last bottle (the 11th) rather than the 9th. At any rate, the whole cast had to come up and be redone. It is one of those days still.

At 1257 it stopped being "one of those days." As I headed up to the plotting room aft of the bridge with John Tyler to check the tentative positions for the Post - Panama stations, the Chief Radioman, Tom Johnson, came out of the radio shack. He asked me if I had seen the message on my desk, and I said, "No, but is it good news or bad?" He said it was about the building and he had a copy there in the radio [66] shack if I wanted to see it. I wanted!

It was a message from Jack saying the funds had been released! It was confirmed by White and the Florida Congressional delegation had been informed. Now on to the competitive bid stage, award, ground breaking, and construction. There will be other hurdles ahead, but none higher than the one we cleared today. Arch Patrick and Monte Poindexter are the only other ones aboard for whom the news has any real meaning, and I sought them out and passed the good word to them. They, too, seem pleased. The word when it came looked like this:

WTEA DE NMG
R 2015052 May 70

FM ATLANTIC OCEANOGRAPHIC LABS
TO USC&GSS DISCOVERER
BT
UNCLASS
PASS TO STEWART. FUNDS RELEASED FOR LAB. FLA
DELEGATION INFORMED ... WHITE SIGNED KOFOED
BT
TOR 20/1647z1NMG116 MHZ RATT/TJ [67]

Although I am sure that Jack already has started the wheels turning to get the bids out, I sent him a message asking that he initiate the ESSA letter to the Naval Facilities Engineering Command telling them the money is in hand - should be some $2.890 million, and to send out the bid requests. It should reach him this afternoon so that he can do it before he leaves tomorrow morning to meet the ship as she arrives in Balboa. I leave Panama Sunday morning, and Jack will fill my place aboard for the remaining two weeks of the trip.

SCOR, John Tyler tells me, is in a financial bind, and he doesn't have enough money in the Miami account he opened to allow him to pay the $1275.00 bill for the 17 members of SCOR to eat at $2.50 per day aboard the DISCOVERER for May. He had felt this might develop, so I had [68] put in for a $1500 travel advance to cover this. Tonight I wrote out a check for the SCOR bill and trust that the advance shows up and gets to the bank before the check to the DISCO does. Oh well! What's a mere $1200 for a man who just had $2,500, 000 released?

Spent most of the evening in the photo lab helping Shorty and Mason run off prints for those of the scientific party leaving at Balboa: Kuhn, Monte, Muller, Blankenheim, and Stewart. Those two put in a lot of extra time doing things for others - things that help make the difference between a ship and a good ship. [69]

21 May, 1970

We are now on our last station before Panama tomorrow. We had planned it so that we would have just enough distance to run to arrive at the Balboa sea buoy at 0800 tomorrow. After breakfast I had a long talk with Tyler, and he is extremely pleased with the cooperation he is getting. "They are running this ship just for us, and it is marvelous," is the way he put it. While we talked, the Exec came in with the word on hurricane ALMA. May is pretty early for the first one. The news reported 80 mph winds and a location 100 miles south of Grand Cayman. By 1130, Tom Johnson had NHC Advisory No. 5 and ALMA is a "tropical storm" rather than a "hurricane." This may be a downgrading with time, it may be an inaccurate

account in the radio news. At any rate, at 1600 Z (1100 local time) she was stationary at 18.5° N, 4° W with maximum sustained winds of 60 knots near the center. She [70] is providing eastern Cuba and Jamaica with heavy rains, and the 12-hr forecast is for a very slow NNE drift with diminishing winds. It should pose no problem to the DISCO when she gets there late next week. But the DISCO will be of little help to NHC either, as Monte and Kuhn both leave at Balboa. Firmple and the Japanese can probably get of some radiosondes if they are needed, but it does seem odd that we have to rely on the Axis powers for our upper air data.

Problems with the STD this morning. The electrical cable to the sensors pulled loose, and a big splice job is now underway in hopes we can get today's lowering later in the day.

In a way, it is too bad we dock tomorrow, for the news on the building gets better every day, and I would like to see this progression continue for at [71] least a few more days. May 11th it was "Building of dead center. May 20th it was “Funds released for lab” and today it is more good news. We now have 3.1 FEC dollars in hand. Translated, that means $3,100, 000 is now available for the building, some $210,000 more than the $ 2,890,000 we had when I left. Sorry this progression won't continue for a few more days at least, and we might even get enough to have the whole building constructed at once.

The STD has been fixed, and a good lowering made, but Jim Alberts' Nansen cast had a hang - up on the fourth bottle, so that will have to be re - done later.

Had a long talk with (long listen to??) the Captain this morning, and we covered the gamut from the overtime problem to a separate Miami Marine Center, from Fort Sill to the PX fire at Thule, Greenland, and from the GILBERT to [72] the RESERCHER. He is a talker, but it is always interesting, usually makes good sense, and more times than not agrees with my own views, so I enjoy these sessions with him. However, don't stop by the Cabin if you have only a few minutes to spare.

There was an interesting change in the thermal structure between Sta. # 15 yesterday at 04° 30' N, 82° 54' W, and Sta. #. 16 today at 06° 35’ N, 79° 56' W. Yesterday the mixed layer at 27.2 °C extended down to 30 m, but today at 26.0 °C, the mixed layer is much shallower, extending down only to 10 m. This is a considerable change and is comparable to the one found approaching the Costa Rica Dome. I went back to our run through this area two weeks ago and found the same thing between stations 6 and 7 on 9 and 10 May. The 9th we were at 07° 36' N, 79° 21' W with the mixed layer at 27.2 °C extending down only 7 m, but by the 10th at [73] 04° 48' N, 81° 46' W, it had dropped to 28 m. The phenomenon is consistent between these observations made 11 days apart. Had I more time, it would make a nice target of opportunity to snoop out, but I am afraid this must wait for another time.

This afternoon being my last day of "vacation," I made no pretense of work or even of interest in the work of others. I spent the entire afternoon in a deck chair on the flying bridge and sleeping, and it was most pleasant indeed.

The last two balloons of the IAMAP radiometersonde comparison went off on schedule this evening. Monte's comment was "That's forty for forty, not bad." Forty good ascents of forty releases is not at all bad. Monte has done his usual superb job aboard, and I wonder just how Pete Kuhn would have made out without him. [74]

22 May, 1970

The day dawned clear, sunny, and warm, and the green hills of Panama were close upon us as I came out on deck about 0730. We had a short wait on the hook, with some eight or ten others waiting to enter the Pacific end of the Canal, and then we eased forward toward the high bridge that marked the Canal entrance.

The tourists are out with their cameras again as we slide under the big bridge and tie up at the fuel dock. Jack Kofoed arrived at the dock just as the DISCO tied up, and we spent most of the day briefing each other on AOML and the SCOR trip so we could switch roles for a while. A visit to Balboa and to Panama City to get stamps on the fancy envelopes, bought a few nice molas - the San Blas Indian dress panels - really colorful, and a wild night on the town with a gang from the ship, then the airport and the flight to Miami and back to the real world. [75]

APPENDIX I

PHOTOGRAPHIC SECTION

Stewart (left) and colleague during the Equator Rite of Passage (first page,blue-bound transcription)

Stewart (right) talking to an officer during the abandon ship drill (May 3) (p. 4, blue-bound transcription)

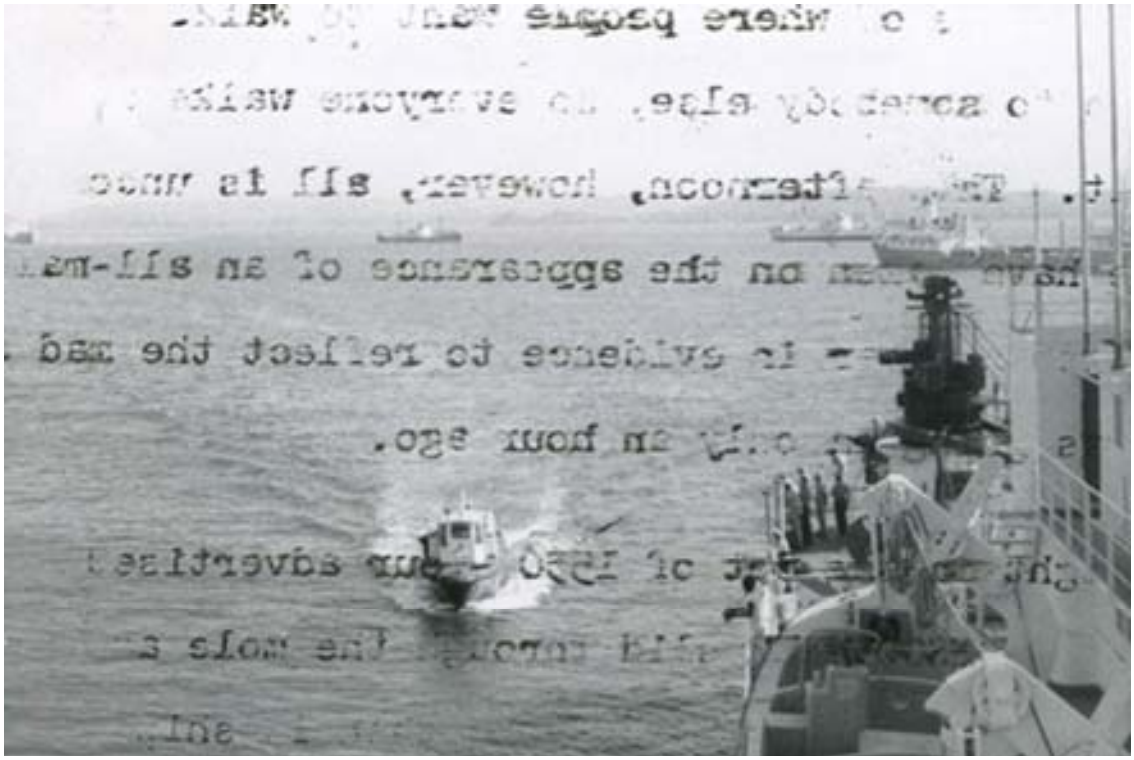
Panama Canal (?) (p. 9, blue-bound transcription)

Overflight (p. 10, blue-bound transcription)

Balloon instrumentation (p. 16, blue-bound transcription)

Balloon release (p. 16, blue-bound transcription)

Quantameter? (p. 37, blue-bound transcription)



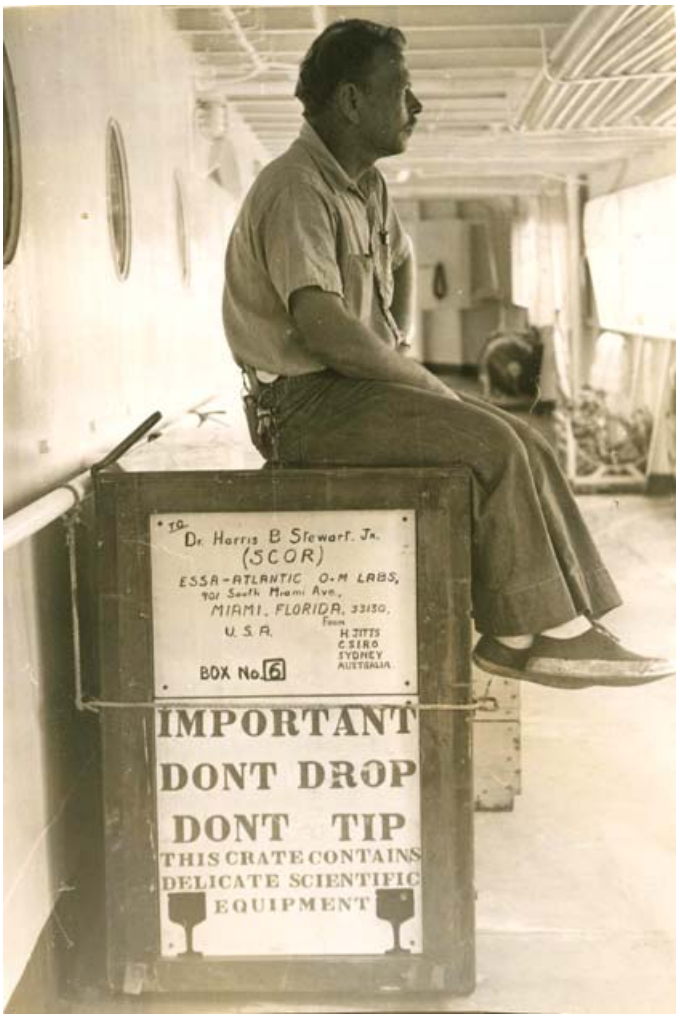
Arrival of pilot at Panama Canal (p. 41, blue-bound transcription)

Observing the transit of the Panama Canal (p. 42, blue-bound transcription)

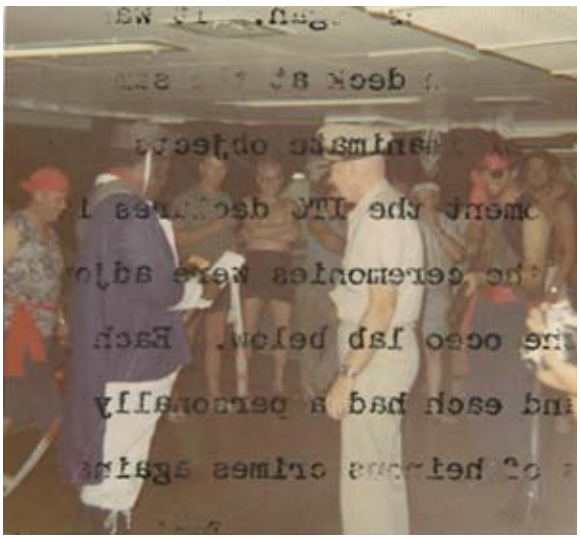
Transit of Panama Canal (p. 43, blue-bound transcription)

Transit of Panama Canal (p. 45, blue-bound transcription)

Instrument panel (p. 50, blue-bound transcription)



Unidentified scientist (p. 55, blue-bound transcription)



Rite of Passage (p. 64, blue-bound transcription)

Rite of Passage (p. 66, blue-bound transcription)

Rite of Passage (p. 67, blue-bound transcription)

Rite of Passage (p. 68, blue-bound transcription)

Rite of Passage (p. 69, blue-bound transcription)

Conferences in the plotting room (p. 75, blue-bound transcription)

APPENDIX II RELATED DOCUMENTS

INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH

532 WG 15
1 October 1968

Dr. H.B. Stewart, Jr., Director
ESSA Atlantic Oceanographic Laboratory
901 S. Miami Avenue
Miami, Florida

Dear Stew:

I enclose a copy of our latest Proceedings, and draw your attention to pages 3 and 18-21 dealing with our Working Group 15 on Photosynthetic Radiant Energy. The problem on which I need your advice is that of finding a suitable ship for the next sea trials. The requirement is for a ship that can accommodate 20 scientists for a period of three full working weeks plus sea-travel to and from the work area. This area should be one where there is available a variety of optical conditions and a range of primary productivity, all in suitably calm waters. Appropriate ships would seem to include the large Soviet vessels like Kurchatov or those of ESSA like Oceanographer. Arrangements for such trials are complicated at best, and I shudder at the thought of handling all of the logistics through a Russian facility. It would be very attractive, on the other hand, to work out of your laboratory on Discoverer. I think it is too late to organize this for 1969, and we should look for a suitable opportunity in 1970. Do you think ESSA would be receptive to such a proposition?

Yours sincerely,

Warren

Warren S. Wooster

cc: J. Tyler

WSW/jw

RESIDENT Professor Warren S. Wooster, Scripps Institution of Oceanography, P.O. Box 109, La Jolla, California 92037 USA (Cable SIOCEAN) | SECRETARY Dr. Klaus Voigt, Institut für Meereskunde, Seestrasse 15 253 Warnemünde, German Democratic Republic

ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION

October 8, 1968

RF27-712-3(1)/10b(3)

Dr. Warren S. Wooster
President, SCOR
Scripps Institution of Oceanography
P. O. Box 109
La Jolla, California 92037

Dear Warren:

In answer to your letter of October 1 I personally am enthusiastic about the possibility of either the DISCOVERER or the OCEANOGRAPHER being utilized in 1970 for the proposed sea trials of SCOR's Working Group No. 15 on Photosynthetic Radiant Energy. I honestly believe that this activitity can be accomplished o n one of these two ships, and I am firing your letter, together with pertinent parts of Volume 4 of the SCOR proceedings, up the line in ESSA to try and get an early commitment for the ship time so that SCOR can proceed with its planning.

The DISCOVERER is based out of Miami and the OCEANOGRAPHER out of Seattle. 1970 schedules for these ships are not yet firmed up with the exception of the OCEANOGRAPHER's involvement January through March 1970 in a cooperative geophysical project with WHOI, MIT, IMS, and SIO. I realize that the time for the SCOR project will have to come from research time allotted to my Labs. I am perfectly willing to agree to this for I am a firm believer in the importance of establishing international intercalibration for as many of our quantitative objectives as is possible. Since the trip will require space for 20 scientists the choice narrows down to USSR and the USA and within the latter two, one of ESSA's large vessels.

CODE	SURNAME	DATE	CODE	SURNAME	DAT
RF27	Sleeper	10/8			
76					

FILE COPY

ESSA FORM 61-2 (FORMERLY ESSA FOR

Assuming I can get concurrence from the Coast and Geodetic Survey that operates these ships for us, I would appreciate knowing as soon as possible what you consider would be the most suitable locations for the experiment nearest to Seattle or Miami. I will let you know when I have a firm commitment.

My best personal regards,

Sincerely yours,

Harris B. Stewart, Jr.
Director

Enclosure

cc: Dr. Benton
ADM Jones
ADM Nygren
IA
PMC
AMC
CDR Patrick
Mr. Sullivan

ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION

Director, ERL
Director, C&GS

October 8, 1968

Director, AOL

RF27-713-3(1)/10b(3)

Request by SCOR for one month's Ship time

The attached letter from Dr. Wooster, President of SCOR, and the attachments from Volume 4 of the SCOR Preceedings are self-explanatory. I have answered Dr. Wooster and a copy of my reply is attached.

In line with the decision reached at our meeting in Boulder in August, I feel the approval of this request should be made jointly by the Directors of ERL and C&GS. Normally a request of this sort would go from me to the Ship Allocation Board at the time the 1970 schedule is completed in draft. However, because of the international involvement among people scattered all over the world Dr. Wooster must know as soon as possible what ship the tests will be carried out on so the rather complex planning can get underway.

I believe it would be to ESSA's advantage and to the further advantage of the U.S. if these tests could be carried out aboard the OCEANOGRAPHER or the DISCOVERER. My suggestion is that we agree to do it, that we request that one or more of the optical people in Boulder be aboard, and that our procedure be a concurrence between the two of you followed by a formal letter from Dr. White to Dr. Wooster offering the necessary time aboard the OCEANOGRAPHER or the DISCOVERER.

Harris B. Stewart, Jr.

Enclosures

cc:
ADM Nygren
IA
PMC
AMC
CDR Patrick
Mr. Sullivan

FILE COPY

CODE	SURNAME	DATE	CODE	SURNAME	DATE
	78				

ESSA FORM 61-2 (FORMERLY ...

file 3(l)
"ell"

Director, Research Laboratories, R

CG5

Director, Coast and Geodetic Survey

ESSA—Ship Support

Ref : RF27-713-3(1)/10b(3) memo of 10/8/68

I have just received Dr. Stewart's letter and the attachments from Volume 4 of the SCOR Proceedings. I do not feel that the Coast and Geodetic Survey, at this time, has the capability of fully evaluating this proposal either from a technical or political standpoint so will accept Dr. Stewart's judgment on the advisability of assigning a CG&S ship for these tests.

It would appear that a realistic estimate of time for these tests would be at least 5 weeks, and if you wish to allocate this time to SCOR from research time, I would recommend assignment of the DISCOVERER.

Don A. Jones

SLHollis:clh 10-23-68

INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH

532 WG 15
21 October 1968

Dr. H.B. Stewart, Jr.
U.S. Department of Commerce
Environmental Science Services Administration
Atlantic Oceanographic Laboratories
901 South Miami Avenue
Miami, Florida
33130

Dear Stew:

Thank you for your letter of 8 October concerning the possibility of using DISCOVERER or OCEANOGRAPHER for the proposed field work of WG 15 on Photosynthetic Radiant Energy (jointly sponsored by IAPSO, UNESCO and SCOR). In discussions with John Tyler, we concluded that it might be most suitable to work out of Miami during the second quarter of calendar 1970. You will recall the criteria of quiet seas and access to a significant range of rates of primary production. We are not sufficiently familiar with the region to know where these conditions would be most reliably available, and would welcome your advice.

Apr-June

Yours sincerely,

Warren

Warren S. Wooster

cc: Executive
K.N. Fedorov
A.E. Maxwell
J. Tyler

A follow-up on my earlier note on this possible cooperation with SCOR - for your info.-

Stew

WSW/jw

PRESIDENT Professor Warren S. Wooster, Scripps Institution of Oceanography, P.O. Box 109, La Jolla, California 92037 USA (Cable SIOCEAN) | SECRETARY Dr. Klaus Voigt, Institut für Meereskunde, Seestrasse 1 253 Warnemünde, German Democratic Republic

UNIVERSITY OF CALIFORNIA, SAN DIEGO

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

SCRIPPS INSTITUTION OF OCEANOGRAPHY

POST OFFICE BOX 109
LA JOLLA, CALIFORNIA 92037

11 December 1969

MEMORANDUM OF 1970 WG 15
EXPEDITION OF USC & GSS DISCOVERER

Potential Significance of Research Measurements

At a planning conference in Miami, Florida, in November 1969, SCOR Working Group 15 put together in considerable detail, a program of research involving measurements of primary productivity, radiant energy and other associated ocean features. This program is carefully designed to pertain to the problems which form the "terms of reference" of WG 15. In addition to the measurements of primary productivity and radiant energy which are a direct necessity, we have agreed that we must have daily intercalibration of the eight or more independent radiation detectors that will be used during the experiment. We also believe that a determination of nutrients would be desirable as it will be necessary to determine if and when productivity is nutrient limited. We also plan to make optical measurements which will record the horizontal stratification due to plankton or seston concentrations, in order to better interpret our results.

The full complement of measurements that we now plan will give us an exciting opportunity to apply our results to other questions and problems associated with the C^{14} method for determining primary production.

Attached, for example, are listed some of the ocean variables we plan to measure, together with some of the ways we believe these data can be applied.

John E. Tyler
Chairman, SCOR WG 15

JET/jw

(1) We will obtain data on primary productivity and available radiant energy that will demonstrate the validity of the early decisions of the Working Group regarding those spectral and directional properties of the light field that are most important to consider when determining primary productivity.

(2) We will obtain data on primary productivity and available radiant energy in a wide variety of water types with a wide range of chlorophyll concentrations. These data will show the applicability of our recommendations to various water types.

(3) We will have for the first time, a complete record of the performance of various radiant energy detectors of the type used in productivity work. This record will be with reference to a U.S. Bureau of Standards, standard of spectral irradiance.

(4) The standard of spectral irradiance referred to will permit day-to-day intercalibration and correction of the many radiant energy detecting devices in use during the research. This will be the first time that oceanic primary productivity has been determined under fully documented radiometry.

(5) By means of the standard of spectral irradiance we will compare all of the radiant energy measuring devices in a quantitative way and under field working conditions. This will permit valid judgements regarding the measurement concept incorporated in each instrument, as well as of their operating characteristics.

(6) We will have optical measurements that will reveal both temporal and spacial variations in the particle concentration within the photic zone, an important factor in the interpretation of the results of primary productivity measurements.

(7) We will be able to specify and recommend in considerable detail a simple instrument that can be used by biologists to measure the radiant energy available for photosynthesis. Furthermore, we will be able to state the expected accuracy of the radiant energy measurement in different types of water.

(8) We will have enough data to specify the applicability of a thermopile-type radiometer for the purpose of measuring the photosynthetic radiant energy as a function of depth and in different types of water and also to specify the condition under which it should not be used for this purpose.

(9) We will be able to compare productivity results obtained by the in-situ and simulated in-situ techniques on the same ocean water samples under the same daylight conditions and with very carefully controlled radiometric measurement techniques. Under these conditions the real variability of the technique, or of the productivity itself, should be evident.

(10) We will be able to show the importance of using color filters (rather than neutral screens) in the incubator used for simulated in-situ determinations of the primary productivity of ocean waters.

(11) Perhaps most exciting of all, we will have an opportunity to compare the productivity per day as a function of depth, obtained by three independent methods:

a) the in-situ C^{14} method,
b) the simulated in-situ method under appropriate optical filters, and
c) by calculation from measurements of the integrated available radiant energy at various depths during the day, and the productivity per hour obtained in an incubator under constant artifical light.

(12) We will have a complete record of the spectro radiometric characteristics of the radiant energy available for photosynthesis under water for a wide variety of ocean waters ranging from the clean ocean water of the Sargasso Sea to the rich upwelling water of the Peru Current. This information will constitute new input to the optical classification of ocean water and will provide data for developing an instrument which will permit biologists to determine "water type" from the deck of a ship and from "water type", estimate the probable spectral energy available for photosynthesis.

(13) We will have measurements of the ratio of radiant energy at two wavelengths obtained by several instruments, including a prototype "color meter". These measurements can be compared with complete spectral data to determine the validity of determining water type by this simple instrumental approach.

(14) We will be able to make new comparisons of chlorophyll concentrations obtained at all depths with other factors, such as productivity, total available radiant energy, and concentration of particulate matter.

(15) We will have data on the spectral signature of various types of ocean water. This information will be of direct application in the problem of remote sensing and estimating of surface chlorophyll.

(16) We will have all of the standard hydrological measurements such as salinity, temperature, oxygen, BT, etc. necessary to make an oceanographic identification of the water. We will also have a determination of the nutrients from which to determine whether or not the productivity is nutrient limited. We will also have an identification of major plankton species at each station.

(17) The Working Group members have expressed an interest in writing a monograph devoted to the research results of our Working Group. This would be a natural and worthwhile undertaking, and could well be prepared in outline form, with the sections delegated to individual members during the period of the expedition. The actual writing would be carried out as a post-expedition activity.

DRAFT
PROJECT INSTRUCTIONS
USC&GS SHIP DISCOVERER

PROJECT NO. AMC/RP - 2 - 70
SCOR/IAMAP PROJECT

I. The USC&GSS DISCOVERER will be engaged on the, SCOR/IAMAP Project from on or about 30 April until on about 3 June 1970. The ship will start and terminate project at Miami, Florida, a tentative schedule is given in Attachment 1.

II. SCIENTIFIC PARTY

A. Chief Scientist

The Chief Scientist for this project Mr. John E. Tyler, Chairman of SCOR Working Group #15 He will have full authority to revise or alter the technical portion of the instructions as the work progresses provided that, after consultation with the Commanding Officer, it is ascertained that the proposed changes will not (1) jeopardize ship safety, (2) exceed the overall time allowed for the project (3) result in excessive additional costs or (4) conflict with the general intent of the project guidelines. The Chief Scientist will be considered, for administrative purposes, to be in change of all SCOR personnel aboard, other responsibilities, of the Chief Scientist are defined in the ESSA Manual.

B. Other Scientists

In addition to the Chief Scientist, there will be 16 Scientists working on the SCOR Project. In addition to the SCOR Project personnel, there will be 9 scientists in the IAMAP Working Group, The IAMAP Working Group is under the Chairmanship of Dr. Peter M. Kuhn of ESSA's Atmospheric Physics and Chemistry Laboratory. For administrative purposes Dr. Kuhn will be considered in charge of all IAMAP personnel aboard.

Two representatives of Equador may also be aboard.

Dr. Harris B. Stewart, Jr. of AOML will be aboard as the ESSA Coordinator between the two Working Groups and the ship, and will resolve questions of priority should program conflicts arise.

A List of all non-shipboard personnel is given in attachment 2.

III. PROGRAM

A. General Statement

The SCOR work consists of daily on - station periods of about ten hours duration observed between 0900 and 1900. During the on-station periods physical, chemical, and biological parameters will be observed with deck mounted instrumentation, instrumentation suspended from tethered and free drifting marker buoys, as well as instrumentation lowered into place with ship's winches. An aircraft from Scripps Institution of Oceanography will overfly the ship at selected times in an effort to determine chlorophyll concentration by using an airborne sensor personnel will provide chlorophyll concentration data as ground truth for the airborne sensor. Plane-ship communication will be required. A tentative schedule of on-station operations is given in Attachment 3, which will be modified as necessary.

The IAMAP work will consist of a series of three daily balloon releases scheduled to occur after the conclusion of each day's SCOR activities. The first sounding will be with small balloon. The second sounding will be with a 12-gram balloon carrying, two radiometersondes. The third sounding will with a 600-gram balloon carrying two radiometersondes. The first sounding will take about 35 minutes. The second and third soundings will take about 2 hours each. No balloon releases will made during the canal transit.

B. Work required

1. SCOR

a. Ship's position will be furnished as required.

b. Depth soundings will be furnished as required.

c. An STD lowering will be made once daily.

d. Ship's personnel will be required for on-loading, installation, deployment retrieval, stowage, and off- loading of SCOR equipment.

[original document missing from e to n]

o. Total available quanta will be measured in situ by French and Danish quanta meters,

p. Color will be measured by one color meter supplied by Denmark.

q. Narrow-band irradiance one narrow-band irradiance meter supplied by Australia.

r. Deck Irradiance will be measured by a deck thermopile supplied by Russia.

s. Simulated in-situ productivity using natural light will be measured by equipment supplied by Australia.

t. Simulated in-situ productivity using artificial light will be measured by equipment supplied by Australia.

u. In - situ productivity will equipment supplied by Japan, This requires that the ship be hove to from noon to sunset. The instrumentation will be suspended from a marker buoy.

v. Nutrients will be measured by a chemist from Florida State University to determine if and when productivity is nutrient limited.

w. Identification of phytoplankton will be published by SCOR biologists.

x. Optical measurements will be made to determine the horizontal stratification due to plankton or waters of the Canal Zone.

VI. DATA DISPOSITION

A Data gathered by ship personnel.

All data gathered by ship personnel, that is desired by the Chief Scientist will be released to the Director, AOML. A letter transmitting field records will be prepared by the ship and receipted by Director, AOML. A copy of the receipted transmittal will be forwarded to the Marine Information Branch, C&GS Headquarters, by the ship and receipted by Director, AOML. A copy of the receipted transmittal will be forwarded to the Marine Information Branch, C&GS Headquarters, by the ship. The Director, AOML, will be responsible for the release of any data to those requesting it. Upon his request, the ship will furnish copies of any data gathered to any other scientist aboard if these copies can be made conveniently. The Director, AOML, is responsible for the final disposition of data to the EDS for transmittal to NODC or other appropriate data centers.

In order to maintain adequate records, the Chief Scientist will furnish the ship and inventory of data gathered by the various non-ship personnel aboard, showing type and quantity of data. A copy of this inventory will also be forwarded to the Marine Information Branch by the ship.

When research is conducted in waters of a foreign country and that country's permission DSr such research is based on the condition that their scientists participate in or observe the research activities, copies of the research data will be made available (within the duplicating capabilities aboard the ship) if so requested. The Chief Scientist will make the additional data available at a later reasonable time.

The Chief Scientist of research cruises in waters of foreign countries is responsible for the forwarding of the results, when available, of that research to the Director, AOML. The Director, AOML will then forward the results to the Office of International Affairs for transmission to the foreign country.

As an interim measure and immediately following the conclusion of the cruise the Chief Scientist should furnish a brief report to the Director, AOML, for forwarding to the Office of International Affairs for transmission to the foreign country. This interim report should include

the ships operational itinerary during the cruise, types and locations of data collected, procedures used in collecting the data, names of any scientists aboard from that foreign country, estimation of when the results the research will become available and any other information possible interest to that country.

VII. OTHER WORK

A. Additional work will be undertaken for the Marine Geology and Geophysics Laboratory of AOML, the Physical Oceanography Laboratory of AOML, and for the International Cooperative Investigation of the Caribbean and Adjacent Regions (CICAR) project, and for ESSA' s National Meteorological center. This work will be accomplished on a not to interfere basis with the work of the SCOR Working Group and the IAMAP Working Group. The ESSA Coordinator is arbiter of whether or not the additional work interferes with the main project.

B. Marine Geology and Geophysics Laboratory Program.

This program is an underway geophysical project requiring the collection of bathymetric, magnetic, and gravity to in the eastern tropical Pacific. The purpose is to supplement the data collected by the USC&GSS OCEANOGRAPHER in this area in 1969 and 1970.

1. Bathymetry

The north-south and east-west lines shown in Attachment 4 are preferred, however, data collected on tracklines oriented in any direction is acceptable.

The narrow beam echo sounder shall be used for all sounding. Because of the rugged bottom topography, frequents scale checks on the PDR will be required.

All work will be plotted on OSS sheets Boat sheets shall be labeled in accordance with the Navy Bathymetric Magnetic Chart Index.

2. Magnetic

Continuous recordings with the Varian Proton Magnetometer shall be made of the total magnetic field intensity. Data shall be simultaneously logged on magnetic tape and analog trace. The analog recorder shall be run at 12 inches per hour and 60-second polarization. The instrument shall be carefully monitored to assure proper tuning and timing sequence at all times. The magnetometer Log (C&GS 385) shall record all operation timing, and tuning of the magnetometer. The magnetometer analog recorder shall be fully annotated with date - time group and position numbers at two - hour intervals

3. Gravity

Continuous gravity recordings shall be made at all times practicable. Data shall be recorded in accordance with General Instructions o, Gravity Observations at Sea, October 1966, Land the shall, be made at the beginning and end of the project.

4. Control

Control shall be by the best means available. Positions shall be plotted each half hour and at the time of all course and speed changes. Positions shall be indicated by consecutive numbers beginning with the first position of the first track line segment and ending with the last position of the last track line segment. Date-time group shall be entered in addition to position number on all positions plotted on the boat sheets. Positions shall be adjusted and replotted as necessary on the boat sheet. Black ink shall be used to ink all positions.

Navigation data forms will be provided by Mr. Paul Grim of AOML. These will be filled out by scaling from the boat sheets position data that mark the beginning or end of a line, or a course, or speed change.

5. Annotation of Records

All records shall be marked with time every half-hour.

6. Automated Data Processing

The raw bathymetric, magnetic, and gravity data will be logged on magnetic intervals.

7. Records Required by AOML

a. All analog records of bathymetric, magnetic, and gravity data.

b. Magnetic tapes with raw data (bathymetry, magnetic, and gravity)

c. Completed AOML navigation forms.

d. Copies of DR abstracts.

e. OSS sheets

C. CICAR Program

1. Bathermograph Observations

Hourly BT observations will be made while underway between Miami and the first two SCOR stations. These observations will contribute to a cooperative synoptic investigation of the eastern Gulf of Mexico called EGMEX and considered as part of the U.S. program for CICAR.

2. Daily Position Reports

The ship will send a 1200 GMT position report of CICARCURAÇAO each day between Miami and Panama Canal on the outbound trip and the Canal and 25^0 N on the return trip.

The first two words of the position are: CICARCURAÇAO POSREP

After these two words a three-digit number gives the Julian date for which the reporting is done.

This three digit number is followed by two numbers of four digits each. The first giving the latitude in degrees and minutes, the second the longitude in degrees and minutes. As all latitudes are North and all latitudes are West, these indications can be omitted.

The two four-digit numbers giving the latitude and longitude at noon GMT, are followed by a five-digit number giving the course in degrees in three digits and the speed in knots in two digits. If the ship is on station during its noon position, the five-digit number is replaced by the word STATION.

The five-digit course and speed number is followed by a progress report covering the day since the last POSREP. This progress report consists of one-six digit number. These digits each represent one of the disciplines carried out in CICAR as follows:

first digit: Physical and chemical, including circulation projects

second digit: Biological work

third digit: Fisheries research

fourth digit: Geology, geophysics, geotraverses, minerals

fifth digit: Bathymetry navaids

sixth digit: Meteorological investigation

For every one of the six digits in the progress report there are ten possibilities, ranging from zero to nine. These will have the following meaning:

0= not applicable

1= not carried out because of equipment or instrument failure

2= not carried out because of weather conditions

3= not carried out because incompatible with other observation

4= carried out but results unsatisfactory, must be done again

5= carried out, satisfactory results

6= carried out, excellent results

7= carried out but further observations in area are needed

8= observations on this line or in this area completed

9= all work in this discipline completed

Finally, a ship reporting its position for the first time when it enters the area of CICAR will precede the word POSREP by the word FIRST. A ship leaving the area will put the word LAST before the word POSREP. The last word of the POSREP is the ship's name. This message will be prepared daily by the ESSA Coordinator aboard.

D. National Meteorological Center Program (NMC)

1. Surface weather observations are to be made daily at 00002, 06002, and 18002, Data are to be transmitted as soon as possible by the best available means for inclusion by NMC in the synoptic charts.

2. If a tropical disturbance develops, radiosonde data should also be transmitted when available.

3. Dr. Peter Kuhn will be responsible for items 1 and 2. Physical Oceanography Laboratory Program (AOML)

E. Physical Oceanography Laboratory AOML

The Physical Oceanography Laboratory of AOML will provide a radiometer for on-deck measurements of Sea surface temperatures at times coincident with ESSA and NASA satellite passages. Since the radiometer utilizes the same wavelength as the satellite sensors, the data obtained will provide ground truth of the satellite sensors. The measurements will be made by Mr. Monte Poindexter.

ATTACHMENT 1

Tentative Ship Schedule
USC&GSS DISCOVERER
SCOR/IAMAP PROJECT

30 April	1970 Depart Miami, Florida
6 May	Arrive Panama Canal for Westward Canal passage
14 May	Arrive vicinity of Galápagos Islands
20 May	Arrive Balboa
21 • 23	In Port
24 May	Depart Balboa for Eastward Canal Passage
3 June 1970	Arrive Miami, Florida

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ATTACHMENT 2

List of non-ship personnel in SCOR/IAMAP Project

SCOR PROJECT

NAME	COUNTRY
Dr. Harry R, Jitts	Australia
Mr. David J. Carpenter	Australia
Dr. Kjell Nygaard	Denmark
Mr. Niels Hojerslev	Denmark
Dr. Andre Morel	France
Dr. Jean - Pierre Bethoux	France
Dr. Yatsuka Saijo	Japan
Mr. Nobutada Nakamoto	Japan
Dr. Jahn Throndsen	Norway
Mr. Ian Baird	United Kingdom
Mr. John E. Tyler	USA
Dr. Raymond C. Smith	USA
Mr. Roswell Austin	USA
Mr. James Albers	USA
Mr. Thomas C, Malone	USA
Dr. Yulen Ochakovsky	USSR
Mr. Anatol Susliaev	USSR

IAMAP PROJECT

Prof. Dr. Hans G. Muller	Fed, Rep of Germany
Mr Hans Fimpel	Fed, Rep of Germany
Dr. Masayoshi Shimizu	Japan
Mr. Akira Yata	Japan
Dr. Peter M. Kuhn	USA
Mr. Monte Poindexter	USA
Air Force Technician	USA

PROJECT COORDINATOR

Dr. Harris B. Stewart, Jr	USA

ATTACHMENT 5

(Attachments 3 and 4 missing from original)

SCOR EQUIPMENT

Equipment to be supplied by SCOR personnel

Australia

Submarine photometer
Plastic Water samplers
Depth calibrator
bottle washer and bottles
lab console
Geiger counter and gas
Spectroradiometer
Quantameters
incubators (3)
hoses
buckets
Winch
Transformers (2)
Xenon Lamp spares
incubator spares
vacuum pump
XY recorder
Tools

Denmark

Underwater light quanta meters
Neoprene cable
Electronics cabinet
Control panel for light quanta color meter
Control panel for Scatterance meter
Light Scatterance meter
Spare neoprene cable
Deck photometer
Underwater color meter
Light quanta meter for use in incubators
Sun elevation meter
Potentiometer recorder
Power supply
Spare parts box
Tool box
Tyndall meter
Autotransformer
Ampere meter
Amplifer
Decade resistance box
Universal instrument ITT metric
Accessory kit for recorder

France

Irradience meter (thermopile type)
Cable
Spectro - irradiance meter
Quanta meter
Recorders

Japan

Cooling apparatus
Polyethelene bottles
Vacuum Pump
Laboratory glassware
Buoy
Recorder
Submarine illuminometer
Water bath of plastic complete with 3 transformer
Pressure resistant vessel

Norway

Microscope
Filters for Australian incubator
United Kingdom
Flurometer
Spectrophotometer
Vacuum pump
Vacuum trap
Homogenizer and motor
Water sampler
Filtering rack
Filtering apparatus
Spares
Laboratory Glassware

USA

Winch
Optical bench
Calculator
Flourescent light incubator
125 mil pyrex glass bottles
C- 4 ampules
Filer manifolds
filters Millipore
Glass filters
Phytoplankton net discs
Desecator
Sample bottles
Reagents
Spectro - irradience meter and control panel
Portable electric generator
transformer
Variacs
Scattering meterTransmissometer and control panel
Irradiance photometer and control panel
Recorders

USSR

Amici prism instrument
Recorders
Control panels
Transformers

Equipment to be supplied by Ship

1. Current meter buoy
2. STD
3. Nansen cast gear as STD back-up
4. Running sea water to incubator locations
5. Mechanical bathythermograph
6. Secchi disc
7. Oceanographic and bathythermograph winches
8. Bow viewing port
9. 28V DC power supply
10. Lead weights

Equipment to be supplied by IAMAP PERSONEL

Federal Republic of Germany

Radiometers	30
Radiosondes	30
Receiver	1
Japan	
Radiosondes	38
USA	
Radiometers	36
Radiosondes	36
Balloons	60
Ventilated net Radiometer & Tripod	1
Cylinders of Helium	50
Receivers	2 (403 MHZ)
Receiver	1 (72 MHZ)

Equipment to be supplied by Ship

1. Weather report data
2. Weather facsimile data

APPENDIX

Working Group #15 of the Scientific Committee on Oceanic search (SCOR) of the International Council of Scientific ions is concerned with the problems of measuring the radiant energy available for photosynthesis in marine waters. It is sired to determine exactly what measurement of irradiance required by biological oceanographers, and then to design suitable instrumentation for its measurement for use by biologists engaged in research on primary productivity. The instruments and procedures designed may then be intercalibrated and standardized on an international basis so that all such measurements made in the future may be intercompared.

Between 1964 and 1966, the members of SCOR Working Group 5 analyzed mathematically the techniques for estimating the total radiant energy available for photosynthesis, and began instruction of the instrumentation required to obtain experimental data in the field. The results of this early work indicated that simple measurements combined with spectral information about water types could probably be used to estimate the total radiant energy available for photosynthesis underwater. In 1966 it was recommended that the instrumentation be given preliminary sea trials and that physical and biological data collected to test the methods for estimating radiant energy. The preliminary sea trials were accomplished in the Gulf of California in 1968. The present project constitutes the full le sea trials recommended in 1966 and will provide a complete record of the correlation between radiant energy and primary productivity in a variety of ocean water types. The project will provide data for developing an instrument which will permit biologists to determine "water type" from the deck of ship, and from this, estimate the probable spectral energy available for photosynthesis.

The Radiation Commission of the International Association Meteorology and Atmospheric Physics (IAMAP) of the International Union of Geodesy and Geophysics conducts intercomparisons the various internationally used radiometersondes. The last comparisons were held in 1965. The last meeting of the Radiation Commission at Bergen, Norway, in 1968 proposed that a new intercomparison be made not later than 1970, and desired to conduct the intercomparison over the ocean because of the homogeneity of the underlying surface. This work will be accomplished by the diometersonde Intercomparison working Group under the chairmanship of Dr. Peter Kuhn of ESSA's Atmospheric Physics and Chemistry Laboratory.

UNITED STATES GOVERNMENT

Memorandum

U.S. DEPARTMENT OF COMMERCE
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATI
COAST AND GEODETIC SURVEY

TO : Director, International Affairs

DATE: APR 2 8 1970

In reply refer to: C351

FROM : Director, Coast and Geodetic Survey

SUBJECT: Project SCOR

A few probable problems have arisen in connection with negotiations for diplomatic clearances to conduct experiments within claimed and/or recognized foreign territorial waters. In order to avoid last minute confusion and the risk of possible international misunderstanding, the position of the Coast and Geodetic Survey is as follows:

1. The ship will not conduct experiments of any kind within claimed territorial waters of a foreign country without proper diplomatic clearance.

2. Conditions under which clearances are granted must be acceptable to International Affairs and State Department.

3. C&GS cannot approve expenditures for transportation or subsistence of representatives of a foreign government to accompany the ship.

/s/ Don A. Jones
Don A. Jones

cc:
Ax2
AOML

BUY U.S. SAVINGS BONDS REGULARLY ON THE PAYROLL SAVINGS PLAN

RF-20
20x3

FORM CD-121 (11-63) (PRES. BY A.O. 209-10)

UNITED STATES GOVERNMENT

Memorandum

U.S. DEPARTMENT OF COMMERCE
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
COAST AND GEODETIC SURVEY

TO : Director
Atlantic Oceanographic and
Meteorological Labs

DATE: 30 April 1970

In reply refer to: CFN2

FROM : Director
Atlantic Marine Center

SUBJECT: Delay in DISCOVERER's Departure for SCOR

Your request to delay the sailing of the DISCOVERER for the SCOR trip is approved. By copy of this letter, Captain Keith is authorized to delay sailing until 2 May when the Norwegian equipment is aboard.

Allen L. Powell

Allen L. Powell

cc: CAPT Keith
Mr. Knecht
CDR Patrick
CAPT Darling
CAPT Stark

RECEIVED
MAY 4 1970

BUY U.S. SAVINGS BONDS REGULARLY ON THE PAYROLL SAVINGS PLAN

R. STEWART

EMERGENCY STATION BILLET
USC&GSS DISCOVERER

BILLET NO. 916 RAFT NO. 1 QUARTERS _____

FIRE & EMERGENCY Wardroom

ABANDON SHIP Raft 1

MAN OVERBOARD Wardroom

EMERGENCY SIGNALS

FIRE & EMERGENCY: Continuous blast on the ship's whistle for at least 10 seconds, supplemented by the same signal on the general alarm bells.

ABANDON SHIP: More than 6 short blasts and 1 long blast on the ship's whistle, supplemented by the same signal on the general alarm bells.

MAN OVERBOARD: Fire & Emergency signal followed by voice announcement of "Man Overboard."

DISMISSAL FROM DRILLS: 3 short blasts on the ship's whistle, supplemented by the same signal on the general alarm bells.

May - June 1970

SCOR PROJECT

TO: ALL GUEST SCIENTISTS ON THE SCOR CRUISE

FROM: COMMANDING OFFICER

I would like to welcome you aboard the USC&GS Ship DISCOVERER with the hope that our voyage will be scientifically successful as well as rewarding and enjoyable. The number of guest scientists on the cruise, from SCOR and IAMAP, is the largest the ship has ever accommodated at one time.

In order to facilitate your becoming familiar with the ship, the following information is provided:

OFFICER COMPLEMENT

CAPT Hubert W. Keith, Jr.	-	Commanding Officer
CDR Richard E. Alderman	-	Executive Officer
CME Ralph C. Johnson, Jr.	-	Chief Engineer
CDR Archibald Patrick, Jr.	-	Operations Officer
LT Richard T. LeRoy	-	Watch Officer and Safety Officer
LTJG Floyd Childress, II	-	Navigation Officer
LTJG Paul M. Duernberger	-	Watch Officer
ENS Charles Langdon, III	-	Watch Officer; Wardroom Mess Treasurer
ENS Lawrence L. Lake	-	Computer Officer
ENS Stephen J. Mangis	-	Assistant Computer Officer
ENS Donald A. Drake	-	Watch Officer
LCDR Kenneth J. Miller	-	Medical Officer

Each officer is ready to assist you with any question you may have.

DINING FACILITIES AND LIVING QUARTERS

Because of the number of guest scientists, the noon and evening meals will be served in two sittings. You will be informed as to which sitting and which place at table have been assigned to you. Meal costs are $2.50 per day.

Meal schedule:	Breakfast - any time,	0700-0800 hours
	Lunch (1) -	1115-1145 hours
	(2) -	1200-1230 hours
	Dinner (1) -	1615-1645 hours
	(2) -	~~1700~~-1730 hours 1715

A room steward will attend to your room each morning and renew your bed linen weekly.

CANTEEN

The ship's store is open each day at 1715-1800 hours.

MOVIES

Movies are shown each evening at 1730 hours and at 2000 hours.

MAIL

The ship's mailing address is as follows:

(your name)
USC&GS Ship DISCOVERER
P.O. Box 4699
Miami, Florida 33101

Mail will be forwarded to Balboa and picked up during passage of the Panama Canal.

OUTGOING RADIO MESSAGES

For outgoing radio messages, see the Executive Officer.

BRIDGE

It is permissible to visit the bridge while the ship is underway, but you are asked to keep such visits to a minimum.

LAUNDRY

Two self-service washers and driers, forward of the crew's mess hall, are available for your use.

MEDICAL

Dr. Miller's office hours are 0945-1000 and 1615-1630 daily. He is available for emergencies at any time.

EMERGENCY DRILLS

Drills are held weekly and everyone aboard must participate. You will be notified of your emergency station.

Hubert W. Keith, Jr.
CAPT, USESSA

SCIENTIFIC PARTY

Name	Country	Room
PROJECT COORDINATOR		
Dr. Harris B. Stewart, Jr.	USA	G-06-101
SCOR WG 15		
Mr. John E. Tyler (Chairman) (Chief Scientist)	USA	F-04-103
Dr. Harry R. Jitts	Australia	F-05-103
Mr. David J. Carpenter	Australia	F-05-103
Dr. Kjell Nygaard	Denmark	F-04-104
Mr. Niels Hojerslev	Denmark	G-05-105
Dr. Andre Morel	France	F-04-106
Dr. Jean-Pierre Bethoux	France	F-04-106
Dr. Yatsuka Saijo	Japan	F-04-108
Dr. Nobutada Nakamoto	Japan	F-04-108
Dr. Jahn Throndsen	Norway	F-04-107
Mr. Ian Baird	United Kingdom	F-04-110
Mr. Raymond C. Smith	USA	F-04-101
Mr. Roswell Austin	USA	F-04-105
Mr. James Albers	USA	G-05-105
Mr. Thomas C. Malone	USA	F-04-105
Dr. Yulen Ochokovsky	USSR	F-05-104
Mr. Anatol Susliaev	USSR	F-05-104
IAMAP		
Dr. Peter M. Kuhn (Chairman)	USA	F-07-102
Prof. Dr. Hans G. Muller	Germany	F-07-102
Mr. Hans Fimpel	Germany	F-04-107
Mr. Masayoshi Shimizu	Japan	G-05-103
Mr. Akida Yata	Japan	G-05-103
Mr. Monte Poindexter	USA	D-09-102
SSG Roger R. Blankenheim	USA	D-09-102

Dr. Stewart

UNITED STATES DEPARTMENT OF
COMMERCE
NEWS
WASHINGTON, D.C. 20230

ENVIRONMENTAL
SCIENCE SERVICES
ADMINISTRATION
Coast and Geodetic Survey
GGS 70 - 50

April 24, 1970

NEWS CONFERENCE ON SCOR EXPEDITION

25 scientists from 9 nations will leave Miami this month on a four-week expedition to the Gulf of Mexico, Caribbean Sea and Pacific Ocean in an effort to establish international standards for measuring ocean and atmospheric phenomena.

Countries represented aboard the expedition's vessel, the Miami-based USC&GSS DISCOVERER, are the United States, Soviet Union, Australia, Denmark, France, Japan, Norway, Great Britain and West Germany. The ship is scheduled to sail April 30.

A news conference will be held prior to the ship's sailing to enable the press to meet the foreign and American scientists and discuss the expedition's objectives. Participants will also be able to view the unique ocean recording equipment which has been assembled for the expedition.

The conference will be held Wednesday, April 29, at 10 A. M., aboard the DISCOVERER, which is berthed at the west end of Dodge Island, Miami, just across the Dodge Island Bridge.

Office of Public Information
Environmental Science Services Administration

- 0 -

ESSA PI (Rockville, Md.) 301-496-8708
ESSA Atlantic Oceanographic & Meteorological
Laboratories (Miami, Fla.) 305-350-4104

UNITED STATES DEPARTMENT OF
COMMERCE
NEWS
WASHINGTON, D.C. 20230

ENVIRONMENTAL
SCIENCE SERVICES
ADMINISTRATION

ES 70 - 29

RELEASE: Wednesday P.M.'s
April 29, 1970

Scientists from nine nations to sail from Miami in effort to establish international standards for measuring ocean and atmospheric phenomena

Twenty-five scientists from nine nations will sail aboard an American vessel to the Gulf of Mexico, Caribbean Sea, and Pacific Ocean in an effort to establish international standards for measuring ocean and atmospheric phenomena.

The scientists are oceanographers, physicists, and meteorologists from the United States, the Soviet Union, Australia, Denmark, France, Japan, Norway, Great Britain, and West Germany.

The one-month expedition is scheduled to leave Miami, Florida, April 30 aboard the Ship DISCOVERER, an oceanographic "floating laboratory" of the Coast and Geodetic Survey, an agency of the Commerce Department's Environmental Science Services Administration.

During the voyage, sea and air experiments will be conducted in and over the Gulf of Mexico and Caribbean Sea and in the offshore waters of South America southwest of Panama. The ship will return to Miami via the Caribbean and the Sargasso Sea.

(more)

Scientists from the United States, the Soviet Union, Australia, Denmark, France, Japan, Norway, and Great Britain will engage in a research program involving measurement of the ocean's primary productivity. This is essentially a measure of the rate at which the phytoplankton--the drifting microscopic plants of the sea--are able to utilize radiant energy from the sun and nutrients from the sea to produce carbohydrates, oxygen, and other products through photosynthesis, much as plants do on land.

The amount of incoming radiation at the sea surface and at several levels below the surface will be measured from the DISCOVERER together with the optical properties of the waters themselves.

By bringing together on one ship the scientists and the various measuring devices and techniques from different countries, it is planned to develop a means for intercalibrating the results so that measurements can be compared on an international basis. If a standard international technique is agreed upon it will then be recommended to scientists throughout the world who are concerned with the measurement of this important feature of the sea--its productivity.

In addition to these measurements, eight or more independent radiation detectors will be intercalibrated daily.

Preparations for the project have been under way for several years. The work is being carried out under the aegis of the Scientific Committee on Oceanic Research (SCOR), a part of the International Council of Scientific Unions.

The SCOR group is headed by John Tyler of the Scripps Institution of Oceanography, La Jolla, California. The scientists wish to determine, among other things, exactly what measurement of radiant energy is most useful for the biological oceanographers and then devise suitable instrumentation for its measurement. The DISCOVERER's trip is planned so that the physicists, marine biologists and chemists will be able to sample a wide range of productivity values, from the relatively sterile areas of the Sargasso Sea to the nutrient-rich and highly productive waters off the west coast of South America. Once this is accomplished, the instrumentation and measurement procedures can then be intercalibrated and standardized on an international scale so that all future measurements may be compared with a common denominator.

(more)

In addition to the SCOR group, meteorologists and technicians from the United States, the Soviet Union, Japan, and West Germany will attempt a comparable intercalibration of radiometersondes used by their nations to measure radiation in the atmosphere. The instruments, which are carried aloft by helium-filled balloons, radio back to the ship data on the variations in radiant energy versus height above the sea. By flying the instruments of the four different countries from the same balloon, the scientists will be measuring the same thing and will be able to carry out the required intercalibration of their equipment.

The radiometersondes will measure the thermal radiation emitted upward and downward from the atmosphere and upward from the sea. As the balloons rise, the instruments will gather data to provide a vertical profile of the variation in radiation. The radiation is emitted by water vapor, carbon dioxide, ozone, dust, and ice crystals in the atmosphere, increasing in intensity as the temperature increases. Such data are considered vital for a useful understanding of what drives the global weather "machine."

Previous intercomparisons involving the same scientists were held in Munich, Germany, in 1963, and in Green Bay, Wisconsin, and Miami, Florida, in 1965. It was determined as a result of these projects that intercomparison of the instruments would be more accurate if conducted over the more uniform sea surface rather than over the varying terrain of land.

This scientific effort, known as the Third International Radiometersonde Intercomparison, is an activity of the Radiation Commission of the International Association of Meteorology and Atmospheric Physics. The project is headed by Dr. Peter M. Kuhn of ESSA's Atmospheric Physics and Chemistry Laboratory, Boulder, Colorado.

Dr. Harris B. Stewart, Jr., Director of ESSA's Atlantic Oceanographic and Meteorological Laboratories in Miami, will serve aboard the DISCOVERER as expedition coordinator, to provide liaison between the two scientific parties and the ship. The DISCOVERER is commanded by Captain Hubert W. Keith, Jr., of Denver, Colorado, and carries a complement of about 83 officers and crew. The 303-foot, 3800-ton vessel is based at Miami, Florida.

(more)

The following scientists are scheduled to make the trip aboard the DISCOVERER with the SCOR group:

Australia -- Dr. Harry R. Jitts, senior research scientist, and David J. Carpenter, experimental officer, of the Commonwealth Scientific Industrial Research Organization, Sydney.

Denmark -- Dr. Kjell Nygaard, chief engineer, University of Copenhagen; Niels Højerslev, research associate, University of Copenhagen.

France -- Dr. Andre Morel, maitre assistant, University of Paris; Dr. Jean-Pierre Bethoux, attache of research, National Center for Scientific Research, Paris.

Japan -- Prof. Yatsuka Saijo, Nagoya University; Dr. Nobutada Nakamoto, doctoral student, Tokyo Metropolitan University.

Norway -- Dr. Jahn Throndsen, University of Oslo.

United Kingdom -- Ian E. Baird, senior scientist, Department of Agriculture and Fisheries for Scotland, Aberdeen, Scotland.

USSR -- Prof. Yulen Ochakovsky, Institute of Oceanology, Moscow; Anatol Susliaev, engineer, Institute of Oceanology, Moscow.

United States -- John E. Tyler, Raymond C. Smith, and Roswell Austin, all of the Scripps Institution of Oceanography, La Jolla, California, and Thomas C. Malone of the Hopkins Marine Station, Pacific Grove, California.

The following scientists are scheduled to make the trip from the Radiometersonde Intercomparison Working Group:

Germany -- Prof. Dr. Hans G. Muller, director, and H. Fimpel, technical assistant, of the Institute for Atmospheric Physics of the German Research and Experimental Institute for Air and Space, Post Wessling/Oberbayern, West Germany.

Japan -- Masayoshi Shimizu and Akira Yata, scientists of the Japan Meteorological Agency, Tokyo.

(more)

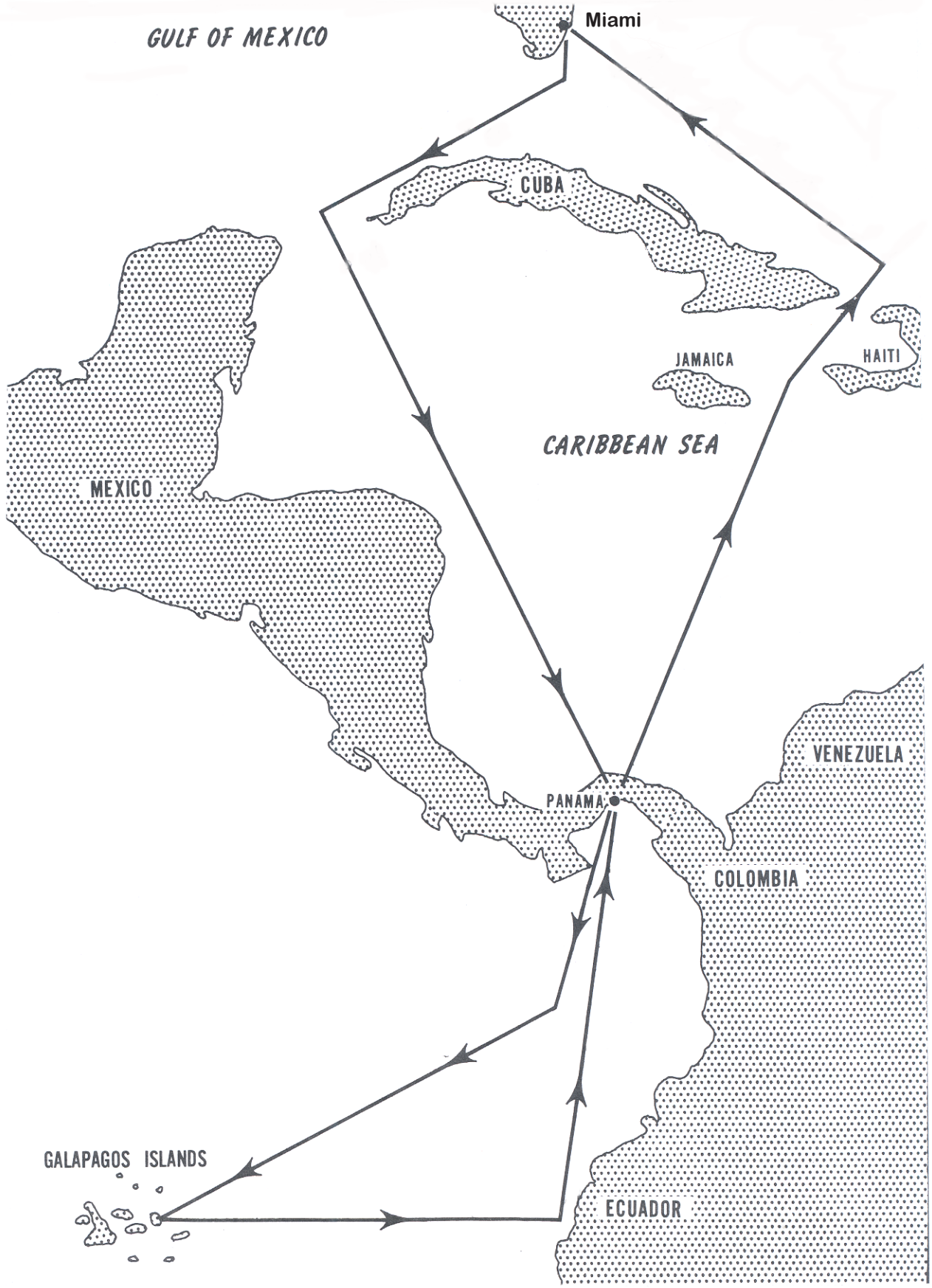
USSR -- Dr. V. I. Shlyakhov, director, and Dr. A. F. Kuzenkov, laboratory chief, Central Aerological Observatory, Moscow.

United States -- Dr. Peter M. Kuhn, ESSA Atmospheric Physics and Chemistry Laboratory, Boulder, Colorado; Monte Poindexter, ESSA Atlantic Oceanographic and Meteorological Laboratories, Miami, Florida.

(Drawing of expedition's route follows)

-0-

Wilcove
(Office) 301-496-8708
(Home) 301-587-9264



Route of U. S. Coast & Geodetic Survey Ship Dicoverer during one month cruise on which scientists from nine nations will attemp to stablish an international standard for measuring ocean phenomena.

SCIENTISTS SEEK A WORLD MEASURE

New System of Comparison Goal of 9-Nation Cruise

By SANDRA BLAKESLEE

Twenty-five scientists from nine nations left Miami on a tropical cruise Thursday, with hopes of returning in 30 days with a new international standard for measuring phenomena of the sea and air.

Throughout the journey the oceanographers, physicists and meteorologists will ply their instruments (manufactured or calibrated according to their own national standards) to the sea and atmosphere. Then they will compare results. In the end they hope to develop a means for intercalibrating their results so that such measurements can be compared on an international basis. No such scientific translating service exists today.

The expedition includes scientists from Australia, Denmark, France, Britain, Japan, Norway, the Soviet Union, the United States and West Germany.

The expedition ship Discoverer, supplied by the United States, is an oceanographic "floating laboratory" of the Coast and Geodetic Survey, an agency of the Commerce Department's Environmental Science Services Administration, sponsor of the voyage.

Through Panama Canal

The trip will be from Miami to the Gulf of Mexico, to the Caribbean Sea, through the Panama Canal, to off the coast of South America and back to Miami again. During the voyage one group of the scientists will dip instruments into various waters to measure the ocean's basic rate of productivity, the rate at which tiny phytoplankton grow by using energy from the sun and nutrients from the sea. Samples should vary in productivity with some low values from relatively sterile seas to highly productive, more lush waters.

A second group of scientists will send up balloons carrying atmospheric radiation detecting devices of four countries at a time. By flying such instruments together, the scientists will be measuring the same phenomenon simulaneously and will be able to compare findings to work out a method of intercalibration that could result in more precise weather forecasting.

Two scientific projects are involved in the expedition—the Scientific Committee on Oceanic Research of the International Council of Scientific Unions and the Radiation Commission of the International Association of Meteorology and Atmospheric Physics.

The New York Times

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Originally published May 3, 1970

NR 1 USCGSS DISCOVERER CK10 03 1800 GMT BT

CICARCURACAO BT

CICARCURACAO FIRST POSREP 123 2356 8246 23314 500000 DISCOVERER

BT

TOD 03/1908Z/PJC/12570/TJ

RF 20
~~2043~~

USC&GS Ship DISCOVERER
P.O. Box 4699
Miami, Florida 33101

May 27, 1970

The Director
Atlantic Marine Center
Norfolk, Virginia

MONTHLY ACTIVITIES REPORT - USC&GSS DISCOVERER (OSS-02)
April 28, 1970 - May 27, 1970

A. GENERAL

1. After loading aboard the final shipment of scientific equipment on the morning of May 2, DISCOVERER sailed at 1600 hours that afternoon on the "SCOR" cruise. On board were fourteen, SCOR Working Group 15 scientists; six, IAMAP meteorologists; two oceanographers from Scripps Institute of Oceanography, a graduate student from Hopkins Marine Station, a marine chemist from Florida State University, a USAF Staff Sergeant to operate the GMD, and Dr. Harris B. Stewart, Jr., Director, AOML and Project Coordinator for the cruise. Roughly 7 tons of assorted marine instruments and equipment accompanied the group.

2. As of this date, approximately 75% of the cruise has been completed with a high degree of satisfaction expressed by all visiting scientists. Our operation of the ship has placed assisting the scientific program in all respects as top priority, after safety and international clearance considerations. Results thus far have exceeded expectations of both the SCOR and IAMAP groups.

3. Measurements with and testing of instrumentation commenced May 3 in the Florida Straits SW of Key West. Thereafter, stations were run almost daily between the hours 0900 - 1900 with the ship underway 1900 - 0900 to the next station. Three no-station days were arranged during the cruise to allow the ship to run further.

4. A press conference preceeded the cruise on April 29 and various media representatives were aboard almost continuously up to the time of sailing.

5. Courtesy calls by the Commanding Officer were performed, while the ship was alongside in Balboa, on Governor Leber of the Canal Zone and RADM Nace, Commander, 15th Naval District.

6. It now appears that our Fourth Quarter restrictive spending program will allow us to meet the budget ceiling set for us by AMC for the quarter.

B. FIELD OPERATIONS

1. Six stations were accomplished between Miami (May 2) and Cristobal, C.Z. (May 8), two stations between Balboa, C.Z. (May 9) and the equator (May 11) (when DISCOVERER operated for the first time in the Pacific Ocean), seven stations south of the equator, and two stations northbound between the equator (May 19) and Balboa (May 22). The station furthest to the south and west was near 7°-52' S, 90°-15' W.

The ship was in Port May 22 - 25, retransited the Panama Canal on May 26, and was underway all of May 27 to reach the next station, SE of Jamaica on May 28.

2. The scientists, representing nine different countries, brought with them a vast assortment of gear - - probably the largest and widest variety ever installed on DISCOVERER. By the third day the uncoordinated plans and varied devices had been hammered into a relatively smooth, 10 hour schedule of experimentation with the gear adapted to the ship's power systems, deck, and lab facilities.

Contributing to a smooth operation were the following factors:

A. The ship's spacious oceanographic lab in which the instruments were installed with plenty of working area left over.

B. The ship's machinary and carpentry capabilities which not only adapted the gear to the ship but performed repair work that allowed continuation of certain experimentation which would have been regarded as complete equipment breakdowns on oceanographic vessels of smaller size.

C. Comfortable quartering and messing for 35 scientists and officers.

D. Direct communications from the ship to the U.S. mainland at all times.

3. The IAMAP group released radiosonde balloons for intercomparison purposes each evening until May 21 when their program was completed. A GMD balloon tracker was successfully installed aboard on May 1 and tracked the balloons with alacrity.

Scripps Institute of Oceanography overflew the ship with a DC-3 aircraft for simultaneous sea parameter measurements during the first seven stations.

Dr. Stewart, utilizing some of the SCOR equipment along with the ship's LODAR, conducted some opportune investigations of the deep scattering layer.

4. Tracklines with bathymetry, magnetics and gravity were run between stations in the Pacific Ocean but were largely curtailed south of the equator due to lack of navigational control. This pointed up the DISCOVERER's need for a Satellite Navigation System.

5. The ship received word on May 9 that clearance to enter Ecuadorian-claimed territorial waters had not been received. As a result, the ship remained 200 miles off the South American Coast at all times. The ship's request for a one day visit to the Galapagos Islands was also denied.

6. The ship's rocket-powered line gun was unsuccessfully tested on May 18. A report by CDR. R.E. Alderman on the test was furnished in a separate memo.

7. Two Soviet meteorologists, Sblyakhov and Kuzenhov, scheduled to be with the IAMAP group aboard, canceled their participation at the last minute.

8. William Metivier, U.S. Weather Bureau Canal Zone laison meteorologist was very helpful during our Panama Canal passage. He received mail and supplies for the ship and saw that we got them, facilitated our canal transits by his close contact with the Canal authorities and saved a crew member from a Panama jail when flown to join the ship without a passport, visa or other appropriate identifying papers - save a travel order.

C. DEPARTMENTAL ACTIVITIES

1. Deck Department operated winches, assisted in the SCOR WG 15 handling of instrumentation and helped with their adaption to the ship.

2. Survey Department assisted with SCOR measurements, performed observations in support of the measurements and stood trackline watches.

3. Electronic Department maintained communication and worked on equipment maintenance.

4. Engineer Department assisted the SCOR working group in adapting instrumentation to the ship and repaired instrumentation as required.

D. PERSONNEL

COMMISSIONED OFFICERS

For the first time since I have been aboard this vessel the commissioned officer complement has had enough to do to keep them fully occupied. With minimum idleness, morale and interest has been the highest in two years or more.

Although, the exigencies resulting from the ship having to accommodate such a large group of scientists with a varied scientific program has had much to do with this situation, the greatest factor has been an officer complement of ten. It is not due to any direct relation of the complement to the scientific program of this cruise.

The complement:

Patrick	-	Coordinating all SCOR, IAMAP and ship's scientific activities with ship's resources.
LeRoy	-	Watch Officer #1, Safety Officer.
Duernberger	-	Watch Officer #2, Meteorology Officer, Security Officer
Langdon	-	Watch Officer #3, Wardroom Mess Caterer, Gravity & Magnetics Officer
Childress	-	Navigation Officer, Ship's Service Officer.
Lake	-	Computer Officer
Mangis	-	Computer Watch Officer
Drake	-	Bridge Watch Officer in training and given responsibility for all matters pertaining to Panama Canal passages.

Total - 8
CO & XO - 2
10 - Commissioned Officer Complement
SCOR cruise.

Two Officers, Chambers and Mandelkern are on leave and did not sail this cruise.

This arrangement clearly shows that a complement of more than 10 officers aboard here is detrimental to moral, ship operations and career incentive. An "eleventh" officer aboard this cruise would have been essentially idle.

It is recommended, therefore, that, aside from one more officer presently needed for the computer section, no additional officers be transferred here until the transfer off of three of the present officers.

Personnel Actions - Commissioned Officer

NONE

Personnel Actions - Crew

Arpointment

HOBBS, Alvin A., Quartermaster, 4/29

Resignations

COOK, Fred S., Quartermaster, 5/1
MASON, Charles D., Ass't Survey Technician, 5/1

Promotions

EVANS, Nicholas A., to Junior Survey Technician, 5/1
WISE, Tommy, to Oiler, 5/16

Change of Status

JOSLIN, Joel E., Wiper, to O.C. 3961909 and to Ord. Seaman (Day), 5/1

ELLIS, Charles B., Chief Survey Technician, transferred to H&O and reassigned to GSO, 5/3

(6)

WISE, Tommy, Fireman from LWOP, 4/29

PARVIN, Robert W., Senior Survey Technician, to LWOP, 5/4

BEZEZEKOFF, Fred S., Radioman, to LWOP, 5/11

Hubert W. Keith Jr.
CAPT, USESSA
Comdg. DISCOVERER

cc: C3
PIx1
Ax2
[illegible]

SUMMARY

After several days delay due to late arrival of equipment, DISCOVERER sailed May 2 with scientists from SCOR and IAMAP aboard to test and compare various scientific instruments. Sixteen testing stations have been accomplished so far as the ship navigated Yucatan Strait May 4, and Panama Canal May 9; crossed the equator May 11, worked in the Humboldt Current May 12 - 18, recrossed equator May 19 and arrived in Balboa, C.Z. May 21. The ship retransited the Panama Canal on May 26 and is heading for station 17 near 16-5^{0}N 76-25W at the present time. The cruise has been successful and all visiting scientists are highly pleased.

May 19, 1970

CAPT Hubert W. Keith, Jr.
Commanding Officer
USC&GS Ship DISCOVERER

Dear Capt. Keith:

On behalf of the IAMAP 1970 Radiometersonde International Intercomparison Group I sincerely thank you, the crew and officers of the U.S. Coast & Geodetic Survey Ship DISCOVERER for your total efforts on our behalf during the SCOR - IAMAP cruise just concluded. Suffice it to say, were it not for your outstanding cooperation our mission could not have succeeded.

As a result of your support, our mission, was a complete success.

Thank you again,

Dr. Peter M. Kuhn
Chairman, IAMAP
Radiometersonde Group

cc: A
CFN
RF20

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VISIBILITY LABORATORY
SCRIPPS INSTITUTION OF OCEANOGRAPHY

SAN DIEGO, CALIFORNIA 92152

JUne 5, 1970,

Dear Stew:

Arrived back in Miami on Thursday at about 2 PM and it was probably a good thing that we did as there ~~was~~ were a great deal of things to do - many of which could not have been done on Saturday or Sunday. My group packed so fast that Roz and Ray left for home on Friday afternoon - about a day earlier than they had planned. The others were almost as fast and I expect to have them all out of town before the weekend is over.

We had some good weather during the last few days of the trip and were able to get some good calibration data - an imporant thing for us to have when you remember that we had so many optical detectors aboard

Everybody in the SCOR group was enthusiastic about the trip and about the results they obtained - some more than others - and I think it is fair to say that we were at least 80% sucessful.

I personally want to thank you for the many things you and Jack Knoed did for us. Your help assured our success. Now that my worries about my responsibilities are subsiding I can express myself better and can more easily see the many things, both large and small, that you and AOML did for us. Thank you very much.

About half way home from the Canal stop I received the good news that ONR had decided to support the expedition. I am pleased especially because I can clear up the ship"s mess bill for May. A check is enclosed.

With sincere thanks,

Sorry about my typing

Jerry

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SAN DIEGO, CALIFORNIA 92152

June 18, 1970

Dr. Robert M. White
Administrator, ESSA
Washington Science Center, Bldg. 5
Rockville, Maryland 20852

Dear Dr. White:

I and the members and delegates of SCOR Working Group 15 are deeply grateful for the use of the research vessel DISCOVERER during the conduct of our recent investigations into the relationship between natural light fields underwater and the primary productivity of the ocean.

Our working group has been represented on the DISCOVERER by seventeen scientists from nine countries. During our five weeks out of Miami our group has worked 24 stations of approximately ten hours each. The success of our daily effort has been assured by the cooperation of the ship's personnel, who have handled our specialized equipment with great skill and in some instances have made expert repairs and improvements to our instrumentation.

I am confident that the results obtained by our working group will have direct application to estimates of the primary productivity of the world's oceans and to the current national effort for synoptically detecting earth resources.

Please accept our sincere thanks for your valued assistance in this research.

Yours very truly,

John E. Tyler
Chairman, Working Group 15

JET:etb

cc: Dr. H. Stewart

cc: C.O. Disco
Air
Tufed
} For your info — Steve

RECEIVED JUN 22 1970

RF 20

U.S. DEPARTMENT OF COMMERCE
Environmental Science Services Administration
Rockville, Md. 20852
OFFICE OF THE ADMINISTRATOR

JUL 20 1970

(Signed) John W. Townsend, Jr.

Dr. John E. Tyler
Visibility Laboratory
Scripps Institution of Oceanography
University of California
San Diego, California 92152

Dear Dr. Tyler:

I am gratified that the project carried out on our Ship DISCOVERER by SCOR Working Group 15 went as well as you have indicated. This type of operation has many benefits to all participants, not the least of which are those that relate to improved international relationships.

We look forward to seeing the published results of your work and to participating in other similar operations in the future.

Sincerely,

(Signed) John W. Townsend, Jr.

Robert M. White
Administrator

RECEIVED
JUL 23 1970
Office of the Director

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SCRIPPS INSTITUTION OF OCEANOGRAPHY

SAN DIEGO, CALIFORNIA 92152

June 18, 1970

Rear Admiral Don A. Jones
Director, Coast and Geodetic Survey
Environmental Science Services Admin.
Rockville, Maryland 20852

Dear Admiral Jones:

Dr. Harris Stewart has told me that you were instrumental in making the ship DISCOVERER available to SCOR Working Group 15 for their research on the relationship between natural light fields underwater and the primary production of the ocean. I believe we have had a very successful expedition and I would like to convey to you the sincere thanks of my entire working group for your interest and support.

During the five weeks we have been away from Miami, we have worked 24 drift stations of about ten hours each. Our efforts have been skillfully supported by the officers and crew of the DISCOVERER who have solved many difficult problems on our behalf.

It may interest you to know that our expedition has had two uncommon features; it has been an international effort involving 17 scientists from nine nations, and, from the scientific point of view, has been interdisciplinary, requiring the close cooperation of both physicists and biologists.

Please accept our sincere thanks for your interest and support.

Sincerely,

John E. Tyler
Chairman, Working Group 15

JET:etb

cc: Dr. H. Stewart

RECEIVED JUN 22

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SCRIPPS INSTITUTION OF OCEANOGRAPHY

SAN DIEGO, CALIFORNIA 92152

June 18, 1970

Dr. Arthur E. Maxwell
IAPSO
Woods Hole Oceanographic Institution
Woods Hole, Massachusetts 02543

Dear Art:

Just to let you know that we returned from the SCOR Working Group 15 expedition on June 5.

It was, in my opinion, a very successful expedition. We completed 23 or 24 stations during the five-week voyage and had only one instrument failure that could not be repaired on the ship. It was not a serious failure as we could substitute results from another instrument.

The one thing that bothered us most was the fact that we could not enter the rich coastal waters along Ecuador.

You will be pleased to know that the IAPSO contribution came in very handy. I plan to use it for support of the chemist and a graduate student who joined the expedition and ran chlorophyll concentrations for us.

Many thanks for your interest and assistance.

Sincerely,

RECEIVED
JUN 22 1970

John E. Tyler
Chairman, Working Group 15

JET:etb

cc: Dr. H. Stewart

P. S. Do you require a formal statement of how the IAPSO money was used? Or is it enough to have the accounting in the SCOR office?

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SAN DIEGO, CALIFORNIA 92152

June 18, 1970

Dr. M. Gilmartin
Biology Oceanography Program
Division of Biology and Medical Sciences
National Science Foundation
1800 G Street, NW
Washington, D. C. 20550

Dear Dr. Gilmartin:

I am writing to tell you that Tom Malone was a great asset to the program of SCOR Working Group 15 during our expedition on the DISCOVERER.

Since his interest was closely related to our requirement for measurements of chlorophyll concentration, I suggested that he could work along with Ian Baird, who was chosen by the Royal Society to fill a vacancy in our working group.

Malone and Baird worked together beautifully and together they have provided much more data than I expected to have.

It is my understanding that Tom also was able to collect a significant amount of data that related specifically to his thesis investigation. I am pleased that it worked out so well for him.

My thanks for your interest in this effort.

Sincerely,

RECEIVED JUN 22 1970

John E. Tyler
Chairman, Working Group 15

JET:etb

c: Dr. H. Stewart

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SCRIPPS INSTITUTION OF OCEANOGRAPHY

SAN DIEGO, CALIFORNIA 92152

June 18, 1970

Dr. Carl Oppenheimer
Department of Oceanography
Florida State University
Tallahassee, Florida 32306

Dear Dr. Oppenheimer:

As you probably know, the SCOR expedition on the DISCOVERER terminated on June 5 and in a very short time the group had dispersed in the directions of their home laboratories.

I am writing to thank you for arranging to have Jim Alberts join the expedition as our chemist.

Jim Alberts made a very significant contribution to the program of our working group. Furthermore, he voluntarily worked in the evenings to complete his analyses each day and was one of the few who turned in a complete record of reduced data at the end of the cruise.

We were all pleased to have Jim working with us.

Sincerely,

John E. Tyler
Chairman, Working Group 15

JET:etb

cc: Dr. H. Stewart

RECEIVED JUN 22 1970

U. S. DEPARTMENT OF COMMERCE
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
RESEARCH LABORATORIES
BOULDER, COLORADO 80302

May 19, 1970

IN REPLY REFER TO:

Dr. Harris B. Stewart, Jr.
Director, Atlantic Oceanographic & Meteorological Laboratories
ESSA Research Laboratories
Miami, Florida

Dear Dr. Stewart:

It is with the sincerest appreciation that I wish to thank you for your untiring support of the IAMAP 1970 International Radiometersonde Intercomparison Program aboard the DISCOVERER. Your total cooperation in assigning Mr. Monte Poindexter to my group together with the support of John Kofoed, Feodor Ostapoff and Willard Shinners was the difference between success and failure.

Due to you and your laboratory we achieved success.

Again, my sincerest thanks.

Peter M. Kuhn

Dr. Peter M. Kuhn
Chairman, IAMAP
Radiometersonde Group

cc: Dr. Robert M. White, ADM, ESSA
Dr. Wilmot N. Hess, DIR, ERL

UNITED STATES GOVERNMENT

Memorandum

U.S. DEPARTMENT OF COMMERCE
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
COAST AND GEODETIC SURVEY

Chief, Operations Division
Atlantic Marine Center, CFN2
Commanding Officer
USC&GSS DISCOVERER
Safety Officer
USC&GSS DISCOVERER

DATE: May 19, 1970

In reply refer to:

Test Firing Of Ship's Line Rocket Gun
(Harvell-Kilgrove Line Throwing Appliance, Model CR52CK)

On May 18, 1970, while the DISCOVERER was adrift on station in a quiescent sea, and at a long-standing recommendation of the Ship Safety Committee, it was decided to test fire the ship's rocket-powered line gun. Besides evaluating its performance, one of the test objectives was to determine the range of the appliance.

After carefully reading the instructions, the mechanism was given a thorough cleaning and clamped to the portside railing, just aft of the forward mast on "I" Deck. The device had been installed during construction of the ship but up to now, had never been tested.

At approximately 0930, the rocket gun was loaded with a floating projectile, without line, and the trigger wired so that it could be set off remotely, allowing as little danger as possible to the trigger man. A small boat was placed in the water, which took up a position on the portside and slightly aft of the ship. Its assignment was to retrieve the floating projectile after the firing. All personnel were warned by the ship's PA system to clear open deck areas on the portside.

At about 0940, the gun was discharged directly abeam. The projectile, with a loud whoosh, went straight out for approximately 100 feet, then veered sharply left and, trailing fire and black smoke, made a gradual but high-speed descent on a line roughly parallel with the ship. Weaving back and forth, it finally plunged angrily into the water abeam the stern. The force of its watery impact was so great the floating projectile never returned to the surface.

Following a brief discussion the test was unanimously deemed inconclusive and a second firing ordered.

BUY U.S. SAVINGS BONDS REGULARLY ON THE PAYROLL SAVINGS PLAN

The crew in the small boat, somewhat unnerved over the rocket's threatening indications of coming in their direction, moved to a new station, about 100 yards directly ahead of the bow, for the second firing. Again the PA announcement was made and the second launch set off at about 0950.

This time the reactive force of the firing caused the entire rocket gun mechanism to shear off at the point where it was mounted to the railing. This resulted in the projectile roaring straight up. It narrowly missed the aloft conning tower, then spiralled high into the sky finally running out of power in a cloud of smoke at a point that appeared to be directly over the small boat. The again-menaced boat crew were observed hastily preparing to jump overboard when the spent missile splashed down about 100 feet away. They then were able to retrieve the rocket which received an entire dented-in side after hitting the water from such a height.

RECOMMENDATION

That the ship be allowed to:

1. Survey the ship's Harvell-Kilgrove line throwing appliance.
2. Procure a standard, Lyle, shoulder line throwing gun as a replacement.

Richard E. Alderman
Safety Officer
USC&GSS DISCOVERER

cc: CO
USC&GSS OCEANOGRAPHER

⊙ **Osaka Castle** — Originally erected by Hideyoshi Toyotomi and rebuilt by Ieyasu Tokugawa in 1620, this castle is famous for the huge stones used in building the walls.

⊙ Le Château de Osaka ⊙ Castillo de Osaka

Nobutada NAKAMOTO
5-8-9, Kyodo, Setagaya, Tokyo

July 17. '70.

Dear Dr. Stewart,

Thank you very much for your kind photograph of Neptune festival. I am really excited with photo. Thank you very much for the big visa to across the equator. I remember the festival. I cannot forget the festival and cruise. I really enjoyed the cruise of Ship Discover. I got a lot of things at the discover, new friends, new experience, and etc.

Please tell my best regards to ~~[illegible]~~ Patrick Kofford, and etc.

Please remember me to your daughter "Dolly".

Yours sincerly
Nakamoto

©

大阪城—西に摂津、但馬、北に山城、近江を控えたこの居城で、豊臣秀吉は乱世の日本を統一した。1583年の創建。当時の威容しのばれる風景である。

PUB BY NBC NIPPON BEAUTY CARD CENTER INC
PRINTED IN JAPAN
NBC

Dr. Harris B. Stewart, Jr.
Director of the Atlantic Oceanic Laboratory
of ESSA
901, South Miami Ave
Miami, Florida
U.S.A.

Air Mail

CF20
20x1

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Washington, D.C. 20230

OFFICE OF THE ADMINISTRATOR

FEB 18 1971

Dr. Harris B. Stewart, Jr.
Director, Atlantic Oceanographic and
Meteorological Laboratories
901 S. Miami Avenue
Miami, Florida 33130

Dear Stew:

Thanks for the SCOR-DISCOVERER patch. By other mail you will get a note of appreciation from me for the tremendous work that was done in connection with this expedition. I agree with you. This is the kind of thing we should do more often. It reflects great credit on the organization, but more importantly it contributes in a very real way to the furtherance of our understanding of the oceans.

Best regards,

Robert M. White
Acting Administrator

cc: Capt. Keith (MSB)
Capt. Munson (Disco)
CDR. Alderman
CDR. Patrick
Mr. Mofford

Done 2/22

For your info —
Stew

20

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Washington, D.C. 20230

OFFICE OF THE ADMINISTRATOR

Date: February 18, 1971

Reply to Attn of: A

Subject: Commendation

To: Dr. Harris B. Stewart, Jr., AOML

I am enclosing a letter from Warren S. Wooster, President of the Scientific Committee on Oceanic Research of ICSU expressing the appreciation of SCOR for the support which you, your staff, and others in NOAA gave to a unique international experiment last May and June. From all reports, and Warren's letter confirms this, support to the Working Group on Photosynthetic Radiant Energy in the work which it undertook aboard the DISCOVERER was first class and deeply appreciated. I have written to Admiral Jones asking him to express my appreciation to the Officers and men of the DISCOVERER and I would like to have you express my appreciation to any members of your staff who contributed to this outstanding success.

Robert M. White
Acting Administrator

Enclosure

cc: Dr. Hess

INTERNATIONAL COUNCIL OF SCIENTIFIC UN

SCIENTIFIC COMMITTEE ON OCEANIC RESEAR

532 WG 15
9 February 1971

Dr. Robert M. White,
Administrator
National Oceanic and Atmospheric Administration
U.S. Department of Commerce
Washington, D.C.

Dear Bob:

During the period 2 May - 4 June 1970, our Working Group on Photosynthetic Radiant Energy conducted experimental work at sea aboard R/V DISCOVERER. The SCOR scientific party consisted of 17 scientists from eight countries. From preliminary reports, it appears that the work was outstandingly successful. I am told that particular thanks are due to the officers and men of the ship and to Dr. H.B. Stewart, all of whom made major contributions to this program. On behalf of SCOR, I would like to express my appreciation to you and to others in NOAA who made this unique international experiment possible.

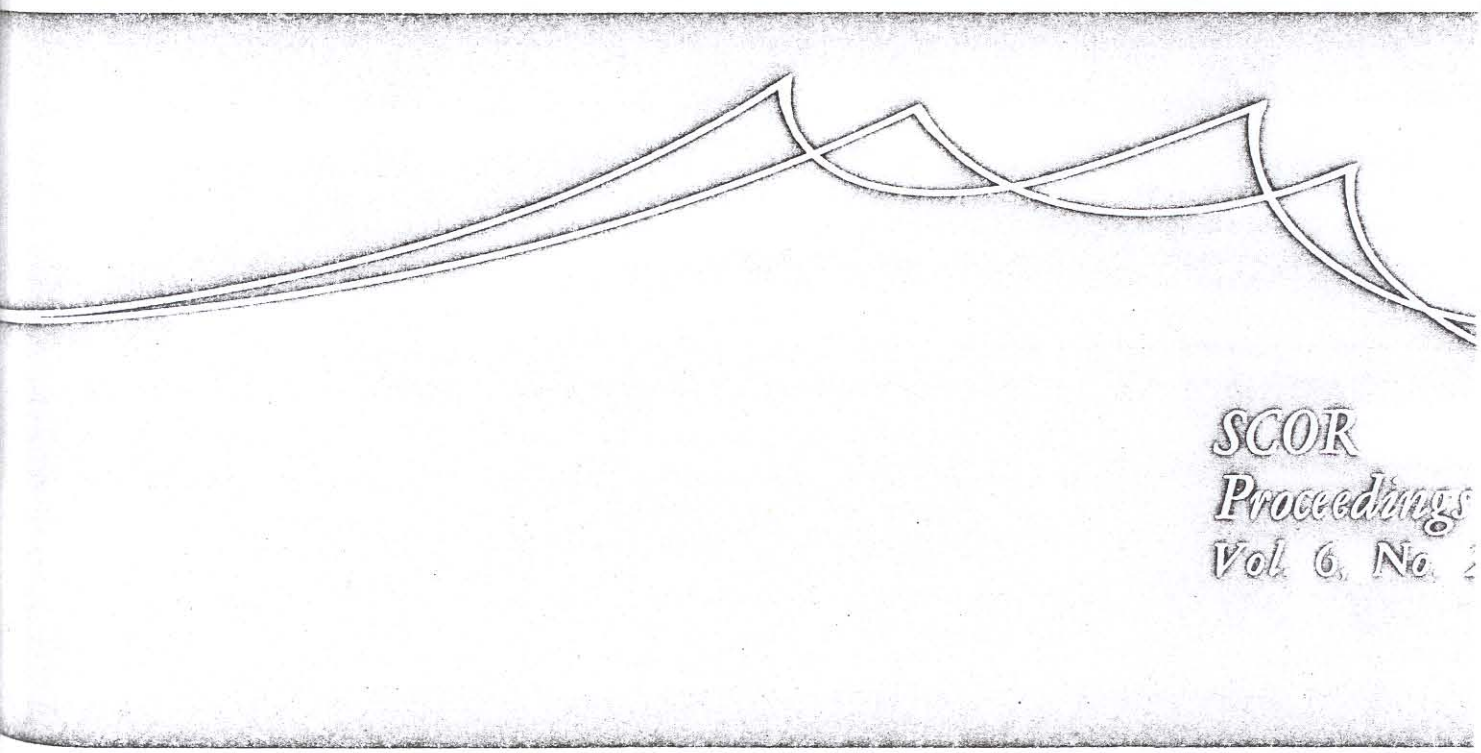
Yours sincerely,

Warren

Warren S. Wooster

cc: Executive
H.B. Stewart
J.E. Tyler

SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH



INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

REPORT OF SCOR WORKING GROUP 15
PHOTOSYNTHETIC RADIANT ENERGY

Sea Trials on R/V DISCOVERER, 2 May - 4 June 1970

Introduction

At the meeting of SCOR Working Group 15 in August, 1966, tentative plans were outlined for the collection of experimental data at sea. Primary objectives of the work at sea were to be the further testing and development of simple instrumentation for measuring the radiant energy available for photosynthesis and the collection of data to reveal any relationship between primary productivity and the radiant energy available for photosynthesis. A broad program including measurements of primary productivity, chlorophyll concentration, nutrient analysis, and other variables as well as optical measurements was outlined in order to have at each station a large body of interrelated data under specified lighting conditions.

It was originally suggested that this research should be conducted during the period of May to August, 1969, in the vicinity of the Canaries, and it was anticipated that a scientific party of 15 would participate.

Dr. W. Wooster initiated ship requests to various oceanographic organizations, but it was not until early in January, 1969, that a firm commitment was made. At that time, through Dr. Harris Stewart, Director of the Atlantic Oceanographic and Meteorological Laboratory, ESSA, and Rear Admiral D.A. Jones, Director of the Coast and Geodetic Survey, ESSA, the vessel, DISCOVERER, was scheduled for our use for a period of three to five weeks during the spring months of 1970.

In November, 1969, the Working Group met in Miami to discuss the program to be conducted during the expedition and to visit the ship. It was decided to equip the stern of the ship with a 25- to 30-foot boom so that the launching of the optical equipment could take place well away from the ship and the presence of the ship as a perturbation to the light field would be minimized. Also at the meeting, each Working Group member was assigned specific tasks related to the objectives of the expedition and arrangements were made to assure that all required instrumentation would be available for the work.

The Working Group was scheduled to sail from Miami on April 30, 1970, but late arrival of essential scientific instrumentation from Europe delayed the departure until Saturday morning, May 2. The effect of late sailing increased the cost of the expedition by approximately $1000. The cost to the Atlantic Oceanographic and Meteorological Laboratory was undoubtedly also increased as a result of late sailing but the dollar amount is not known. Late sailing did not affect the duration of the expedition's sea time.

The ship returned to Miami on Thursday, June 4, and all members of the SCOR group were on their way to their homes by Saturday, June 6. During the period at sea the Working Group obtained data at 23 stations.

Participants

The SCOR scientific party aboard the DISCOVERER during the expedition consisted of 17 scientists from eight nations, as follows:

James J. Alberts; Chemist; now at State Geological Survey of Kansas, the University of Kansas, U.S.; sponsored by Dr. C. Oppenheimer.

Roswell W. Austin; Research Engineer; Scripps Institution of Oceanography, University of California, San Diego, U.S.; accompanied Mr. J.E. Tyler.

- Ian E. Baird; Biologist; Department of Agriculture and Fisheries, Marine Laboratory, Scotland; member of Working Group 15.
- Jeane-Pierre Bethoux; Attaché de Recherche, C.N.R.S.; Laboratoire d'Oceanographie Physique, France; accompanied Dr. A. Morel.
- David Carpenter; Experimental Officer, C.S.I.R.O.; Division of Fisheries and Oceanography, Australia; accompanied Mr. H.R. Jitts.
- Niels Højerslev; Research Associate; Institute of Physical Oceanography, University of Copenhagen, Denmark; accompanied Dr. K. Nygaard.
- Harry R. Jitts; Senior Research Scientist, C.S.I.R.O.; Division of Fisheries and Oceanography, Australia; member of Working Group 15.
- Thomas C. Malone; Graduate Student; Hopkins Marine Station, U.S.; sponsored by Dr. M. Gilmartin.
- Andre Morel; Maitre Assistant; Laboratoire d'Oceanographie Physique, University of Paris, France; delegated by Working Group member Professor A. Ivanoff.
- Nobutada Nakamoto; Graduate Student; Department of Biology, Tokyo Metropolitan University, Japan; accompanied Dr. Y. Saijo.
- Kjell Nygaard; Chief Engineer; Institute of Physical Oceanography, University of Copenhagen, Denmark; delegated by Working Group member Dr. N. Jerlov.
- Yulen Ochakovsky; Physicist; Institute of Oceanology, USSR Academy of Sciences, USSR; member of Working Group 15.
- Yatsuka Saijo; Biologist; Water Research Laboratory, Nagoya University, Japan; member of Working Group 15.
- Raymond C. Smith; Physicist; Scripps Institution of Oceanography, University of California, San Diego, U.S.; accompanied Mr. J.E. Tyler.
- Anatol Susliaev; Engineer; Institute of Oceanology, USSR; accompanied Dr. Y. Ochakovsky.
- Jahn Throndsen; Magister Scientia; Institute of Marine Biology, University of Oslo, Norway; delegated by Professor Steemann-Nielsen.
- John E. Tyler; Research Physicist; Scripps Institution of Oceanography, University of California, San Diego, U.S.; Chairman of Working Group 15.

The officers and other personnel on the ship provided valuable scientific and logistic support and in a very real sense became a part of the Working Group effort during the voyage. Comdr. R.E. Alderman, the Executive Officer, easily solved the many problems associated with the presence of two international Working Groups on the ship(1).

Comdr. R.C. Johnson, Jr., Chief Engineer, and his staff solved numerous electrical and mechanical problems associated with the use of our specialized equipment on the ship. Comdr. Johnson personally assisted in re-engineering and repairing scientific equipment that was damaged or failed to function properly.

Comdr. Archibald Patrick, Jr., Operations Officer, provided valuable assistance during several weeks of pre-expedition arrangements, and during the voyage, assisted in scheduling the experiments and acted as liaison between the Working Group and the ship's personnel.

Because of the importance of local sun time to the determination of primary productivity and to the scheduling of radiant energy measurements, the ship's Navigation Officer, Lt.(jg.) Floyd Childress, made arrangements to provide the laboratory with a "sun-time" clock which was set correctly each morning to indicate noon when the sun reached maximum altitude. He also had posted under the clock zulu time for sunrise and sunset and provided latitude and longitude determinations for the beginning and end of each daily drift station as well as the ship's position for local apparent noon.

The computer officers, Ens. Lawrence Lake and Ens. Stephen Mangis, together with the group of survey technicians under Mr. Hopkins, took full responsibility for providing the SCOR

(1) The other Working Group was engaged in intercalibration of radiometersondes. The instruments were launched with helium-filled balloons in the evenings. The group was chaired by Mr. P. Kuhn.

group each day with a record of temperature, salinity, and density as a function of depth to 500 meters. They also made two daily casts with a mechanical BT to 275 meters, generally at times 1000 and 1400, and obtained surface temperature with a bucket thermometer. On several days expendable BT's were used every four hours to locate upwelling and the associated high chlorophyll concentration.

Chemical analysis of the sea water at each station was conducted by James Alberts. Alberts used sea water from the "Jitts bottles" (explained below under simulated-in-situ procedure) and, at greater depths from the Nansen bottles. He determined phosphates, silicates, nitrates, and nitrites and reported phosphorous, silica, and nitrogen in microgramatoms per liter. On the water from the Nansen bottles he also obtained water temperature and salinity. During the first week of the expedition he obtained samples to depths of 200 meters and after that he extended his sampling to 500 meters in order to more precisely describe the water type.

Continuous recording of total energy and energy available for photosynthesis (both at the ocean surface) was the responsibility of Dr. Yulen Ochakovsky. Total energy, including the infrared, was measured by means of a thermopile and electrolytic integrating recorder. Integration was carried out from noon to sunset every day to coincide with the period of incubation of the primary productivity samples. Measurements of total energy by means of a second thermopile were also continuously recorded on a strip-chart recorder for the same period of time. Measurements of the total energy available for photosynthesis were continuously recorded by the Russian Amici-prism instrument on a second strip-chart recorder and for the same period of time. The Amici-prism instrument isolates and records the energy within the spectral regions from 350 nanometers to 700 nanometers by means of a fitted template in the image plane of an Amici-prism dispersing system.

The time recorded energy, on occasion, showed massive changes in surface energy due to the passage of clouds over the sun. This, of course, is a real event to the phytoplankton and should be recognized for purposes of correlation. These events do, however, create problems with subsequent integration of the time recordings. These problems were discussed and tentative methods were adopted for reporting the time based data.

The Amici-prism instrument was also used to collect data on total energy as a function of depth in the ocean. These measurements will provide additional means for studying the relationship between primary productivity and the energy available for photosynthesis.

Identification of plankton species and estimation of relative populations was the responsibility of Jahn Throndsen. Throndsen generally analyzed six samples at as many depths at each station. He separated the phytoplankton into five size groups and counted the dinoflagellates, coccolithophores, diatoms, and flagellates in each size group. He also reported the total number of cells per liter in each size group, the total cells for each form and the percents of total in each case.

Spectral irradiance as a function of depth was measured by Dr. R.C. Smith, who employed the Scripps spectroradiometer. This measurement was made at or near noon, sun time, to avoid possible changes in irradiance due to changes in the altitude of the sun. A scalar irradiance collector was used as a deck reference cell. In order to avoid taking data during the intervention of a cloud over the sun, Smith observed the performance of the Russian instruments that were monitoring and recording surface energy on strip-chart recorders. The Russian instruments were located where they could be easily observed for this purpose. Smith also used the spectroradiometer to obtain monochromatic values of irradiance as a function of depth. These latter measurements were for intercomparison with similar measurements being made from the ship with other instruments. Measurements with the Scripps spectroradiometer were made to a depth of 90 meters. During the time assigned for this work on the stern boom an average of about five or six spectroradiometric curves were obtained at each station.

Spectral irradiance measurements were also made by Dr. A. Morel with a French designed instrument capable of rapid spectral scanning. Spectral irradiance measurements were made to a depth of 150 meters with this instrument. The French group employed other instrumentation for

measuring radiant energy. Attached to the same frame, and lowered at the same time, were an underwater thermopile and a quanta meter of French design. Results from these three instruments will be exactly comparable in space and time. To record the deck irradiance the French group employed an Eppley thermopile and an irradiance meter filtered to have sensitivity at 480 nanometers.

During the time assigned to the French group on the stern boom they were able to obtain an average of about 20 measurements of spectral irradiance per station as well as measurements with the thermopile and the quanta meter lowered on the same frame.

The measurement of the total quanta available for photosynthesis was undertaken primarily by the Danish group, who constructed quanta meters for their own use during the expedition and supplied, as well, several of these instruments to other members of the Working Group. The quanta meters were used, for example, in conjunction with other radiant energy measurements, in the incubators used for simulated-in-situ primary productivity work and in connection with the in-situ samples for primary productivity.

The measurement of total quanta as a function of depth was obtained regularly (generally every hour) by Dr. K. Nygaard, who also frequently lowered his quanta meter by attaching it to the frame of the French or American spectral irradiance meter.

The Danish group also obtained samples of water and made laboratory scattering measurements at 45° and 90° from the forward direction. They also employed instruments for measuring the scattering function and the total scattering function which were used after dark when the ambient light in the water would not interfere with the measured results.

The transmittance of the water, for a beam of light, and the scattering function between 10° and 170° were measured by Mr. Austin. The beam transmittance was measured before and after the midday period in order to locate and describe any existing stratification and record any changes in stratification during that period.

The scattering function was measured after dark, again to avoid interference by ambient daylight underwater.

The measurement of primary productivity by the in-situ method was made each day by Dr. Y. Saijo. Dr. Saijo used water from the Jitts bottles which he inoculated with C^{14} in the usual manner. The string of about seven bottles had included with it a quanta meter located at the level where 25% (sometimes 18%) of surface light was obtained. When launched, the string of bottles was attached to a Roberts buoy inside of which was a small battery-operated strip-chart recorder. Dr. Saijo was able, therefore, to obtain exactly correlating measurements of the quanta available for photosynthesis and the in-situ primary productivity. Since the attenuation coefficient for quanta will be available for each station from Dr. Nygaard's measurements, Dr. Saijo will be able to have the quanta available for photosynthesis at every bottle depth as well as the measured productivity at each depth.

Dr. Saijo also performed enrichment experiments in the laboratory and determined particulate carbon and nitrogen.

The measurement of primary productivity by the simulated-in-situ method was carried out by Mr. Jitts. Mr. Jitts used a daylight incubator with blue filters to simulate the light level and its spectral distribution at six depths. He also used an artificial light incubator. Both incubators were equipped with quanta meters and the quanta actually available for photosynthesis during incubation in each incubator was carefully monitored and recorded.

The technique used for the simulated-in-situ procedure was the determinant for the Jitts depths and for the water samples used for other analyses. This comes about as follows. At about time 1000 a measurement was made of quanta as a function of depth at the station site. The blue filters in the Jitts incubators transmitted a fixed percentage of incident quanta. The depths at which these percentage transmissions occur in the ocean were read from the curve of quanta

versus depth for the station and these depths became the Jitts depths. This technique resulted in all incubations being conducted under very nearly the same selected levels of quanta.

The determination of chlorophyll concentration was the responsibility of Dr. Ian Baird. Dr. Baird also used water from the Jitts bottles and, at greater depths, from the Nansen bottles. A typical station analysis consisted of 10 to 14 samples from as many depths. Both chlorophyll-a and phaeo-pigments were determined. The determination of chlorophyll-a was done by means of a Turner fluorometer and also by a standard spectrophotometer method.

Mr. Malone, who worked with Dr. Baird, was collecting data for a doctoral thesis which involved the determination of chlorophyll-a in nannoplankton versus net plankton. His study fitted in beautifully with the interests of the Working Group and provided a more detailed study of chlorophyll concentration than had originally been anticipated.

A daily record of all measurements made is included in the Appendix.

Planned Track

The track of the expedition was primarily planned with the objective of reaching ocean waters with widely different productivities. From Miami the track was planned to round the west end of Cuba, travel through the Caribbean Sea to the Panama Canal, through the canal into the Gulf of Panama and then southerly into the plankton rich water along the coast of South America, then southwesterly into south Pacific water as far as time would permit.

On the return voyage it was planned to repeat some of the stations south of the canal and one or two in the Caribbean. The return track would then take us through Windward Passage and into the Sargasso Sea to about 25°N65°W and then westward to Miami.

Although an early request was made to the government of Ecuador to enter the coastal waters off Ecuador for research purposes, their answer was overtly delayed and the conditions imposed by them were unacceptable, nor could their conditions be reconciled with the time requirements of the expedition.

The studies in the ocean and the collection of water samples were carried out from two deck areas, the stern area and an outboard station on the starboard side. These areas were separated by about 25 feet. The stern area had been specially equipped with a 25-foot aluminum I-beam with a trolly and appropriate rigging. The heavy optical instrumentation could be conveniently launched and hauled out to the end of the boom where the optical perturbation caused by the ship would be minimized. Also available in this area and accessible from the deck above, were the ship's smaller A-frame and two heavy duty winches. These launching facilities were prepared and used alternately. At times, wire was being payed out from the A-frame on the upper deck while instrumentation was being retrieved from the stern boom. Although the wires often crossed, careful observation and planning prevented their fouling.

On the starboard side the ship's equipment provided an overhanging platform, a suitable davit with metering pulleys and heavy duty winches. The United States group had also located an electric cable winch in this area. The STD was launched at this location followed by the Nansen cast and later by instrumentation requiring the electric cable winch. It was thus necessary to employ three wires at this location and to rerig the davit with the block appropriate for each wire.

The launching of the in-situ primary productivity experiments and the Roberts buoy also took place on the starboard side.

The scheduling of events to meet the requirements of this program was complex. The optical measurements required that the stern of the ship be exposed to the sun. The work from the starboard platform required that the wind should be on the starboard side. The in-situ primary productivity samples had to be launched at noon on the windward side and recovered at sunset. The most valuable time for optical measurements was the four hours around sun noon. All instru-

ments, of course, had to be out of the water in order to maneuver the ship. The ship's engines required time to warm up, etc., etc.

The reconciliation of these conflicting requirements required close cooperation between the ship's officers and the scientific party. Fortunately the ship could usually be hove-to with the wind on the starboard and the stern exposed to the morning sun. At noon, as soon as the Roberts buoy was adrift, the ship was often rotated 180° to expose the stern to the sun during the afternoon. On days when conditions did not favor this simple solution, the ship was turned more often.

A chronological routine for the measurements in the ocean was soon established and is illustrated in Table I.

TABLE I

Sun Time	Starboard Platform			Ship Orientation	Stern		Over The Side
	Wire 1	Wire 2	Wire 3		A-Frame	Boom	
0800				Wind on Starboard			
0900	Hopkins	Austin C-Meter		↓			Throndsen Net Sam. Malone 3-m. Sam.
1000		Saijo Water Sam		Sun on Stern Wind on Starboard		Morel Optics Kjell N.	Hopkins Mechn.BT Jitts H-Meter
1100		Albert's NansenCst Saijo		↓	Jitts Water Sam		
1200		In-Situ Samples	Austin C-Meter	Sun on Stern and on Deck Incubator		Smith Optics	Marker Buoy over
1300			↓	↓		Optics Nygaard-Smith	Amici Prism
1400			↓	↓		Morel Optics	Hopkins Mech.BT
1500						Nygaard Morel Optics	Malone 3-M Sam.
1600						Nygaard Morel Optics	
1700		Saijo		Steaming to Marker Buoy		Nygaard Morel Optics	Marker Buoy
1800		Samples Aboard	Austin Scattering			Nygaard Scattering	Recovery

Intercalibration and Standardization

A tungsten-iodine lamp mounted on a 2-meter optical bench was provided on the ship for purposes of standardization and intercomparison of the various radiant energy detectors. This facility was used for checking the linearity of response of photodetectors, comparing the outputs of various instruments, rechecking output over elapsed time, determining absolute calibration within the range of energy levels provided by the lamp and performing other tests on the phototubes and photocells being used in the work.

In addition to this, the last two experimental stations, both in Sargasso Sea water, were devoted to direct underwater intercomparisons. All available radiometric instruments were first fastened to the frame of the Scripps spectroradiometer and readings were taken simultaneously with all instruments at specified depths to 90 meters. Then the same procedure was carried out with the same complement of instruments attached to the frame of the French spectroradiometer. The French and Scripps spectroradiometers could not be launched simultaneously because together they exceeded the load limit of the stern boom.

Sponsorship

The DISCOVERER Expedition was a planned activity of the Scientific Committee on Oceanic Research Working Group 15 and enjoyed the financial and moral support of SCOR, UNESCO and IAPSO.

As stated earlier in this report, the ship DISCOVERER was provided by the U.S. Coast and Geodetic Survey through the courtesy of Rear Admiral D.A. Jones, Director, Coast and Geodetic Survey, Environmental Science Services Administration and Dr. Harris Stewart, Director of the Atlantic Oceanographic and Meteorological Laboratories of ESSA.

The parent laboratories of the various Working Group members, of course, provided direct support of the participant's time during the expedition, as well as the use of specialized scientific equipment. In many cases the parent laboratories supported the modification of construction of special equipment to be used during the expedition and plan to support the time necessary for data reduction.

For the DISCOVERER Expedition, scientific skills in addition to those available among Working Group members were required to carry out the integrated program of research that had been planned. The additional expenses involved in securing skilled personnel, providing for suitable equipment, transporting both to and from the ship, and solving the many local problems attendant to a large expedition received financial and/or direct-action support from the NSF, the Royal Society, the ONR and the U.S. Air National Guard. Travel for two graduate students was provided in one case by the Hopkins Marine Station and in the other case by Florida State University.

U. S. DEPARTMENT OF COMMERCE
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
RESEARCH LABORATORIES

IN REPLY REFER TO:

RELEVANT RADIO MESSAGES SENT AND RECEIVED BY USC&GS SHIP DISCOVERER DURING THE SCOR/LNLP EXPEDITION

R 111800Z MAY 70

FM ATLANTIC OCEANOGRAPHIC LABS

TO USC&GSS DISCOVERER

BT

UNCLAS

PASS TO STEWART.

BUILDING OFF DEAD CENTER NOTHING DEFINITE LOOKS GOOD FOR PRIOR TO YOUR RETURN. WILL ADVISE ASAP. APPEARS ANDY RANG BELL AT BOB WITH RESTON JOB. I LEAVE MIAMI MAY 21 AT NOON. SIGNED KOFOED

TOR 11/1857Z/NMG/16 MHZ RATT/TJ

WTEA DE NMG

R 201505Z MAY 70

FM ATLANTIC OCEANOGRAPHIC LABS

TO USC&GSS DISCOVERER

BT

UNCLAS

PASS TO STEWART. FUNDS RELEASED FOR LAB.

FLA DELEGATION INFORMED...WHITE. SIGNED KOFOED

BT

TOR 20/1647Z/NMG/16 MHZ RATT/TJ

ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION

RF 20 Box 3

Environmental Science Services
Administration

X

1030000 191204

GLAVGIMET
MOSCOW USSR

URGENT FOR FEDOROV. PLEASE IGNORE MY PREVIOUS MESSAGE REGARDING RADIOMETEORSONDE COMPARISONS. FINANCIAL ARRANGEMENTS THROUGH ICSU UNKNOWN TO ME. I REGRET INCORRECT INFORMATION ON FINANCIAL ARRANGEMENTS FOR YOUR SCIENTISTS. SINCERELY HOPE YOUR SCIENTISTS CAN STILL PARTICIPATE IN COMPARISONS BY JOINING ESSA SHIP DISCOVERER AT BALBOA, CANAL ZONE ON MAY 8. JULIUS LONDON, SECRETARY RADIATION COMMISSION WILL PROVIDE ALL TRAVEL FROM NEW YORK TO BALBOA AND RETURN TO NEW YORK AT END OF CRUISE. ADDITIONAL INFORMATION ON TRAVEL ARRANGEMENTS FROM NEW YORK TO SHIP AND RETURN WILL BE PROVIDED URGENTLY.

WHITE

RECEIVED MAY 5 1970

1 1

CODE	SURNAME	DATE	CODE	SURNAME	DATE
	8406		5/1/70	9:20 AM	
147					

UNCLASSIFIED

R. Culnan

FILE COPY

ESSA FORM 61-2 (FORMERLY ESSA FORM

P 081940Z MAY 70
FM COAST AND GEODETIC SURVEY ATLANTIC MARINE CENTER NORVA
TO RUCLFWA/USCGSS DISCOVERER WTEA
COM GRNC
BT
UNCLAS
CLEARANCE TO CONDUCT RESEARCH IN ECUADORIAN TERRITORIAL
WATERS NOT REPEAT NOT APPROVED.
BT

TOR 09/1326Z/NMG/12 MHZ RATT/TJ

R 082050Z MAY 70
FM ACTING DIRECTOR ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LAB MIAMI
TO USC&GSS DISCOVERER
BT
UNCLAS
PASS TO STEWART.
REQUEST FOR FUNDS APPROVED PER ESSA HQ.
INFO COPY ADMINISTRATOR AMC.
BT

TOR 09/1328Z/NMG/12 MHZ RATT/TJ

R 111845Z MAY 70

FM COAST AND GEODETIC SURVEY ATLANTIC MARINE CENTER NORVA

TO RUCLFWA/USCGSS DISCOVERER WTEA

COM GRNC

BT

UNCLAS

References

A. PANAMA STATE DEPT MESSAGE NO 1708, 091905Z MAY 70

B. OUR 081940Z MAY 70

C. YOUR 051820Z MAY 70

PERMISSION TO VISIT GALAPOGOS NOT REPEAT NOT APPROVED.

BT

TOR 11/1935Z/NMG/16 MHZ RATT/TJ

VZWHCA3 MIA 211600

ESSA NATIONAL HURRICANE CENTER MARINE/AVIATION ADVISORY NUMBER 5
TROPICAL STORM ALAMA 1600Z MAY 21 1978..

SQUALLS OCCASIONALLY REACHING GALE FORCE OVER JAMAICA AND
EASTERN CUBA.

STORM CENTER LOCATED NEAR LATITUDE 18.5 NORTH LONGITUDE 80.4 WEST
AT 21/1600Z. POSITION GOOD/ACCURATE WITHIN 20 MILES BASED ON
AIR FORCE RECONNAISSANCE.

PRESENT MOVEMENT STATIONARY.
MAX SUSTAINED WINDS OF 60 KT NEAR CENTER.
RAD OF 30 KT WINDS 200 NE 150 SE 50 SW 100 NW QUAD.
REPEAT CENTER LOCATED 18.5N 80.4W AT 21/1600Z.

12 HOUR FORECAST VALID 22/0400Z LATITUDE 19.0N LONGITUDE 80.2W.
MAX WINDS OF 50 KT NEAR CENTER.
24 HOUR FORECAST VALID 22/1600Z LATITUDE 19.6N LONGITUDE 79.4W.
MAX WINDS OF 45 KT NEAR CENTER.

HEAVY PRECIPITATION OVER CENTRAL AND EASTERN CUBA AND JAMAICA.

NEXT ADVISORY AT 21/2200Z

TOD 21/1605Z MAY 16MHZ RATT WTEA WTEG KKKK

NMG NMG DE WTEA WTEA RRRRRRR QSL QSL QSL KKKKKKK

(AP) HURRICANE "ALMA" HAS RAKED THE BRITISH RESORT ISLAND OF GRAND CAYMAN IN THE WESTERN CARIBBEAN WITH DRIVING SQUALLS AND HEADED

TOWARD THE GULF OF MEXICO. HURRICANE HUNTER PLANES FLEW INTO THE STORM AND REPORTED EIGHTY-MILE-AN-HOUR WINDS NEAR ITS CENTER. ALMA, NEWLY-SPAWNED FIRST HURRICANE OF THE SEASON, WAS LOCATED FIVE-HUNDRED FIFTY MILES SOUTH OF MIAMI AND ONE-HUNDRED MILES SOUTH OF GRAND CAYMAN. GALES IN SQUALLS ARE FORECAST FOR CUBA AND THE FLORIDA STRAITS THURSDAY AFTERNOON.

POOR HEALTH. HOUSE MAJORITY LEADER [illegible]

RECEIVED
MAY 21 1970
USC&GSS
DISCOVERER

R 211405Z MAY 70

FM ATLANTIC OCEANOGRAPHIC LABS

TO USC&GSS DISCOVERER

BT

UNCLAS

PASS TO STEWART. THANKS FOR MESSAGE RE BUILDING. PLEASE BE COOL. NAVY WAS SET UP VIA ESSA AND DOC LAST WEEK. MORE GOOD NEWS. WE NOW HAVE 3.1 F.E.C. DOLLARS IN HAND. WILL BE AT BALBOA FACILITY FRIDAY. SIGNED KOFOED

BT

TOR 21/1455Z/NMG/16 MHZ RATT/TJ

RR NMG

DE WTEA NR[illegible]07

R 2019 15Z MAY 70
FM USCGSS DISCOVERER
TO ATLANTIC OCEANOGRAPHIC LABS, MIAMI, FLA
BT
UNCLAS
PASS TO KOFOED
ONE MORE HURDLE CLEARED. GREAT NEWS! PLEASE INITIATE LETTER
TO NAVFAC FROM ESSA SO BID REQUESTS CAN GO OUT ASAP.
DISCOVERER ARRIVES BALBOA PIER FACILITIES 0900 LOCAL TIME
MAY 22. SEE YOU THEN. SIGNED STEWART
BT

TOD/20 1921Z/NMG/16 MHZ RATT/TJ

NNNN

RR NMG
DE WTEA NR05

R121600Z
FM USCGSS MAY 70
TO ATLANTIC OCEANOGRAPHIC LABS, MIAMI, FLORIDA
INFO C AND GS AMC NORVA
BT
UNCLAS
ATTENTION KOFOED
1. GREAT ON THE BUILDING. KEEP ME APPRISED OF DEVELOPMENTS.
2. SEVEN SCOR STATIONS AND EIGHT RADIOMETERSONDE ASCENTS
COMPLETED SUCCESSFULLY. TYLE AND KUHN PLEASED WITH DATA.
AND HIGH CAPABILITY AND COOPERATION OF DISCOVERER
3. NEPTUNUS REX ABOARD YESTERDAY FOR FINE EQUATOR CROSSING.
ALL GOES WELL BUT OUTSIDE EQUADORIAN WATERS. SHIP DUE
BALBOA FORENOON MAY 22. SIGNED STEWARD
BT
TOD 12/1747Z/NMG/16 MHZ RATT/TJ

NNNN

R 111800Z MAY 70

FM ATLANTIC OCEANOGRAPHIC LABS

TO USC&GSS DISCOVERER

BT

UNCLAS

PASS TO STEWART.

BUILDING OFF DEAD CENTER NOTHING DEFINITE LOOKS GOOD FOR PRIOR TO YOUR RETURN. WILL ADVISE ASAP. APPEARS ANDY RANG BELL AT BOB WITH RESTON JOB. I LEAVE MIAMI MAY 21 AT NOON. SIGNED KOFOED

TOR 11/1857Z/NMG/16 MHZ RATT/TJ

RB NNG
DE WTEA NR07

R151842Z MAY 70
FM ATLANTIC OCEANOGRAPHIC LABS MIAMI, FLORIDA
BT
UNCLAS
PASS TO KOFOED
1. DISCOVERER DOCKS AT PORT OF BALBOA, MORNING 22 MAY
2. I REMAIN WITH SHIP THROUGH 23 MAY FOR OVERLAP WITH YOU.
3. SUGGEST CONTACTING WILLIAMS METIVIER ESSA PORT MET OFFICER CRISTOBAL ON ARRIVAL FOR ASSISTANT IN COLLECTING SHIPS MAIL FROM POSTMASTER BALBOA.
4. PLEASE FIND OUT DATE OF CRD. ALDERMAN'S APPOINTMENT WITH DR. WEISER, USPHS, THAT WAS MADE BY CAPT. STARK.
5. TODAT AT SOUTHERN MOST STATION AT 27-52S 090-12W.
ALL CONTINUES WELL. SIGNED STEWART
BT
TOD 15/1903Z/NMG/16 MHZ RATT/TJ

"

P 142035Z MAY 70

FM C AND GS AMC NORVA

TO RUCLFWA/USCGSS DISCOVERER/WTEA

COM GRNC

BT

UNCLAS

YOUR 141510Z MAY 70

BOUNDARIES OF BROKEN CLOUDS AS OF 141715Z FOLLOW. CLOUDS WILL ALWAYS BE TO LEFT OF LINE PLOTTED THRU FOLLOWING POINTS BEGINNING AT:

LAT	LONG
05.5 S	94.0 W
01.0	92.4
10.0	89.5
10.0	88.0
12.0	87.0
10.0	83.0
10.0	85.5
08.8	85.5
08.0	87.5
07.0	88.0
07.0	85.0
10.0	83.0
FORMATION NUMBER 2	
01.0	92.0
04.5	90.0
03.0	93.0
FORMATION NUMBER 3	
00.0	89.0
03.0	88.0
04.0	86.0
05.0	86.0
03.0	89.0
01.0	90.0
00.0	91.0
FORMATION NUMBER 4	
02.0	81.0
04.0	84.0
01.0	85.0
00.0	86.0

20 MILE IN DIAMETER BREAK AT 07.6S, 89.4W; 30 MILE DIAMETER BREAK AT 04.8S, 89.5W; 40 MILE DIAMETER BREAK AT 05.5S. 84.0W

BT TOD 15/0015Z/NMG/16 MHZ RATT/TJ

WTEA DE NMG

R141725Z MAY 70
FM ATLANTIC OCEANOGRAPHIC LABS BT
UNCLAS
PASS TO STEWARD.
1. AMMONIUM MOLIBDATE IN HAND NO PROBLEM.
2. WHERE DOES ONE JOIN DISCOVERER? RODMAN, BALBOA, CRISTOBAL,
OTHER?? SCHEDULE HOW TO ARRIVE BALBOA PAA 87
1335 MAY 21. PLEASE ADVISE.
3. MANY TOPICS TO REVIEW. PLEASE ALLOW ONE DAY IF POSSIBLE.
SIGNED KOFOED.
BT

NNNNG
TOD 141800Z MAY 70 2 16MHZ WTAE RATT/KK

RR NMG -T-
DE WTEA NR05

R 131455Z MAY 70
FM USCGSS DISCOVERER/WTEA
TO ATLANTIC OCEANOGRAPHIC LABS, MIAMI, FLORIDA
BT
UNCLAS
ATTENTION KOFOED
1. CAN YOU BRING FOR ALBERTS 100 GRAMS AMMONIUM (PARA) MOLYBDATE, (NH4)6 M07024 4H20. IT IS A STANDARD REAGENT USED AT IMS OR TABL.
SIGNED STEWART
BT

O.K. RGA

TOD 13/1530Z/NMG/16 MHZ RATT/TJ

NNNN
CFM (NH4)6 M07024 4H20

for
Dr. Stewart

RR NMG
DE WTEA

R 141510Z MAY 70
FM USCGSS DISCOVERER/WTEA
BT
UNCLAS
SATELLITE PHOTO REQUEST

1. SHIP POSITION 05-20S 087-17W UNDER HEAVY STRATUS CLOUD COVER. REQUEST ASAP COORDINATES OF CLOUD SYSTEM WITHIN 500 MILES RADIUS FROM LATEST SATELLITE PHOTOGRAPHS. THIS INFORMATION AVAILABLE FROM OLIVER OR FERGUSON, NESC, FTS 301-440-7380.
BT

NNNNG
TOD 14/1524Z 15 MHZ NMG RATT KKK

RR NMG
DE WTEA NR04

R141500Z MAY 70
FM USCGSS DISCOVERER/WTEA
TO C AND GS AMC NORVA
BT
UNCLAS
PASS TO DR. H.K. WEICKMANN, ESSA-APCL-R31, BOULDER, COLO.
ZIP CODE 80302 FTS TELEPHONE 303-447-6382
FOR YOUR INFORMATION AND ADVISE DR. LONDON AND MRS. STEARNS
PER HIS REQUEST. HAVE COMPLETED ELEVEN VERY SECCESFUL FLIGHTS.
CURSORY LOOK AT DATA SHOWS AGREEMENT EXCEPTIONALLY GOOD.
FLIGHTS
WERE OVER OCEAN TEMPS RANGING FROM 21C TO 29C MOSTLY
CLOUDLESS.
TWO DAYS JAMAICA LIDAR SIMULTANEOUSLY RUN. VENTILATED
RADIOMETER,
TWO CHANNEL CHOPPER RADIOMETER, PYRANOMETER AND VOLTZ
PHOTOMETHER ALL RUNNING SUCCESSFULLY. WILL HANDLE FILTER
ORDERS FOR PRT-6
ON RETURN. REGARDS. SIGNED DR. P. M. KUHN

TOD 14/1520Z/NMG/16/MHZ RATT/TJ

NNNN

Dr. Stewart

RR NMG -T-
DE WTEA NR05

R 131455Z MAY 70
FM USCGSS DISCOVERER/WTEA

TO ATLANTIC OCEANOGRAPHIC LABS, MIAMI,FLORIDA
BT UNCLAS
ATTENTION KOFOED
1. CAN YOU BRING FOR ALBERTS 100 GRAMS AMMONIUM (PARA) MOLYBDATE,
(NH4)6 M07024 4H20. IT IS A STANDARD REAGENT USED AT IMS OR TABL.
SIGNED STEWART
8T

O.K. RGA

TOD 13/1530Z/NMG/16 MHZ RATT/TJ

NNNN
CFM (NH4) 6 M07024 4920

Dr Stuart

RR NMG –T
DE WTEA NR04

R131425Z MAY 70
FM USCGSS DISCOVERER/WTEA
TO SCRIPPS RADIO (WWD) LA JOLLA, CALIFORNIA
BT
UNCLAS
PASS TO DR. W. NEIREMBER, DR W. WOOSTER (C/O MRS. J. MEYERS),
DR. S. DUNTLEY
A.YOUR 122130Z MAY 70
1. MADE SEVERAL GOOD STATIONS IN THE CARIBBEAN AND ARE NOW CONCENTRATING OUR EFFORTS ON THREE WATER TYPES; COASTAL WATER IN THE GULF OF PANAMA, UPWELLING WATER IN THE WESTWARD FLOW FROM THE PERU CURRENT, AND CLEAN PACIFIC WATER AT ABOUT TEN DEGREES SOUTH LATITUDE. HAVE EXPERIENCED SOME EQUIPMENT BREAKDOWNS BUT SKILLFUL REPAIRS BY SHIP PERSONNEL KEEP THE PROGRAM GOING.
2. EXPECT TO ARRIVE BALBOA, CANAL ZONE FRIDAY MAY 22, AM, AND DEPART THERE ABOUT MAY 26.
3. ASK T. J. PETZOLD, VIS LAB, TO SEND ONE HUNDRED ADDITIONAL TRANSMISSOMETER GRAPH SHEETS FOR USE AFTER CANAL.
4. SHIP PREFERS COMUNICATIONS VIA COAST GUARD RADIO NET ANYTIME AS NEEDED. SIMILAR MESSAGES WILL BE FURNISHED FROM TIME TO TIME. SIGNED TYLER.

O.K. RGA

TOD/13/1522Z/NMG/16/ MHZ RATT/TJ

NNNN

P 081940Z MAY 70
FM COAST AND GEODETIC SURVEY ATLANTIC MARINE CENTER NORVA
TO RUCLFWA/USCGSS DISCOVERER WTEA
COM GRNC
BT
UNCLAS
CLEARANCE TO CONDUCT RESEARCH IN ECUADORIAN TERRITORIAL
WATERS NOT REPEAT NOT APPROVED.
BT

TOR 09/1326Z/NMG/12 MHZ RATT/TJ

P 082025Z MAY 70
FM COAST AND GEODETIC SURVEY ATLANTIC MARINE CENTER NORVA
TO RUCLFWA/USCGSS DISCOVERER WTEA
COM GRNC
BT
UNCLAS
OUR P 081940Z MAY 70
THE AMERICAN EMBASSY IN PANAMA HAS TRAFFIC CONCERNING CLEARANCE.
BT

TOR 09/1330Z/NMG/12 MHZ RATT/TJ

UNIVERSITY OF CALIFORNIA, SAN DIEGO

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

VISIBILITY LABORATORY
SCRIPPS INSTITUTION OF OCEANOGRAPHY

SAN DIEGO, CALIFORNIA 92152

April 17, 1970

Professor Warren S. Wooster
c/o Dr. Mario Ruivo
Chief, Research Programs Section
Fisheries Biology Branch
Food & Agriculture Organization of the UN
Viale delle Terme de Caracalla
Rome, ITALY

Dear Warren,

As you can see, I am now in Miami.

The group here at ESSA have really done a great job for us. Lcdr. Patrick has been busy reconcilling the requirements of our research with the limitations of the ship. Jack Kofoed has been taking care of shipments, and Stew has been helping us with funding problems with considerable success, and with international problems with less evident success.

We do not yet have permission from the government of Ecuador to work in the plankton rich waters near their shores. I presume that Ecuador is a member, in good standing, of the UN and it therefore seems very strange to me that they would stand in the way of a research endeavor sponsored by the United Nations. In fact, I should think it would be very embarrassing to Ecuador to have eminent scientists from eight or nine major nations return home from this important expedition to relate to their colleagues that Ecuador had not cooperated and had thus prevented an important aspect of our work. Furthermore, the various scientific reports that must result from this expedition would surely reveal any lack of support by Ecuador as the real reason for curtailment of scientific results.

Of course, there are a few days left before we sail and it may be that I have misinterpreted their lack of response. I hope so.

Sincerely,

John E. Tyler
Chairman, WG-15

INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH

c/o FAO Fishery Resources Division
Via delle Terme di Caracalla
Rome, Italy 22 April 1970

532 WG 15

Mr. John E. Tyler
c/o ESSA, AOML
901 South Miami Avenue
Miami, Florida 33130

Dear John:

Thank you for your cheerful letter of 17 April. To be honest, I was a bit reluctant to open it, fearing that further insuperable difficulties had arisen.

It is difficult to predict whether Ecuador at the last minute will grant permission. I suppose Bill Sullivan in State is pursueing the matter. Whatever the outcome, it will not be easy to embarass Ecuador on such a problem. But you might keep in mind a couple of alternative locations of highly productive waters.

One is the Costa Rica Dome, in the high seas south of Puntarenas, Costa Rica. The thermocline is always extremely shallow and the productivity relatively high in this region. Without easy access to the literature, I can't give you the position of this feature, but Bruce Taft should be able to do so.

The other possibility is the northern part of the Peru Current, just south of the Equatorial Front. If you cross the equator midway between Ecuador and the Galápagos (about 85° W), you should cross the front at one or two degrees south. There is a rapid change in surface temperature and salinity and the thermocline becomes more shallow and weak. The waters are characteristic of the Peru Current, and I believe the productivity is relatively high. See my paper in the Fuglister volume of Deep-Sea Research for further details. We have always worked freely in this region without permission from anyone.

Stew sent me a copy of the press release. I was surprised to see the biological measurements emphasized so much more than the physical measurements. He also sent me a copy of the Ivanoff cartoon, for which please give him my thanks.

I wish you the best of success. Let me know how it all turns out.

Yours sincerely,

Warren

Warren S. Wooster

ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION

April 18, 1970

Miss Ellen Gavrischeff,
Soviet and Eastern European Exchanges
Department of State
Washington, D. C. 20520

Dear Miss Gavrischeff,

I am now in Miami at the ESSA laboratory and expect to be here u until the ship departs, which is estimated to be April 30.

The Russian Scientists, Yuhen Ochakovsky, and Anatol Susliaev, are expected to fly Aeroflot to N.Y. on April 23. Their route from there to Miami is not known to me at the present time.

I am enclosing a letter that I wrote to Prof. Wooster, President of SCOR, regarding clearance from the Government of Ecuador to work in the plankton-rich waters near their shores. Clearance for this was initiated by this laboratory, that is, ESSA, and was I presume forwarded to the State Department. However, I have not seen the correspondence and do not know if the Government of Ecuador has in fact been told that this expedition is sponsored by UNESCO as well as other international organizations. Furthermore I doubt very much if Ecuador has been told that this expedition comes under the Soviet and Eastern European Exchange Program.

If you are in a position to clarify the situation for us we would certainly appreciate any help or assistance that you can provide.

Sincerely yours,

John E. Tyler, Chairman WG15
ESSA-Atlantic Oceanographic and Meteorological L
Laboratories
901 South Miami Ave.,
Miami, Florida 33130

CODE	SURNAME	DATE	CODE	SURNAME	DATE

ILE COPY

ESSA FORM 61-2 (FORMERLY ESSA FORM 7)

082050Z MAY 70
M ACTING DIRECTOR ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LAB MIAMI
O USC&GSS DISCOVERER
T
NCLAS
ASS TO STEWART.
EQUEST FOR FUNDS APPROVED PER ESSA HQ.
NFO COPY ADMINISTRATOR AMC.
T

OR 09/1328Z/NMG/12 MHZ RATT/TJ

RR NMG
DE WTEA NRØ3

R Ø81405Z MAY 7Ø
FM USCGSS DISCOVERER/WTEA
TO C AND GS AMC NORVA
BT
UNCLAS
ECUADOR
1. REQUEST ASAP LATEST STATUS DIPLOMATIC CLEARANCE REQUEST, ECUADORIAN TERRITORIAL WATERS.
2. CAN SHIP ENTER ECUADORIAN TERRITORIAL WATERS WITH "PRELIMINARY" CLEARANCE?
BT

TOD 08/1410Z/NMG/16 MHZ RATT/TJ

NNNN

TOD/13/1522Z/NMG/16 MHZ RATt/TJ
WTEA DE NMG
R 08 15 1 0 Z MAY 70
FM C AND GS AMC NORVA
TO USCGSS GS AMC NORVA
UNCLAS
YOUR *071345Z* MAY 70
CADLE SHIPPED UNITED AIR FREIGHT LEAVING NORFOLK 072130Z MAY 70.
BT
ZDK WTEA 08/1601Z MAY 8 MHZ RATT KK

R 071740Z MAY 70

FM C AND GS AMC NORVA

TO USCGSS DISCOVERER WTEA

BT

UNCLAS

RUSSIAN SCIENTISTS EXPECTED FOR RADIOMETERSONDE INTERCOMPARISON

UNABLE TO COME. ACKNOWLEDGE.

BT

TOR 071846Z/NMG/12 MHZ RATT/TJ

RR NMG
DE WTEA NRØ8

R Ø71ØØZ MAY 7Ø
FM USCGSS DISCOVERER/WTEA
TO C AND GS AMC NORVA
BT
UNCLAS
RUSSIAN SCIENTISTS
A. YOUR Ø71740Z MAY 7Ø
1. ACKNOWLEDGED
BT
TOD 07/1911Z/16 MHZ RATT/NMG/TJ

NNNN

RR NMG
DE WTEA NRØ9

R Ø71955Z MAY 7Ø
FM USCGSS DISCOVERER/WTEA
TO C AND GS AMC NORVA
BT
UNCLAS
PASS TO PROF. JULIUS LONDON, DEPT. ASTRO GEOPHYSICS, UNIVERSITY OF COLORADO, BOULDER, COLORADO (8Ø3Ø2) FTS 3Ø3-443-2211
1. INTERCOMPARISON HAS BEEN VERY SUCCESSFUL. FIVE JOINT ASCENTS SO FAR. SORRY USSR SCIENTISTS COULD NOT COME. OBSERVATIONAL WEATHER IDEAL.
REGARDS /S/ P.M. KUHN
BT

TOD 07/2017Z/NMG/16 MHZ RATT/TJ

NNNN

RR NMG
DE WTEA NR04

R 071345Z MAY 70
FM USCGSS DISCOVERER/WTEA
TO C AND GS AMC NORVA
BT
UNCLAS
PASS TO KOFOED, AOML FOR INFO
1. TWO HUNDRED FIFTY METERS OF CABLE THREE SIXTEENTHS OR FIVE THIRTY SECONDS REQUIRED. CAN IT BE AIRFREIGHTED TO METIVIER FOR DELIVERY TO DISCOVERER ON MAY 8?
2. ALTERNATIVE IS TO CUT CABLE FROM REEL NOW ON OCEO WINCH.
BT

TOD 07/1417Z/NMG/16 MHZ RATT/TJ

RCA

NNN

STEW:
Copies for your info

R 061320Z MAY 70

FM ATLANTIC OCEANOGRAPHIC LABS MIAMI

TO USCGSS DISCOVERER

BT

UNCLAS

PASS TO STEWART THREE OPTICELLS SENT AIRMAIL TO

W. METIVIER, ESSA, CMZ. SIGNED KOFOED.

TOR 061353Z/12 MHZ RATT/NMG/TJ

WTEA WTEA DE NMG NMG

R 052005Z MAY 70
FM COAST AND GEODETIC SURVEY ATLANTIC MARINE CENTER NORVA
TO RUCLFWA/USCGSS DISCOVERER WTEA
COM GRNC
BT
UNCLAS
1. ADVISE IMMEDIATELY ETA CRISTOBAL AND BALBOA FOR POSSIBLE EMBARKATION OF TWO RUSSIAN SCIENTISTS.
2. OFFICIAL CLEARANCE FOR GOE STILL PENDING.
BT
FOD 05/2052ZMAY 70 WTEA/NMG 8MHZ RATTY QRU AR

RR NMG
DE WTEA NR04

R 061345Z MAY 70
FM USCGSS DISCOVERER
TO C AND CS AMC NORVA
BT
UNCLAS
CANAL EMBARKATIONS
A. YOUR 051335Z MAY 70
B. YOUR 052005Z MAY 70
1. ETA CRISTOBAL 082030Z MAY 70. ETA BALBOA UNCERTAIN DUE TO UNKNOWN LENGTH OF WAITING TIME FOR CANAL TRANSITING.
2. SINCE SHIP DOES NOT PLAN STOP BALBOA, REFERENCE PERSONNEL SHOULD EMBARK CRISTOBAL ALONG WITH CANAL BOARDING PARTIES. WILLIAM METIVIER,

PORT METEOROLOGICAL OFFICER, CRISTOBAL, CAN ADVISE ON BEST BOARDING PROCEDURE AND MAY BOARD HIMSELF. SUGGEST DORAN CONTACT METIVIER.
3. NEED KEPT CLOSELY ADVISED SITUATION REGARDING USSR SCIENTISTS AS SHIP HAS BILLETING PROBLEM. METIVIER, WEATHER BUREAU EMPLOYEE, SHOULD BE ALERTED TO SITUATION AND CAN BE REACHED VIA CODE W13 WEATHER BUREAU HEADQUARTERS.
BT

TOD 06/1437Z/NMG/16 MHZ RATT/TJ

RR NMG
DE WTEA NRØ3

R Ø51820Z MAY 7Ø
FM USCGSS DISCOVERER
TO C AND GS AMC NORVA
BT
UNCLAS
ECUADORIAN CLEARANCE
1. REQUEST STATUS
2. PENDING CLEARANCE RECEIPT, URGE THAT HOWARD APRIL, OFFICE OF INTERNATIONAL AFFAIRS, BE INSTRUCTED TO IMMEDIATELY ARRANGE WITH STATE DEPT A MESSAGE TO ECUADORIAN GOVERNMENT STATING THAT INTERNATIONAL SCIENTIFIC PARTY ABOARD DISCOVERER DESIRES PERMISSION FOR A SHORE VISIT OF GALAPAGOS ISLANDS.
BT

doctored to make it a bit more palatable to the Ecuadorians
HBJ

NNNN

RR NMG
DE WTEA NRØ3

R Ø5 182ØZ MAY 7Ø
FM USCGSS DISCOVERER
TO C AND GS AMC NORVA
BT
UNCLAS
ECUADORIAN CLEARANCE
AMC NORVA PASS AOML FOR INFO
1. REQUEST STATUS
2. PENDING CLEARANCE RECEIPT, URGE THAT HOWARD APRIL, OFFICE OF INTERNATIONAL AFFAIRS, BE INSTRUCTED TO IMMEDIATELY ARRANGE WITH STATE DEPT A MESSAGE TO ECUADORIAN GOVERNMENT STATING THAT INTERNATIONAL SCIENTIFIC PARTY ABOARD DISCOVERER DESIRES PERMISSION FOR A SHORE VISIT APPROXIMATELY MAY 19 OF SEVERAL HOURS FOR OBSERVATION ONLY AT GALAPAGOS ISLANDS. DISCOVERER'S DOCTOR CAN BE MADE AVAILABLE FOR TREATMENT OF ISLANDERS.
BT

TOD 05/1957Z/NMG/8682 KHZ RATT/TJ

NNNN

RR NMG
DE WTEA NR01

R 051410Z MAY 70
FM USCGSS DISCOVERER
TO ESSA ROCKVILLE, MD.
INFO C AND GS AMC NORVA
BT
UNCLAS
ATTENTION TO DR. ROBERT M. WHITE
AMC NORVA PASS TO DIR C AND GS, DIR ERL, ACTING DIR AOML
COAST SURVEY SAYS NO ADDITIONAL FUNDS AVAILABLE FOR SCOR TRIP.
WE ARE WORKING ELEVEN-HOUR CREW WORK DAY. EVEN WITH TWO
WATCHES, MINIMUN OF FOUR ADDITIONAL MAN-HOURS OF CREW REQUIRED
TO COMPLETE EACH DAYS WORK. AT TWENTY-TWO DOLLARS OVERTIME
NEEDED PER DAY FOR THIRTY DAYS, MINIMUM OF SIX HUNDRED AND
SIXTY DOLLARS NOT NOW AVAILABLE NEEDED TO COMPLETE SCOR/IAMAP
TRIP SUCCESSFULLY, CAN FUNDS BE AUTHORIZED DISCOVERER VIA AMC.
REPLY ASAP. OTHERWISE TRIP GOES WELL. WILL MAIL REPORT FROM
PANAMA. SIGNED STEWARD.

TOD 05/1444Z/NMG/8682 KHZ RATT/TJ

O. K.

NNNN

Reta

RR NMG
DE WTEA NRØ3

R Ø3 1 7ØØZ MAY 7Ø
FM USCGSS DISCOVERER
TO C AND GS AMC NORVA
BT
UNCLAS
1. ONLY ONE RADIOMAN ABOARD. IF NMC WEATHER BUREAU WANTS ØØØØ AND Ø6ØØ GMT WEATHER OBS TRANSMITTED, THREE HUNDRED DOLLARS EXTRA OVERTIME WILL BE REQUIRED TO COVER FOR CRUISE. PLEASE CHECK AND ADVISE.
BT

NNNN
TOD Ø3/1937Z / 8682 KHZ RATT/NMG NMG

NAME OF AGENCY

ACCOUNTING CLASSIFICATION

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PRECEDENCE

ACTION:

INFO.:

TYPE OF MESSAGE

☐ SINGLE ☐ BOOK

☐ MULTI-ADDRESS

SECURITY CLASSIFICATION

STANDARD FORM 14 MARCH 1957
GENERAL SERVICES ADMINISTRATION
FPMR (41CFR) 101-35 306

TELEGRAPHIC MESSAGE

OFFICIAL BUSINESS
U. S. GOVERNMENT

MESSAGE TO BE TRANSMITTED (Use double spacing and all capital letters)

THIS COL. FOR AGENCY

R 041700Z MAY 70

FM USCGSS DISCOVERER

TO C AND GS AMC NORVA

BT

UNCLAS

PLEASE PASS TO MRS. L.P. STEARNS, ESSA-ERL-APCL,

BOULDER, COLORADO (TEL 303-447-6208 FTS)

1. EYRE'S SHOP BILL FOR DC-6 RADIOMETER INSTALLATION

MUST BE CHARGED TO HAIL PROJECT PHILLIPS. CONTACT

LEE JOHNSON ADVISING THAT ALL PARTS FOR NASA JET

EXCEPT RADIOMETER HEAD WILL BE AT AMES 13TH. I WILL

BE AT BOULDER 23 AND 24 AND NASA SAN FRANCISCO 25TH.

SIGNED KUHN

BT

TOD 04/1800Z/8682 KHZ RATT/NMG/TJ

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PAGE NO. | NO. OF PAGES

NAME AND TITLE OF ORIGINATOR (Type)

ORIGINATOR'S TEL. NO.

DATE AND TIME PREPARED

SECURITY CLASSIFICATION

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(Signature)

U.S. GOVERNMENT PRINTING OFFICE 1965 OF—755-152—(58E)

14-305

R 111845Z MAY 70

FM COAST AND GEODETIC SURVEY ATLANTIC MARINE CENTER NORVA

TO RUCLFWA/USCGSS DISCOVERER WTEA

COM GRNC

BT

UNCLAS

A. PANAMA STATE DEPT MESSAGE NO 1708, 091905Z MAY 70

B. OUR 081940Z MAY 70

C. YOUR 051820Z MAY 70

PERMISSION TO VISIT GALAPOGOS NOT REPEAT NOT APPROVED.

BT

TOR 11/1935Z/NMG/16 MHZ RATT/TJ

NAME OF AGENCY

PRECEDENCE

ACTION:

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GENERAL SERVICES ADMINISTRATION
FPMR (41CFR) 101-35.306

TELEGRAPHIC MESSAGE

OFFICIAL BUSINESS
U. S. GOVERNMENT

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NR 1 USCGSS DISCOVERER CK9 04 1800 GMT BT

CICARCURACAO BT

CICARCURACAO POSREP 124 2106 8428 13215 540005

DISCOVERER

BT

TOD D4/2[illegible]Z/PJC/125[illegible]TJ

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14-305

NR 1 USCGSS DISCOVERER CK8 05 1800 GMT BT

CICARCURACAO BT

CICARCURACAO 125 1834 8133 13214 650006 DISCOVERER

BT

TOD 05/1809Z/PJC/12570 KHZ/TJ

NR 1 USCGSS DISCOVERER CK9 06 1530 GMT BT

CICARCURACAO BT

CICARCURACAO POSREP 126 1630 7858 12814 650006 DISCOVERER

BT

TOD 06/1745Z/PJC/16754 KHZ/TJ

NR 1 USCGSS DISCOVERER CK 13/11 08 1830 GMT BT

CICAR CURACAO BT

CICAR CURACAO LAST POSREP 128 0948 7941 STATION 670006

DISCOVERER BT

TOD 08/1920Z/PJC/13042/12567/TJ

NR 1 USCGSS DISCOVERER CK 12/10 07 1530 GMT BT
CICAR CURACAO BT
CICAR CURACAO POSREP 127 1340 7849 19314 660006 DISCOVERER
BT

TOD 07/1545Z/PJC/480/KHZ/TJ

NR 1 USCGSS DISCOVERER CK 13/11 08 1830 GMT BT

CICAR CURACAO BT

CICAR CURACAO LAST POSREP 128 0948 7941 STATION 670006

DISCOVERER BT

TOD 08/1920Z/PJC/13042/12567/TJ

NAME OF AGENCY

PRECEDENCE

ACTION:

INFO.:

TYPE OF MESSAGE

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GENERAL SERVICES ADMINISTRATION
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OFFICIAL BUSINESS
U. S. GOVERNMENT

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START MESSAGE ADDRESS HERE

NR 1 WILLEMSTAD CURACAO CK 16 4 1313 BT

MASTER DISCOVERER/WTEA PJC BT

SAREPCICAR 124 ASKOLD YESTERDAY 1822 7542 DISCOVERER

FIRST YESTERDAY 2356 8246 BT CICAR CURACAO

BT

TOR 04/2123Z/PJC/13042/TJ

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14-305

WILLEMSTAD CURACAO NR 1 CK 16 5 1612 BT

MASTER C DISCOVERER/WTEA PJC BT

SAREPCICAR 125 ASKOLD YESTERDAY 1820 7547 DISCOVERER YESTERDAY

2106 8428 BT CICAR CURACAO

TOR 06/1733Z/PJC/17170 KHZ/TJ

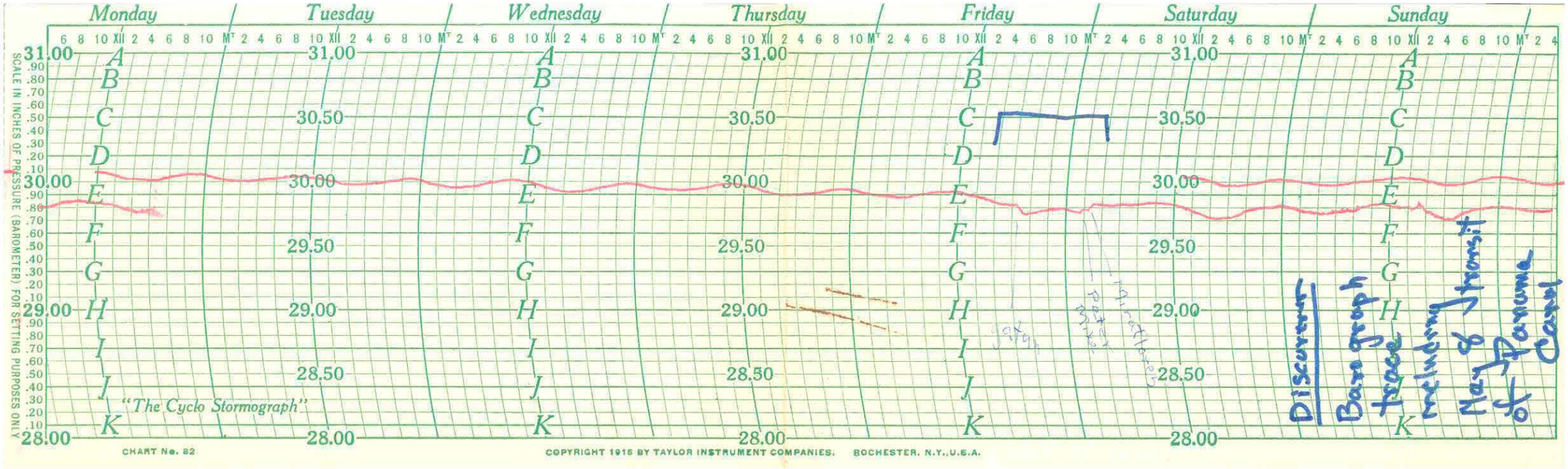
WILLEMSTAD CURACAO NR 1 CK 13 6 1954 BT

MASTER DISCOVERER/WTEA PJC BT

SAREPCICAR 126 DISCOVERER 1630 7858 ASKOLD 1820 7547 BT CICAR CURACAO

TOR 07/1537Z/PJC/438 KHZ/TJ

WILLEMSTAD CURACAO 1 13 7 1722 BT
MASTER DISCOVERER/WTEA PJC BT
SAREPCICAR 127 ASKHOLD 1820 7547 DISCOVERER 1340 7849 BT CICAR CURACAO
TOD 08/1915Z/PJC/13042/12567/TJ


Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
SCALE IN INCHES OF PRESSURE (BAROMETER) FOR SETTING PURPOSES ONLY
31.00
30.50
30.00
29.50
29.00
28.50
28.00
"The Cyclo Stormograph"
CHART No. 82
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Discussion
Barograph trace indicating transit of Panama Canal