H ~~SECRET~~
WORKING PAPER, DESTROY
OR CONTROL BY _____

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL ENGINEERING DEPARTMENT

Memorandum ME 44

TO: Distribution DATE: July 27, 1971

FROM: L.B. Molaskey ✓

SUBJECT: Recovery of RV - #3

A meeting was held, this date at HQS, to formulate plans for the recovery of RV #3 of SVI from the bottom of the ocean off Hawaii.

Attendees

Cdr. E.E. Henifin	U.S. Navy
L/C J.P. Hillock, Jr.	SPO
Maj. R.A. Schow, Jr.	SPO
Mr. R.A. Koch	EK
Mr. D.H. Schoessler	EK
Mr. L.B. Molaskey	SSC
Mr. D.W. Patterson	HQS
[redacted]	HQS
	HQS
	HQS (Security)

The agenda covered is as follows:

AGENDA

1. Re-entry footprint
2. Impact loads and damage assessment
3. Recovery configuration and constraints
4. Equipment requirements
5. Despooling and processing
6. Payload handling
7. Transportation/logistics
8. Organization
9. Security
10. Schedule
11. Cost and funding

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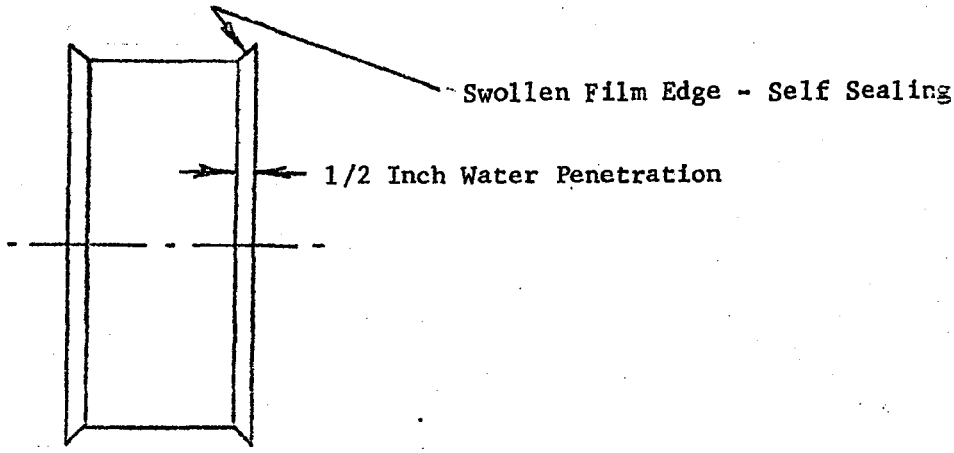
After the proper Hx introduction the meeting convened with an informal discussion of the problem at hand.

Mr. R. Koch (EK) indicated that EK had performed a submersion test of 1414 film. He indicated that after immersion in "simulated Pacific sea water" for five days that a sample 10,000 foot roll tended to be self sealing. He sketched the sample roll as follows:



He said that in his opinion much of the information contained on the film could be recovered if it was maintained wet and dark until processed.

Following the above agenda the meeting discussion addressed who will be responsible for the various items and how and on what schedule they should be accomplished.

Item #1 - Re-entry Footprint

SPO will be responsible for identifying, as accurately as possible, the impact point. Col. Hillock agreed to provide whatever information was available and to investigate, through the recovery force, what additional information was available: i.e., flight recorder information; impact time information; visual evidence, etc. It was noted that the RV entered the water at between 400 to 500 feet per second impacting with the RV spin axis perpendicular to the water (nose on). The heat shield was in place. Speculation is that the ballast between the heat shield and the pressure canister (24# of lead) tore out through the heat shield om impact. Previous rumor that the RV surfaced and was sighted after impact was indicated to be erroneous. There is, however, indication that there was evidence of dye from the "dye marker" as well as bubbles evident on the surface in the area of suspected impact. These observations will be checked out by SPO with the recovery team. Cdr. Henifin (U.S. Navy) agreed to provide information as to the sea currents and the nature

of the bottom in a 10 mile square area at the impact point. He agreed to provide data as to the drift of the RV in sinking to the bottom. He needs, however, estimated sink rates.

Item #2 - Impact Loads and Damage Assessment

MWC and SSC will be responsible for assessing the damage to the TU/RV on impact. Preliminary estimates by MWC (from [redacted] via telecon on 7-22-71 were that the bucket saw 20-25G shock when the parachute deployed which caused the chute attachments to fail and that the RV entered the water, as indicated earlier, at 400 to 500 feet per second. Estimates of 3000 G's on impact were mentioned).

From the estimates of damage, failure modes, etc. SSC and MWC are asked to predict the decent rate through the ocean. Of special interest is the velocity expected at the bottom which is estimated to be 14,400 feet. The above data will be used by the Navy to estimate the drift during decent and the effects of impact on the bottom. (Is it likely to be imbeded in the mud?)

Item #3 - Recovery Configuration and Constraints

Extended discussion concerning the configuration and capability of the search and recovery requipment revealed:

- The RV package will be searched for and hopefully located by a commercial contractor search vessel commanded by Dr. F.N. Spiess. The technique will be for the search vessel to tow a sensor "fish" on a 30,000 ft. cable. The sensor employs high resolution side looking sonar having a range of 1000 feet transverse to the towing direction. The RV package will be located and its location marked by some sort of transducer anchored to the ocean bottom adjacent to the package. The recovery vehicle "The Trieste II" will be positioned at the surface above the transducer and will decend, homing in on the transducer, to the bottom. The Trieste has a lift capability of over 2000 pounds. It is rigged with a wench and hook arrangement which is used to lift the payload. A mechanical manipulator with six degrees of freedom having a grip strength of 3000 pounds will be used to attach the payload to the hook or suitable lifting apparatus.

Various photographic and television instrumentation will record the underwater operation. There is also a view port in the 7 ft. diameter spherical operating chamber for the three man crew to observe and control the operation.

Item #4 - Equipment Requirements

When the unit is located on the bottom by the Trieste the plan is to somehow attach a hook to the RV. SSC and MWC are to investigate the probable configuration of the unit on the bottom and devise a means to attach the hook.

This operation is performed by use of the manipulator to roll the unit out of the mud and attach the hook. The Trieste then starts up while playing out the cable until it is about 120 feet off the bottom. Then both proceed to the surface with the RV suspended from the 120 foot depth below the Trieste. At this point divers will be sent down with a cargo net which is lined with black canvass. The illumination levels at this depth must be investigated to preclude exposure of the material (SSC is responsible).

The unit will be wrapped with the canvass and secured light tight by the divers. A separate wench cable from the support ship will be attached, the Trieste's cable detached and the package hoisted to the support ship.

A suitable container immersed or full of sea water will receive the entire package, net and all. The container will be sealed and filled with sea water and transported to Hawaii for transfer to an aircraft for the flight to Rochester.

SSC has been asked to investigate the availability of suitable containers (in parallel with SPO and MWC).

Item #5

At Rochester the unit will be opened in the dark, the structure removed by whatever means necessary while maintaining the unit wet. A hole will be bored through the shaft center parallel to the rotation axis and a rod inserted to provide an axle about which to rotate the spools. The film will be removed by hand and transferred directly to processing in 2,000 to 3,000 foot lengths. One side will be handled at a time.

EK is responsible for all of the tools and equipment required in the despooling operation. SSC will be asked to consult on possible schemes and methods of removing the hardware from around the film, and in attaching the axle.

Item # 6 - Payload Handling

Most of the handling of the recovery package was discussed above. Considerable discussion about protecting the unit from exposure to light and from drying out was held. There are still questionable areas concerning -

a. The use of bright light to find the package on the ocean bottom.

b. The use of light to take pictures of the recovery operation and and hardware configuration.

c. The illumination level at the 120 foot transfer depth.

No other payload handling problems are anticipated.

Item 7 - Transportation and Logistics

All transportation and logistics will be handled by SPO working with the Navy and HQS.

Item #8 - Organization

There was no "official" organization published or directed at this time. However, as noted under the other items above, responsibilities were defined. The Navy will be responsible for the actual recovery operation. It was indicated that it would be helpful to have a responsible individual from each involved organization identified. The contractors were asked to work through their respective customers in all data transmittal. The responsible individuals are:

HQS	D. Patterson [redacted]
SPO	L/C J.P. Hillock, Jr.
EK	D. Schoessler
MWC	[redacted]
SSC	L.B. Molaskey
Navy	Cdr. E.E. Henifin

Item #9 - Security

In general the security plan for this operation will be to brief as few new people as possible and only to level necessary for them to perform their function.

Several areas where full briefing will be required are:

a. The Trieste operators (3).

b. The divers who enclose the payload in the net (4).

c. One photo processor who develops the hardware photos from the "fish".

d. The commander of the search vehicle (Dr. F.N. Spiess).

e. Several Navy personnel.

Item #10 - Schedule

This meeting affectively started the operation rolling. It is estimated that the modifications to the search vehicle will start by August 16th with the search to start five days later. It is estimated that the recovery

will take 10 days on station. Two days will be required to return to port and transfer to the aircraft. Despooling is estimated to start in mid September.

Item #11 - Cost and Funding

It is estimated that the subcontract for the search operation (a civilian contractor) will be between 75 to 100K.

Each of the contractors will submit proposals, prepared in parallel with the effort, defining the cost, schedule, and tasks involved. The proposals will be submitted to the respective customers.

L.B. Molaskey 7-27-71

LBM/cj

cc: M.F. Maguire
H. Robertson
R. Jones
C. Karatzas
P. Petty
R. Roylance
J. Braddon
R. McLaughlin

BYE-109733-71
Copy 6 of 15
28 July 1971

MEMORANDUM FOR THE RECORD

SUBJECT: RV-3 Recovery Planning Meeting

1. A meeting was held to plan the possible recovery of the third HEXAGON RV from Mission 1201. Attachment I is a list of attendees. Attachment II is the agenda.

2. The Navy proposed the use of the deep submergence vehicle Trieste. At the present it is certified to a depth of 13,000 feet. A test dive is planned to 20,000 feet in August. No trouble is anticipated in demonstrating this capability. The location of the RV would first be determined prior to deploying the Trieste. The impact point must be determined as accurately as possible (action - SP-7). Based on the impact point, it is necessary to predict the sink rate and the effect of the currents on the decending RV. P.E. and McDonnell Douglas need to estimate the shape of the RV, the effective density to determine the location on the ocean floor and the terminal velocity to assess the penetration (action - P.E. and McDonnell). A good current profile of the area is available and will be supplied (action - NAVOP 03U2).

3. The Trieste will use a cable with a hook to retrieve the RV and/or take-up. P.E. and MWC are to define the potential attach points, the weight in water, and the weight in air (action - NRO and NAVOP).

4. The RV will be located by a search team contracted for by NAVOP 03U2 with funds supplied by the NRO. The estimate for ten days of search time plus four days of travel time is $100K. The NRO is looking into the best method of transferring the funds (action - NRO).

5. During the recovery operation, voice contact will be available with the Trieste. They will be photographing the RV using 1600 watt lights. They will hook the RV with the boom hook. Some advice

may be necessary from HEXAGON personnel. Ninety percent of the ship's crew are contract civilian personnel, so this should not be a security problem. Probably the three men in the Trieste, four divers, the film processor, and the leader of the search team will need to be cleared (action - OSP).

6. At a depth of less than 120 feet, the RV/TU will be covered with a canvas bag by the divers and transferred to the surface ship. The RV/TU will be placed in a light tight can, partially filled with water. If it is possible, an existing can will be used (action - SP-7 and OSP). Eastman Kodak, P.E., and McDonnell Douglas will determine the probable amount of damage from an analysis of the impact, update their analysis as a result of photographs, and obtain the equipment necessary to despool. The despooling will be by hand and will be a slow process. OSP will function as the contact point for the Navy and will coordinate the effort (action - OSP).

7. The search team will start modifications on 16 August and start the search on 24 August. The Trieste will recover the vehicle sometime in September. The despooling operation should plan on starting about 27 September.

8. The consensus was that there was a good chance of recovering the RV and that the film would be usable with some small degradation.

DONALD W. PATTERSON
HEXAGON Sensor Subsystem Program Director

Attachments a/s stated

SUBJECT: RV-3 Recovery Planning Meeting

Distribution:
Cy 1 - Col. F. S. Buzard
Cy 2 - L/C J. P. Hillock, Jr.
Cy 3 - Maj. R. A. Schow, Jr.
Cy 4 - Mr. R. A. Koch
Cy 5 - Mr. M. F. Maguire
Cy 6 - Mr. L. Molaskey
Cy 7 - 15 - Internal

Attachment I

RV-3 RECOVERY PLAN

27 July 1971

Attendees

Cdr. E. E. Henifin

L/C J. P. Hillock, Jr.

Maj. R. A. Schow, Jr.

Mr. R. A. Koch

Mr. D. H. Schoessler

Mr. L. Molaskey

Mr. D. W. Patterson

[redacted]

Attachment I to
BYE-109733-71

EX CLUDED
SPECIAL HANDLING

Attachment II

RV-3 RECOVERY PLAN

27 July 1971

Agenda

1. RE-ENTRY FOOTPRING
2. IMPACT LOADS AND DAMAGE ASSESSMENT
3. RECOVERY CONFIGURATION AND CONSTRAINTS
4. EQUIPMENT REQUIREMENTS
5. DESPOOLING AND PROCESSING
6. PAYLOAD HANDLING
7. TRANSPORTATION/LOGISTICS
8. ORGANIZATION
9. SECURITY
10. SCHEDULE
11. COST AND FUNDING

Attachment II to
BYE-109733-71

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

ME-45
2 August 1971

TO: Distribution

FROM: L. B. Molaskey

SUBJECT: Recovery of RV #3 - Meeting at MWC, 7/30/71

The following is a report on the meeting held at MWC in support of the planning for the recovery of RV #3 from the ocean floor.

Attendees:

L. B. Molaskey	SSC
[redacted]	HQS
	MWC
	MWC
	MWC
	MWC
	EK

Agenda:

Although no formal agenda was provided it was agreed to review the detail plans discussed at HQS (to bring MWC up to date) and to provide whatever new data had been generated or obtained to date. Also to discuss possible methods for attaching the payload to the recovery hook or cable.

Discussion:

MWC's refined estimate of the impact conditions are:

A. Velocity at impact 450 ft/sec
450 (.6818) = 306.81 miles/hr.

B. Shock at impact 2600 Gs

C. Weight at start of descent in water 1051 pounds

D. Buoyant weight at sea level 550 pounds total

E. Buoyant weight of payload less RV = 246 to 270 pounds

MWC's Estimate of Impact conditions, cont.

F. Calculated descent rate in water (terminal velocity) V_t = 10 to 18 ft/sec (MWC); 11.5 ft/sec (SSC). These rates are based on assuming a spherical shape in the water and drag coefficients - Reynolds number relationships derived from the data provided in Attachment I. (Reference: Boundary Layer Theory - Dr. Hermann Schlichting - 1960, McGraw-Hill Book Co., Inc.)

G. Kenetic Energy = $1/2\ MV^2$
assuming w = 1051 #

V_t = 14 ft/sec

$$E = \frac{1}{2} \frac{(1051)}{32.2} (14)^2 = 3210 \text{ ft \#}$$

H. Descent time approximation (assuming constant V_t from surface to the bottom which is understood to be "over simplification" of the real case)

$$T = \frac{D}{V} = \frac{14,400}{14(60)} = 17.2 \text{ minutes}$$

I. Sequence of structural failure:

At ≈ 30G Takeup Beryllium Shaft broke at both ends separating the payload from its mounting in the RV structure.

At ≈ 50G The heat shield broke away from pressure canister.

At ≈ 300G The pressure canister buckles (a cross sectional profile of the pressure canister is provided in Attachment II.)

At ≈ 2600G The pressure canister is assumed to be "hydro-dynamically molded" to the payload in the nose of R.V. Consensus of opinion is that the R.V. and payload will be all in one piece with holes or tares in the pressure canister.

Considerable discussion was held on how to attach the lifting cable to the R.V. on the bottom. MWC indicated that the parachute bridle (See Attachment III), similar to observed failures during the development program, would have separated at the apex leaving three individual straps, with loose ends, attached to the R.V. structure. They also pointed out that there was little chance of any remaining

load path from the RV aft structure to the TU since the beryllium shaft undoubtedly broke. The use of a net, which could be laid on the ocean floor with long cables to the primary hook was discussed. The manipulator could be used to roll or lift the payload into the net and attach the rings on the net cables to the lifting hook. See Attachment IV.

It was suggested that Vise-grip type pliers or clamps on the end of cables be used to attach to the parachute bridle. This was discarded because of the lack of load path within the RV and the complexity of activating so small a component.

A plunger inserted into the drogue mortar hole was suggested and rejected because of the same type of problems.

The primary choice is to use a mechanism similar to a "hay hook" which is secured to the lifting cable and when activated would surround the entire payload providing a basket to lift the unit. See Attachment V and Va.

The net and "hay hook" approaches will be discussed with the operations people (U.S. Navy) for their comments and suggestions. The question of who will supply the hardware involved is still open at this time.

The container to be used to transport the recovered payload also presents somewhat of a problem. Ideally it should be large enough to contain the payload package, the lifting apparatus, and the transfer net and canvas (Ref. ME-44, dated 27 July 71). It must be light and water tight and capable of being transported by aircraft and truck. A size restriction, imposed by EK, was identified. It must be able to pass through a door 71 inches wide and 81 inches high. Attachment VI shows the approximate size and weight of such a container.

Each of the contractors were asked to check the availability of such a container.

Additional operating constraints concerning the container, suggested by EK, were:

A. The temperature should be maintained below 80°F at all times - no constraint on low temperature.

B. A drain plug is required. (EK plans to save the water for use during despooling.)

C. It should be capable of being transported by hand truck in the despooling facility or have its' own wheels.

In the dark despooling room the container will be emptied and the sea water saved for use in the despooling operation to keep the stack wet. The payload will be lifted out of the container, the canvas and lifting apparatus removed and the unit set up for disassembly.

It is expected that all the pyros in the RV will have fired or will be otherwise safe.

Other related data, reported here for the record, was also discussed. The data is listed as follows:

A. It is estimated to require 3,000 pounds force to lift the payload out of the water.

B. The heat shield, during a test, experienced 310G when impacting the water at 156 ft/sec.

C. The takeup shaft broke on the keyway side at 30G in the water impact test.

D. The flight recovery sequence is illustrated in Attachment VII.

E. The latest schedule, predicated on the availability of the search ship, is that the search will start the first week in October.

The next phase of the effort will be to review progress to date with the operations people and to provide additional data on light levels at the transfer depth. Also, investigation of potential shipping containers is required.

A summary of the hardware requirements is as follows:

A. Attachment fixture to fix the payload to the lift cable.

B. Transfer net and light shield for lifting the payload out of the water.

C. Shipping Container.

D. Disassembly stands and tools for the despooling operation (EK supplied).

L. B. Molaskey

LBM/cb
cc: M. F. Maguire (w. encs.)
H. Robertson "
R. W. Jones "
C. Karatzas "
P. Petty "
R. Roylance "
J. Braddon "

ATTACHMENT(1

Fig. 1.6 reproduces photographs of the stream-lines about circular cylinders in oil taken by F. Homann [6]. They give a good idea of the changes in the field of flow associated with various Reynolds numbers. For small Reynolds numbers the wake is laminar, but at increasing Reynolds numbers at first very regular vortex patterns,

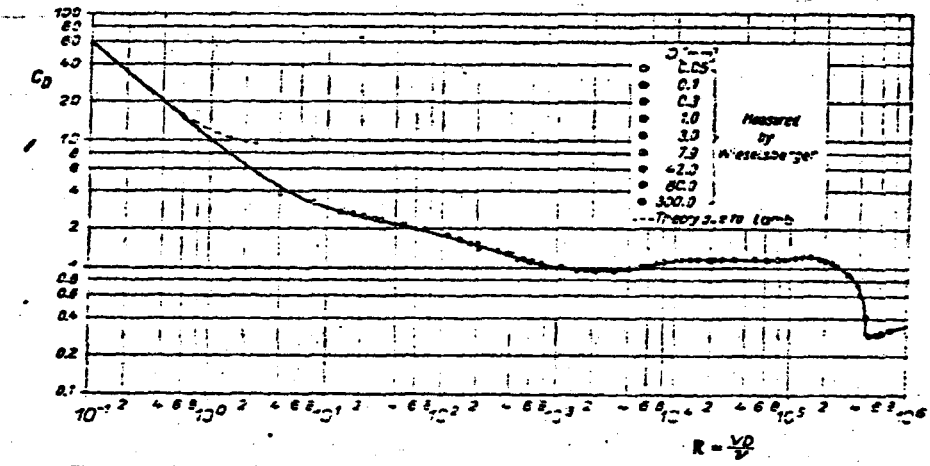


Fig. 1.4. Drag coefficient for circular cylinders as a function of the Reynolds number

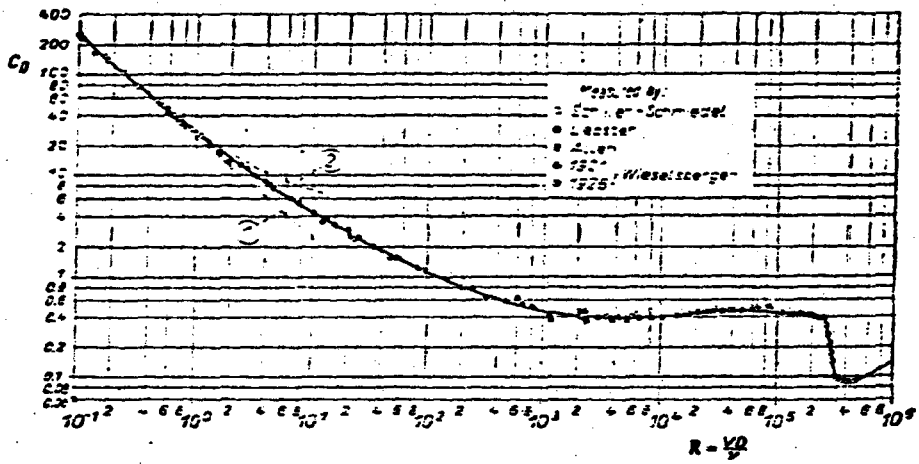
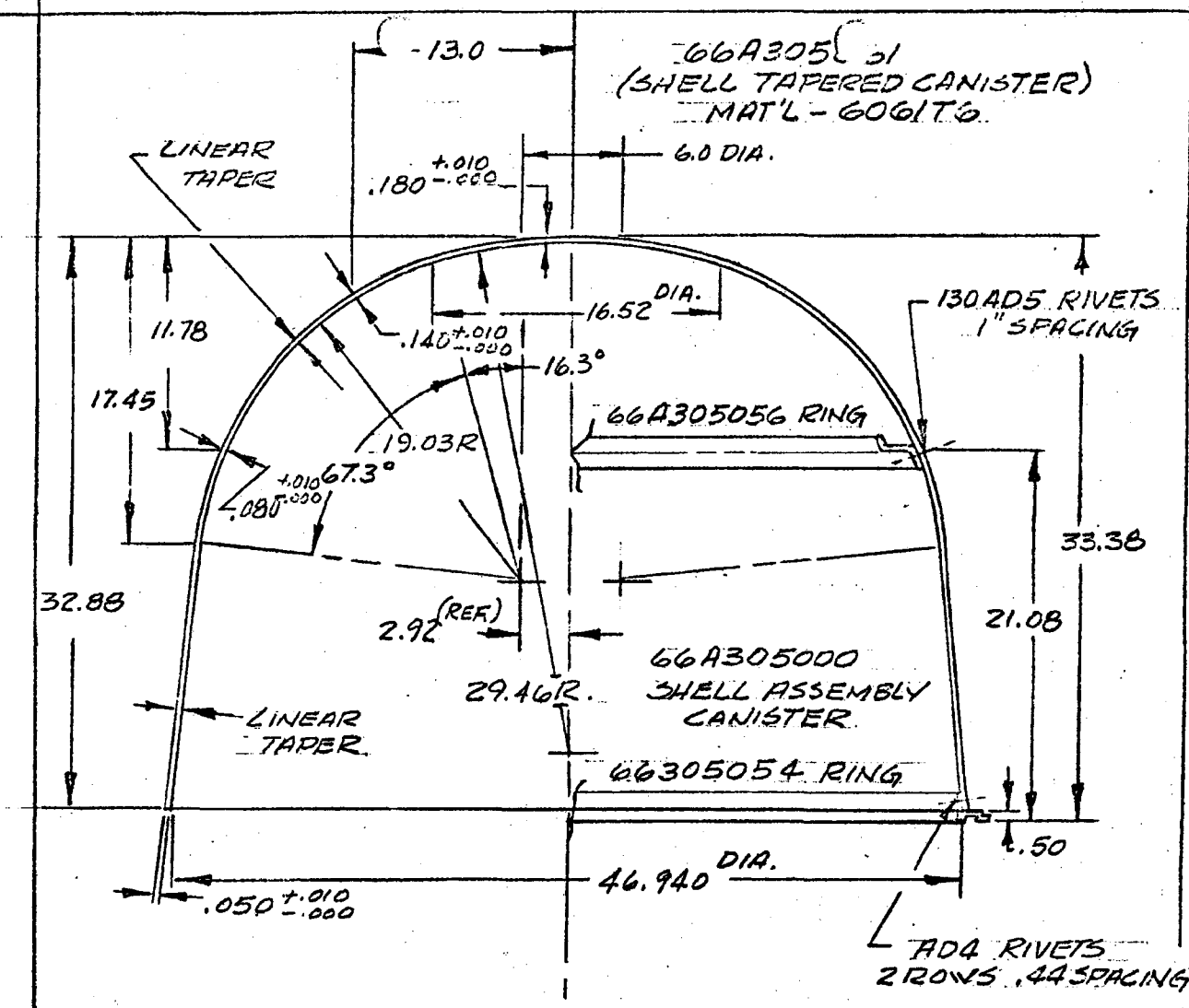


Fig. 1.5. Drag coefficient for spheres as a function of the Reynolds number
Curve (1): Stokes' theory, eqn. (6.10); curve (2): Oseen's theory, eqn. (6.13)



CRITICAL AREAS:

NONE - WATER IMPACT
SHEAR BUCKLING IN SHELL FROM RING LOADS
AXIAL COMPRESSION IN SHELL AT BASE

ATTACHMENT II

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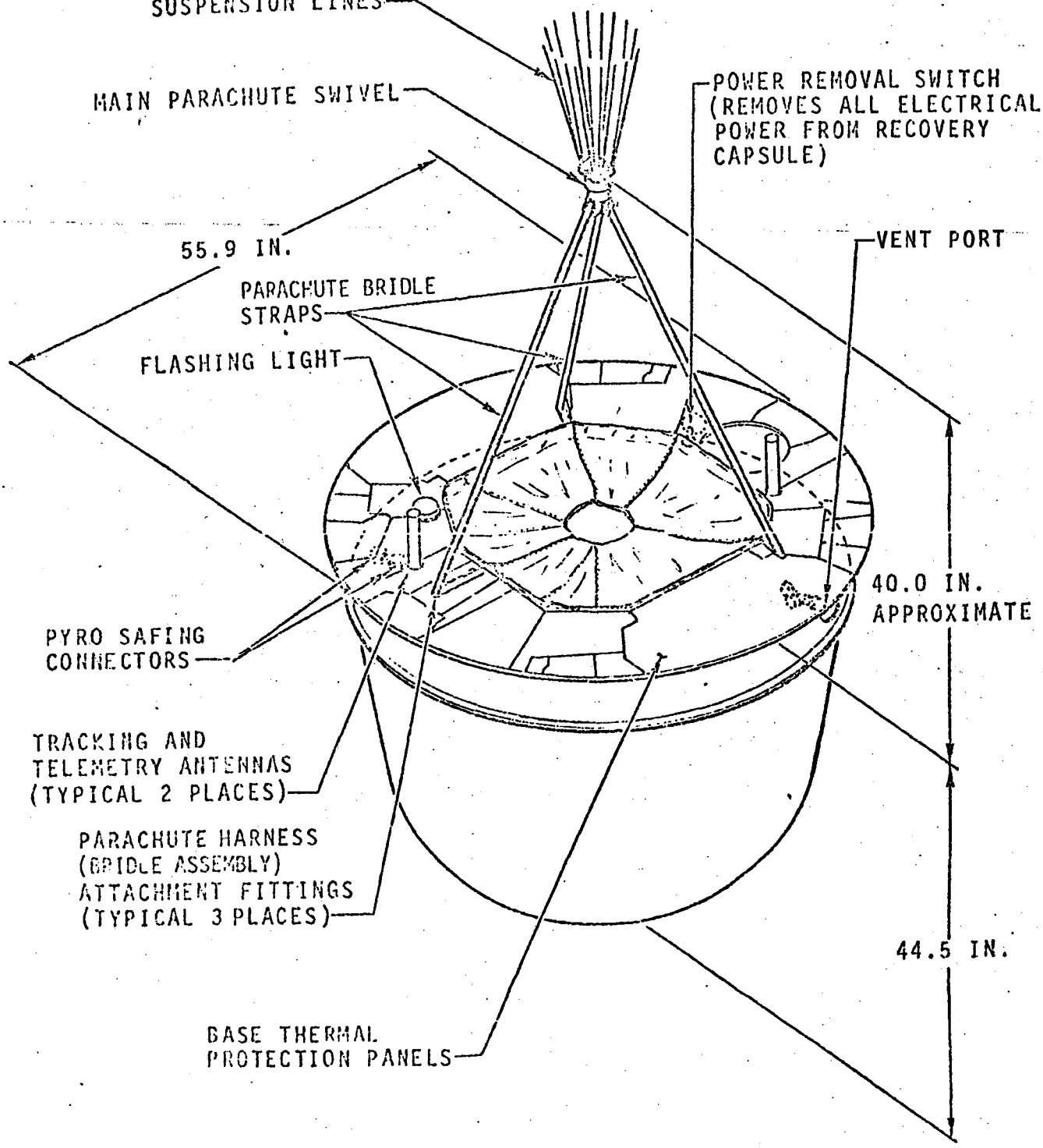
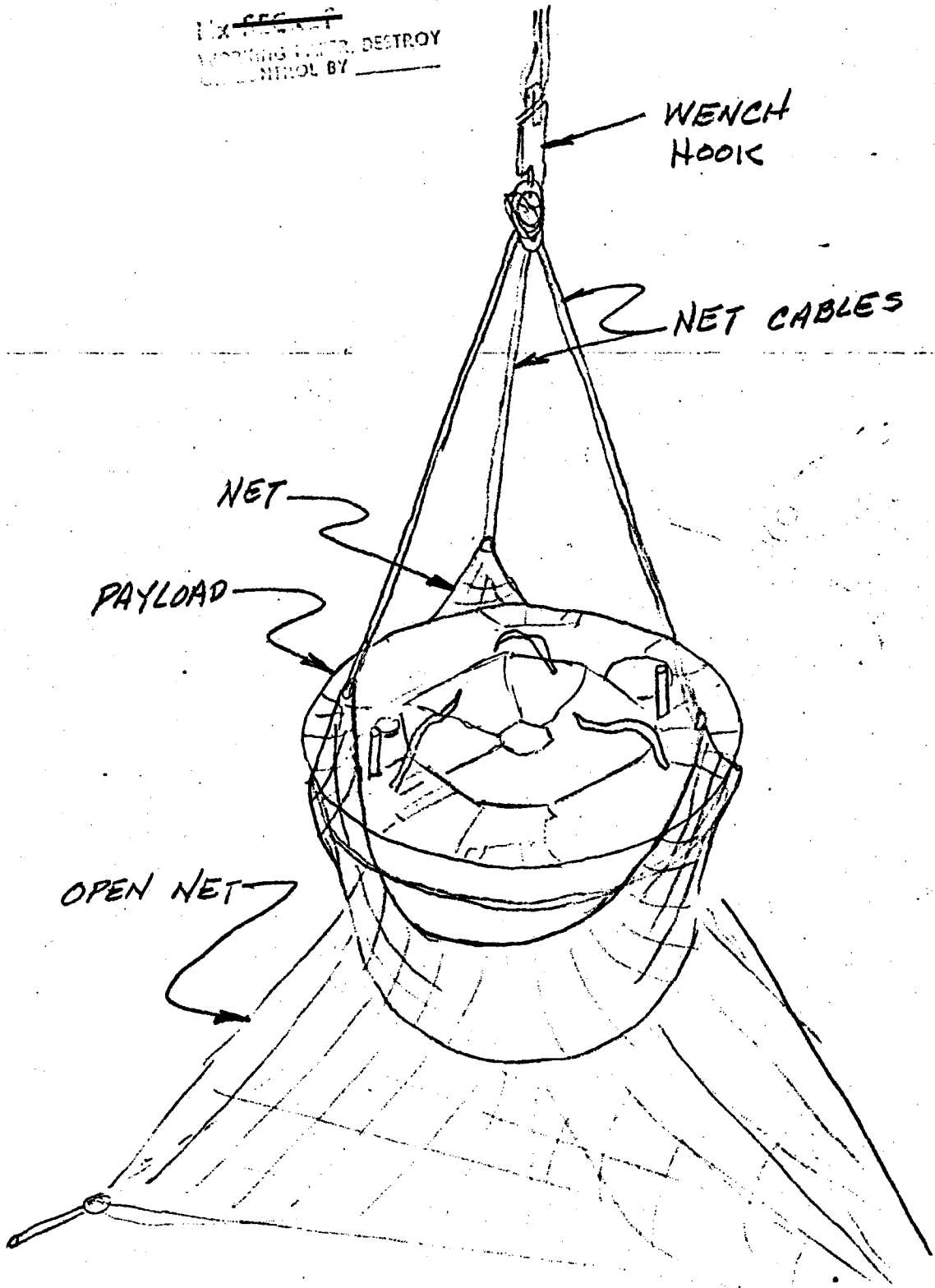
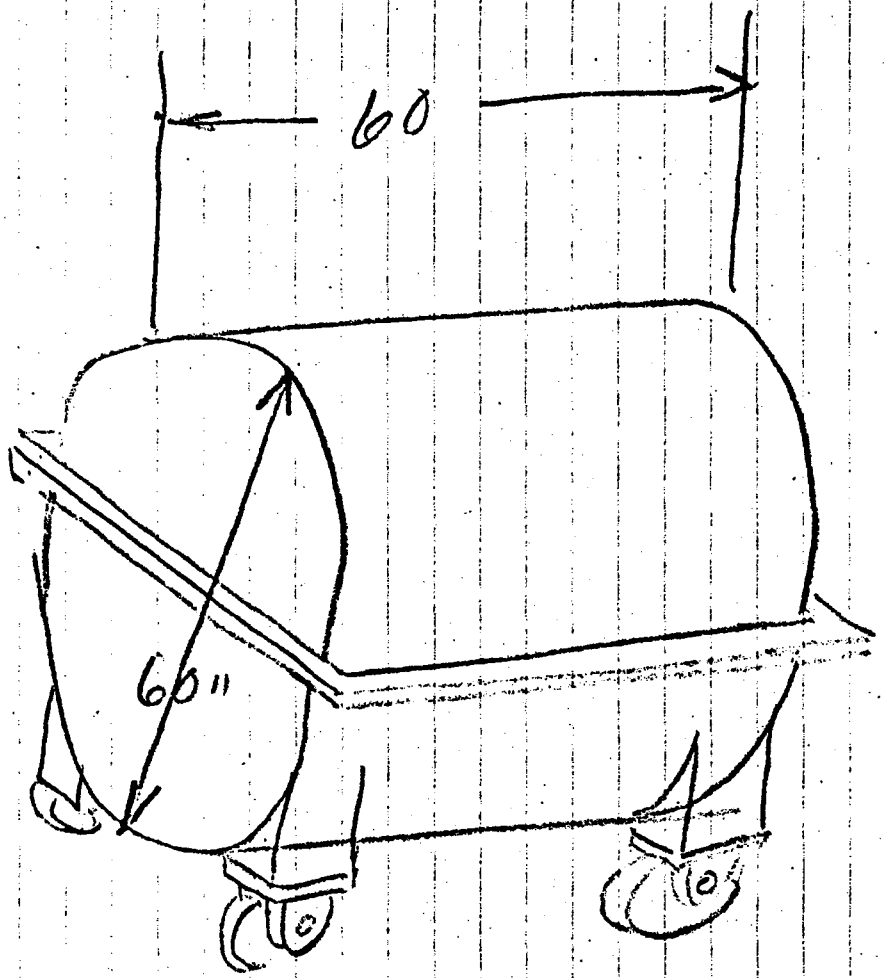
ATTACHMENT III





ATTACHMENT IV



$V = AL$

$= \pi \cdot 2.5^2 (5)$

$= 98.2 \text{ ft}^3$

Assume Cam = 500#

RV, Hook, Net, Etc = 1300#

WATER ≈ 60 FT³ = 3900

TOTAL = 5,500#

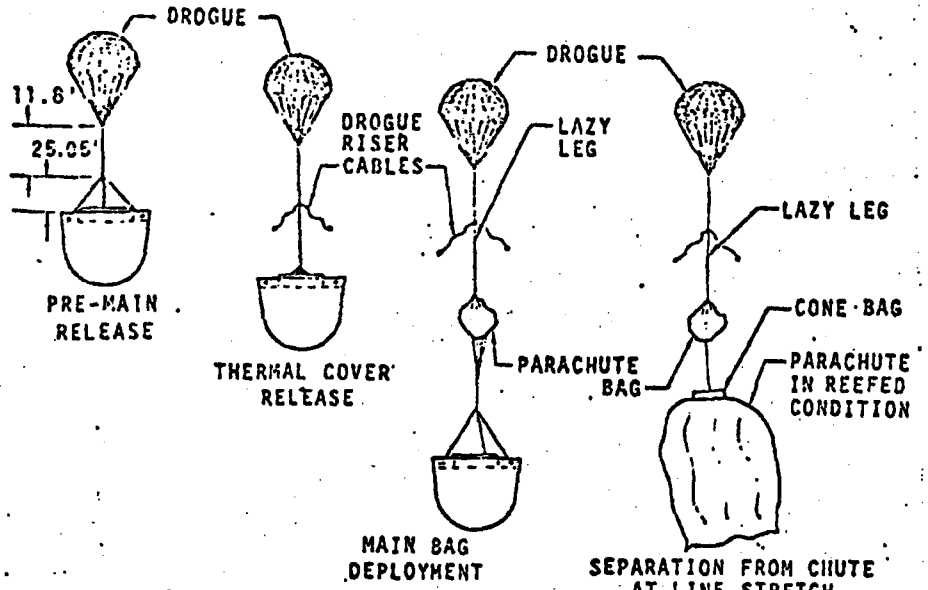
SAY 3 TON

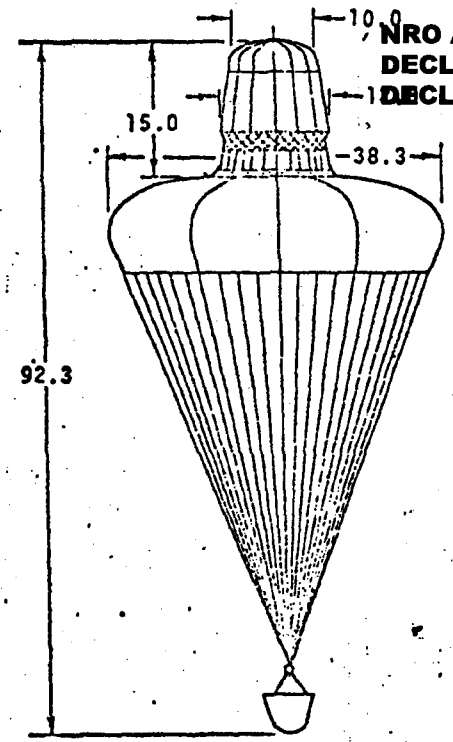
ATTACHMENT VI

Hx ~~SECRET~~

WORKING PAPER, DESTROY OR CONTROL BY _____

MAIN PARACHUTE DEPLOYMENT SEQUENCE





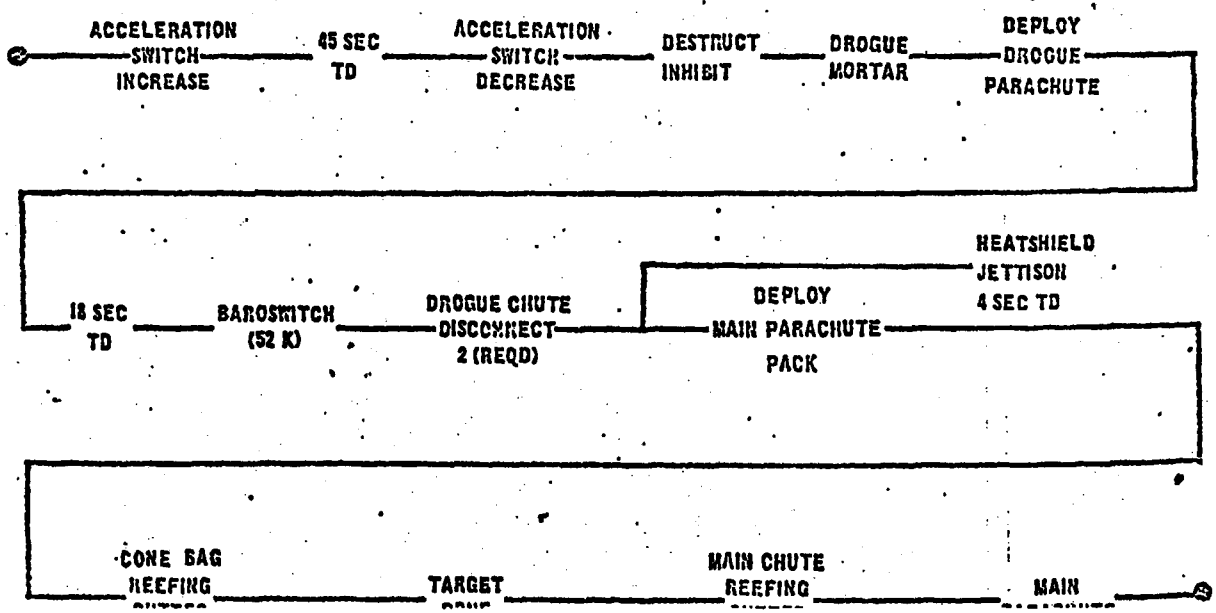
CONICAL EXTENSION
$C_D S$ = 2070 FT^2

MAIN CANOPY:
- NOMINAL DIA Do = 38.3 FT
- VENT DIA. = 7.2 FT
- NO. OF GORES = 56
- REEFING LINE LENGTH = 33.

TARGET CONE:
- TOTAL HEIGHT = 15 FT
- SLOT HEIGHT =
- BASE DIA = 12 FT
- CROWN DIA = 10 FT

SUSPENSION:
- LINE LENGTH = 56.3 FT
- 4 LINES @ 600 LB STRENGTH
- 52 LINES @ 300 LB STRENGTH

RECOVERY SUBSYSTEM



OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 48

TO: Distribution DATE: August 4, 1971

FROM: L.B. Molaskey

SUBJECT: Telecon to [redacted] - Recovery of RV #3.

Configuration of Trieste

I called [redacted] to request information on the configuration of the cable and wench on the Trieste to aid in the design of the RV recovery hook. He indicated that he would request the data and let me know sometime this afternoon as to its availability.

Sea Currents

He also had some new data on sea currents and the nature of the bottom in the impact area. The data is as follows:

Sea Currents in Impact Area

Depth	Rate	Direction
0-25 M	0.2 to 0.5 knots	Easterly
*25-200 M	0.2 to 0.5 knots	Westerly
200 to bottom	0.2 to 0.5 knots	Westerly
Bottom	0.5 knots	Westerly

*The 25 to 200 meter depth zone is a "transition" zone between the two layers and the rate and direction stated are questionable and may not be constant.

Nature of the Bottom

The sea bottom in the impact area is classified as "soft clay silt". He also provided estimates of the penetration of the payload into the bottom. Assuming an impact velocity of 20 ft/sec at the bottom the data is:

Weight of Payload	Penetration %
2000 pounds	50 to 100%
1000 pounds	35 to 80%
500 pounds	25 to 60%

14

BIF 007-1365-71

Contrary to previous opinion the Navy indicated that the sonar search vehicle could not detect an object which is immersed in the silt of the bottom. This has reduced the probability of locating the payload from the original 90 to 95% to 30 to 50%. The exercise, however, is still full speed ahead.

Shipping and Handling

In a call from Don Schoessler earlier this week, Don indicated that because of the growth of bacteria on the film that the unit must be maintained at a temperature below 40°F for the entire recovery and shipping cycle.

This, of course, presents quite a problem with respect to the shipping container and handling procedures for the return trip. [redacted] has requested EK to investigate the use of fungicides to prevent the bacterial growth. This would greatly simplify the shipping and handling.

I reported that we had located a shipping container which could be considered for the job. It is a 64 inch diameter aluminum cylinder of all welded construction 61-1/2 inches high. It has a flat cover attached at the top flange and provides an O-ring seal. Dale indicated that Col. Hillock had located a couple of candidate containers in Hawaii. These will be checked to make sure they can handle the job. In the meantime we have requested quotations and delivery for the one we located. The manufacturer is Container Research Corporation of Glen Riddle, Pa. A sketch and quotations are expected before the end of the week.

Light Levels

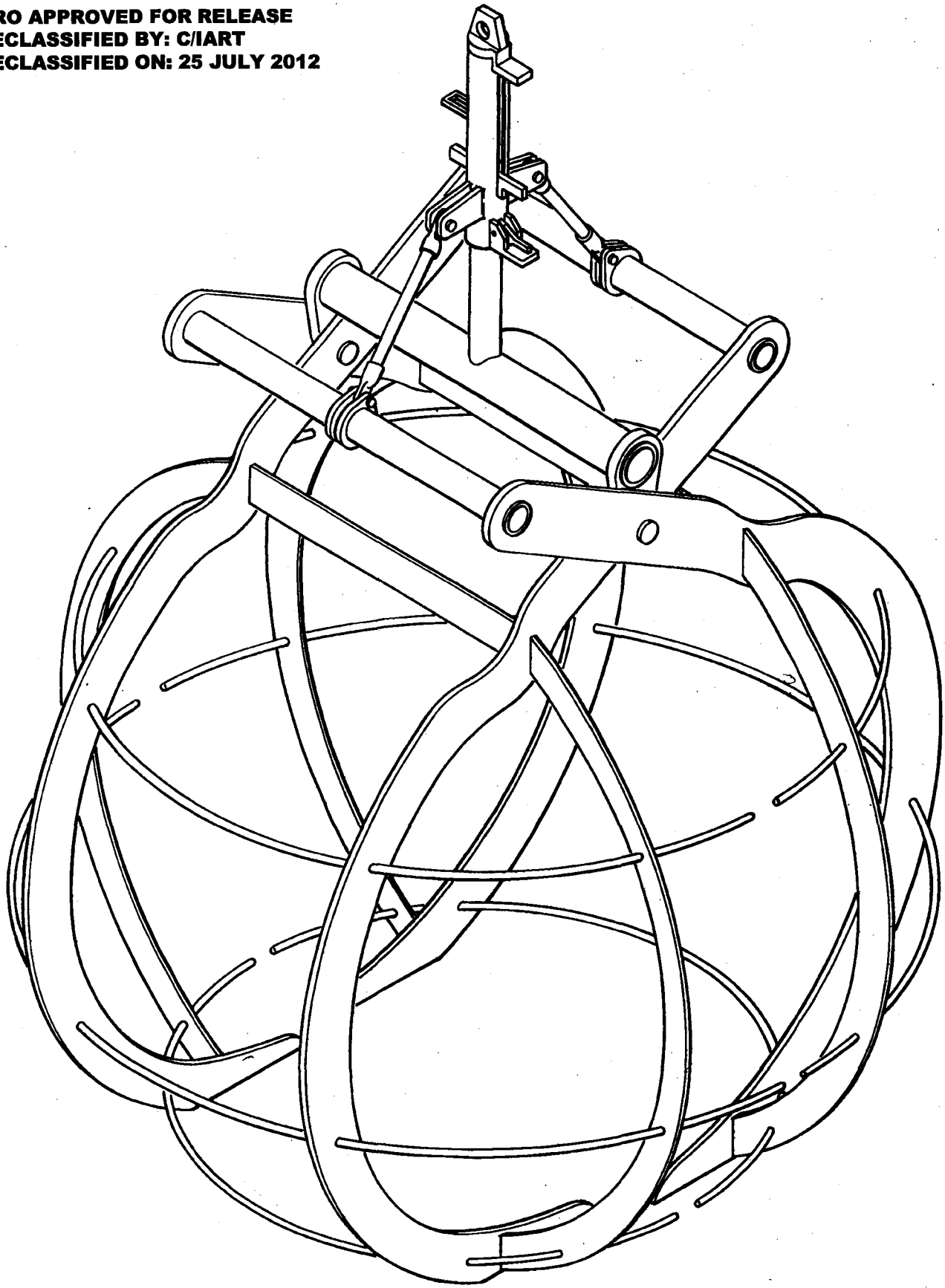
I reported that we had started a preliminary investigation of the light levels one could expect at the 120 foot transfer depth. I pointed out that determination of the light levels, spectral content, and vulnerability of the payload package to light exposure, at best, can only be estimated. There is, at this point however, enough evidence to indicate the need to consider protecting the payload from exposure at depths greater than 120 feet. I indicated that it is probably quite feasible to encorporate a light protecting cover on the lifting hook. This concept will be investigated with the hook layout.

L.B. Molaskey 8-4-71

LBM/cj

cc: M.F. Maguire
H. Robertson
R.W. Jones
C. Karatzas
P. Petty
R. Roylance
J. Braddon

BIF 007-1365-71



~~Hx SECRET~~
WORKING PAPER, DESTROY
OR CONTROL BY 90

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 49

TO: Project File - Recovery of RV #3 DATE: August 5, 1971

FROM: L.B. Molaskey

SUBJECT: Penetration of the RV Into the Ocean Bottom

According to the data provided by the Navy with regard to the penetration of the RV into the ocean bottom, a revised estimate is herein presented. Not knowing the assumptions upon which the Navy's estimates were made, we can only compare the parameters stated. They are weight and velocity. All other parameters considered equal, the penetration into the ocean bottom should be proportional to the kinetic energy at impact with the bottom.

Therefore if a 1000 pound body penetrates the bottom 35 to 80% of its volume when impacting at 20 ft/sec a 1051 pound body traveling at 14 ft/sec will penetrate the bottom the same amount multiplied by the ratio of their kenetic energy or

$$P_2 = P_1 \left(\frac{KE_2}{KE_1} \right)$$ where subscripts

1 denotes conditions of first estimate and
2 denotes conditions of updated estimates.

or $$P_2 = (35 \text{ to } 89) \frac{1/2\ M_2 V_2^2}{1/2\ M_1 V_1^2}$$

since $M = \frac{W}{G}$ and G is constant

$$P_2 = 35 \text{ to } 80 \left(\frac{1051(14)^2}{1000(20)^2} \right)$$

$$P_2 = 35(.51499) \text{ to } 80(.51499)$$

$$P_2 = 18 \text{ to } 41\%$$

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WORKING PAPER, DESTROY
OR CONTROL BY 90

Therefore if the estimates of descent velocity are correct it can be concluded that the penetration of the RV into the bottom is probably not as bad as originally estimated.

L.B. Molaskey

LBM/cj

cc: M.F. Maguire
H.W. Robertson
R.W. Jones
C. Karatzas
P. Petty
[redacted] (HQS)
[redacted] (MWC)
D. Schoessler (EK)

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OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 50

TO: Project File - Recovery of RV #3 ✓ DATE: August 5, 1971

FROM: L.B. Molaskey

SUBJECT: Effect of Salt Water on Beryllium

At the meeting of 30 July 1971 held at MWC concerning the recovery of RV #3, a question of the survivability of the beryllium when immersed in salt water was brought up. Investigation into the matter has produced evidence that although there is certain to be corrosion on the beryllium, it is very doubtful that serious damage to the structural integrity of the core and/or shaft components will occur as a result of corrosion. The attached data indicates that even when cycled through salt water immersion and elevated temperatures in air, the effects of corrosion are insignificant compared to the structural function of the take-up core and shaft.

It is therefore concluded that corrosion of the beryllium components will be negligible compared to the other effects of water impact and subsequent immersion in sea water.

L.B. Molaskey

LBM/cj

cc: M.F. Maguire
H.W. Robertson
R.W. Jones w/enc
C. Karatzas
P. Petty
[redacted] (HQS) w/enc
[redacted] (MWC) w/enc
D. Schoessler (EK) w/enc

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It is pointed out, however, that corrosion rates in such service are higher than can be tolerated, so that additional protection is required for satisfactory service life.

Salt Fog

Bare beryllium specimens (nominal 2 percent BeO content) were exposed to a 5 percent salt-fog spray at 100 F for 30 days at the Astropower Laboratory.[7] Localized pitting occurred on the bare pieces after only 1 day of exposure. The attack increased with exposure time. The specimens were rinsed in distilled water after 30 days and then were weighed. The weight loss at several time intervals is given in Table 4. The values in the last column (actual) were obtained by dissolving the corrosion product in 49 percent HNO_3 and 1 percent HF and adjusting for the bare metal dissolved. The corrosion rate corresponding to weight losses in the range shown is 2.2 mpy. Pit depths of 15 to 25 mils were measured on the coupons.

TABLE 4. WEIGHT LOSSES OF FORGED 1x2-IN. IN 5 PERCENT SALT-FOG SPRAY AT 100 F (Reference 7)

	Weight Loss at Indicated Exposure Times, mg							
Specimen	1 Day	2 Days	4 Days	7 Days	14 Days	21 Days	30 Days	30 Days (Actual)[a]
3-4	0.33	0.50	0.90	1.6	3.8	5.6	7.3	23.1
5-4	0.42	0.7	0.89	1.2	2.3	2.7	3.1	27.2
5-5	0.40	0.7	0.91	1.1	2.0	2.4	2.9	17.6
1-1	--	0.5	0.71	0.9	1.9	2.6	3.5	22.5

(a) (Actual) values indicate weight losses of specimens after corrosion products were stripped from coupons, and are equivalent to about 2.2 mpy.

In another study at the same laboratory, coupons were alternately exposed to a 5 percent salt fog at 100 F for 16 hours, and then immediately placed in an oven for 8 hours at 200, 400, 600, or 800 F.

The following observations were reported for polished beryllium when exposed to alternate cycles of salt-fog spray and elevated temperatures.

(1) Chemical attack was observed on polished bare beryllium following the initial cycle at all of the above temperatures. Initially, weight loss was observed, due to chemical attack by the salt environment. After the first few cycles, a thin oxide coating was formed, due to oxidation in air at the elevated temperature.

(2) At 200 F the pitting observed after the first initial cycle increased with each subsequent cycle as evidenced by the increase in the number and size of the pits. The behavior at this condition is very similar to the results obtained for the 30-day, 5 percent salt-fog spray.

(3) At 400, 600, and 800 F, the cyclic effect of temperature and salt contamination was found to proceed by two independent mechanisms.

(4) At 800 F, very small white oxide patches started to appear at about about the tenth cycle. At this stage the coupons started to show small weight increases. The appearance of the white oxide is indicative of the onset of the catastrophic oxidation, which is discussed later in this report.

Acids

Beryllium reacts with the halogen acids in all concentrations at room temperature. It reacts with dilute sulfuric acid readily and with concentrated sulfuric acid slowly. It is attacked by dilute nitric and acetic acids, but not glacial acetic acid or concentrated nitric acid at room temperature. With concentrated nitric acid, reaction occurs and becomes violent as the temperature is increased above room temperature.

Straumanis and Mathis report studies with premium-grade vacuum-cast metal (assaying 99.0 percent Be) in HF, HCl, and H_2SO_4.[12] The metal is removed uniformly in HF and H_2SO_4. The reaction with HCl is more localized, and a black deposit forms which has been identified as fine needles of metallic beryllium. The black deposit was not found when concentrations greater than 0.5N HCl were used.

The reaction mechanisms were checked by measuring the volume of hydrogen evolved from weight samples. It was concluded that the reactions with acids are:

$$Be + 2HF \rightarrow BeF_2 + H_2$$

$$Be + 2HCl \rightarrow BeCl_2 + H_2$$

$$Be + H_2SO_4 \rightarrow BeSO_4 + H_2$$

Rapid attack and the formation of a black deposit were observed in $HClO_4$ and HBr.

It is interesting that a similar black deposit, consisting mainly of fine beryllium needles, is formed on beryllium anodes when the metal is electrolytically disolved in a 0.5N HCl solution.[13]

Alkalies

Beryllium is vigorously attacked by aqueous alkaline solutions. Molten alkalies may react explosively with the metal.

TABLE 2. CORROSION OF BERYLLIUM IN SALT SOLUTIONS AT 60 F (Reference 9)

Environment	Overall Corrosion Rate[a], mpy	Max Pit Depth, mils
Distilled water	0.8	0.8[b]
Synthetic seawater	13.7	4.6
Natural seawater	18.4	4.6
3% NaCl solution	21.5	--
3.5 NaCl solution	33.4	6.8[c]

(a) 30 days.
(b) 18 days.
(c) 8 days.

TABLE 3. CORROSION IN NATURAL SEAWATER AT ABOUT 60 F

Continuous total immersion. (Reference 9)

Time, days	Corrosion rate, mpy	Max Pit Depth, mils	Percent of Surface Pitted
2	--	1.5	Negligible
5	--	1.6	1
20	13.0	3.0	5
30	10.5	3.0	12
40	9.0	2.5	15
60	6.5	3.0	20
182[a]	2.4	--	--

(a) Extrapolated value.

It should be pointed out that the maximum pit depth also increased in a similar manner from about 1.6 to 3.2 mils as the exposure time increased from 5 to 150 days. A summary of the results concerning pitting is given in Figure 4. It can be noted that the percentage of the surfaces pitted increased linearly from about 2 to 45 percent as the exposure period increased from 5 to 150 days.

In work at Battelle, a very low general rate of attack was found for beryllium in seawater, but evidence of possible pitting was also observed. The beryllium was exposed in aerated seawater (except for a period of about 6 hours a day, for 5 days a week, when it was suspended above the water). After 2 weeks' exposure, the corrosion rate was equivalent to 3.6 mpy. The surface appeared to be coated with a white powder, probably BeO, and had small-size clear hydroscopic bubbles on its surface. Underneath these bubbles some pitting was found.

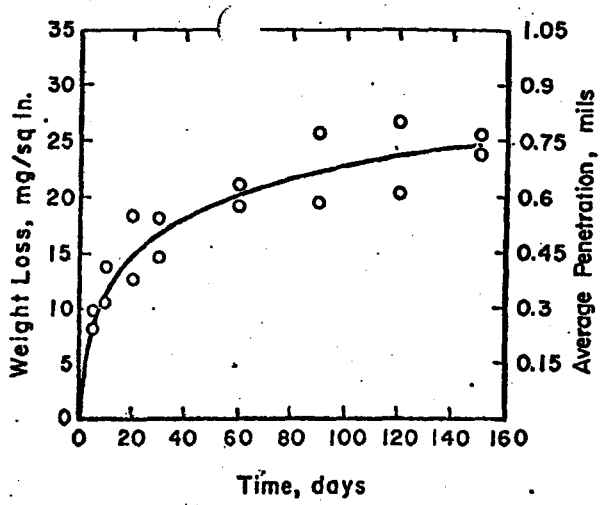

FIGURE 3. CORROSION OF UNSTRESSED, PICKLED BERYLLIUM SHEET MATERIAL EXPOSED TO SYNTHETIC SEAWATER AT 77 F
(Continuous total immersion testing. Reference 11).

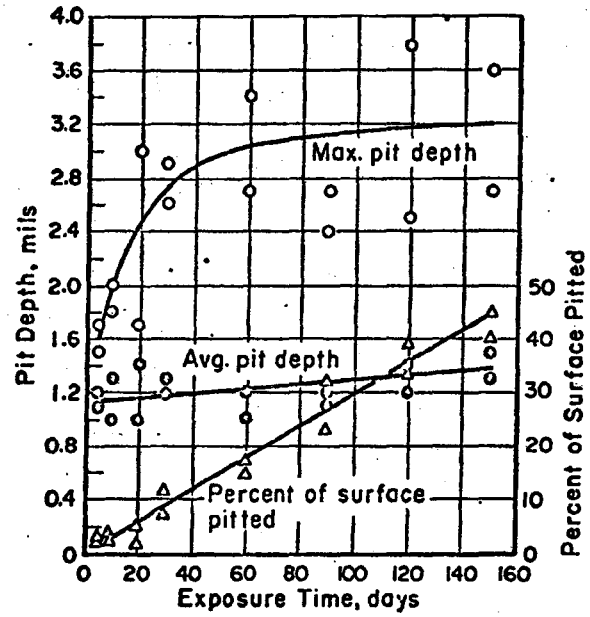

FIGURE 4. PITTING ATTACK OF UNSTRESSED, PICKLED BERYLLIUM SHEET MATERIAL EXPOSED TO SYNTHETIC SEAWATER AT 77 F
Continuous total immersion testing. (Reference 11).

Workers at Astropower exposed bare beryllium (nominal 2 percent BeO content) specimens alternately to a 5 percent salt solution at 100 F for 16 hours, followed by air exposure at elevated temperatures up to 800 F for 8 hours.[7] Tests were continued for a total of 14 cycles. The specimens were first attacked at localized areas (pitting). The maximum corrosion resistance was found at 600 F and was attributed to the formation of a protective oxide film.

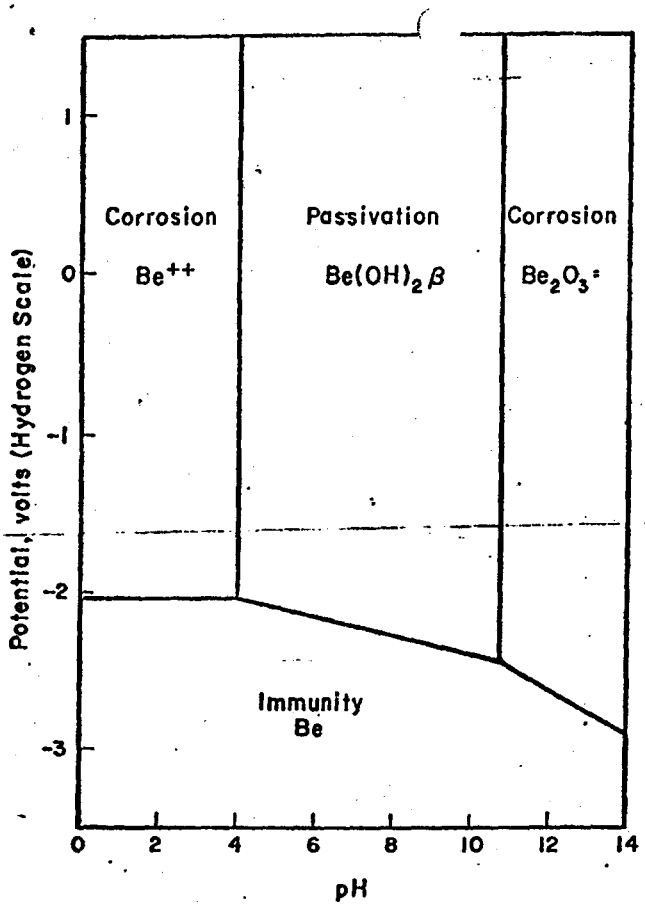

FIGURE 1. EQUILIBRIUM POTENTIAL - pH FOR THE SYSTEM BERYLLIUM - WATER AT 77 F[6]

Alloy additions of nickel or combinations of nickel and iron (4000 ppm Ni, 2000 ppm Ni-2000 ppm Fe, or 5000 ppm Ni-5000 ppm Fe) greatly improved the corrosion resistance of high-purity beryllium. For example, specimens made from alloyed Pechiney CR-grade powder showed no signs of attack for times up to 43 days in water at 650 F. The beneficial effect from nickel was not confirmed by Stonehouse and associates.[2]

Additional research will be required to clarify the cause of the unpredictable behavior of beryllium. There is some indication that it is related to the presence of small amounts of copper contamination in the water. General results can be summarized as follows:

(1) Specimens with acid etched surfaces were less corrosion resistant than those not etched.

(2) Mechanical removal of more than 12-14 mils of the outer surface also rendered the specimens less corrosion resistant.

(3) Localized boiling on specimen surfaces increased the corrosion rate.

Beryllium specimens exposed to steam at 752 F at 1500 psi were attacked in much the same manner as those in water at 650 F. The localized attack in steam was somewhat more severe.

Salt Solutions

As was mentioned in an earlier section, beryllium is subject to pitting attack in aqueous environments containing chloride ion. Intermittent immersion tests conducted by Prochko and associates[9,10] at ambient temperatures (about 60 F) and 30 days of exposure indicated overall corrosion rates and penetrations listed in Table 2. Corrosion-test specimens were prepared from cross-rolled, surface-ground, flash-pickled ($HF-HNO_3$) sheet. The 60-mil beryllium sheet of commercial purity assayed 98.3 percent Be, 1.63 percent BeO, and 0.113 percent carbon.

Figure 2 shows the weight losses and penetrations for the specimens in the five test solutions after intermittent exposures.

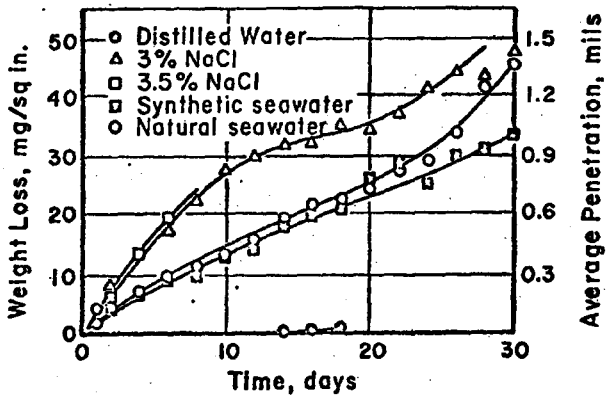

FIGURE 2. CORROSION OF PICKLED BERYLLIUM SHEET IN FIVE ENVIRONMENTS (Intermittent total immersion testing was conducted using these selected chloride solutions at 60 F. (Reference 9)

Exposures at 60 F and 95 F showed that the corrosion rate increased as the temperature was raised. For example, after 14 days of intermittent total immersion in natural seawater the rates for the above temperatures were 17.1 and 25.9 mpy, respectively. By comparison, the corrosion rate for anodized beryllium was only 0.3 mpy after 60 days in seawater.

The corrosion rates decreased with time of exposure for samples exposed continuously at 60 F in natural seawater. Results are summarized in Table 3.

A later report from the same laboratory indicates that the corrosion rate of beryllium in synthetic seawater decreases from about 21.2 mpy at 5 days' exposure to about 3.0 mpy at 150 days.[11] Figure 3 illustrates these results.

OPTICAL TECHNOLOGY DIVISION
Test Equipment Design Section
9 August 1971

AUG 9 1971

TE-396-71

To: L. B. Molaskey

From: P. F. Cavanaugh

Subject: Support for Recovery of RV-3, TA 330

The following defines costs related to providing a shipping container for RV-3:

1. Outline brief design spec, including loads, etc. - 8 hrs.

2. Contact Vendors - 4 hrs.

3. Obtain drawing or sketch of container and verify that it meets design spec. Add other items required, i.e., drain valve, casters, lift truck pads and lifting sling outriggers - 24 hrs.

4. Obtain official quotation, issue TER, follow-up requisition and P.O., visit vendor facility to inspect and qualify container - 24 hrs.

TOTAL EST. ENGINEERING HRS = 60

TOTAL EST. CONTAINER COST = $1,000 *

* Assumes available container 64" I.D. x 61 1/2" high at Container Research Corporation, Glen Riddle, Pa.

Prepared by: _____
T. Urban

Approved by: _____
C. Schmid

Approved by: _____
P. F. Cavanaugh

~~TOP SECRET~~

SEC E-4

HANDLE VIA
BYEMAN
CONTROL SYSTEM

~~TSI~~ NATIONAL RECONNAISSANCE OFFICE
WASHINGTON, D.C.

THE NRO STAFF

10 August 1971

MEMORANDUM FOR COLONEL SHIELDS

SUBJECT: Recovery of RV-3

I have discussed your concern about the SOVIETS attempting to recover the HEXAGON RV if we should fail in our attempt to recover it. Dr. Naka has discussed the problem with the Navy, and they are planning to disguise the operation as a practice exercise with the actual operation being handled on a strict need-to-know basis. This method of conducting the search should arouse minimum interest by the SOVIETS should they observe the operation.

A message has also been sent to CIA requesting the following information:

a. May we assume that the SOVIETS know/ suspect that we failed to recover the RV?

b. Do they have a capability to recover it if we fail to do so?

c. Is it probable that they may monitor this recovery attempt, and do they normally monitor our air recoveries?

As soon as CIA provides a response I will forward the information to you and the concerned staff personnel. Thank you for calling the problem to my attention.

[redacted]

HEXAGON
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CONTROL SYSTEM

~~T O P S E C R E T~~ 102125Z AUG 71 CITE WHIG 1248.
PRIORITY [redacted]
HEXAGON/SECUR
FOR: MR. BROWNMAN
FROM COL BRADBURN

1074
(2)

IN REGARD TO THE EFFORT TO RECOVER THE LOST HEXAGON RE-ENTRY VEHICLE THE FOLLOWING QUESTIONS HAVE ARISEN REGARDING THE SOVIETS:

A. MAY WE ASSUME THAT THE SOVIETS KNOW/SUSPECT THAT WE FAILED TO RECOVER THE RV?

B. DO THEY HAVE A CAPABILITY TO RECOVER IT IF WE FAIL TO DO SO?

C. IS IT PROBABLE THAT THEY MAY MONITOR THIS RECOVERY ATTEMPT, AND DO THE NORMALLY MONITOR OUR AIR RECOVERIES?

REQUEST YOU PROVIDE ANY PERTINENT DATA OR COMMENTS.

~~T O P S E C R E T~~
BT

[redacted]

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Dr McLucas		
Dr Nitze		
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~~T O P S E C R E T~~ 121902Z AUG 71 CITE [redacted] 2437
PRIORITY WHIG
HEXAGON SECUR
FOR COL. BRADBURN FROM MR. BROWNMAN
REFERENCE: WHIG 1048

1. RE YOUR QUESTIONS CONCERNING THE LOST RV, FOLLOWING ANSWERS ARE KEYED TO YOUR QUESTIONS:

A. WE HAVE NO EVIDENCE THAT THE SOVIETS KNOW OR SUSPECT THAT WE FAILED TO RECOVER THE RV.

B. WE ARE VIRTUALLY CERTAIN THEY HAVE NO CAPABILITY TO RECOVER IT.

C. THE SOVIETS DO NOT NORMALLY MONITOR OUR AIR RECOVERIES.

2. IT SHOULD BE NOTED THAT THE SOVIETS HAVE A CAPABILITY TO MONITOR OUR RECOVERIES AND COULD IMPLEMENT IT VERY EASILY IF THEY CHOSE. THEY KEEP A SEAGOING TUG ON STATION IN THAT PART OF THE PACIFIC OCEAN, PRIMARILY TO SUPPORT THEIR OWN NUCLEAR SUBMARINE OPERATIONS. THE TUG IS EQUIPPED WITH SOPHISTICATED COMMUNICATIONS EQUIPMENT AND PRESUMABLY COULD MONITOR

REENTRIES IF THE SOVIETS CONSIDERED IT IMPORTANT TO DIVERT IT TO IT. HOWEVER, WE HAVE CHECKED AND HAVE DETERMINED THAT ON THE DATE IN QUESTION IT WAS NOWHERE NEAR THE REENTRY AREA.

~~T O P S E C R E T~~
BT

~~TOP SECRET~~
HANDLE VIA BYEMAN

E-4

THE ASSISTANT SECRETARY OF THE NAVY
(RESEARCH AND DEVELOPMENT)
WASHINGTON, D.C. 20350

~~TOP SECRET~~
Handle via BYEMAN HEXAGON
Control System

BYE 65878/71

18 August 1971

MEMORANDUM FOR DIRECTOR NATIONAL RECONNAISSANCE OFFICE

SUBJECT: Deep Sea Recovery of HEXAGON Reentry Vehicle

REFERENCE: Your Memo of 10 August 1971

1. The referenced Memo describes the loss of one of the HEXAGON reentry vehicles near Hawaii on 10 July 1971 and advises that CDR E.E. Henifin, USN (Op-232) has been primary point of contact for preliminary discussions on recovery.

2. Navy is pleased to assist in this recovery effort.

3. Present planning for this recovery operation includes:

a. Employment of USNS DESTEIGUER, a survey ship capable of towing a search "fish" to more than 20,000 feet;

b. The services of Dr. Fred Speiss and a team of experts from the Marine Physical Laboratory Scripps Institution of Oceanography to provide the search fish and direct the search operation;

c. The use of TRIESTE II, with support ships and divers, capable of lifting the lost reentry vehicle and securing it for safe transfer to port;

d. Search operations by DESTEIGUER are now scheduled to commence about 1 October 1971 for some ten days;

e. Recovery operations by TRIESTE could commence after 5 October 1971.

4. The success of the operation depends upon location of the reentry vehicle, by no means a certainty. Bottom conditions are believed reasonably favorable, but the small size of the package and the accuracy of the reported sinking position make location a difficult task. Recovery can be effected if location is achieved.

5. Funding as stated in your Memorandum is probably adequate and presents no problem at this time.

6. Discussions are continuing between Mr. Patterson and Op-23 on details of the operation.

7. I shall keep you advised as planning progresses and hope that the operation can be terminated successfully.

for Robert A. Frosch

Copy to:
Mr. Patterson, CIA/OSP

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BIF-007-1266-71

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 52

TO: Distribution DATE: August 20, 1971

FROM: L.B. Molaskey ✓

SUBJECT: Trip Report - Recovery of RV #3

The writer attended two meetings in Washington on the Recovery of RV #3. The first meeting, at HQS, with D. Patterson was for the purpose of bringing Don up-to-date on our progress and to make arrangements for the second meeting which was held at the office of Capt. Larcombe in Room Number 4D-472 in the Pentagon.

The purpose of the meeting in the Pentagon was to discuss the proposed recovery technique with Navy personnel and to define the hardware interfaces involved. Participants at the meeting were:

Captain Larcombe	(Navy)
Commander E. Moore	(Navy)
[redacted]	(HQS)
L.B. Molaskey	(SSC)

Capt. Larcombe presented slides of the Trieste II showing the overall configuration. He did not, however, have detailed information and/or drawings which are required to interface the proposed hardware. A manual, "FBM Developmental System - External Control Mechanism (U)" Volume 5 Part 2, was made available at the meeting. This manual provides adequate detail of the "manipulator" but does not show the relationship of the manipulator to the remainder of the vehicle and vehicle mounted equipment.

A review of the proposed recovery technique indicated that scheme appeared to be compatible with the capability of the Trieste and in some ways was preferable to the techniques being investigated by the Navy. A significant point brought out by Cdr. Moore was that the use of a net or other sling type of device would undoubtedly stir up the sediment on the ocean floor to the extent that the operator's visibility would be reduced essentially to zero for periods of up to an hour. This would curtail the operation until the very slow currents on the bottom cleared the water or until the sediment cloud settled. A technique which did not disturb the bottom until after the payload was secured, such as the hook technique proposed, therefore, would be far less time consuming.

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Capt. Larcombe indicated that the Navy is considering the use of a purse net which could be dragged along the bottom. If the payload is not imbedded too deeply into the mud the net would cause the unit to tumble into its pocket and when lifted would completely surround the unit. It could be transferred to the support ship in the same manner as originally proposed. This technique, however, has a potential light exposure problem at the 120 foot transfer depth if the unit has any large holes and is held at that depth for any length of time.

Capt. Larcombe indicated that he would request the information required as it was now understood (He investigated the availability of the drawings, etc. at the Pentagon hoping that we could go over it the next morning. I agreed to stay over but the only source of the drawings proved to be in San Diego, and it would take a few days to get here). Capt. Larcombe suggested that we review the drawings and get together with his office personnel again. He also suggested that we continue with the hook concept layouts and design but prior to committing the hardware to fabrication that we contact and visit with the crew and inspect the vehicle (at San Diego). He indicated that such arrangements could easily be made from his office.

The meeting adjourned with agreement to provide the drawings requested and if required to hold another meeting at the Pentagon to decide the most economical and effective approach to be selected. Contact between SSC and Capt. Larcombe will continue to be handled through HQS.

L.B. Molaskey
8-20-71

LBM/cj

cc: M.F. Maguire
H.W. Robertson
R.W. Jones
C. Karatzas
P. Petty
[redacted] (HQS)

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OPTICAL TECHNOLOGY DIVISION
PROGRAM MANAGEMENT

Memo # 0011

20 August 1971

TO: DISTRIBUTION

FROM: W.A. Izzo

SUBJECT: RECOVERY OF RV-3 - Minutes of Proposal Meeting

Per the meeting held 19 August the following schedule for this effort was established:

Design complete	27 August 1971
Fabrication complete	23 September
Test complete	27 September
On Site	1 October
Final Report	30 November

A review of estimates resulted in the following "first cut" costs:

Dept/Sect. Title	Dept/Sect. No.	Manmonths	Non-Labor	ROM Total
Manufacturing	8763	1.0	[redacted]	
Test	8555	.7		
Quality Assurance	8611	.7		
Design & Drafting	8526	1.5		
Opto-Mechanical	8523	1.5		
Technical Doc.	8581	.5		
Systems Analysis	8541	.8		
Change Control	8493	.2		
		6.9		

The Program Plan was presented by Len Molaskey, and consideration was given to alternate methods and to possible problem areas which could arise.

Len Molaskey will review the cost situation and advise as to further action.

W.A. Izzo

DISTRIBUTION:
A. Bassaro
E. Collins
A. D'Aquila
J. Jack
L. Molaskey
J. Shanley
B. Todd

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OPTICAL TECHNOLOGY DIVISION

MEMORANDUM

02425

TO: L. Molaskey August 24, 1971 AUG 2 5 1971

FROM: J. Jack

SUBJECT: Cost Estimate for Hay Hook Test Program - Recovery of RV-3

The task description for the Hay Hook Test Program - Recovery of RV-3 is as follows:

Task Description

1. Design and fabricate a dummy load. The requirements are as follows:

a. Size - Similar to a 50 gallon drum
b. Weight - 1,000 lb. when used in air
- 500 lb. equivalent weight when in water
c. External Surface - Similar to a thick wood plank surface
d. Handling - Provide lifting hooks

2. Provide a crane and operator for testing of the Hay Hook in air.

3. Provide the procedure and report of handling test.

The cost estimate is as follows:

Engineering	80 hrs. @ 18.42	=	$1,474
Technician	40 hrs. @ 12.09	=	484
Purchases		=	500
	TOTAL		$2,458

This anticipates that there will be fabrication costs of $500 from someone such as Vaghi Brothers, Bethel, Connecticut for the dummy load.

In order to have the dummy load and procedure ready by September 27, 1971, Test Department will require a turn on by September 1, 1971.

Prepared by: _____
J. T. Jack

Approved by: _____
J. D. Campbell

Approved by: _____
C. O. Bryant

JTJ:hc
cc: GBeniash
JDiMicco

INTER-COMPANY COMMUNICATION

PERKIN-ELMER

Date: August 26, 1971
8761-JS-134

To: L. B. Molaskey

From: J. P. Shanley

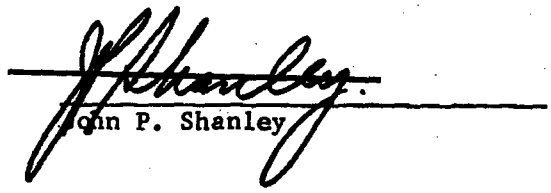
Subj: Telephone Conversation From Metal Masters, Inc., Regarding Quote on "Hook".

J. Canepari personally delivered prints of the latest "Hook" layout to the subject company on 8/24/71. Their Mr. Al Brigante was here for a vendor's briefing on the previous design on 8/20/71.

It was established that their quotation would include:

- all material and hardware (this includes the large compression spring only if it is commercially available "off the shelf").
- all fabrication, assembly and painting
- demonstration of satisfactory operation in air
- crating of unit for shipment

Mr. Brigante telephoned a quotation of $6000.00 on 8/25/71.



John P. Shanley

JS:ec

CC:
F. Johnson
H. J. Haberland
W. Izzo
M. Shaw
J. Canepari
B. Todd

INTER-COMPANY COMMUNICATION

PERKIN-ELMER

Date: August 26, 1971
8761-JS-135

To: L. B. Molaskey

From: J. P. Shanley

Subj: 1. Discussion With Robert Fulton Concerning "Hook Shroud" Construction
2. Telephone Conversation With Robert Fulton Regarding Quote (subject to later revision) on "Hook Shroud".

1. This vendor was selected to quote on the shroud because:
   a. he has made similar size light tight cloth bags for us (620-0070-401)
   b. he has demonstrated experience in sea recovery problems
   c. he is located in Danbury (on airport)

The vendor meeting was attended by L. Waldeck (who procured previous bags), J. P. Shanley and Robert Fulton. M. Shaw of the Purchasing Department was unable to attend.

The problem had been described in detail (via telephone conversation) to Mr. Fulton and he came prepared with sketches.

It was stated that Robert Fulton Company would:

1. provide their own minimum working sketches with direction to their shop and suppliers
2. provide all material and hardware
3. fabricate, assemble and paint unit
4. demonstrate satisfactory operation in air
5. crate unit for shipment

Various methods of releasing the shroud were discussed. The choice of a method was left to Robert Fulton Company, providing that it was "short stroke" and was accessable to the actuator.

Operation in sea water was stressed. With the exception of the shroud material, the choice of materials was left to Robert Fulton Company.

2. Mr. Fulton telephoned to offer an ROM quote (subject to written confirmation) of $4625.00.

JPS:ec

John P. Shanley

CC: F. Johnson
H. J. Haberland
M. Shaw
J. Canepari
L. Waldeck
W. Izzo
B. Todd

0-0832-02

~~SECRET~~
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OR CONTROL BY 90

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 53.

TO: Distribution DATE: September 1, 1971

FROM: L.B. Molaskey

SUBJECT: Trip Report - Visit to San Diego Re: Recovery of RV #3

PURPOSE:

The purpose of this trip was to coordinate the fabrication of the underwater recovery hook with the Navy and to outline the tasks and responsibilities for the recovery operation.

ATTENDEES:

L. Molaskey - SSC
[redacted] - HQS
[redacted] - SPO

RESULTS:

The Navy has agreed to assume the responsibility for the fabrication of the hook using the SSC design. Completion of the hardware is scheduled for 14 September 1971. An in-air and at sea test program is planned starting 16 September and concluding about 1 October at the test site about 60 miles west of San Diego in the Pacific Ocean. The Trieste, after completing the test program, will be towed directly to the recovery site some 350 miles off of Hawaii.

The search vessel is scheduled to return from its last assignment, to Seattle, Washington before the end of this week. It will be outfitted there and will embark in about a week for the recovery site. It is scheduled to start the search on 1 October but is currently running about two days behind schedule.

The Trieste will rendezvous with the search vessel on about the 18th of October to commence the recovery operation. As scheduled, one dive can be made every three days. It is expected that the operation will be complete by 1 November.

DISCUSSION OF DETAILS:

The first meeting, after an introductory meeting with the commanding officer of Submarine Development Group One Captain was held in

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OR CONTROL BY 90

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OR CONTROL BY 90

the group conference room with the following attendees:

Navy

Cdr. Brad Mooney	-	Chief Staff Officer CSDG-1
L. Cdr. Ron Doyle	-	Sub Dev. Group One Staff
L. Cdr. Rich Anderson	-	Sub Dev. Group One Staff
Lt. Dick Taylor	-	Trieste Pilot

Others

L.B. Molaskey	-	SSC
[redacted]	-	HQS
	-	SPO

[redacted] provided a briefing on the details of the recovery task describing the size, shape, weight, etc. of the payload and some of the background with regard to the effort performed to date.

L. Cdr. Anderson reviewed the Navy's effort to date and outlined the schedule requirements for deployment of the Trieste and search ship.

L.B. Molaskey presented a summary of the recovery techniques which have been considered to date resulting in the primary method embodied in the recovery hook design presented. The model of the prime recovery hardware was reviewed and demonstrated and it was agreed by all parties that the hook design and method of recovery proposed was probably the optimum approach.

The discussion which followed centered upon the means for fabricating and testing the hardware for the selected approach. In summary, the Navy agreed to assume responsibility for fabricating the required hardware in conformance with the SSC design. However, several minor design modifications were recommended. They are:

1. Rotate the cocking mechanism 90° with respect to the hook "open" direction so as to shorten the reach requirements for the manipulator.

2. Eliminate the main spring and provide counterweight mounting points for attaching lead weights which provide the same closing moment as the proposed spring.

3. Eliminate the bottom bar on the basket which presents a relatively long area for penetrating the mud on the ocean bottom. Replace this member with a bar, similar to the circumferential members, except that it is oriented in a

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OR CONTROL BY 90

plane parallel to the main hook arms.

4. Detail the latching mechanism (on a single drawing sheet) to provide the information necessary to fabricate the individual piece parts.

It was agreed that the above information would be forwarded to the Navy, by mail, before the beginning of next week (a phone call this morning 9-1-71 initiated the effort required to make the above drawing changes).

SPO reported that they had started fabrication of a special shipping container for return of the payload to the despooling facility. A telecon to Lt. Col. Hillock in request of the actual dimensions of the hardware, however, revealed that there was no design in process. HQS, therefore, requested that SSC take steps to procure the shipping container previously located by SSC. HQS was reminded of the restrictive message which authorized design activity only on the hardware involved. [redacted] agreed to instruct SSC, by message, to provide the container.

The detail steps to be performed by the recovery team were discussed. It was concluded that the most practical method of recovery was to use the hook as proposed by SSC. The dive will either be scheduled to bring the payload to the surface after dark or if need be, the Trieste will be maintained at a very deep (safe from a light exposure standpoint) level until after dark. Contrary to previous reports the payload will be suspended approximately 60 feet below the water surface during the transfer from the Trieste to the support ship. This constraint is due to the fact that the total cable length on the Trieste's winch is only 75 feet as compared to the earlier reported length of 120+ feet. The "after dark" recovery, however, eliminates the need to provide a light shroud and simplifies the hardware requirements considerably.

The matter of protecting the payload from fungus growth has not been solved by the addition of a fungicide because of the uncertainty of the possible long term damage potential of adding untested chemicals to the water. The result is either to maintain the payload, after recovery, at a temperature below 40°F or to limit the time at temperatures higher than 40° to a minimum. The approach selected as the most practical was a combination of both of the above. The Air Force is arranging to transfer the payload from the recovery vessel support ship to an Air Force operated ship from the recovery force. In this way, the payload can be returned to Hawaii in less than half the time required by the support ship. Upon reaching Hawaii the payload, in its shipping container, will be cooled by dry ice and insulation for the flight to Rochester. Logistics for these requirements are being handled by SPO.

This meeting concluded with an inspection tour of the Trieste. A series of photos was taken and will be available for review as soon as they are processed. The tour also included an inspection of the capsule simulator containing all the controls and instrumentation for systems on board.

A second meeting was held in the afternnon at NUC (Naval Underwater Research and Development Center) to discuss the merits of the selected approach and to investigage the possibility of their shop fabricating the hardware. The attendees at this session were; in addition to SSC, HQS and SPO representatives:

Robert L. Watts - NUC Engineering
Jim Held - NUC Engineering
Art Schlosser - NUC Machine Shop

After discussing various alternate recovery approaches and equipment designs (all of which were quite complicated) the hook concept sketch was reviewed. It was again concluded that the design proposed was probably the best approach. The fabrication drawings were reviewed and the aforementioned changes discussed. Mr. Schlosser indicated that he could meet the schedule requirements if given sufficient priority and funds to apply the manpower required. A firm decision, , however, could not be made until the commitment was reviewed by the proper authorities. It was agreed to have a firm commitment the following morning. At this writing there is still no word but it is probably 90% certain that that shop will do the job. Mr. Schlosser's phone number was made available so that the proposed changes could be coordinated directly.

A back-up scheme was suggested as insurance in case there was a problem with the primary hook approach. After again discussing several approaches the one selected was the use of a net with a frame and plow teeth as illustrated in Figure 1. The Navy agreed to pursue the design and fabrication of this device as well as the primary hook.

A third meeting was arranged for the following morning to discuss the search operation with Dr. F. Speiss the search contractor. At this meeting the search technique was reviewed. The expected location was transmitted and the schedule discussed. Dr. Speiss reiterated his confidence that if the payload was in the area indicated that it could be located. He agreed that a HQS representative (probably Dale Ruth) would be of significant help on the search operation. It was tentatively agreed to proceed on that assumption and arrangements are to be made for Dale to meet the search vessel in Hawaii on about 1 October.

SCHEDULE SUMMARY:

The attached chart, Figure 2 shows the schedule for the overall recovery operation.

L.B. Molaskey 9-2-71

LBM/cj

Distribution:
M.F. Maguire
H.W. Robertson
R.W. Jones
C. Karatzas
P. Petty
R. Roylance
J. Braddon
[redacted]

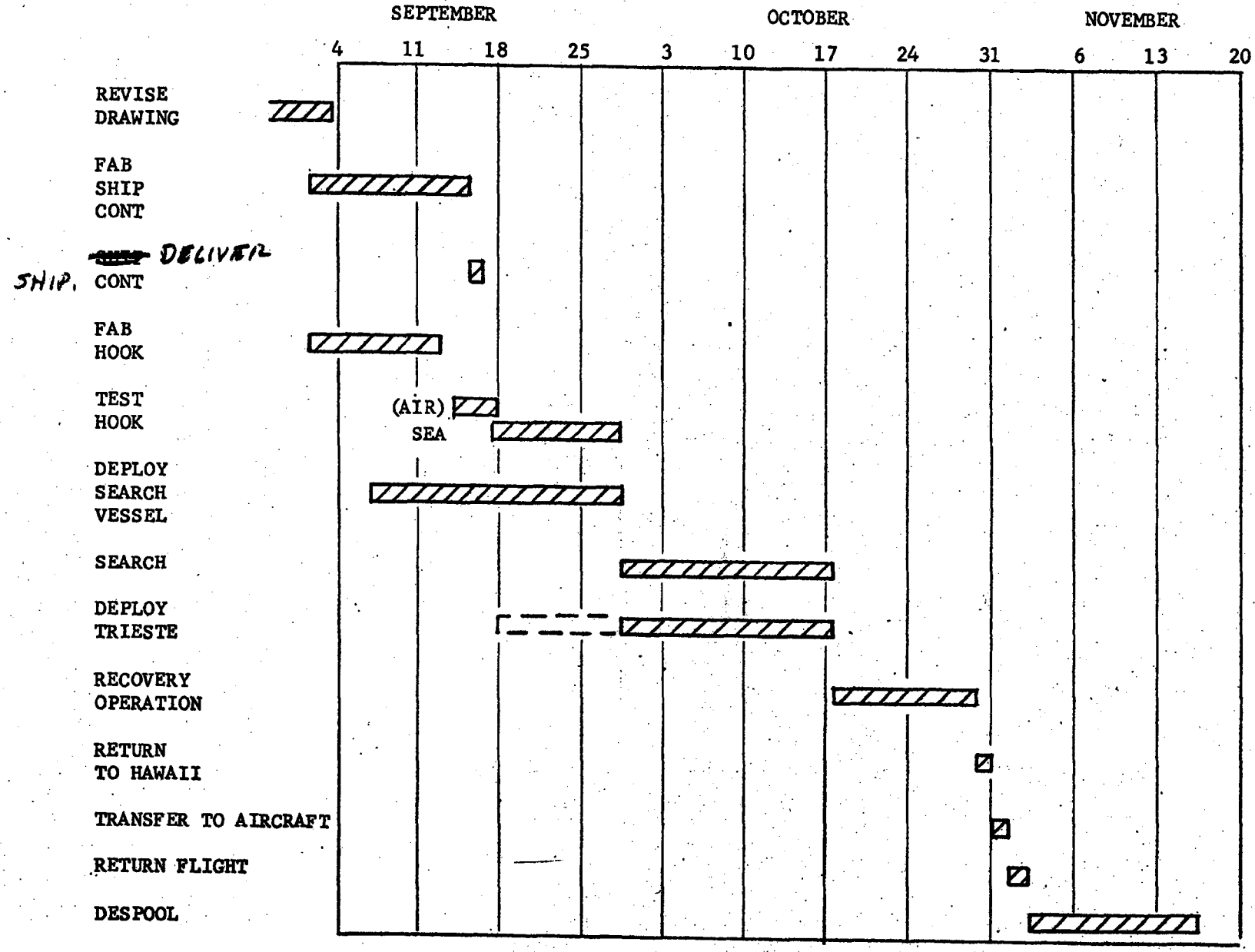

Figure 2

9-4-71
LBM

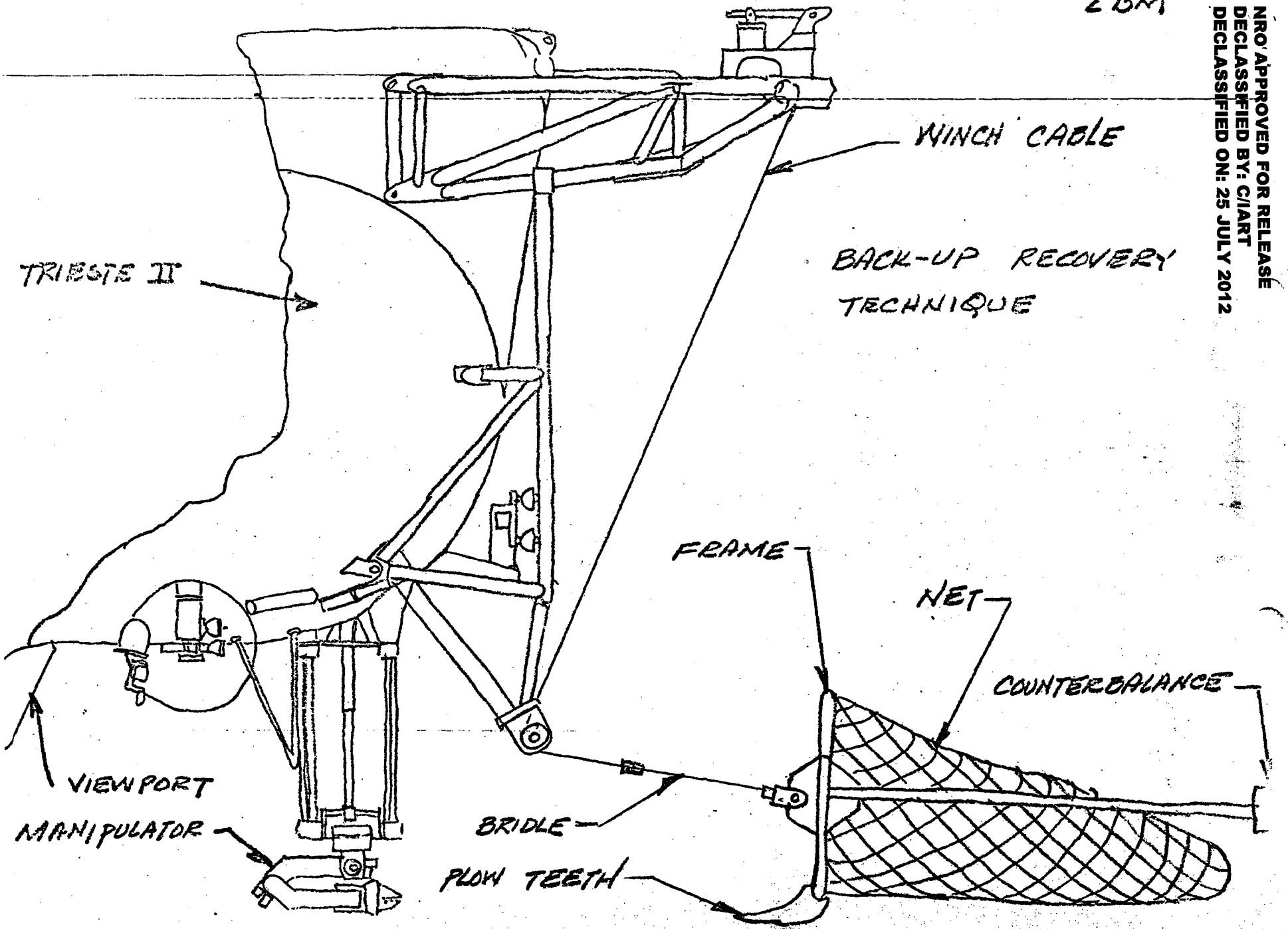

FIGURE 1

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OPTICAL TECHNOLOGY DIVISION
SYSTEMS ENGINEERING DEPARTMENT
SYSTEMS ANALYSIS AND EVALUATION

SEP 7 1971

Memorandum #140

2 September 1971

TO: L. B. Molaskey

FROM: A. T. Bassaro

SUBJECT: RV-3 Recovery Hook Structural Analysis

A structural analysis of the RV-3 recovery hook revealed that the bending stresses developed in supporting the weight of the RV in seawater will not exceed 5000 psi. Since typical structural steel has a yield strength of 35,000 psi, a sizeable margin of safety exists.

Prepared by: ~~A. T. Bassaro~~
A. T. Bassaro

Approved by: ~~P. T. White~~
P. T. White

ATB:glh

Hx ~~SECRET~~
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OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN SECTION

Memorandum ME 57

TO: Distribution DATE: September 15, 1971

FROM: L.B. Molaskey ✓

SUBJECT: Telecon - Lt. Commander R. Anderson - USN - San Diego, Calif.

I called Lt. Cdr. Anderson to check on the Progress with the fabrication of the underwater recovery hook and the schedule for the recovery tests. He indicated that the project is proceeding on or near to the original schedule. The assembly of the hook should start before the end of the week and be complete by Friday, September 17th. The test program will start on Monday the 20th with the hook being used to pick up a loaded 55 gallon drum from a sandy beach using a crane. Various immersion depths will be tried to evaluate the ability of the hook to penetrate the ocean bottom. These tests will be performed in air.

The Trieste is scheduled to depart from San Diego on 24 September, prepared to go all the way to Hawaii. On Monday the 27th of September an underwater recovery test will be performed somewhere at sea off the coast of California. A dummy RV, provided by SPO, will be dropped in about 2000 feet of water and the Trieste will dry run the recovery operation.

Two back-up schemes have been devised and are being prepared by the Navy. Both schemes employ net type hardware which will be attached to the winch on the Trieste. It is planned to test at least one of these devices at sea also.

Lt. Cdr. Anderson is leaving for Hawaii at the end of this week. He designated Lt. Cdr. R. Doyle as the contact in San Diego for the test program. Lt. Cdr. Anderson will be the contact in Hawaii.

For the record I asked Lt. Cdr. Anderson the name of the Captain of Submarine Development Group I which I neglected to record on our first visit. The captain's name is Samuel Packer.

Lt. Cdr. Anderson suggested that I join the test team on Monday, 20 September to assist in both the in-air tests and the at-sea tests. He is making arrangements for a ship to meet the Trieste at the test site. I plan to arrive early on the afternoon of the 20th, support the in-air tests and join the Trieste at sea on the 27th.

L.B. Molaskey

LBM/cj

cc: M.F. Maguire
H.W. Robertson
R.W. Jones
C. Karatzas
P. Petty
R. Roylance
J. Braddon
[redacted] (HQ)

L Molaskey
~~833~~ 845

OPTICAL TECHNOLOGY DIVISION
MEMORANDUM

September 9, 1971 SEP 10 19

To: L. Molaskey

From: J. Ross

Subject: Telecon Report - [redacted] J. Ross 9/9/71

The undersigned called [redacted] to advise that the shipping container for the RV-3 recovery will be tested on 14 September 1971 at the place of manufacture and delivered to Willow Grove on 16 September 1971 to be air lifted. [redacted] agreed that this date was acceptable, but commented that it was success oriented.

Jim

JR/fb
cc:
BTodd
RRoylance

OPTICAL TECHNOLOGY DIVISION
TEST EQUIPMENT DEPARTMENT
TE 405

SEP 1 3 1971

15 September 1971

To: L. Molaskey

From: T. Urban

Subject: Trip to Container Research Corp., Glen Riddle, Pa. on 9-14-71, RX-3, Container #71-618, P. O. 63164 TA

Purpose: To witness qualification of the subject container with PECO Quality Control.

Personnel Contacted: George Lewis - Marketing & Production
Fred Schmidt - Engineering
Ed Scholtz - Sales

Summary: The Container Research Corp., was extensively damaged by a flash flood on 9-14-71, thereby curtailing all operations. The container and cover less wood skids and casters was salvaged. Container Research was directed to ship the salvaged container as scheduled. Prior to the flood, Container Research loaded the container with 7,000 lbs (water and weights) and qualified its structural integrity under handling, with lifting hooks and lift truck. This was not witnessed by PECO personnel.

Discussion: The main office of Container Research was flooded with 6 feet of water virtually destroying their engineering, sales, purchasing and management offices. Almost all drawings and paperwork were lost. The manufacturing facility was full of silt about a foot deep and containers were scattered all over. The RX-3 container was on a higher level and escaped damage. The cover was located in the silt, undamaged, and was assembled to the container for shipment. The casters and skids were in the stock room and only one caster could be located up to 4 P.M. on 9-14-71. They will continue to look for them and advise as soon as possible, although the outlook is not good. The fast currents during the flood could have carried the casters and skids out thru smashed doors or windows into the river.

It is noted that Container Research cooperated fully under very difficult conditions and this was acknowledged.

TU/mf

P. Cavanaugh

T. Urban

cc: M. Shaw
Richard Sisk

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME59

TO: Distribution DATE: September 24, 1971

FROM: L.B. Molaskey ✓

SUBJECT: Trip Report - Recovery Hook Test Program - San Diego, California
20 - 21 September 1971

9-20-71 - Upon arrival on 20 September, I checked at the Naval Base at the office of Commander Mooney who is in charge of the operation in San Diego. I was directed to the dock where the Trieste was being outfitted.

At the dock I inspected the hook with Lt. Taylor and discussed the tests which had been performed earlier that day using a crane on the beach. The dummy load was lifted successfully from various orientations, i.e., nose down, laying on its side, etc. Apparently there were no operational problems with the design although it is reported to be somewhat heavier than calculated, 900 pounds versus 750 pounds. Some of this increased weight is due to the counterbalance weights which have been installed. This extra weight, however, is no problem.

No grease had been packed in the operating mechanism or latch assembly. I recommended that it be loaded and well lubricated prior to use at sea. I was surprised to find that the hook had been completely painted black (the paint was still wet during the test program). Lt. Taylor indicated that the black color was to reduce back-scatter from the lights when operating at sea and was changed from the white paint recommended on the drawings by the Trieste crew.

9-21-71 - I reported directly to the "compound" (Trieste dock and work area) and witnessed part of the rigging operation in preparation for loading the Trieste into the support ship, the White Sands. We then boarded the White Sands and inspected the shipping container. Although somewhat marked up and scratched from the flood ordeal it appears to be sound. All four casters are available but plans are to leave them off for now since the container is much easier to handle without casters aboard ship. They will be assembled, for check-out purposes, disassembled and will be maintained with the container.

Lt. Taylor and I had a briefing with the captain of the White Sands, who is also the captain of the Trieste, Commander Mal Bartels. We reviewed the plans commencing from now through the end of the recovery operation. Significant points brought out are:

1. Cdr. Bartels was not aware of any plans to transfer the loaded shipping container from the White Sands to the Air Force ship on the site. He suggested that such an operation would be very difficult. I explained the need to maintain the payload at 40°F or to rush the unit to its destination. We agreed to check the status of the Air Force ship with [redacted] reported that there is some uncertainty as to the availability of the ship because it is scheduled to be coming out of dry dock on October 16th and that that schedule is somewhat flexible. It could slip. It was decided to pursue the cooling of the entire shipping container as previously planned.

We checked on possibly loading enough dry ice aboard the White Sands to take care of the operation, but found it was impossible to maintain the dry ice long enough. Air drop at the site was also suggested but rejected for various reasons. The current plan is to make regular ice aboard the White Sands. The Navy, therefore, is investigating the availability of a machine capable of making 400 - 500 pounds of ice per day. The plan is to put the shipping container into a big wooden box and keep it packed with ice.

2. After dark recovery of the payload is again being questioned. It appears that the way the load is suspended below the Trieste causes a hazzard for the divers. Also the depth of the unit below the surface, when Trieste is at the surface has again been modified. This time they say 35 to 40 feet. The light levels at this depth, of course, are too high for extended periods of exposure. It looks like our original idea of the curtain would have solved the problem. As it is we are planning to make a simple shroud that can be tied around the payload at the 35 - 40 foot depth. I plan to sketch up such a device and give it to Cdr. Mooney in the morning.

The remainder of this week's schedule and the plans for next week are about the same. The Trieste, aboard the White Sands, will be towed out to the test range, leaving Friday afternoon. The practice dive is scheduled for Monday and/or Tuesday, the 27th and 28th.

L.B. Molaskey

LBM/cj

Distribution

M.F. Maguire	P. Petty
H.W. Robertson	R. Roylance
R.W. Jones	J. Braddon
C. Karatzas	[redacted] (HQS)

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 61

TO: Distribution DATE: September 29, 1971

FROM: L.B. Molaskey

SUBJECT: Trip Report - Recovery of #3 - San Diego, California - 23 and 24 September

Activities of 9-23

The hook was rerigged from the bow hoist to a pulley system off center and closer to the capsule and mechanical manipulator. The new position allows the manipulator to reach the latch and cocking lever of the hook when the payload is suspended on the cable. This new position was photographed, as were the details of all the modifications made for the project. They will be available on my return.

I sketched up a light cover of black nylon cloth to be used for covering the payload as it is brought to the surface. The Navy purchased the material in Los Angeles and is having it sent to their upholstery shop on the base to be fabricated. I visited that facility and reviewed the sketches with the man responsible for making the thing. There are no problems except for the delivery of the material which, at this writing, has not yet arrived. The device will tie onto the hook and completely surround the hook, payload and all. It has "draw strings" that when pulled by the divers will cinch off the top and bottom and completely cover the unit. Fabrication of the cover is scheduled for completion by Monday.

The cooling problem with the payload after recovery has been solved by building a refrigerator. The Navy purchased a refrigerator unit and plans to build a box to enclose the entire shipping container. Lumber, insulation and sealing materials have been loaded aboard the White Sands and the plan is to fabricate the box while in transit to the site.

Activities of 9-24

Departure of the Trieste for the test site was delayed from this morning until Monday the 27th due to ship equipment problems. Because of this I will be joining the ship on Monday morning at the dock and will sail out to the test site aboard the White Sands. Because of the delay only one dive is planned.

A meeting was held, aboard the White Sands, to discuss the techniques to be used to direct the Trieste to the target on the bottom. Attendees were as follows:

[redacted]	- Westinghouse Tech. Rep.
	- Sperry Tech. Rep.
	- Sperry Tech. Rep.
Lt. Cdr. P.C. Stryker	- Trieste II AOINC
Lt. A. Amaro	- Trieste II Elec/Elex Officer
Lt. R. Taylor	- Trieste II Engineer
Lt. Cdr. M.G. Bartels	- Trieste II/White Sands OINC
L. Molaskey	- Civilian - USN
M.R. Boegemann	- MPL (Scripps)
R. Lockwood	- MPL (Scripps)

Of primary concern was the interface between the Trieste, the White Sands and the DeSteiguer equipment to locate the ships on the surface and direct the Trieste on the bottom.

Apparently their navigation systems are not completely compatible, nor are the transponders, markers, hydrophones, etc. The interface was worked out, however, by supplementing the Trieste's capability with equipment from the DeSteiguer. Two schemes will be available for use at the site. My next report will provide the details.

The plan is now to put to sea on Monday to a test range west of San Diego, that is instrumented in a manner similar to the network that will be laid out at the target site. The dummy payload will be instrumented with a pinger and droped over the side. The Trieste will make one dive about 5,000 feet, retrieve the payload, make the transfer to the White Sands, load the Trieste aboard the White Sands and head for the target site. I will return by small boat to the base along with some of the Navy personnel who will be there to witness the test.

L.B. Molaskey

LBM/cj

cc: M.F. Maguire
H.W. Robertson
R.W. Jones
C. Karatzas
P. Petty
R. Roylance
J. Braddon
[redacted] (HQS)

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OR CONTROL BY 90

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 60

TO: Distribution DATE: September 30, 1971

FROM: L.B. Molaskey ✓

SUBJECT: Trip Report - Recovery of #3 - San Diego, California - Activities of 9-22-71

It was reported this morning that the DeSteiguer, the search ship which is being outfitted in Seattle, Washington, has been delayed due to a cable/winch problem. At last report it was two days behind schedule and slipping on a day for day basis until the problem is solved. They report that it should set out for the site on Thursday 9-23-71.

Most of the day was spent rigging the hook to the Trieste in such a manner that it won't swing around in heavy sea and damage the instrumentation located in the area. The Trieste's crew fabricated a channel iron frame which they mounted to the bow structure. They then bolted the hook in place and found that the structure was too flexible to secure the hook adequately.

I recommended the addition of a couple of braces that were then fabricated, welded in place, and did the job.

They are also rerouting the hoist cable so as to locate the hook closer to the manipulator to avoid having to drive up to the payload to operate the hook. This has been a problem and as yet is not solved. More work is scheduled on it for tomorrow.

Close inspection of the hook revealed that it doesn't open as far as it should. There is probably a dimensional error in the positioning of the latch mechanism. Although it opens enough to surround the test shape, it leaves little room for maneuvering. To aleviate this I had them shorten the center rod on each side by about 3 inches. This provides a minimum opening of 70 inches which should be adequate.

It was also reported today that the "test shape" provided by SPO was the wrong one. A new one is scheduled to arrive at noon on Thursday 9-23. We will have to drill some holes and instrument the dummy to allow it to sink and be able to find it on the bottom.

No word yet on the ice machines. That will be checked tomorrow.

~~R.B.M.~~ for
L.B. Molaskey

LBM/cj

cc: M.F. Maguire
H.W. Robertson
R.W. Jones
C. Karatzas
P. Petty
R. Roylance
J. Braddon
[redacted] (HQS)

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LBM

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 62

TO: Distribution DATE: October 4, 1971

FROM: L.B. Molaskey ✓

SUBJECT: Trip Report - Recovery of #3 - Activities of 27 September through 3 October 1971

Monday, 27 September - The White Sands, being towed by a sea-going tug boat, the "Apachie" left the dock at about 3:30 P.M. The ship's activities prior to leaving the dock were all related to preparing for the total operation including the test dive and the actual recovery dive.

There was little activity on the recovery hardware or the Trieste.

A discussion concerning various search, navigation, and homing techniques was held. Mr. Boegemann of MPL, representing the search team, suggested various transducer-receiver set ups as well as a scheme for marking the bottom with a dredge from the search vessel.

In general, the plan is to lay a network of transponders on the ocean floor, survey them using satellite navigation and once the payload is located to reference the payload location to the transponder and mark its location with a pinger. There is no automatic means either in the Trieste or on the surface to actually determine, to any degree of accuracy, the location of the Trieste under the surface. A scheme using hydrophones, transponders, etc., some of which will be supplied by the search ship will be put together so that the surface ships can direct the Trieste to the target. Alternate schemes using air filled glass bottles as a target for the Trieste's doppler system as well as a trench in the bottom laid by the search ship will be used.

Tuesday, 28 September - Activity on the White Sands commenced at 04:30 A.M. The plan for the day was to unload the Trieste from the dock well of the White Sands and to fill its tanks with gasoline and steel shot. This is accomplished by flooding the dock well and towing the Trieste out through the stern gate. I photographed various stages of this sequence.

At 11:00 A.M. the captain, Lt. Cdr. M.G. Bartels, called a meeting to firm up the test sequence and to define the steps required to implement the test. It was decided to carry the test shape to the bottom with the Trieste in order to avoid having to search for it (and possibly spend a long time or even lose it) on the bottom.

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CONTROL BY 9Q

In summary, the plan is to dive to the bottom (4,200 ft.), cut the shape loose, and manuever to pick up the shape in the recovery hook. Once the pick-up is successful, drop the shape by activating the opening mechanism and back off 50 - 100 yards and check the sensitivity of the pinger and pinger receiving equipment in the Trieste. If the sensitivity is inadequate they can follow the "trail ball" mark on the bottom and return to the shape. This accomplished, the shape will again be picked up and the Trieste brought to the surface. A complete dry run of the transfer operation is also planned.

In order to rig for the dive the test shape will be lowered to the water from the White Sands with a float attached. It will be tied to the forward port skeg of the Trieste and the flcats removed. Upon reaching the bottom the rope will be cut by the manipulator and the shape separated from the Trieste.

Reaching the surface after completing the dive the following sequence of events will be performed:

1. Strap the hook closed under water as it is suspended below the Trieste (approximate 30 feet).
2. Attach flotation to recovery hook.
3. Attach safety (back-up) line to recovery hook.
4. Assemble shroud and secure light tight.
5. Reel winch wire off Trieste (wire is not fastened to winch to preclude the possibility of hanging up on the bottom).
6. Hook crane to recovery hook and lift aboard White Sands.
7. Disassemble shroud, open hook, and place payload in nylon net.
8. Place payload, net and all, into the shipping container.
9. Fill shipping container with sea water and seal top.
10. Cover refer box and cool payload.
11. Off to Hawaii.

Discussion with Lt. Cdr. R. Doyle firmed up the contact point for the support required in Hawaii. I should check with Lt. Cdr. Doyle on about the 12th of October to determine the final schedule (presently set for about 19 October in Hawaii). In Hawaii I am to contact:

Dev. Group Liaison Officer - Trieste
c/o Sub Base - Pearl Harbor
Comm. Sub Float 5
Operations Office.

The following data are the specifications of the pinger used to mark the test shape: "General Purpose Pinger" Model 606 A manufactured by:

Burnett Electronics Lab. Inc.
P.O. Box 23015, San Diego, Calif. 42123
Tel. (714) 278-6370

Its specifications are:

Frequency: 37 KHz nominal

Emission: Pulse

Duty Cycle: (A) Approx. 20 MS on; 1 sec off
(A1) 15 ms on; 500 ms off

Beam Pattern: Omnidirectional

Acoustic Output: Approx. 1500 dynes/cm^2 at 1 meter

Operating Pressure: 6,000 ft.

Activation: Water immersion

Power Source: Mercury cell (Mallory TR-145)

Battery Life: 21 days continuous; one year shelf life

Weight: 215 grams, including battery

Dimensions: 4-1/4" long x 1-1/2 in diameter.

The last activity of the day was to load the ballast shot and gasoline into the Trieste. It requires over 25 ton of steel shot which is loaded from the White Sands to the floating Trieste via a water slurry pumping system. A fire hose, 200 feet long, is attached to the Trieste and the steel shot is pumped from the White Sands in a slurry of water to the tanks of the Trieste. The shot is supplied in 55 gal. drums containing 25 pound bags which must be unloaded by hand and dumped into a hopper. The hopper is then lifted by crane to the slurry mixing chamber and metered into the pump. The total shot loading operation requires about 10 hours. It was completed about midnight on the 28th. The gasoline is similarly pumped from the White Sands and requires 4 to 6 hours.

Wednesday, 29 September - After completing the loading operation preliminary check out of the electronics instrumentation revealed several problems. They were worked through the night and a more or less formal series of "predive

preparation tests" were started early the next morning. Due to a series of test anomalies, the predive sequence was completed about six hours later than planned.

After releasing the tow and service lines the pilots were transferred to the Trieste and the dive commenced at 15:45. The scaph descended as planned directly to the bottom at about 4,200 feet in approximately 45 minutes.

Several electronics equipment problems occurred almost immediately. I didn't get all the details but there was trouble with the television, sonar, cameras, and navigation systems.

Upon reaching the bottom the pilots attempted to cut the shape loose and experienced much difficulty due to the lack of tension in the "polycrow" line. They solved this by raising off the bottom to establish tension in the line and were successful in cutting the shape loose. The above was somewhat complicated by the fact that the line was wrapped around the television and camera equipment on the front of the scaph. They then moved away from the test shape to test their ability to locate it with the marking device (pinger). Although some of the equipment did not function as expected they were able to return to the shape. They then proceeded to locate the hook over the shape in order to pick it up. This proved to be extremely difficult because of the lack of depth perception out of the view port. Although they were able to come close they did not succeed in lowering the hook over the test shape. During these maneuvers, the winch cable evidently jumped off a pulley and during the next attempt to operate the winch the cable parted, dropping the hook to the bottom. Having lost 900 pounds of weight, the Trieste immediately ascended toward the surface. The fathometer indicated that the scaph went up 400 feet before sufficient gasoline could be released to stop the ascent. When they got back to the bottom the hook and target shape were not in sight. A search pattern was initiated and after approximately 45 minutes the target and hook were located. After consultation with the Westinghouse tech representative on board the White Sands it was decided that they should attempt to pick up the hook in the mechanical manipulator jaw and surface with the hook hanging straight down below the Trieste. This was successfully performed and the hook brought to the surface. It was immediately secured to the bow frame by divers and subsequently attached to floats and transferred to the White Sands. The pilots finally got off of the Trieste and back to the White Sands at about 2:00 A.M. Thursday morning.

Thursday, 30 September - A conference was held early in the morning to decide on a course of action for the remainder of the test. Cdr. Mooney, representing the Submarine Development Group I Commander, very strongly indicated that a recovery technique must be perfected with haste and that all steps possible should be taken to achieve that goal. The following plan was established:

1. The Westinghouse, Straza, and Sperry tech reps should proceed immediately to the scaph to work out the electronics problems at hand.

2. The Trieste should be kept in tow and all repairs and rework performed in that mode. This was to avoid a four to five day turn-around time if the Trieste were to be loaded onto the White Sands. The long turn-around time results from having to degas the Trieste prior to bringing it aboard the White Sands. That operation, of course, requires re-gassing once it is launched again.

3. Recharge the Trieste's batteries.

4. Rework the hook to provide more clearance in the open position. (There was an error in the fabrication of the hook which did not allow it to open to its designed position.)

5. Replace the lost "trail ball" - It appears that the trail ball somehow was lost during the dive. The purpose of the trail ball, a 250 pound ball of lead which is suspended on a cable 30 feet below the scaph, is to automatically reduce the ballast when the scaph reaches the bottom. It also allows the Trieste to hover 30 feet above the bottom without active control.

6. Rerig the hook winch line through the forward bow pulley, as opposed to the earlier "side" arrangement.

7. Replenish shot and gasoline used in first dive. (Because of all the maneuvering done on the first dive more shot and gasoline were used than on any previous dive).

8. Perform predive check-out.

9. Repeat dive to recover test shape.

The problem with the opening span of the hook was due to an error in the location of the lower link pivot points on both arms. The problem was solved by disassembling the links and lengthening them from 15-7/8 to 17-3/16 inches. This was done by cutting the links in half and welding a longer tube over them.

An extension for the latch trip mechanism was also designed and fabricated. This will allow more freedom for the actuation of the manipulator. In addition the hook was painted with white stripes (although the drawings had called for white paint the pilots changed the color to black to preclude back scatter which would interfere with their television reception.) Several areas were also painted with "international orange" for test purposes.

After completing the modifications the unit was tested on the crane to verify its new open and closed position and lifting capacity. During the test the latch was noted to dig into the shaft causing the hook to remain partially open. This was remedied by removing the sharp edge on the latch lever.

Friday, 1 October - I suggested that a wand which could be used to extend the reach of the manipulator be made so as to allow moving the hook over the test shape with the arm rather than maneuvering the entire scaph. I made up a sketch and the part was fabricated.

As an aid to locating the hook over the target it was suggested that a "plumb bob" be added along the center axis of the hook. The plumb bob will be suspended from the hook so as to ride three to four feet above the bottom when the Trieste is sitting on the ocean floor. By locating the plumb bob directly over the test shape (or actual payload) the hook can be accurately located prior to release from its stowed position. It is felt that it will be easier to position a single line over the shape rather than the complex recovery hook. The hook was modified and the plumb bob added.

During the Trieste charging operations it was determined that there were problems with the monitor and power cables (this was the first time these cables had been used - new cables). The connectors on the monitor cable had to be rewired. The time required to diagnose the problem and repair the cable was approximately 20 hours. Charging started about 5:00 P.M. on the 1st. This, of course, delayed the start of the next dive until Sunday morning.

During the course of the activity on Friday morning, it was discovered that there was a leak in the cooling chamber of the fresh water condenser on the White Sands which supplies fresh water to the entire ships's water system including the boilers. As a result all aboard were asked to conserve water. Later in the morning it was announced that the water was not potable and that the boilers had been contaminated with salt water. This requires a complete shut down of the boilers and water evaporators; repair of the leak; flushing of all the fresh water tanks and boilers. Meanwhile, the crew could not use any fresh water. Orders were requested from the Sub Dev. Group. Those orders directed the White Sands back to a location just outside San Diego harbor where a water barge could be safely brought alongside to replenish the ship's water supply and assist in the flushing operation. This was expected to add one to four days to the schedule depending on the time required to locate and repair all the damage.

These orders were subsequently modified and the White Sands ordered back to port. It was planned to attach the tow line back to Apachie and towing the Trieste in tandom return to the mouth of the harbor. There the tow line from Apachie will be transferred from White Sands to Trieste and the Apachie tow the Trieste in to its mooring. It would then return to tow White Sands in to its pier. In this way, regassing and reshoting of the Trieste is avoided cutting down the preparation time for the next dive.

The plan was implemented and we returned to port. Inasmuch as the hook modifications were complete and the consensus of opinion of the pilots was that the new rigging techniques would be successful, I decided, with concurrence

from the Captain, that no further support for the test series was required. I therefore left the ship and returned home.

Plans for the remainder of the test series are as follows:

1. Flush the White Sands fresh water system at the pier - 40,000 gallons of fresh water required - complete by Monday night.

2. Replenish shot in the Trieste by hand at the pier. Approximately 10,000 pounds required.

3. Proceed to the test site on Tuesday morning.

4. Locate the test shape from the surface using Satellite navigation and by tracking the pinger from a small boat equipped with a receiver tuned to the proper frequency.

5. Tow Trieste over the target to confirm the signal from the pinger.

6. Locate Trieste over the target and dive.

7. Search the bottom homing in on the pinger and locate the shape.

8. Maneuver the Trieste over the shape and activate the recovery hook.

9. Surface and transfer the hook and test shape to White Sands.

10. Complete recovery operation as previously planned.

11. Drop remaining shot, degas and load Trieste onto White Sands.

12. Proceed to recovery site off Hawaii. Estimated date for completion of test: 7 October '71. - Arrival at recovery site, 27 October '71.

In summary I would like to say that although the operation will be difficult the equipment is capable of meeting the requirements of the job. It is pointed out that this will be the first operational use of the Trieste's capability since it was used to locate the Thresher. The dedication of the officers of the Trieste, especially Lt. R. Taylor, Lt. Cdr. P. Striker, Lt. A. Amara, and Lt. Cdr. M. Bartels is outstanding. The cooperation of the entire crew, in the face of all the problems reported above was commendable.

L.B. Molaskey

LBM/cj

cc: M.F. Maguire
H.W. Robertson
R.W. Jones
C. Karatzas
P. Petty
R. Roylance
J. Braddon
[redacted] (HQS)

NOTE: Photos of the hardware and many of the above operations will be available in my office.

E-4

ROUTINE ********** SECRET **********

MD B 00534 01 279 211314

AFIN: 11729 (6 Oct 71) L/wtp

ACTION: SAFSS-3, INFO: RD-4 (8D)

RTISZYUW RUWJEBA3519 2792008-SSSS--RUEFHQA.
ZNY SSSSS
R 061730Z OCT 71 061730
FM SAMSO LOS ANGELES AFS CALIF
TO RUEFHQA/OSAF/SAFSS
RUEKJCS/OSD/ARPA
RUEFHQA/HQ USAF/ROPM
RUEOAWA/AFSC/DO/ANDREWS AFB MD
RUWJABA/SAMSO/RN/NORTON AFB CA
RUWMFHA/AFSCF/DET 1 DOZA/SUNNYVALE CA
INFO RUCLBQH/AFETR/DOOT/PATRICK AFB FLA
RUEBNHA/MIT/L G HANSCOM FLD MA
BT
SECRET LIMDIS CCDS.
THE FOLLOWING MSG IS A RE-TRANSMITTAL OF OUR 291630Z SEP 71
AMENDED TO INCLUDE ADDITIONAL ADDRESSEES.
SUBJECT: TRAP/PRESS SPECIAL MISSION REQUEST.
1. IN JULY 71 TRAP AND PRESS RESPONDED TO AN URGENT REQUEST BY
THIS OFFICE TO CONDUCT HIGH RESOLUTION PHOTOGRAPHY OF A DATA
CAPSULE AND PARACHUTE IN THE HAWAIIAN AREA. WE ARE PLANNING
TO CONDUCT UP TO FOUR SIMILAR TESTS IN THE NEAR FUTURE FOR
WHICH WE REQUEST TRAP/PRESS SUPPORT. CURRENT PLANNING IS TO

PAGE 2 RUWJEBA3519 SECRET LIMDIS
CONDUCT ALL FOUR TEST DURING THE PERIOD 23 NOV 71 TO 7 JAN 72.
SAFSS SHOULD MAKE ARRANGEMENTS FOR THE APPROPRIATE
PRIORITY.
2. AN OPERATIONS PLAN IS BEING DRAFTED WHICH WILL COVER
TEST DESCRIPTION, KEY PERSONNEL, COMMUNICATIONS AND
TIME LINE. THIS WILL BE AVAILABE FOR REVIEW BY 18 OCT 71.
SUGGEST A MEETING AT SAMSO, BLDG 110, RM 2213 AT 0900 ON
19 OCT 71 TO CONDUCT MISSION PLANNING AND REVIEW THE OPS
PLAN DRAFT. PROSPECTIVE ATTENDEES SHOULD SUBMIT
CLEARANCES TO SAMSO (SPOV) WITH AN INFO COPY TO MAJOR M.
BUCHEN (SAMSO/CCSD). PROJECT OFFICER IS MAJOR M. BUCHEN
(AUTOVON 833-1594) (GP-1).
BT
#3519

NNNN

[illegible] COPY

ROUTINE ********** SECRET **********

~~HxSECRET~~
WORKING PAPER, DESTROY
OR CONTROL BY 90

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 63

TO: Distribution DATE: October 7, 1971

FROM: L.B. Molaskey ✓

SUBJECT: Telecon to [redacted] (EK)

I called [redacted] in response to his request of a day earlier and provided the following information as to the materials in the electronics box and take-up structure.

A-2 ELECTRONICS (621-0407)

Part No.	Name	Material
621-2898-005	End Plate (inboard)	Mag. ZK60A temper T5
621-2899-005	End Plate (outboard)	Mag. ZK60A Temper T5
621-2901-002	Mounting Frame	Mag. QQ-M-44 Comp. AZ 31B Cond. 0
621-2900-002	Cover	Mag. QQ-M-44 Comp. AZ 31B Cond. 0

TUA Materials Be and MG

Part No.	Name	Material
621-2816-001	Central Shaft (Blank)	Extruded Beryllium per SM 0180 (98% Be min, BeO 2% max)
621-2795-005	Central Spacer	Mag ZK 60 A Temper T5
645-6948-002	Arm (B/R)	Mag casting QQ-M-56 Comp. AZ 91C, Temper T6
645-7141-005	Roller Housing	Mag casting QQ-M-56 Comp. AZ 91C, Temper T6
621-2741-001	Sleeve (Blank)	Beryllium block hot pressed, standard grade SM 0080 Type I Class 2

[redacted] inquired about the shipping container for the return of RV #3. I explained that SSC has provided the container and that I would send him a sketch of the container with the drawings promised earlier.

L.B. Molaskey

LBM/cj

cc: MF Maguire
H.W. Robertson
R.W. Jones
C. Karatzas
P. Petty
R. Roylance
J. Braddon
[redacted] (HQS)

~~SECRET~~
WORKING PAPER, DESTROY
OR CONTROL BY 90

WORKING PAPER, DESTROY
OR CONTROL BY 90

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 64

TO: Distribution DATE: October 8, 1971

FROM: L.B. Molaskey ✓

SUBJECT: Status of RV-3 Recovery (Telecon to Cdr. Mooney, Sub Dev. Group I)

I called Cdr. Mooney to inqure as to the status of the RV-3 recovery tests which are continuing off San Diego. He indicated that the second dive had been completed but that the Trieste was unable to locate the test shape on the bottom. He indicated that the Trieste surfaced about 5 miles from the target point. No explaination was given for the error.

Cdr. Mooney indicated that a third dive is scheduled for early Friday morning and suggested that I again call him to check the status. He said that even if they can't locate the shape that they will operate the hook on the next dive to check its operation.

I suggested an alternate means for opening the hook, which may prove to be simpler than operating the opening mechanism. The scheme was simply to lay the closed hook on the bottom and lift it with the mechanical arm from one side, similar to the way it was recovered on the first dive. This will allow the hook to open by gravity and the latch will hold it in the open position. He agreed to notify the pilots of this scheme.

Cdr. Mooney indicated that the search ship DeSteiguer is also having problems. It seems that after they left Hawaii for the recovery area they experienced a failure in their Loran "C" satellite navigation system and in their tracker. They have returned to port for repairs and are currently awaiting receipt of a part for the tracker.

He agreed that tentative plans should be made to arrive in Hawaii about the 26th of October. He indicated that either he or Capt. Packer will also be going out to supervise the recovery operation and that we should plan to use the same means of transportation from Hawaii to the recovery site. He will make the necessary arrangements.

L.B. Molaskey

LBM/cj

cc: M. F. Maguire
H.W. Robertson
R.W. Jones
C. Karatzas
P. Petty
R. Roylance
J. Braddon
[redacted] (HQS)

Hx SECRET

WORKING PAPER, DESTROY
OR CONTROL BY 90

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 65

TO: Distribution DATE: October 12, 1971

FROM: L.B. Molaskey ✓

SUBJECT: Telecon with Lt. Cdr. Doyle

I called Lt. Cdr. Doyle to inquire of the status of the underwater hook recovery test program being conducted off San Diego. He indicated that there was a problem of some sort with the hook which occurred during the operation of transferring the hook from the White Sands to the Trieste. Something either broke, came apart or was damaged. He had no details of the exact problem. However, the damage has been repaired and as far as he knows the hook is now operable.

Recovery of the test shape is being delayed because as yet the shape hasn't been located. The dive that occurred last Wednesday was unsuccessful due to a failure in the underwater navigation computer. In preparation for the third dive that anomaly has been corrected. However, they haven't been able to pin-point the location of the test shape from the surface.

Lt. Cdr. Doyle said that he expected they could complete the test program by Friday or Saturday at the latest. Adding 19 days for travel time to the site they should arrive on or about the 3rd or 4th of November. He suggested I delay my arrival in Hawaii to that time.

He reported that the DeSteiguer has experienced some problems in locating the test site. They apparently laid a network of transducers on the ocean floor from an initial survey. In rechecking their location it was concluded that they were in the wrong place. However, a second check indicated they were probably in the right place. (no official word has yet been received.) The DeSteiguer is apparently still having trouble with their satellite navigation system.

Lt. Cdr. Doyle suggested I keep in touch so that the logistics of my up-coming trip can be worked out smoothly.

L.B. Molaskey
10-12-71

LBM/cj
cc: M.F. Maguire P. Petty
H.W. Robertson R. Roylance
R.W. Jones J. Braddon
C. Karatzas [redacted] (HQS)

Hx ~~SECRET~~
WORKING PAPER, DESTROY
OR CONTROL BY 90

~~SECRET~~
WORKING PAPER, DESTROY
OR CONTROL BY 90

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 66

TO: Distribution DATE: October 13, 1971

FROM: L.B. Molaskey

SUBJECT: Status of RV-3 Recovery

In a telecon to Lt. Cdr. Doyle concerning the status of the RV-3 recovery operation Lt. Cdr. Doyle indicated that on the last dive the crew of the Trieste has successfully operated the recovery hook on the bottom. They did not, however, pick up the test shape.

After maneuvering to the location of the test shape on the bottom they were running low on battery power. It was therefore decided to exercise the hook in the normal recovery mode without actually maneuvering over the test shape. The operation was successful and the pilots are confident they can, in fact, pick up the shape given enough time. After surfacing, the Trieste was loaded into the White Sands and the ship departed for Hawaii this morning. Current schedule is to arrive at the test site on about the 28th of October. Lt. Cdr. Doyle asked that I check with him in about 5 or 6 days to confirm my arrival date in Hawaii currently scheduled for the 27th of October.

L.B. Molaskey

LBM/cj

cc: M.F. Maguire
H.W. Robertson
R.W. Jones
C. Karatzas
P. Petty
R. Roylance
J. Braddon
[redacted] (HQS)

~~SECRET~~
WORKING PAPER, DESTROY
OR CONTROL BY 90

WORK IN PROGRESS
OR CONTROL BY 90

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 70

TO: Distribution DATE: November 18, 1971

FROM: L.E. Molaskey

SUBJECT: Trip Report - Recovery of RV #3

LOCATION: At Sea - 350 Miles Northwest of Hawaii

INTRODUCTION

This trip report covers all the activity in which I was involved or witnessed commencing on October 28th through November __ concerning the recovery of RV #3. The report is organized chronologically as, in fact, it was written on a day by day basis. A complete set of photographs of significant events and operations accompanies this report with limited distribution. Copies of the photos are available for review in my office.

THURSDAY, 28 OCTOBER 1971

Contacted Lt. Cdr. R. Anderson at the Submarine base in Pearl Harbor and arranged to meet with him to discuss the status of the operation and the plans for transportation to the recovery site. Lt. Cdr. Anderson indicated that arrangements had been made for transportation to meet the White Sands about 300 miles off Hawaii. The sea-going support ship for the "Sea Cliff" and the "Turtle", the "Maxine-D" will carry the following personnel to rendezvous with the White Sands:

Commander B. Mooney - O in C of Recovery Team
T. Turner - Straza Representative
[redacted] - HQS
L. Molaskey - SSC
[redacted] - [redacted]
5 Sailors - new transfers to the White Sands' crew

The Maxine-D is scheduled to depart Honolulu early Sunday morning, 31 October.

The progress of the White Sands was reported to be on or slightly ahead of the last reported schedule. No report from the search force was available from Lt. Cdr. Anderson. He indicated, however, that [redacted] is expected to have the underwater photographs with him when he arrives on Friday.

A meeting was arranged for Saturday morning to review the photos and discuss the recovery plan.

FRIDAY, 29 OCTOBER 1971

No project activity scheduled - I went fishing.

SATURDAY, 30 OCTOBER 1971

Contacted [redacted] at his hotel and arranged for him to join the meeting scheduled with Lt. Cdr Anderson and Cdr. Mooney at the Sub base.

The meeting was held primarily with Cdr. Mooney. Lt. Cdr. Anderson left to catch a 1:00 P.M. flight back to San Diego. The photographs were reviewed as were the location plots provided by the search team (No direct representation from the sea ch team was, or will be provided for the recovery operation.) The overall plans were discussed and arrangements made for weather reports to be provided twice daily for the duration of the operation.

Final arrangements; location, time, phone number, etc. were made for the transfer to the recovery site.

Ship	-	Maxine-D
Sailing time	-	0600
Location	-	Pier 43 - Honolulu
Date	-	October 31, 1971

SUNDAY, 31 OCTOBER 1971

Sharing a cab with [redacted] we arrived at Pier 43 at approximately 0545. Upon boarding the ship there was no evidence of any activity aboard and it was apparent that plans for the 0600 departure had been changed. As it turned out, the Maxine-D had some kind of mechanical problem with one of its main drive clutches and although the parts were scheduled to be in Hawaii on Saturday, they had not yet shown up. They arrived about 0930 and were installed in less than an hour. The ship was ready to depart. Sailing time was set for 12:00. At 12:00, with the pilot aboard, one of the passengers, [redacted] was missing. The ship set sail without him. As we pulled out of the harbor a message was received indicating that the missing passenger had been located and that he would be ferried out by a Navy torpedo retriever boat. We then proceeded to the mouth of Pearl Harbor to wait for that transfer. We finally put to sea at about 1500 that afternoon.

The Maxine-D is 165 feet long and can make about 12 knots. The plans were to overtake the White Sands as it approached the recovery site and after making the transfer, the Maxine-D was to proceed directly to San Diego. The White Sands to travel the remaining 100 or so miles to the recovery site.

MONDAY, 1 NOVEMBER 1971

The trip proceeded on schedule and we overtook the White Sands at about 1600 in the afternoon. The White Sands put out a 16 foot Boston Whaler and the passengers made the transfer from the Maxine-D to the Whaler to the White Sands. There were swells of about 8 to 10 feet at the time making the transfer a rather difficult operation. No casualties were reported but most of our luggage got quite wet.

We were received aboard, made the necessary introductions, assigned living quarters, had supper and again got under way for the site. The Maxine-D left with her signal flags reading "THINK DEEP". The White Sands responded with "THINK DEEPER".

TUESDAY, 2 NOVEMBER 1971

We were now approaching the recovery site and activity in preparation for the first dive began. The refrigerator for cooling the payload was in final stages of completion. As originally constructed, the unit consisted of a 3/4 inch plywood box built around a 2 x 4 frame. The outside dimensions approximately 8 x 8 x 8 feet. The insulation consists of 1-1/2 inch glass wool blankets fabricated with the aluminum side facing the interior of the box. The cooling unit was mounted to the outside of the box blowing air from the outside into the box through an opening behind the cooling coil. After reviewing the requirements with Lt. Abbot, the ship's engineer, it was agreed that the set up could not adequately refrigerate 8,000 pounds of sea water to below 40°F in the outside ambient of about 90°F in bright sunlight. [redacted] and I got together to plan modifications which would improve the installation. We recommended the following:

1. Paint the outside all over with white paint.
2. Construct a recirculating duct to take the cooled interior air and pass it over the cooling coils in a closed system.
3. Insulate the cooling unit as much as possible.
4. Tape all seams to shut off air leakage.

The original plan was to move the refrigerator, after completion, aft to the starboard wing wall where the payload could be lifted by the crane and loaded directly into the waiting precooled shipping container full of water. This plan was abandoned because of lack of adequate space on the wing wall and it was decided to leave the refrigerator on the deck at the forward end of the dock well. This meant a change in the handling procedure for the classified payload. These details were worked out and the handling plans finalized.

We then requested that the shipping container be installed in the refrigerator immediately so that the large mass of water could start cooling.

This was accomplished with some difficulty because of the minimum amount of clearance between the shipping container and the inside dimensions of the box. Even small swells cause the ship to roll and with the shipping container hung from the crane it tends to swing like a house wrecker's ball. The operation was finally completed and the containers filled with salt water from the fire main. (The hose and fire main were flushed for 20 minutes prior to filling the containers.)

We planned to fill the container about 2/3 full of sea water so that when the payload was immersed in the container the water level would just about reach the top. However, as the water was being pumped into the container, some of the glass wool insulation fell into the water. To remove this contaminant, the container was overflowed until all of the particles poured over the top. The container lid was installed and the box sealed to start the cooling process. The initial water temperature was recorded to be 70°F.

While this was going on the Trieste was being prepared for launching. At about 2030 the dock well was flooded and by 2230 the Trieste was trailing in tow off the sterm of the White Sands. Gassing operation started as soon as the dock well was pumped out.

WEDNESDAY, 3 NOVEMBER 1971

The gassing operation, pumping 67,000 gallons of aviation gas into the ballast tanks of the Trieste, were completed by about 0930. This operation is explained in one of the previous trip reports. Loading of the steel shot ballast started immediately. In this operation, as explained in an earlier trip report, 32 ton of steel shot is pumped in a slurry of salt water into the hoppers of the Trieste. Several problems occurred during the shotting operation. The pump housing broke down and had to be replaced. In trying to make up for lost time due to the pump problem, the shot flow rate was increased causing the hose to clog up. A section of the hose was removed and the problem cleared. The flow rate was slowed down to avoid further clogging problems. The shotting operation was completed at about 2200 and the predive checks started.

At this point it was decided not to dive this night to allow for completion of the predive checks and to give a rest period for the crew and pilots who had been working 'round the clock.

Meanwhile the temperature of the interior of the refrigerator appeared to have stabilized at about 56°F. The coolant coil could not increase the differential. It was therefore decided to request an air drop of dry ice to lower the temperature. In addition, plastic bags and buckets of fresh water were loaded into the deck top refigerator to make ice. The plan being to open the box, install the dry ice and regular ice, seal it up and hopefully lower the temperature below 40°F.

THURSDAY, 4 NOVEMBER 1971

At about 0100 the aircraft showed up to drop the dry ice. A small boat was deployed from the White Sands. The aircraft first dropped a smoke marker then in six successive passes parachuted capsules containing the dry ice. They were recovered by the small boat and brought aboard the White Sands. The top was removed from the refrigerator box and the packets of dry ice installed. During this operation some of the insulation on the sides of the box was torn and had to be repaired. It became obvious that more insulation was required. A request for more insulation was made, but there was no more available on board. The water in the freezer had not solidified as yet so the refrigerator was again sealed.

While the air drop was in process, the White Sands was heading for the "zero dot". This is the transponder laid on the bottom by the search team to mark the location of the package. It is a transmitter that when interrogated by a signal of the proper frequency returns a signal of its own. The search team had planted two such dots. The zero dot being 160 - 165 yards north of the payload and the other dot, designated dot 3, was reported to be about 110 yards N E of the zero dot.. These dots were located from the surface using satellite navigation and then interrogating them from the Apache. Apache, meanwhile was preparing to plant two additional dots in the area.

The new dots were planted and their position, or at least the position of the Apache as the dots were released from the surface, was recorded. These additional dots were to act as position markers to help remove ambiguity in the range readings from the other dots and to provide a fixed pattern on the ocean floor from which to navigate on the bottom. The preliminary data, before the first dive, was:

Channel No.	Operating Frequency	Estimated Location
0	12.5 KHz	160 yards N of P.L.
2	13.5 KHz	On Trieste
3	14.0 KHz	110 yards N.E. of 0
5	15.0 KHz	5,330 yards S.W. of 0
8	16.5 KHz	5,670 yards S.E. of 0

The position of the 0 dot is reported to be a 37 KHz pinger was also planted by the search team. This was reported to be within 30 yards of dot zero.

Final preparations for the dive commenced as the White Sands approached the location of the 0 dot. The recovery hook was attached to the Trieste by the divers, the anti-chamber filled with sea water and the Trieste descended towards the bottom.

Hydrophone communciation with the Trieste was maintained throughout the dive. At about 2000, one hour and forty-five minutes after leaving the surface, the Trieste reported their position 300 feet above the bottom which was at 16,400 feet. Relaying their range to each of the dots in the pattern, the Trieste attempted to close in on the zero dot. At the same time, their position was plotted both on Apache and White Sands. As the Trieste approached the zero dot they observed a sonar contact on their CTFM. They changed course to investigate the contact and found nothing. The same type of search maneuvers were conducted with several other sonar contacts. Each time no visual observation was made. During the dive, there seemed to be a discrepancy in the range data indicating that the dots were not located where they were reported to be. At about 0200 the dive was terminated unsuccessfully. The scaph reached the surface at about 0345.

Meanwhile the temperature of the refrigerator box had stabilized at just below 50°F.

FRIDAY, 5 NOVEMBER 1971

A meeting was held to brief all parties oncerning the observations made on the first dive, to review the data taken and to plan the activities for the next recovery attempt. At this point the weather was beginning to deteriorate to the point where it was extremely difficult to operate a small boat on the surface and almost impossible to board the Trieste. Two officers from the Apache attended the meeting. (They were part of the navigation team on the first dive). After discussing the data taken and trying to draw conclusions as to the location of the dots it was apparent that a survey of the field should be taken from the surface. A plan was laid out that would have Apache attempt to cross the line between successive pairs of dots while recording range to each dot. A plot of the sum of the ranges to two dots will minimize on a line between the two dots. The data taken on the surface between each pair of dots can then be used to determine the distance between the dots on the bottom. Assuming the location of the payload is accurate with respect to the zero dot and knowing the range between dots the Trieste can navigate as required within the field without losing its reference. It can seek the combination of ranges that will put it over the payload.

The meeting was terminated early to allow the Apache officers to return to their ship because the weather kept getting worse. The plan to survey the field had to be postponed because the White Sands could no longer maintain headway against the wind and the sea. Apache was required to provide a tow so as to maintain control over the Trieste which was being towed by White Sands. All recovery activity ceased pending improvement in the the weather.

SATURDAY, 6 NOVEMBER 1971

Winds in excess of 22 knots with gusts up to 30 knots prevented any recovery activity. Although previously called off via message to Hawaii, the

aircraft carrying 150 square yards of 3 inch styrofoam insulation and an additional 1000 pounds of dry ice came out. The air drop was called off via radio because the seas were too rough to attempt to launch a small boat for the pick-up. The recovery force with Apache towing White Sands and White Sands towing Trieste maneuvered into the wind in an effort to maintain within the operational area.

SUNDAY, 7 NOVEMBER 1971

Weather conditions remained about the same with no let-up in sight. Winds as high as 29 knots with gusts up to 35 knots were reported during the night. Sea swells of about 8 to 10 feet with white caps prevailed throughout the day. No recovery activity was performed.

MONDAY, 8 NOVEMBER 1971

Weather conditions remain the same. No recovery activity today. At this point Apache's fuel supply began to reach a critical level. She reported that only 50% of her fuel supply remained. Using about 3% per day, this left only five days operating time before she must ballast with salt water. Not having used this procedure for quite some time there was a question of contaminating her remaining supply due to pipe leaks, etc. To avoid this potential problem one of several alternatives could be chosen.

1. Hope that the weather cleared in the next five days so that Apache could be refueled from White Sands.
2. Send out another ship to provide the tow for White Sands and have White Sands and Trieste stay on station to wait for the weather to clear while Apache goes to port unencumbered for fueling.
3. Have the entire recovery force head for port for fueling and repair.
4. Send out another ship capable of refueling Apache while towing White Sands.

Commander Mooney recommended alternate number 2 via a message requesting direction from Sub Fleet 5.

L.B. Molaskey

LBM/cj

cc: M.F. Maguire
H.W. Robertson
R.W. Jones
C. Karatzas
P. Petty
R. Roylance
J. Braddon
[redacted] (HQS)

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING
Memorandum ME 71

22 November 1971

To: Distribution

From: L. B. Molaskey

Subject: Trip Report - Recovery of RV #3

Location: At Sea - 350 Miles Northeast of Hawaii

INTRODUCTION

This trip report continues chronologically the events of the subject task for the period of 9 November thru Thursday 18 November 1971.

TUESDAY, 9 NOVEMBER 1971

The weather still prevents any dive activity. The task force is headed for the Southern most sector of the operation area awaiting word on how the Apache fuel problem is to be solved. There is also growing concern for the status of Trieste. Being towed at length in such rough sea there is a possibility of damage to exterior equipment. The forward speed of the tandem tow has been reduced to a minimum. About two knots is required to maintain steerage.

WEDNESDAY, 10 NOVEMBER 1971

Word was received that another ship was being sent out to relieve Apache so that she can go to Pearl Harbor for fuel. White Sands, Apache, and Trieste are headed for the rendezvous area. The weather has showed some signs of abating but the seas are still too high even to board Trieste to assess the damage done by the rough weather.

THURSDAY, 11 NOVEMBER 1971

A salvage ship, about the same size as Apache, will meet with White Sands, to relieve Apache at about 1400. Meanwhile, one of the officers on Trieste, Al Amara, is reported to be suffering from apendicitis. A Navy task force including the Aircraft Carrier Ticonderoga was reported to be somewhere nearby. They were contacted and plans were made to evacuate Lt. Amara via helicopter from the deck of White Sands. This transfer occurred at about 1300. A sequence of photos was taken of the operation.

The "Current" arrived on schedule and the tow was transferred from the Apache to the "Current". Apache headed to Pearl Harbor. The first outgoing mail was transferred to Apache prior to her departure. Arrangements were made, through [redacted] to mail my trip report to his wife who was requested to get a copy to D. Patterson and to my office.

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The plan at this time is to proceed toward Pearl Harbor; de-gas the Trieste in the lee of one of the small islands; load Trieste into the dock well of White Sands and return to Parl Harbor. A review of the condition of Trieste and the equipment damaged at sea and a check with the long range weather predictions will be the deciding factor upon which the future of the project is planned. In my opinion that decision has already been made and the project will be postponed until far more favorable weather can be predicted than is normal for the search area in December and January. The decision, however, is being held until after the review in Pearl Harbor.

FRIDAY, 12 NOVEMBER 1971

The task force is underway, heading for Pearl Harbor at about 4 1/2 knots. The seas are somewhat calmer but still running about 4 to 6 feet. Winds are from 10 to 15 knots. No significant activity performed.

SATURDAY, 13 NOVEMBER 1971

Still heading for Pearl Harbor at about 4 1/2 knots. No activity planned for the day.

SUNDAY, 14 NOVEMBER 1971

Trieste was de-gassed commencing at about 0800. The seas have calmed down to 1 to 3 feet with winds about 10 knots. The towing speed was reduced to about 2 knots during the 8 hour de-gasing operation. De-gassing is performed by connecting a gas hose between Trieste and White Sands. The tanks in Trieste are then pressurized by about 4 pounds per square inch of nitrogen. The aviation gasoline is then pumped out through the hose into the tanks of White Sands. All open flames, cigarette smoking, etc., are prohibited during the de-gasing operation for obvious reasons. Once sufficient gas has been removed from Trieste to raise it in the water to the level required to clear the tail gate of White Sands the Trieste will be towed into White Sands and docked. (The shot has been removed prior to the de-gasing operation.)

During de-gasing operation one of the service lines to Trieste became entangled in the bow frame. The crew of the whaler (16 ft. Boston Whaler) was dispatched to untangle the lines by coming alongside the Trieste and reaching out to the lines. In the process, the Trieste bow frame, coming down from a sea swell, landed on the bow of the whaler tipping it up on end and flipping the two sailors aboard into the water. When this occurred, of course, the "man overboard" alarm was sounded and all hands mustered to the proper stations.

Actually, there was little danger to the sailors who were in life jackets at the time as they immediately caught hold of the Trieste and were taken aboard. There was, however, significant damage to the whaler and its engine. A second whaler was launched to replace the damaged boat and the original recovered.

SUNDAY, 14 NOVEMBER 1971 (Cont)

Once the gas was removed the hawser boat was launched, the service lines to Trieste were disconnected and the White Sands flooded down to allow the Trieste to be brought aboard. This operation, essentially the reverse of the launching operation, is conducted in a similar manner. (Unfortunately both the launching and docking sequences were performed after dark and were therefore not photographed.) The Trieste was safely aboard and secured by about 0100 the following morning.

MONDAY, 15 NOVEMBER 1971

The task force was met by three tugs at the mouth of Pearl Harbor just after noon. The Apache was uncoupled and White Sands proceeded to a pier on Ford Island. This is an island in the middle of Pearl Harbor and is accessible only by launch or ferry. [redacted] and I went ashore and established lodgings at the Holiday Inn and returned later for our luggage. At this time the recommendation from Cdr Mooney was to discontinue all further recovery efforts until the spring because of the predicted poor weather at the site. The official decision, however, and future plans were to be formulated at a meeting to be held the following morning with Adm. Lacey. Cdr Mooney contacted his superior, Cap. S. Packer, in San Diego and briefed him on the operation and presented his recommendation. A review of all of the photography taken of the operation was held in the ward room and approximately 70 slides were selected to illustrate the operation for the briefing. Duplicate copies of the selected slides were made and arranged to serve as official coverage of the operation for the Trieste's file. Approximately 30 of my slides were used.

TUESDAY, 16 NOVEMBER 1971

The briefing meeting was held at the Submarine Base commencing at 1430. All the officers of the Trieste and White Sands, and Cdr. Mooney participated. Following that meeting [redacted] met with Adm. Lacey for further discussion of the operation. The outcome of these briefings and discussions was a decision to return to the site and again try to recover the payload. This time, however, more support from the Navy will be available. It seems that much more attention from the higher ups in the Submarine fleet will be directed toward successful completion of the operation. As a result Lt. Cdr Bartels was direct to outline his needs and requirements for continuation of the operation. A list of requirements was started immediately. The objective was to be ready to go back to sea by Saturday, 20 November.

WEDNESDAY, 17 NOVEMBER 1971

Activity on the ship became intense as plans were being made to repair Trieste, order replacement parts, provision the ship for the operation, etc. Among the items required were: two new outboard motors, a new whaler, a large refrigerator to replace the one built aboard ship on the way out, gas

hose for refueling Apache and loading Trieste, more shot, lithium hydroxide for Trieste's life support system, fuel oil, lubrication oil, food, a new washing machine, fire pump parts, etc.

At this point in time I called the office to seek direction as to our participation in the next attempt to make the recovery. [redacted] had indicated that he felt it was not imperative that I return to sea for the next attempt. He indicated, however, that I should use my own judgment. I therefore called home to seek direction and later received word to remain with the task force for the next operation. I informed [redacted] that I concurred with the decision to remain on the job and would continue to provide whatever support and/or service I could, but that it would mean a change to our contract in that such a long period at the site was not originally anticipated. He indicated that this was understood.

This afternoon [redacted] and I visited [redacted] of the Air Force. We thanked him for his cooperation in providing the dry ice (via the air drop) and discussed the Air Force's capability for providing weather information at the site. This discussion led to a definition of the requirements for operation of the Trieste. In order to better illustrate the problems associated with preparation for and making a dive we suggested a review of the slides of the operation. We threfore presented all of the slides used for briefing Adm. Lacey as well as a few others concerning the air drop. During these discussions [redacted] indicated that [redacted] was in Honolulu and that he would be very interested in the operation. [redacted] was contacted and arrangements were made to provide the same briefing to him on the following morning at 0830 at [redacted] office.

THURDSAY, 18 NOVEMBER 1971

We met with [redacted] as scheduled and presented the briefing planned. Cdr. Mooney also attended and participated in the discussion. The meeting was very informal but I feel quite opportune. [redacted] appeared genuinely interested in the operation and seemed appreciative of the opportunity to get such firsthand information on the subject.

In further discussion of the Air Force's operation out here in Hawaii, the general capabilities on the subject was covered. The question of Multi-Bucket configurations was also brought out. I got the feeling that [redacted] recognized this as the "next step" on the program.

After [redacted] left, [redacted] gave us a slide presentation and showed a motion picture of his entire operation.

In addition Cdr. Mooney was introduced to the people who have access to the most modern, up-to-date weather information gathering equipment and who agreed to provide weather data in support of our activity. I feel that the meeting was very informative for all parties concurred.

In the afternoon we returned to White Sands (she had been moved from the pier on Lord Island to a berth in the shipyard at the Naval Base).

ME 71

We discussed the operation required to bring the payload aboard White Sands and to load it into the newly acquired freezer box. Another piece of equipment was identified for the requirement to transfer the payload from the dock well to the freezer. It was decided to try to obtain a dolly, with wheels, capable of transporting one tow on the deck of the dock well. This would preclude having to lower the fork lift truck into the dock well and thereby simplify the freezer loading sequence. The request was made for such a dolly.

L. B. Molaskey

LBM/mf
cc: M. F. Maguire
H. W. Robertson
R. W. Jones
C. Karatzas
P. Petty
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[redacted] (HQS)

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OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 72

TO: Distribution **DATE:** December 10, 1971

FROM: L.B. Molaskey

SUBJECT: Trip Report - Recovery of RV #3

LOCATION: At Sea - 350 Miles Northeast of Hawaii

FRIDAY, 19 NOVEMBER 1971

We checked with the White Sands at the ship yard to determine if things were progressing on schedule. Provisions were being loaded and the Engineer, Lt. Abbot, was out picking up the freezer. The unit is a self-contained unit, all assembled. It is 8 feet x 8 feet x 24 feel long and is said to be capable of maintaining temperatures as low as zero degrees F ±1°F. It will be loaded where the make-shift freezer is presently located. The ship yard crew will also complete all the electrical installation and make sure that the unit is operating.

We were informed that sailing time was set for 1300 on Saturday. The plan is to use a new towing ship, "The Coucall" to tow White Sands to the recovery site and to be joined later by Apache. This gives Apache an extra day in port and also allows Apache to initiate the search for the target markers (DOTS - Deep Ocean Transponders) without having to transfer tow to Coucall. Repair was underway on all critical items. Two new out-board engines had been delivered and were on board. They were not able to locate a Boston Whaler and were checking all possible sources in Honolulu. A new DOT checkout box was being flown in from San Diego and if it doesn't arrive in time to make the White Sand's departure, it will be brought out by Apache.

SATURDAY, 20 NOVEMBER 1971

We checked out of our hotel and got to White Sands by about 1000. We were told that a critical problem with the #2 boiler had not yet been resolved and that the 1300 sailing time was in jeopardy. We loaded our lug-gage aboard and went out for lunch to await the final decision. During lunch we received work that the sailing had been postponed until Sunday, 20 November at the same time. We checked back into the motel.

SUNDAY, 21 NOVEMBER 1971

We got underway on schedule (1300). White Sands was towed away from the pier by three tug boats. The Coucall joined White Sands in the channel of Pearl Harbor and the tow line transferred. As we reached the mouth of the harbor, Coucall reported that their towing engine (a device that maintains proper tension in the tow line) had failed and that she could no longer tow White Sands safely. The tow line was separated, White Sands headed out under her own power, and a rush call put in for Apache. Fortunately, the crew of Apache were all aboard and she was dispatched immediately to pick up the tow. We were underway by nightfall.

Commander Mooney was replaced by Capt. S. Packer, Commodore of Submarine Development Group I, from San Diego. The Commander, similar to the previous role of Commander Mooney, is in charge of the operation at sea. He joined the task element to get a first-hand appreciation of the diving operation and to add his full authority to the day-to-day decisions. Commander Mooney returned to San Diego to act for the Commodore at the Development Group. In my opinion this change will do little to help the operation; not because of the ability of either of the two men involved, but because of the lack of continuity in the leadership due to the change.

MONDAY, 22 NOVEMBER 1971

The task element is underway at about 5 knots heading for the recovery site. Plenty of time for fishing but not much else.

TUESDAY, 23 NOVEMBER 1971

This morning was highlighted by another helicopter transfer at sea. An Air Force helicopter carrying parts for the aviation gasoline pump for White Sands arrived at about 1030, lowered the parts and picked up the out-going mail.

Meanwhile a battery problem on Trieste has been surfaced. One of the primary battery cells is grounding out and they are not sure if it is cracked due to the pressure from the 16,400 foot dive or if it is due to the rough weather after the dive. In any event, the problem must be resolved before the next dive and work has been going on around the clock to repair the damage.

This afternoon a fire drill was conducted, unannounced. This sent the crew scurrying around and caused a good deal of concern to those unfamiliar with the practice.

The weather has improved somewhat this afternoon. The wind is now about 6 to 10 knots and the seas down to two to three feet with swells

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of about 4 to 7 feet. The task element is still heading for the site at about 5 knots — no fish today!

WEDNESDAY, 24 NOVEMBER 1971

The task element reached the operation area early this morning. Personnel and equipment were transferred by small boat to Apache to assist in the survey for the transducers on the ocean bottom. The plan is to separate the tow to allow the much more maneuverable Apache to search for the dots via a "Deep Ocean Transducer Interrogator" (Straza Model 7060). This device has a sensor head which is suspended from the side of the ship to about 75 feet below the bottom of the hull.

The search commenced in the early afternoon and continued on through the night. There was originally a good deal of concern that the two dots which were placed by the DeSteiguer had expired. They have a guaranteed life period of one month and since they were deployed about the middle of October they might not now be operating. By early evening, however, the first reports came back that they had located dot #3 (one of the original units) and they thought that dot zero was also responding.

THURSDAY, 25 NOVEMBER 1971 (Thanksgiving)

Continuing the transducer survey on into the night (early morning), it was discovered that the response of the equipment seemed to be better than during daylight hours. All of the dots were located and through an iterative process of ranging to each of the dots while changing the location of the surface sensor (moving Apache across the base line between dots 5 and 8, 3 and 5, and 3 and 8) they were able to calculate the relative location of all the dots with respect to one another. The results of this survey is illustrated in Figure 1.

The weather still remains the major problem. Winds of about 8 knots, seas of about 2 feet and swells averaging 7 feet continued throughout the day. Although the wind and seas were about marginal for launching Trieste the 7 foot swells prevented such an operation.

The battery problem appears to have been solved. Apparently two grounding problems in series were the cause of the trouble. Until each was located and repaired independently, the fix to neither seemed to make any difference. By nightfall the repairs had been made and battery charging commenced.

A meeting was held in the Ward Room after dinner to discuss the results of the survey and to lay out plans for the future. The discussion of the survey was covered above. The plans for the future are simply to remain

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on station until the weather cooperates enough to launch Trieste. Then launch, gas, shot and dive Trieste within the triangle formed by the dots in the nav net. Several changes from the previous dive are sure to aid in the successful completion of the next dive. One, the trail ball which failed to deploy on the bottom on the last dive will be deployed prior to the dive and remain out to about 35 feet during the entire dive sequence this time. Two, the up-dated survey information will be used to navigate Trieste on the bottom thereby allowing the surface ships to assist in vectoring Trieste to the target. Three, operating with the trail ball at 35 feet will reduce the stirring up of the bottom caused by riding on the skegs as on the previous dive as well as allow the proper functioning of the sonar which is not designed to operate so close to the bottom.

It is significant to point out that the latest nav net information indicates that the #3 dot is not located as reported by the MPL search team. This apparent discrepancy was deduced from data taken both from the first dive as well as the survey just completed by Apache. If this is correct and the dots continue to operate, it is felt that Trieste can be vectored directly to the payload and not require an elaborate search. In any event, Trieste is ready to go. All we need now is adequate weather.

FRIDAY, 26 NOVEMBER 1971

The taks element remained on station awaiting a break in the weather. Apache is again towing White Sands. The wind has picked up to 12 knots with seas of 3 feet and swells averaging 6 feet. Still too rough to launch.

SATURDAY, 27 NOVEMBER 1971

Situation about the same. Winds 13 knots, seas 3 feet and swells running 8 feet. Not possible to launch Trieste. Conducted a review of the presentation made by Lt. Cdr. Bartels to Admiral Lacey for Capt. Packer. [redacted] also showed Capt. Packer the slides we presented to [redacted] and [redacted] It was suggested by Capt. Packer that we make slides of the nav nets to include in the set for future briefings that he felt were sure to be required.

SUNDAY, 28 NOVEMBER 1971

Although it is somewhat cloudy, the seas seem to have calmed down somewhat. Wind was reported to average 7 knots, the seas running 2 feet and swells about 6 feet. Last night the anamometer (wind velocity measuring device) was dropped and broken. Although the unit was repaired and appears to function properly, its calibration is in question. Wind velocities reported from here on, therefore, are probably not as accurate as those previously reported. They will, however, provide a pretty good estimate of the conditions and inasmuch as the magnitudes reported are average figures, it is felt that they will be adequate.

[redacted] BY
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No dive today pending improvement in the weather. The latest weather prediction is for one or two days of improved weather ahead. We all hope it will be good enough to launch Trieste. The plan for tomorrow is to launch in the morning -- "weather permitting".

MONDAY, 29 NOVEMBER 1971

Although the winds built up to as high as 20 knots during the night they were down to 10 knots or lower this morning. The decision to prepare to dive came at about 10:00 and from that point on the White Sands and Trieste became a beehive of activity.

I asked and was given permission to ride the hauser boat that tows Trieste out of the dock well after White Sands floods down. The purpose of the request was to get better photographic coverage of the launching activity. [redacted] agreed to take pictures for me from the dock well while I got picturs from the other side. It was quite an experience.

The launch came off without a hitch and gasing has been started. They expect to finish gasing and shoting during the night and dive early tomorrow morning.

As soon as Trieste was safely launched, Apache separated the tow and set out to locate the transducers on the bottom. At last report, they had located dots 3 and zero and were hoping to have the others shortly.

A message was received from Cdr. Mooney indicating that Dr. Speiss noted a discrepancy in the location of the payload with respect to dot zero. Where we were using dimensions of 165 yards South and 35 yards West, Dr. Speiss indicated that it should be 165 yards West and 35 yards South. The nav net has been so changed although the difference is almost in the noise level. Several new plots of the nav net for use in the sphere and with a scale and coordinate system compatible with the computer on board the White Sands are included as Figures 2, 3 and 3A.

The weather today was reported -- winds up to 10 knots, seas 2 feet, swells 5 feet.

TUESDAY, 30 NOVEMBER 1971

Gasing was completed in record time yesterday afternoon -- 4 1/2 hours. Shoting was completed early this morning and electrical checkout started by about 0800. There were a number of grounding problems uncovered. This is not unusual. When Trieste is launched and all the electrical interconnections get wet this can be expected. What they do is send divers down and change connecters and/or components until all of the systems check out. Most of the exterior equipment is modular and if remating connecters doesn't solve the

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problem they change the module. This operation today, however, was slowed down by the presence of a number of uninvited visitors. About a dozen large sharks and a 15 - 20 foot killer whale came over to see what all the activity was. They remained in the area most of the day. Although it did not stop the divers completely it slowed them down considerably because while two worked on the scaph one kept an eye out for the sharks. When the sharks got in too close they all got right out of the water. The sharks were eating the paper wipers the divers use to cover the camera and television lenses.

All of the electrical problems were resolved, the recovery hook lowered into the water on floats and Trieste towed to the dive site. The hook was fastened into place (It is attached just prior to the dive so that it and Trieste are not subjected to long periods of exposure to surface action which could cause damage.)

The dive got underway at 17.45. On the way down, the scaph developed a list to port of about 25°.. The pilots tried to correct the attitude by balancing by dropping shot from the opposite side. It was stated that the pilot didn't feel he had control until after they reached a depth of 7,000 feet.

They continued on down to about 15,000 feet, stoped, and started interrogating the transducers. They first pinpointed their location about 5,000 feet from the #3 dot. After driving to the target and lowering to the bottom they searched the base line between dots #3 and zero crossing the base line about four times. In the process they encountered several equipment problems. The computer power supply failed and dumped part of the navigation memory. Riding with the trail ball out to about 35 feet they couldn't see the bottom so they winched it in to 10 feet. That was a little too much because when they started to move forward, the cable assumes a slight angle to the rear pulling the scaph down slightly. With the residual list because of improper metering of the shot ballast on the way down, the port skeg started draging the bottom. They then tried to lower the trail ball slightly and it wouldn't pay out. The end result was that they either had to slow down or slide the skeg on the bottom. In this configuration it was extremely difficult to steer a steady course.

The doppler sonar system also failed on the bottom. This device provides both height off the bottom information as well as horozontal velocity. The loss of this information is not critical to the mission since they have redundant depth indicators and a means of determining their position other than through velocity — time relationships. After searching the 3 - 0 base line and investigating several CTFM sonar signals with no success and having been down for almost eight hours the battery voltage was reaching its minimum safe level, they picked up a CTFM signal in a direction West of dot #3. They drove in that direction until they suddenly lost the contact. They immediately slowed down and peering out the viewing scope they spotted the payload passing about two feet to the right of the starboard skeg. (The reason for losing the

target is that the CTFM has a minimum range of 30 yards but the visual range through the viewer is about 30 feet. There is a dead zone between the two). They came to an immediate stop but their momentum carried them beyond the package. They then started to maneuver the scaph around to bring the payload into view when the low voltage battery alarm came on. They tried to operate the mechanical arm in order to plant another transducer next to the payload for future reference and the shoulder movement would not operate to the right. It was suspected that the combination of low voltage and the list of the vehicle was too great a load for the arm shoulder motor. In any event they were not able to deploy the dot. With very little power remaining and little hope of even tripping the recovery hook they decided to head for the surface. The last check of the battery on the bottom indicated 4 of the 65 or so cells had been depleted to the extent that they had reversed polarity. The decision to surface was confirmed. They reached the surface at 0415 Wednesday morning. It was a long day!

The weather meanwhile had cooperated nicely. Winds averaged less than 7 knots with the seas running 2 feet and swells of about 4 feet.

WEDNESDAY, 1 DECEMBER 1971

(Prior to the dive on Tuesday another sea going tug boat, the "Abnaki" joined the task element to provide additional flexibility during the operation. Inasmuch as the operation was well underway, she was asked to stand clear to await further instructions after completion of the dive.) The Trieste was again secured to White Sands, the recovery hook removed and stowed in the dock well and all other equipment secured.

At 10:30 a meeting was called to review the nights activity and to make plans for the next operation. In attendance were all Trieste and White Sands officers and all civilians. The first order of business was a review of the "out of commission" items. The list includes

1. Computer power supply and part of the navigation memory.
2. The trail ball winch — the ball suspended to 10 feet.
3. Doppler sonar — horizontal velocity indicator and depth gauge.
4. Mechanical Arm — right shoulder motion.
5. Batteries depleted — check for reversed cells.
6. Two search lights — beams not collimated.
7. G. P. meter.
8. Ballast control tank/magnet — list to port.

Next, a discussion of the navigation data and operation on the bottom was held. The plan is to locate Trieste on the surface so that when she free-falls to the bottom, she will be within 500 feet of the T_0 - T_3 baseline. This is accomplished by towing Trieste up the drift current to a calculated position that will carry her to the proper spot on the bottom. This is not as easy as it sounds because in descending to the bottom without power the Trieste tends to move in a large spiral. In addition, the current direction and velocity is a non-linear function with respect to depth, prevailing weather conditions, location, etc. and very little data is available.

On this dive the first range data to T_3 and T_0 indicated that Trieste was located over 5,000 feet from T_3. This required several hours to close the gap to the search area. The navigation data from the previous dive and in real time from Apache enabled Trieste to locate the search area and eventualy locate the package as discussed earlier. Figure 4 shows the relationship of the package to dots 0 and 3. It was concluded that knowing the location of the package the next dive could be considered a recovery dive rather than a search dive and that every attempt should be made to position Trieste more accurately for the drop point so that so much time (and battery life) is not consumed in getting to the payload.

Plans were established to repair the failed equipment, charge the batteries, re-gas and re-shot Trieste within the next few days with the goal of being ready to dive again within 48 hours. In the afternoon I prepared a briefing chart of the nav net data showing the location of the payload as determined by Trieste as compared to the original data supplied by the search team. This chart, as had previous charts of the current nav net data, have been photographed for inclusion in a slide presentation for the skipper. [redacted] and I also will have copies.

By late afternoon the weather had turned for the worse with seas and winds building. Weather predictions do not look good and there is some question of being able to complete the battery charge tonight.

THURSDAY, 2 DECEMBER 1971

Charging was discontinued in the early morning due to the high wind and building seas. Winds of 20 knots, seas of 2 feet and swells of over 6 feet prevail. All dive activity was halted.

FRIDAY, 3 DEMBER 1971

Weather remains about the same. Another day of waiting for the seas to calm down so that diving activity can be started.

A meeting of the officers, the navigation team, and the civilians was held in the Ward Room to discuss the next dive. The results of this meeting

were little change to the previous plan. The most significant point brought out was the criticality of the life of dots 0 and 3. As a result it was agreed that the amount of interrogation of the dots would be held to a minimum to preserve their life for the next dive. It was also agreed to provide more communication from Trieste during the dive.

The tow of White Sands was transferred from Apache to Abnaki and Apache picked up the tow on Trieste. This simplified the towing arrangement and avoided the horse shoe effect encountered when arranged in a tandom tow with White Sands (with its large profile exposed to the wind) in the middle between Apache and Trieste. The task element remained in this dual configuration throughout the remainder of the day.

Another helicopter personnel pickup occurred today. This time a sailor from Abnaki was lifted off for emergency leave. His mother was very ill in the Phillipines. Because of our distance from the nearest land two helicopters came out. The Air Force to the rescue!

SATURDAY, 4 DECEMBER 1971

White Sands took Trieste in tow again and completed the battery charge. The weather appears to be getting steadily worse. Gusts up to 35 knots were reported this afternoon. No other recovery activity was conducted.

SUNDAY, 5 DECEMBER 1971

Coucall returned to relieve Abnaki early this morning but the weather prevented changing the tow immediately. At about 1000 this morning an announcement over the ships's loudspeaker summoning the captain to the bridge alerted the crew that something unusual was happening. I went aft to the fantail only to find that Trieste was up very close to the stern gate and there was a lot of activity amongst the crew. What had happened was in the very heavy seas White Sands has apparently slowed or momentarily stopped. Trieste's momentum had carried her up almost into the stern of White Sands causing the tow line to slack off wherein it got wound around the port station keeper propeller. The station keeper engine was immediately secured but the damage had been done. Trieste was being towed from the propeller and that power source was inoperative. A grapling hook was lowered over the stern gate and the tow line caught and raised to the deck. A line was spliced to the tow line anchoring it to the deck of White Sands and the tow line was cut on either side of the station keeper. Before the tow line could be spliced back together a high swell caught Trieste in a surge putting tension in the tow line, sufficient to part the temporary tie down, separating Trieste from White Sands. Trieste was adrift. Apache was summoned to the rescue and chased after Trieste, came alongside, and managed to pick up the tow line. Apache fastened an extension to the tow line, took up the tension and secured Trieste in tow. Fortunately there were no collisions and no real damage to any of the vessels concurred.

However, the port station keeper on White Sands is inoperative until weather permits divers to go down to clear the tow line from the propeller. For the remainder of the day the weather continued to be about the same with swells of 10 to 12 feet and winds over 20 knots. The task element is heading for a spot in the lee of the islands between Oahu and Kauai where they hope weather will permit docking of Trieste and repair of the station keeper.

MONDAY, 6 DECEMBER 1971

The task element is still heading for the islands at a speed of around 2 knots. The winds and seas seem to abate somewhat in the early morning but build in the afternoon well above the level required to dock Trieste. No other recovery activity today.

TUESDAY, 7 DECEMBER 1971

Towing of White Sands was transferred from Abnaki to Coucall at about 0700 this morning. Abnaki is being relieved to return to port. At about 0930 [redacted] asked me if I wanted to return on Abnaki to Pearl Harbor. We reviewed the plans assessing the probability of achieving another dive in the near future and concluded that the probability of not making another dive before Christmas was about 90%. Also, it would be over a week, probably two, before White Sands were back on station in the recovery area. I therefore decided to head for home. [redacted] will stay with White Sands until firm plans are established. He will then return home and if necessary, a replacement will be sent out to supervise the next recovery attempt (if any).

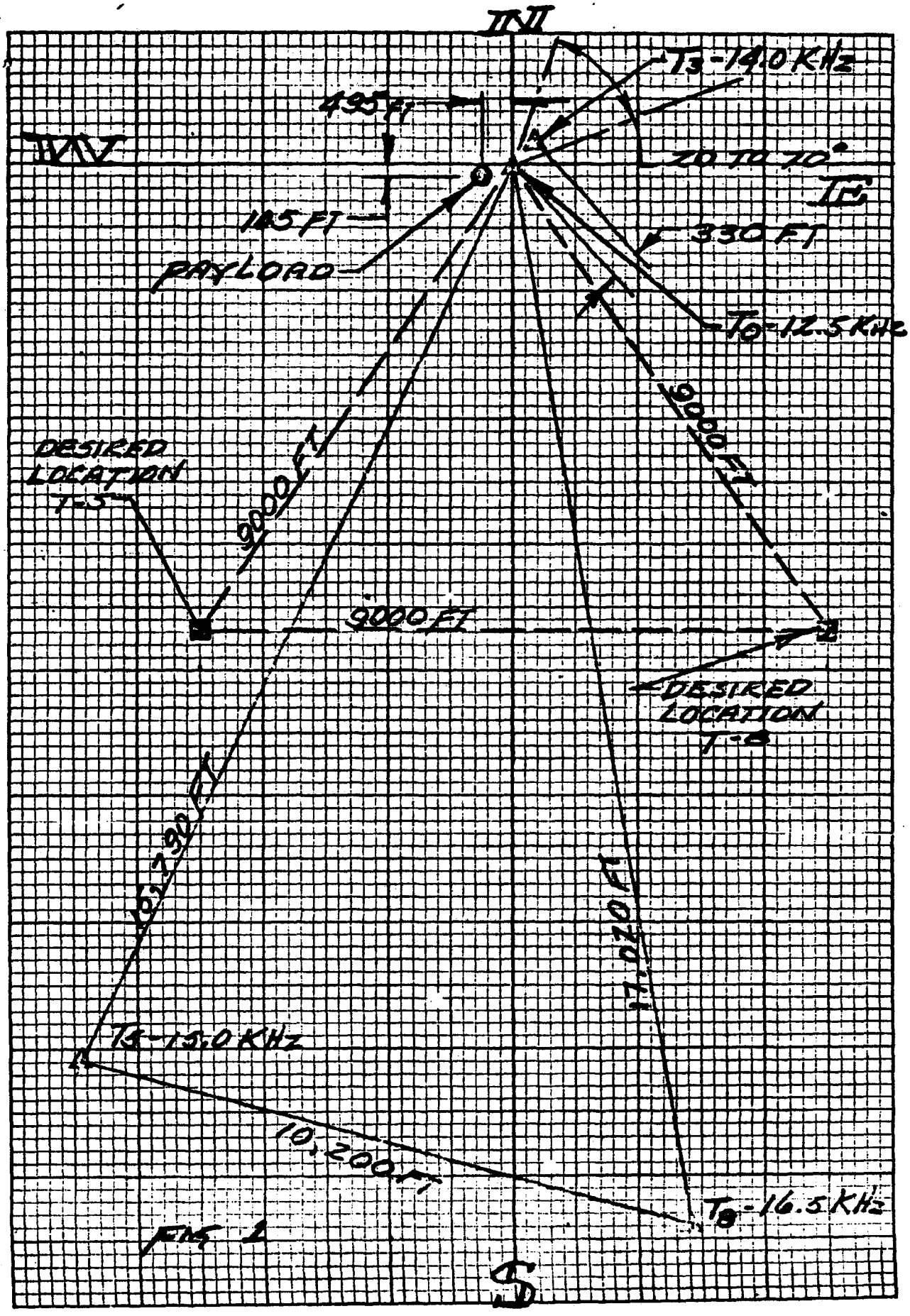
At 11:30 I was loaded into the Whaler and taken over to Abnaki. Abnaki remained with the task element while Coucall demonstrated that she could handle the tow. At about 18:30 Abnaki was released and headed for Pearl Harbor. ETA is 1600 Wednesday. I plan to catch the first available flight out.

(NOTE: Figure 1 refers to my previous Memos #70 and 71.)

L.B. Molaskey

LBM/cj

cc: M.F. Maguire
H.W. Robertson
R.W. Jones
C. Karatzas
P. Petty
R. Roylance
J. Braddon
[redacted] (HQS)



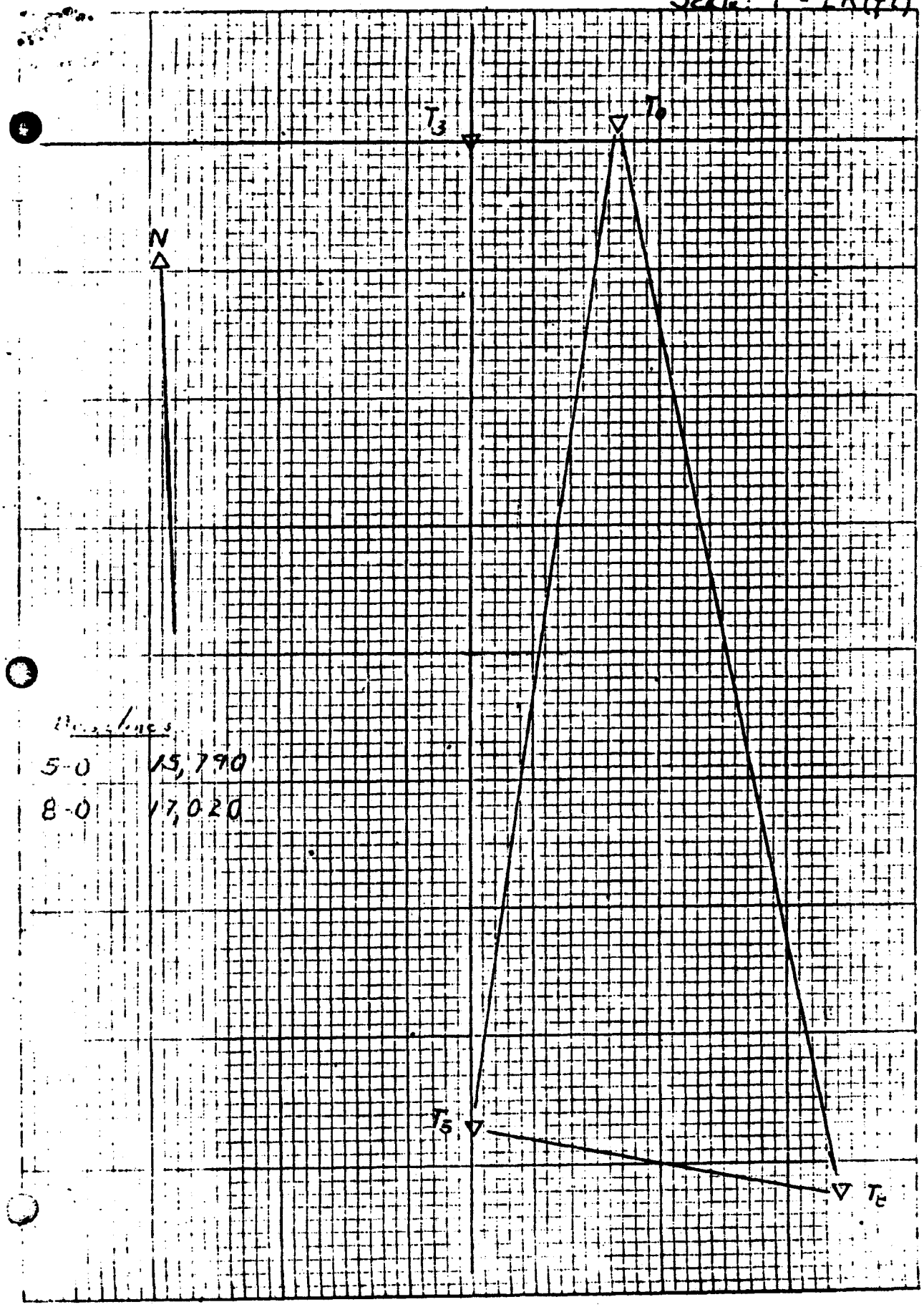


FIG 2

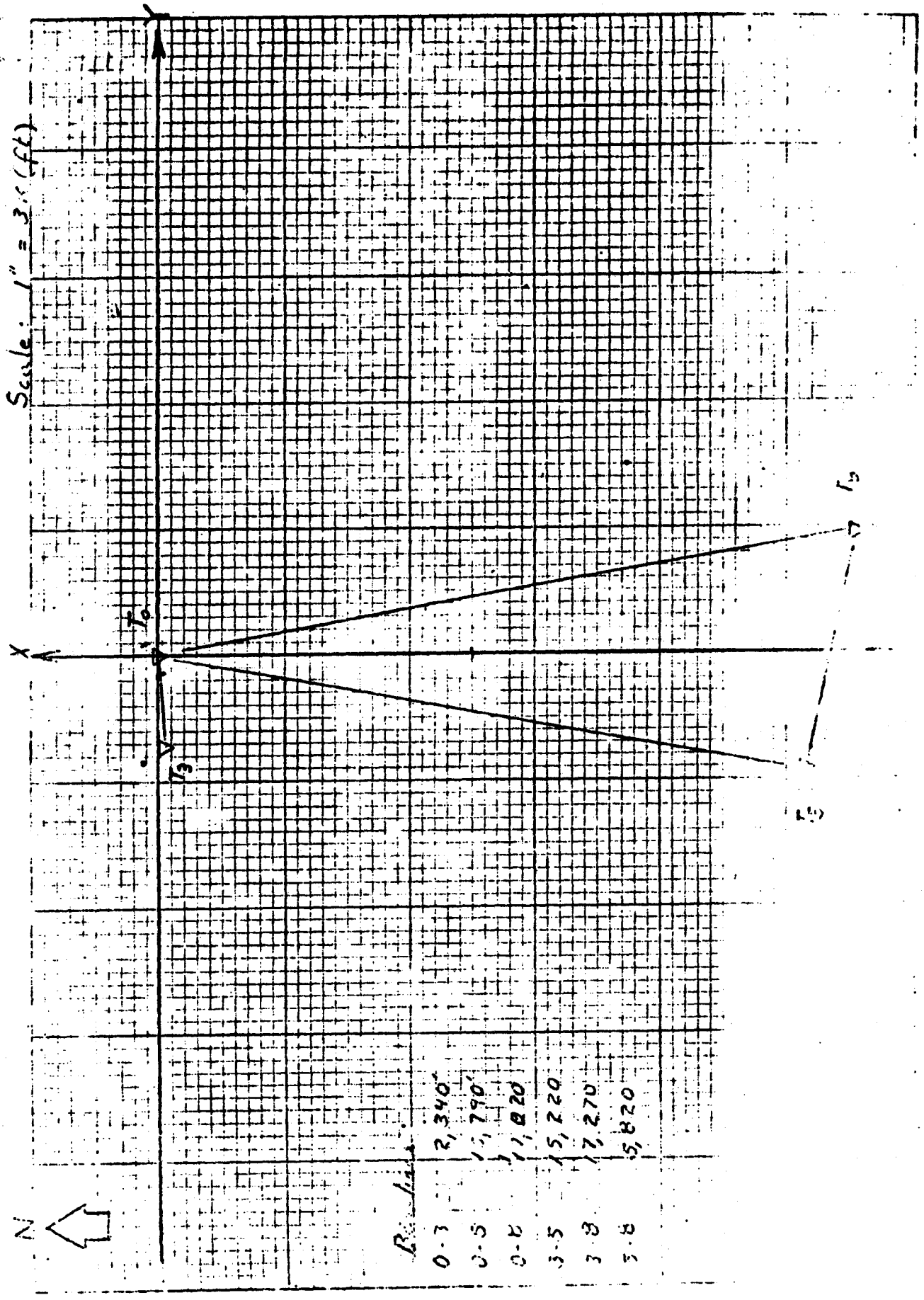


FIG 3

Plotter Scale factor = 2000'/in.

Plotter center X_{PC} 0 Y_{PC} = +8000

Where ϕ 2312, -381, 16370

3 0, 0, 16370

5 0, 15220, 15900

8 5723, 16279, 15900

Then, where

X_{00} = 2312, Y_{00} = -381, H_0 = -92°

ϕ 0, 0, +16370

3 (-)306, (-)2318, +16370

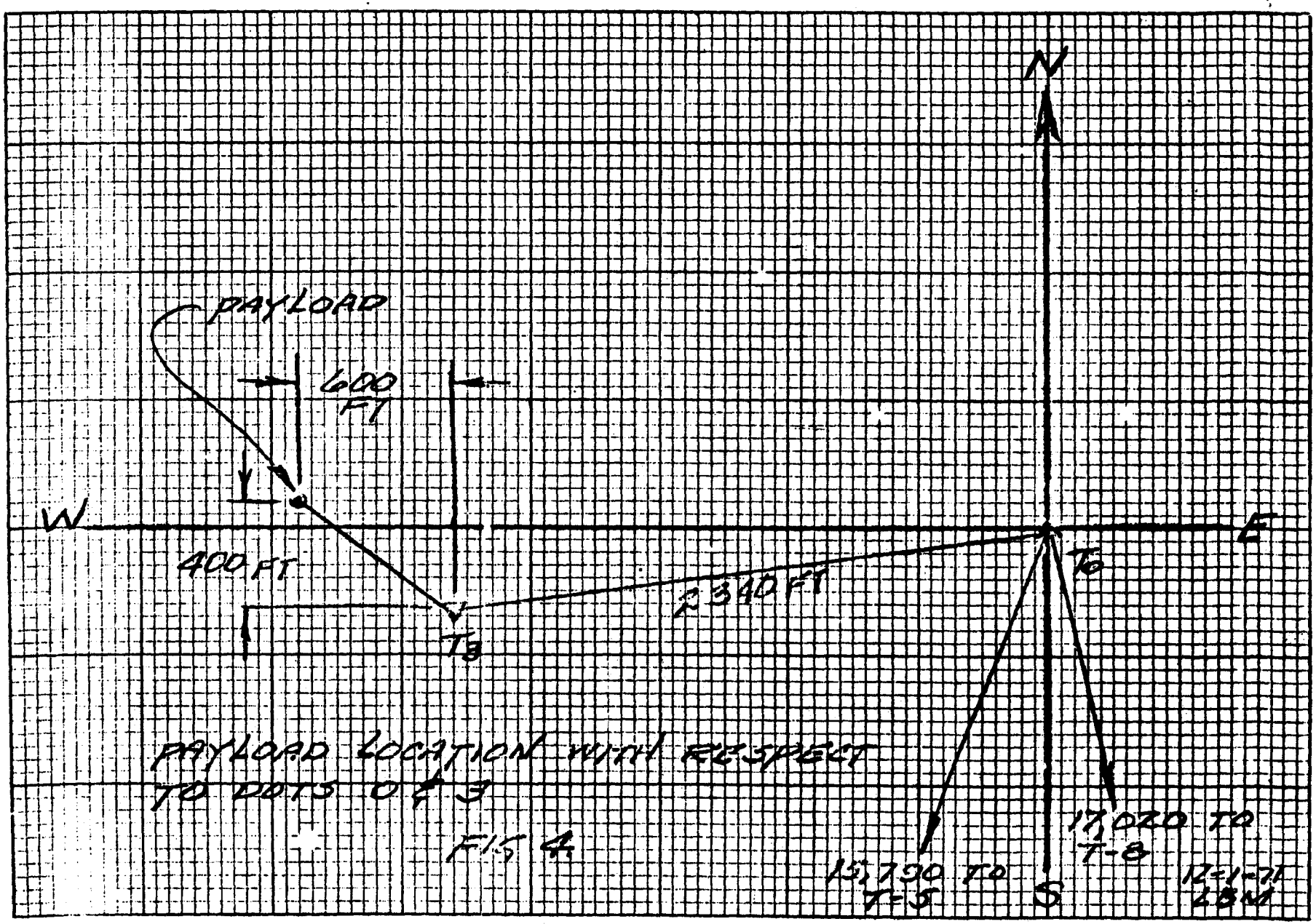
5 (-)15496, (-)2837, +15960

8 (-)16767, +2827, +15900

Plotter Scale Factor = 3000'/in

Plotter Center = X_{PC} - 7500, Y_{PC} = 0

FIG 3A



PAYLOAD LOCATION WITH RESPECT TO POINTS OF 3

FIG 4

~~HX SECRET~~
WORKING PAPER, DESTROY
OR CONTROL BY 90

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 73

TO: D. Launder DATE: December 14, 1971

FROM: L.B. Molaskey ✓

SUBJECT: Recovery of RV-3 SPO 20053 Task 10272

From October 27, 1971 through December 10, 1971 I have been on a trip to the recovery site of RV-3 off of Hawaii. Charges for my time for that period, therefore, should be applied to SPO 20053 - 10272 directly. Total time applied should be 264 hours based on 6 3/5 five day weeks at 40 hours per week.

An accounting of my expenditures is being processed and will follow shortly. No further charges are anticipated in the immediate future pending customer direction.

L.B. Molaskey
12-14-71

LBM/cj

cc: R.W. Jones
B.L. Todd
P.V. Jones

~~HX SECRET~~
WORKING PAPER, DESTROY
OR CONTROL BY 90

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 74

TO: B. Malin DATE: December 20, 1971

FROM: L.B. Molaskey ✓

SUBJECT: Improved Viewing Capability for Bathyscaph Trieste II

During my recent experience with the Trieste II operation off Hawaii, it was very apparent that one of the most serious operational limitations is the pilot's viewing range out of the ball when operating on the ocean bottom. Although the Trieste is equipped with a window, lights, viewing optics, television, and sonar, its ability to search the bottom is limited to a range of less than 30 feet from the ball in a 120° cone along the vehicle axis.

The search method currently employed is to maneuver the bathyscaph along the ocean floor with the trail ball (a 250 pound ball tethered on a light cable) extended about 35 feet. This places the pilots about 30 feet from the bottom. Sonar is used to locate large solid targets up to a range of about 3,000 feet. The scaph is then maneuvered toward the target until visual contact is made (30 feet) or until the sonar reflection disappears because the target is outside the inner edge of the viewing cone of the sonar (inside the minimum range). At that point a visual search is conducted. Recognition of a target, as compared to rocks, other debris, or physical contours of the ocean bottom is very difficult with sonar. The result is that each potential target must be investigated visually. The improvement achieved by increasing the visual capability so that target discrimination can be achieved at a greater range is therefore an area function.

I have recently reviewed Engineering Report #10706, "Undersea Laser Sensor", prepared for the U.S. Navy in May 1971 and think that the principal described therein could be applied to the Trieste. I also understand that some recent work in solid state detectors at OTD could be used to improve the reliability of such a system.

I don't know if the Trieste has any development money to use for such an item but I do know that they would be very receptive to an unsolicited proposal and would help pursue the funds required if convinced that the improvement is feasible. I have discussed this matter with Lt. Cdr. Bartels, Officer in Charge of Trieste, and Cdr. Mooney and Capt. Packer of Submarine Development Group I, all of whom expressed interest in any device which would improve their viewing range.

Recognizing that the best proposals address specific problems with detailed solutions that are tailored to the hardware involved I requested and

obtained the following details of the Trieste and its equipment:

NOTE: Assume that one or two sensor systems, composed of a sensor head which is external to the pressurized ball, mounted to the "pan and tilt platforms" which are located on both sides and just forward of the ball and a viewing and control station which is located in the ball.

Sensor Head Design Requirements

Form Factor - 10 inch dia. x 36 inches long.

Mounting - Clamped to 10" dia. via quick coupling device capable of activation underwater by divers at a depth of 30 feet.

Weight - No firm requirement but should be minimized as consistent with application and maintenance.

Vibration - Not known - should be consistent with environment - handling, test, and operation on surface and below.

Shock - Same as vibration.

Temperature - a. Operating 30 to 110°F
b. Storage 0 to 140°F

Pressures - Operation at P = 13,500 PSI external water pressure

- Test - Must be capable of withstanding 10 cycles of pressure change. Nine cycles from one atmosphere to 13.5K PSI held for 10 minutes. Final cycle from one atmosphere to 13.5 K PSI held for one hour - no leaks or permanent deformation. Must operate at both pressures.

Wave Motion - 10,000 pounds per square feet of exposed area.

Power Available - $24\ ^{+4}_{-2}$ VDC

- $120\ ^{+29}_{-5}$ VDC

* - 115 V 60 cycle single phase

* - 115 V 400 cycle single phase

*This power is available from a converter but is in limited supply.

(All power is from two battery sets aboard the Trieste. The 24V system has a total mission capacity of 5,000 amp hr. The 120V system has a total capacity of 952 amp hr. These batteries operate all systems aboard. Propulsion system 120V. Life support and instrumentation 24V.)

Connectors - Electro Oceanic heavy duty series. Maximum of two leads per connector pin - as many pins as required.

Diagnostics - None on present equipment but can be considered if useful.

Field of View -

a. Low power - must provide wide area coverage (present viewing optics is 120° FOV.) for search.

b. High power - at least 2 times low power - consistent with other parameters to aid in discrimination of underwater targets at maximum range.

The mount on which the sensor head is fixed provides azimuth pointing of 360° and elevation of ±90°. Both motions require twisting of electrical cable. The mount is #RP-3 Pan and Tilt Unit manufactured by Hydroproducts Division of Dillingham Corp., Serranto Valley, California.

Focus Adjustment - 3 feet to infinity.

Viewing and Control Station

Form Factor - 6 x 10 x 12 rack mounted box.

Mounting - hard mounted to structure of sphere.

Weight - No limit.

Vibration - Not known - consistent with application - environment is not severe.

Shock - Not known - same as vibration.

Temperature - 60 to 110°F operating
0 to 140°F storage

Relative Humidity - 35 to 95%

Pressure - Sea level minus 2" hg.

Environmental Gas - O_2 content 20% $^{-2\%}_{+5\%}$

remainder - air constituents

Generation of Toxic Compounds - The unit shall not generate any compounds, elements or other materials that are toxic or otherwise harmful to the pilots when exposed to the equipment operating in the sealed environment for periods of up to 24 hours.

Explosion Proof - The equipment must be explosion proof per mil specs.

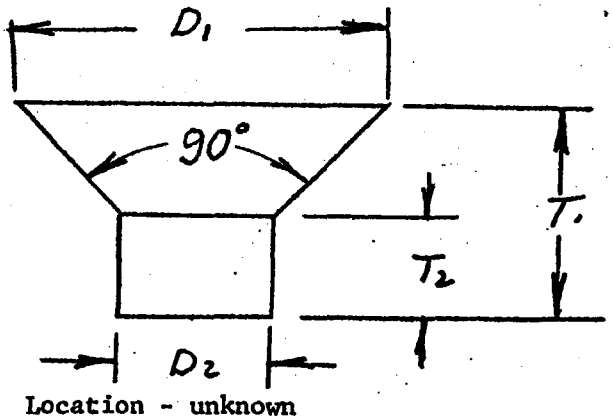
Display - Conrac, 8 inch diagonal, 500 TV lines or equivalent.

Controls - T.V. as required
Standby - if required
System On
System Off
High Power
Low Power
etc.

The following data is provided to give an idea of the Trieste's present capability:

Viewing Port - Cone shaped $D_1 = 17.062$, $D_2 = 4.782$, $T = 6.14$ inches; material Plexiglass G (Thermoplastic acrylic resin) No optical coatings located on forward centerline of the ball.

Peep Holes (4) - $D_1 = 4.008$, $D_2 = 1.00$, $T_1 = 4.3$, $T_2 = 2.8$ inches



Location - unknown

Viewing Optics - Binocular viewing system (manufactured by Kolmorgan) - approximately 3 inch diameter objective - coated lenses. Eyepiece can be separated to provide two monocular systems (for two pilots simultaneously.) Each eyepiece has diopeter adjustment +1 to -3. Power changer by mechanical lever. Field of view through window -

high power 72° field

low power 120° field

NOTE: Pilots can not look out the view port except through the viewing optical system.

TV Viewing Systems - There are provisions for mounting four TV cameras outside the ball on the pan and tilt mounts or hard mounted. Any three T.V. can be viewed inside on 8 inch television sets (Conrac).

Typical TV Camera - Zoom TV Model TC-150-MIL-ST-2-T manufactured by: Systems Division of Dillingham Oceanographic Engineering Co., San Diego, Calif.

Horizontal resolution - 500 TV lines

Lens - focal length in air 13 mm to 52 mm with maximum aperture of f/2.0

Focus range - 3 feet to infinity

Horizontal field of view - 38° to 10.5°

Vertical field of view - 30° to 8°

Both in water.

or

Underwater TV Camera Model II - same manufacturer

Lens - 12 mm, 60° field of view

Focus range - 3 feet to infinity

Horizontal resolution 600 TV lines

Present TV's operate on 24 VDC supplied from main battery on 2 leads of #16 wire (power and return) - Signal leads are coax except through ball penetration where they are on separate pins.

Lighting System - see attached sketch.

I believe there is real potential in this area. The Navy has several deep submersibles which all have the same visibility problems. They are interested in getting new improved equipment to extend their capability for search and rescue work on the bottom.

I was given two names of project people at NAV - SHIPS who have responsibility for developing this type of equipment. They are:

Dan Spadone and

Joe Cestone at PMS 395

Deep Submergence

Because of the security aspects of my association, my name should not be associated with Perkin-Elmer except with Lt. Cdr. Bartels, Lt. Taylor, Cdr. Mooney or Capt. Packer. I would be glad to set up introductions, etc. for any contact you feel could be used to further investigate this area of potential business.

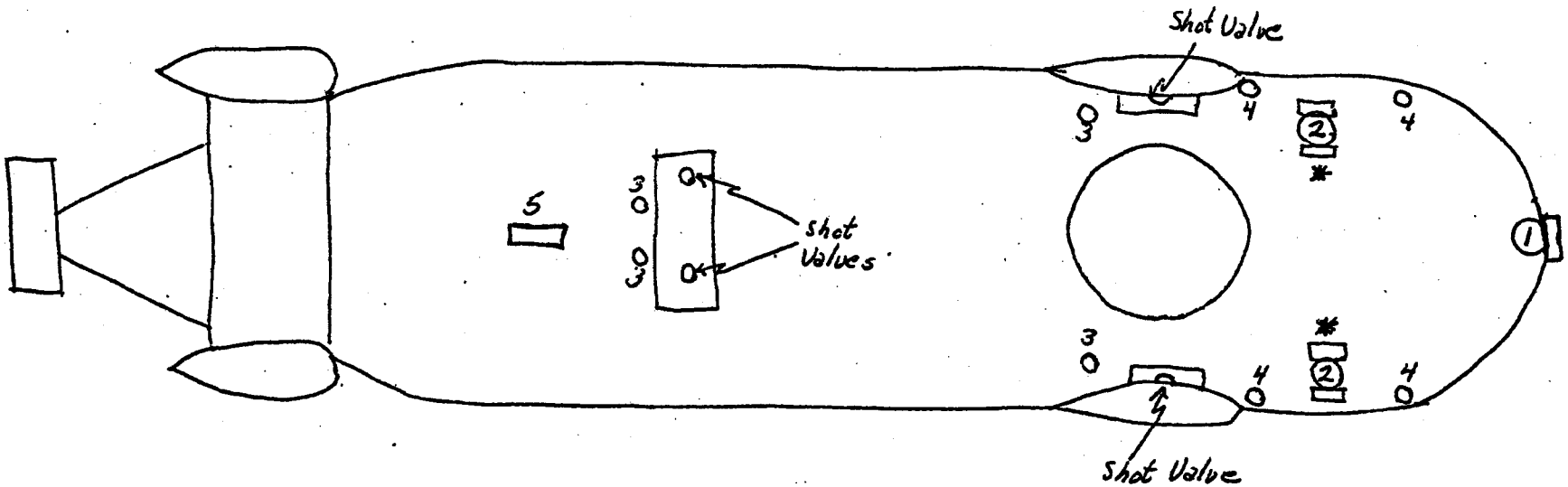
L.B. Molaskey

LBM/cj

cc: R.W. Jones
H.W. Robertson
M.F. Maguire

1. Four (4) Search lights on Pan & Tilt. 120 VDC, 750 W each
2. Two lights on each TV Pan & Tilt. 120 VDC, 250 W
   24 VDC T.I. (Thallium-Iodide) 250 watt
3. Four (4) Silo lights 24 VDC 400 W quartz-iodine
4. Four (4) Flood lights Same as Silo lights except 2 filaments for 800 watts eac
5. Aft TV Same as TV Pan & Tilts.

* TV PAN & TILTS each have a 24 VDC STROBE 500 watt-second



· Bottom View

MONTHLY REPORT - DECEMBER '71

Recovery of RV-3 (SV #1)

Headquarters [redacted] and SSC (L. Molaskey) representatives joined the recovery team at sea on 1 November as the White Sands approached the recovery site. Preparations for the first dive got underway almost immediately.

The refrigerator for cooling the payload was in final stages of completion. As originally constructed, the unit consisted of a 3/4 inch plywood box built around a 2 x 4 frame. The outside dimensions approximately 8 x 8 x 8 feet. The insulation consists of 1-1/2 inch glass wool blankets fabricated with the aluminum side facing the interior of the box. The cooling unit was mounted to the outside of the box blowing air from the outside into the box through an opening behind the cooling coil. After reviewing the requirements, it was agreed that the set up could not adequately refrigerate 8,000 pounds of sea water to below 40°F in the outside ambient of about 90°F in bright sunlight. Therefore, the following modifications were recommended:

1. Paint the outside all over with white paint.
2. Construct a recirculating duct to take the cooled interior air and pass it over the cooling coils in a closed system.
3. Insulate the cooling unit as much as possible.
4. Tape all seams to shut off air leakage.

After these modifications were accomplished (Figure 1) the shipping container was loaded into the box, (Figure 2) flushed, and filled with clean sea water. The original water temperature was recorded to be 70°F. The unit was then sealed and the cooling process started.

While this was going on the Trieste was being prepared for launching. At about 2030 the dock well was flooded and by 2230 the Trieste was trailing in tow off the stern of the White Sands. The gassing operation started as soon as the dock well was pumped out. By 2200 on 3 November 67,000 gallons of aviation gasoline and 32 tons of steel shot had been loaded into Trieste and predive checkout had started.

Meanwhile the temperature of the interior of the refrigerator appeared to have stabilized at about 56°F. The coolant coil could not increase the differential. It was therefore decided to request an air drop of dry ice to lower the temperature. In addition, plastic bags and buckets of fresh water were loaded into the deck top refrigerator to make ice. The plan being to open the box, install the dry ice and regular ice, seal it up and hopefully lower the temperature below 40°F. The following afternoon as the predive checks were being completed the Air Force parachuted (Figure) 600 pounds of dry ice which was then loaded into the unit.

While the air drop was in process, the White Sands was heading for the "zero dot" (Deep Ocean Transponder). This is the transponder laid on the bottom by the search team to mark the location of the package. It is a transmitter that when interrogated by a signal of the proper frequency returns a signal of its own. The search team has planted two such dots. The zero dot being 160 - 165 yards north of the payload and the other dot, designated dot 3, was reported to be about 110 yards N E of the zero dot. These dots were located from the surface using satellite navigation and then interrogating them from the sea going tug boat Apache. Apache, meanwhile was preparing to plant two additional dots in the area.

The new dots were planted and their position, or at least the position of the Apache as the dots were released from the surface, was recorded. These additional dots were to act as position markers to help remove ambiguity in the range readings from the other dots and to provide a fixed pattern on the ocean floor from which to navigate on the bottom. The preliminary data, before the first dive, was:

Channel No.	Operating Frequency	Estimated Location
0	12.5 KHz	160 yards N of P.L.
2	13.5 KHz	On Trieste
3	14.0 KHz	110 yards N.E. of 0
5	15.0 KHz	5,330 yards S.W. of 0
8	16.5 KHz	5,670 yards S.E. of 0

The position of the "zero dot" was reported to be 24° 47.5' North latitude by 162° 01.7' West longitude. A 37 KHz pinger was also reported to have been planted on the bottom 30 yards from the zero dot by the search team.

Final preparations for the dive commenced as the White Sands approached the location of the 0 dot. The recovery hook was attached to the Trieste by divers, (Figure), the anti-chamber filled with sea water and the Trieste descended toward the bottom.

At about 2000, one hour and forty-five minutes after leaving the surface, the Trieste reported their position 300 feet above the bottom which was at 16,400 feet. Relaying their range to each of the dots in the pattern, the Trieste attempted to close in on the zero dot. At the same time, their position was plotted both on Apache and White Sands. As the Trieste approached the zero dot they observed a sonar contact on their CTFM. They changed course to investigate the contact and found nothing. The same type of search maneuvers were conducted with several other sonar contacts. Each time no visual contact was made. During the dive, there seemed to be a discrepancy in the range data indicating that the dots were not located where they were reported to be. At about 0200 the dive was terminated unsuccessfully. The scaph reached the surface at about 0345.

Meanwhile the temperature of the refrigerator box had stabilized at just below 50°F.

Immediately following the dive the weather conditions deteriorated to the extent that it became impossible to safely operate the small boats required to service Trieste. After waiting several days for the weather to improve the recovery team returned to Pearl Harbor to repair damage to Trieste caused by the rough seas. (A pan and tilt camera assembly had been broken off and lost as well as the dot launcher containing an operational dot).

On 17 November, the day following arrival at Pearl Harbor, a briefing was held with Admiral Lacey at the Submarine Base. All the officers of the Trieste and White Sands, and Cdr. Mooney participated. Following that meeting [redacted]

met with Adm. Lacey for further discussion of the operation. The outcome of these briefings and discussions was a decision to return to the site and again try to recover the payload. This time, however, more support from the Navy will be available. It seems that much more attention from the higher ups in the Submarine fleet will be directed toward successful completion of the operation. As a result, Lt. Cdr. Bartels, Officer in Charge of White Sands and Trieste, was directed to outline his needs and requirements for continuation of the operation. A list of requirements was started immediately. The objective was to be ready to go back to sea by Saturday, 20 November.

Activity on the ship became intense as plans were being made to repair Trieste, order replacement parts, provision the ship for the operation, etc. Among the items required were: two new outboard motors, a new Boston Whaler, a large refrigerator to replace the one built aboard ship on the way out, gas hose for refueling Apache and loading Trieste, more shot, lithium hydroxide for Trieste's life support system, fuel oil, lubrication oil, food, fire pump parts, etc.

The task element got underway at 1300 on Sunday, 21 November. Another tow ship, the "Coucall" joined White Sands in the channel of Pearl Harbor and the tow line transferred. As they reached the mouth of the harbor, Coucall reported that her towing engine (a device that maintains proper tension in the tow line) had failed and that she could no longer tow White Sands safely. The tow line was separated, White Sands headed out under her own power, and a rush call put in for Apache. Fortunately, the crew of Apache were all aboard and she was dispatched immediately to pick up the tow. They again were underway by nightfall.

The following day, while in transit to the recovery site a battery problem on Trieste was surfaced. One of the primary battery cells was grounding out and it could not be determined if it was cracked due to the pressure from the 16,400 foot dive or if it were some other problem resulting from the rough weather after the dive. In any event, the problem had to be resolved prior to the next dive. Around-the-clock attention was directed towards a solution which finally turned out to be not one big problem as suspected but two small failures in series. These were corrected and the Trieste was ready to dive again.

Continued bad weather and high seas prevented further operations until 29 November when Trieste was launched and the evaluation in preparation for the next dive commenced. The predive checks were completed, all of the electrical problems resolved, the recovery hook lowered into the water on floats and Trieste towed to the dive site. The hook was fastened into place (It is attached just prior to the dive so that it and Trieste are not subjected to long periods of exposure to surface action which could cause damage.)

The dive got underway at 1745. On the way down, the scaph developed a list to port of about 25°. The pilots tried to correct the attitude by dropping shot from the opposite side. It was stated that the pilot didn't feel he had control until after they reached a depth of 7,000 feet.

They continued down to about 15,000 feet, stopped, and started interrogating the transponders. They first pinpointed their location about 5,000 feet from the #3 dot. After driving to the target and lowering to the bottom they searched the base line between dots #3 and zero crossing the base line about four times. In the process they encountered several equipment problems. The computer power supply failed and dumped part of its memory. Riding with the trail ball out to about 35 feet they couldn't see the bottom so they winched it in to 10 feet. That was a little too much because when they started to move forward, the cable assumes a slight angle to the rear pulling the scaph down slightly. With the residual list because of improper metering of the shot ballast on the way down, the port skeg started draging the bottom. They then tried to lower the trail ball slightly and it wouldn't pay out. The end result was that they either had to slow down or slide the skeg on the bottom. In this configuration it was extremely difficult to steer a steady course.

The doppler sonar system also failed on the bottom. This device provides both height off the bottom information as well as horizontal velocity. The loss of this information is not critical to the mission since they have redundant depth indicators and a means of determining their position other than through velocity time relationships. After searching the 3 - 0 base line and investigating several CTFM sonar signals with no success and having

been down for almost eight hours the battery voltage was reaching its minimum safe level, they picked up a CTFM signal in a direction West of dot #3. They drove in that direction until they suddenly lost the contact. They immediately slowed down and peering out the viewing scope they spotted the payload passing about two feet to the right of the starboard skeg. (The reason for losing the target is that the CTFM has a minimum range of 30 yards but the visual range through the viewer is about 30 feet. There is a dead zone between the two). They came to an immediate stop but their momentum carried them beyond the package. They then started to maneuver the scaph around to bring the payload into view when the low voltage battery alarm came on. They tried to operate the mechanical arm in order to plant another transponder next to the payload and the shoulder movement would not operate to the right. It was suspected that the combination of low voltage and the list of the vehicle was too great a load for the arm shoulder motor. In any event they were not able to deploy the dot. With very little power remaining and little hope of even tripping the recovery hook they decided to head for the surface. The last check of the battery on the bottom indicated 4 of the 65 or so cells had been depleted to the extent that they had reversed polarity. The decision to surface was confirmed. They reached the surface at 0415 Wednesday morning.

Again after several days of waiting for the weather to abate to the level where operations could be resumed it was decided to head for the shelter of the islands where Trieste could be reloaded into White Sands and any damage repaired before attempting another dive.

E-4

SS-1		✓
SS-2		
SS-3		
SS-4		✓
SS-5		
SS-7	✓	
SS-		
COMP		
SS-1/RF		✓
RD-2/RF		
FILE		

ZCZCXQA128BAA304
PP RUXQAA
DE RUXQBAA 133 0072320
ZNY XXXXX KKK
P 072221Z
BT
XXXXX
[redacted] WHIG

~~T O P S E C R E T~~ 072221Z JAN 72 CITE CHARGE 0123.
PRIORITY WHIG
MEXAGON
TO D. BRADBURN FM F. BUZARD
1. WE HAVE PONDERED THE THOUGHT OF A SOVIET ATTEMPT TO RECOVER MX RV #3 (1201-3) IN THE EVENT WE DECIDE TO ABANDON THE SCENE FOR A SHORT PERIOD OR PERMANENTLY. HERE ARE OUR FINDINGS, THOUGHTS AND CONSIDERATIONS:
A. WHAT INTEREST AND CAPABILITY WOULD THE SOVIET HAVE IN RETRIEVING 1201-3?
(1) INTEREST --- OBVIOUSLY GREAT.
(2) CAPABILITY --
IT APPEARS THAT THERE COULD BE A SOVIET CAPABILITY BASED ON DATA AVAILABLE IN DIA SECRET DOCUMENT ST-CS-01-12-70 ENTITLED: "OCEANOLOGY -USSR AND COMMUNIST CHINA." ITEMS DESCRIBED ON PAGES 92 THRU 97 ALONG WITH OTHER INFORMATION AVAILABLE THROUGH

A LOCAL CURSORY SEARCH REVEAL THE FOLLOWING SPECIFICS OF INTEREST THE VESSEL SEVER-2 WHICH THE SOVIETS CLAIM HAS A 6000 FOOT DEPTH AND MANIPULATOR ARMS FOR DEEP RETRIEVAL HAS BEEN ACTIVE SINCE 1968. THE DSB-11 AND B-11 VESSELS, BELIEVED TO BE UNDERGOING TESTS IN THE SOVIET UNION, ARE CAPABLE TO DEPTHS OF 33,000 FEET. INFORMATION CONCERNING MANIPULATOR ARMS ON THESE TWO VESSELS IS UNKNOWN HERE. RECENTLY IT HAS BEEN REPORTED THAT THE SOVIETS ARE PURCHASING VESSELS, WITH MAINPULATOR ARMS, IN VANCOUVER B.C. CANADA. THESE VESSELS ARE DESTINED FOR SOVIET AGOR'S (OCEANOGRAPHIC RESEARCH SHIPS)
B. AS YOU KNOW THE SOVIETS, ET AL, HAVE THE SAME TERRITORIAL RIGHTS IN THE OCEAN AS WE. IF WE ABANDON THE SITE THEY CAN MOVE IN. E.G., THEY HAVE BEEN STATION KEEPING DIRECTLY OVER THE DOWNED SOVIET NOVEMBER CLASS SUBMARINE IN THE NORTH ATLANTIC FOR OVER A YEAR AND A HALF. THEY MAINTAIN ONE SHIP AT THE POINT CONSTANTLY, PRESUMBABLY TO PRECLUDE ANY U.S. EFFORT TO RECOVER HARDWARE FROM THIS SOVIET SUBMARINE.
2. SUGGESTIONS:
A. NOW THAT WE HAVE ESTABLISHED A PRECISE AREA OF EXTREME INTEREST, WHICH THE SOVIETS MUST BE AWARE, WE SHOULD NOT ABANDON

T

HE SITE UNTIL OUR OBJECTIVE IS ACHIEVED.

PAGE 3 CHARGE 0123. ~~T O P S E C R E T~~
B. IF WE ABANDON SITE WITHOUT ACHIEVING THE OBJECTIVE, WE SHOULD PERFORM ALL ACTIONS THAT MAKE IF APPEAR AS IF WE HAVE RETREIVED 1201-3 INCLUDING THOSE COMMUNICATIONS WHICH WOULD BE ORDINARILY NEEDED FOR, ADDITIONAL LOGISTICS FOR SUPPORTING AND COMPLETING THE MISSION SUCCESSFULLY AND CONGRATULATIONS.
~~T O P S E C R E T~~
BT

TOP SECRET
HANDLE VIA BYEMAN
CONTROL SYSTEM

NNNN 080040

~~SECRET~~
(WHEN FILLED IN)

DATE: 7 January 1972
ORIGINATOR: L.B. Molaskey
EXTENSION: 5597

	ROUTINE
	PRIORITY
	IMMEDIATE

STANDARD EXECUTIVE

TO [redacted] INFO CITE [redacted]

HEXAGON

REF: A. [redacted] MSG 3228

B. [redacted] MSG 3320

SUBJ: EXTENDED COVERAGE OF RV-3 RECOVERY ACTIVITY

DUE TO THE EXTENDED DURATION (6 WEEKS VICE 2 WEEKS ORIGINALLY PLANNED) OF THE RECOVERY MISSION OFF HAWAII THE [redacted] BUDGET ESTABLISHED LIMIT IMPOSED PER REF A WILL BE EXCEEDED BY APPROXIMATELY [redacted] THIS INCREASED COST IS A DIRECT RESULT OF THE LABOR HOURS AND EXPENSES ASSOCIATED WITH THE TECHNICAL SUPPORT PROVIDED ABOARD THE WHITE SANDS AT THE RECOVERY SITE.

END OF MESSAGE

APPROVALS:		DATE	TIME	APPROVALS:		DATE	TIME
1. P.Jones				5.			
2. R.W.Jones				6.			
3. A. Wallace				7.			
4. H.W.Robertson				8.			

~~SECRET~~
(WHEN FILLED IN)

DELTA RV-3 COST

[redacted] =

O/H 103.1% =

EXPENSES =

TOTAL PRIME =

G&A 26.7% =

FEE 8.5% =

SELL [redacted]

~~SECRET~~

WORKING PAPER, DESTROY
OR CONTROL BY 90

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 79

TO: D. Launder DATE: January 31, 1972

FROM: L.B. Molaskey

SUBJECT: Recovery of RV-3 — SPO 20053 Task 10272

From January 15th through January 26th I was on a trip to Hawaii in response to HQ's direction to support the recovery of RV-3 (Ref. Pilot 8209).

My time for that period (64 hours) should be charged directly to SPO 20053-10272. An accounting of my expenditures is being processed and will follow shortly. The approved time remaining for future support of this activity is approximately 56 hours and one more trip to the recovery site.

L.B. Molaskey 1-31-72

LBM/cj

cc: B.L. Todd
R. Cerda
R.W. Jones

~~SECRET~~

WORKING PAPER, DESTROY
OR CONTROL BY 90

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 80

TO: Distribution DATE: January 31, 1972

FROM: L.B. Molaskey

SUBJECT: Trip Report — Recovery of RV #3

In response to HQ's message 8209 and a telecon from [redacted] I flew to Honolulu on Saturday, 15 January 1972. At that time the weather in the recovery area was improving and it was anticipated that Trieste would be launched in preparation for the next recovery attempt on the following day. The plan was to have [redacted] and me travel out to the White Sands aboard the "contingency tug" Quapaw. As it turned out the weather in the recovery area did not improve as expected and Trieste was not launched. [redacted] and I, therefore, remained in Honolulu while maintaining periodic contact with the I.O.U. (Integrated Operating Unit) through LCDR. Ron Doyle who is Operations Officer for Sub-Dev. Group I in Honolulu.

We remained in Honolulu waiting for the weather in the recovery area to clear hoping to join the operation once Trieste was launched.

While in Honolulu we visited Col. Quinn and Major Tweede of the 6594th Test Group at Hickam Field. They are the group responsible for aerial and/or at sea recovery of the RV's. I gave Maj. Tweede several pictures of the range ships "Longview" and "Sunnyvale" which I had taken on my first trip to the area.

The launch of SV2 occurred while we were in the area so we were invited into the Recovery Control Center (RCC) to listen to the launch over the network. When the first attempt was postponed, we were invited and again returned to the RCC to hear the actual launch.

Major Tweede also escorted us on a tour through one of the recovery aircraft.

After checking with Fleet Weather Central and the Air Force weather people and with their long range (10 day) predictions for continued heavy seas and storms in the recovery area it was decided to return home. Arrangements have been made to notify [redacted] when and if Trieste has been launched. At that point we will again go out to Honolulu where we will be flown out to the White Sands via helicopter.

The latest word is that the Navy plans to remain at the recovery site until about 7 February 72. If unable to dive by that time they will consider returning to San Diego prior to resuming the operation sometime later in the spring or early summer.

LBM/cj

L.B. Molaskey 1-31-72

cc: M.F. Maguire, H.W. Robertson, R.W. Jones, C. Karatzas, P. Petty, R. Roylance, J. Braddon, [redacted] (HQS)

OPTICAL TECHNOLOGY DIVISION
OPTO-MECHANICAL DESIGN ENGINEERING

Memorandum ME 83

DATE: 15 February 1972

TO: P. Green

FROM: L. Molaskey

SUBJECT: Pictures of the Trieste Operation

I have received a request from [redacted] in behalf of Cdr. E. E. Henifin at the Pentagon for prints of some of the pictures taken on my recent trip aboard the White Sands. One 8 x 10 color print of the following:

711314	711335	711370
711317	711349	711371
711328	711357	711401
711334	711366	

Please make copies of these prints as soon as convenient and notify me when they are ready.

Thanks for your help on this order as well as the excellent support in the past.

L. Molaskey

LM:cb
cc: MFMaguire
HWRobertson
RWJones
CKaratzas
PPetty
RRoylance
JBraddon

~~SECRET~~
HANDLE VIA BYEMAN
CONTROL SYSTEM

1972 AUG 14 [illegible] 52

E, 4

Lig 7362

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PASS WHIG

~~S E C R E T~~ 141916Z AUG 72 CITE CHARGE 4390.
WHIG
SECUR
FOR [redacted] FROM [redacted]
1. THE FOLLOWING ARTICLE FROM UNDER SEAS TECHNOLOGY, PAGE 25, JULY 72, IS QUOTED BELOW FOR YOUR INTEREST.
2. "TRIESTE RECOVERS ELECTRONICS PACKAGE FROM 16,400 FT ~~DEPTH~~. SINCE OCTOBER 1971, THE BATHYSCAPH TRIESTE AND TWO SUPPORT VESSELS HAVE BEEN WORKING AS AN INTEGRATED OPERATING UNIT IN A MANNED UNDERWATER SEARCH AND RECOVERY OPERATION TO LOCATE AND RECOVER A SMALL ELECTRONICS PACKAGE AT A DEPTH OF 16,400 FT. 400 MILES NORTH OF HAWAII. THE SUPPORT VESSELS ARE THE USS APACHE AND WHITE SANDS.

IN APRIL, ON THE THIRD DIVE, THE TEAM RECOVERED THE PACKAGE. THIS IS THE DEEPEST RECOVERY ATTEMPT BY THE U.S. AND THOUGHT TO BE THE DEEPEST OPERATION OF ITS KIND EVER SUCCESSFULLY ACCOMPLISHED IN THE WORLD. BAD WEATHER FORCED RETURN TO PEARL

PAGE 2 CHARGE 4390 ~~S E C R E T~~
HARBOR ON THREE OCCASIONS IN THE COURSE OF THE EIGHT-MONTH OPERATION.

ON THE SUCCESSFUL DIVE, TRIESTE WAS MANNED BY NAVY HYDRONAUTS LCDR. MAL BARTELS, LCDR. PHILLIP STRYKER, AND LT. DICK TAYLOR, WITH LCDR. BARTELS COMMANDING. LCDR. C.W. HUDIBURGH COMMANDS THE WHITE SANDS, AND LT. M.D. BAKER COMMANDS THE USS APACHE. THE GROUP WORKS DIRECTLY FOR COMMANDER SUBMARINE DEVELOPMENT GROUP ONE IN SAN DIEGO."
~~S E C R E T~~
BT

~~SECRET~~
HANDLE VIA BYEMAN
CONTROL SYSTEM

NNNN 141955

~~TOP SECRET~~

HANDLE VIA
BYEMAN
CONTROL SYSTEM

~~(S)~~ NATIONAL RECONNAISSANCE OFFICE
WASHINGTON, D.C.

THE NRO STAFF

23 August 1972

MEMORANDUM FOR THE RECORD

SUBJECT: (A) CHARGE 4390 Dated 14 August 1972
(B) HEXAGON

On 15 August, Dr. Naka spoke to OP 967 regarding the article appearing in the publication "Under Seas Technology" page 25, dated July 1972. The article apparently refers to the Navy's attempt to recover bucket No. 3 of the first HEXAGON mission.

Dr. Naka was advised that OP 967 did not authorize release of the article and is attempting to trace the source of the article. Dr. Naka was advised he would be contacted again by OP 967.

[redacted]
Assistant for Security

HEXAGON
HANDLE VIA
BYEMAN
CONTROL SYSTEM

~~TOP SECRET~~
EXCLUDED FROM AUTOMATIC REGRADING
DOD DIRECTIVE 5200.10 DOES NOT APPLY

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PAGE 1 OF 1 PAGES

I. INTRODUCTION

This proposal addresses the effort requested by the customer of SSC in support of the recovery of RV #3 from the ocean bottom off Hawaii. It documents the effort, on the part of SSC, which has been performed to date and provides a description of remaining effort to support the task of recovering the lost RV and the information it contains.

The recovery sequence for RV #3, after successfully completing its on orbit mission requirements wherein the take-up was loaded to its nominal capacity of 52,000 feet of exposed film from primarily high priority operational sequences, commenced on JULY 10, 1971. After proceeding successfully through most of the recovery sequence and entering the atmosphere within the expected impact area, a failure in the primary parachute system prevented normal aerial recovery and allowed the RV to fall, unsupported, into the ocean at a velocity estimated to be 307 (450 ft/sec) miles per hour.

Preliminary reports, rumored to be from the recovery task force, indicated that a visual sighting of the RV on the surface of the ocean for a short period after impact have been found to be erroneous. The confusion seems to have been the result of a spurious signal, generated by one of the recovery aircraft in the area, which was similar to the normal output of the beacon on the RV. There were, however, reports that a spot in the expected impact area exhibited evidence, such as bubbles and a discoloration of the water which could have been caused by the high velocity impact of the RV with the water.

It is estimated that the impact point of the RV with the water can be determined to an accuracy of about 10 square miles. The film manufacturer, Eastman Kodak, has indicated that there is a high probability that if the spools can be recovered without significant exposure to light, and if maintained "wet", that a good percentage of the imagery can be recovered.

The problem then, is how to locate and retrieve the spools from the bottom of the ocean at a depth of 14,400 feet.

II. BACKGROUND

A. Preliminary Planning

A preliminary planning meeting was called at Headquarters on 27 July 1971 (Ref. BYE 109733-71). At this meeting a review of the information retrieval potential confirmed the value of attempting a recovery from the ocean bottom. Consultation with the Navy revealed that the deep submergence vehicle Trieste II could be used to penetrate the ocean depths if the payload could be located. They (the Navy) indicated that a search vehicle, operating out of the Scripps Oceanographic Institute, commanded by Dr. F.N. Spiess is experienced in and capable of locating such objects on the ocean floor. The technique employed in locating an object on the ocean bottom is to search the target area with a ship towing a sensor "fish" suspended on a 30,000 foot cable. The primary sensor in the "fish" is a high resolution scanning sonar system having a cross track range of 1000 feet reported to be capable of locating objects smaller than 5 feet cubed at the operating depth.

Once located, and confirmed by television pictures, a camera is lowered and pictures are taken of the payload. If confirmed to be the RV, a transducer will be lowered to the site to mark the target location. The Trieste will then be located over the transducer and subsequently lowered to the bottom for the recovery operation.

The meeting identified several areas of investigation required to implement the recovery. SSC was requested to:

1. In cooperation with MWC assess the probable damage to the RV and take-up to aid in identifying the configuration of the unit on the bottom.

2. Define the probable configuration of the unit and devise a means to attach the recovery cable from the winch on the Trieste.

3. Investigate the illumination levels at approximately 120 feet depth to determine the vulnerability of the film to exposure at that level.

4. Investigate the availability of a suitable shipping container for the return of the payload to the despooling facility while maintaining it

immersed in water and protected from light exposure.

5. Coordinate with Eastman Kodak and provide technical liaison concerning disassembly of the damaged take-up and adapting a despooling apparatus.

The meeting also established a "recovery team" consisting of representatives from the various organizations involved as well as established communication channels for information flow between parties.

B. First Working Session

Immediately following the meeting at Headquarters a working session was held at MWC to discuss the probable configuration of the payload after impact with the water. Although there is no positive means, other than by recovery of the payload or by duplicating the impact situation, of determining the final (after impact) configuration concensus of opinion of those most familar with the hardware is that the unit will be in one piece.

A means for attaching the payload to the lifting cable on the Trieste was discussed. Several approaches presented were:

1. The use of a net, which could be laid on the ocean floor with long cables which are attached to the recovery hook on the Trieste's wench was considered.

2. The use of "Vise-grip" type pliers or clamps, attached to the lifting cables which could be fastened to the parachute bridle straps was discussed.

3. A plunger, inserted into the empty drogue morter-canister was considered.

4. A "Hay hook" type of device which has arms large enough to encircle the entire payload was suggested.

The meeting adjourned with the recommendation that either the net or the "Hay hook" approach be considered further. Discussion of these approaches with the Operations Team was recommended so as to assess the compatibility of the hardware available and the experience of the crew.

c. Second Working Session

A working meeting was held ~~to discuss~~, with Navy personnel at the Pentagon, for the purpose of discussing the proposed recovery technique and to define the hardware interfaces involved.

Participants at the meeting were:

[redacted] (Navy)
(Navy)
(HQS)
L.B. Molaskey (SSC)

[redacted] presented slides of the Trieste II showing the overall configuration. He did not, however, have detailed information and/or drawings which are required to interface the proposed hardware.

A review of the proposed recovery technique indicated that the scheme appeared to be compatible with the capability of the Trieste and in some ways was preferable to the techniques being investigated by the Navy. A significant point brought out by [redacted] was that the use of a net or other sling type of device would undoubtedly stir up the sediment on the ocean floor to the extent that the operator's visibility would be reduced essentially to zero for periods of up to an hour. A technique which did not disturb the bottom until after the payload was secured, such as the hook technique proposed, therefore, would be far less time consuming.

[redacted] indicated that the Navy is considering the use of a purse net which could be dragged along the bottom. If the payload is not imbedded too deeply into the mud the net would cause the unit to tumble into its pocket and when lifted would completely surround the unit. It could be transferred to the support ship in the same manner as originally proposed. This technique, however, has a potential light exposure problem at the 120 foot transfer depth if the unit has any large holes and is held at that depth for any length of time.

[redacted] indicated that he would request the INTERFACE information required as it was now understood. He suggested that we review the drawings and get together with his office personnel again. He also suggested that we continue with the hook concept layouts and design but prior to committing the hardware to fabrication that we contact and visit with the crew and inspect the vehicle (at San Diego). He indicated that such arrangements could easily be made from his office. (Ref. BIF 007-1266-71 - ME52 Trip Report - Recovery of RV #3)

d. Recovery Hook Design

During this period of interface and requirements definition SSC has undertaken a design effort to convert the hook concept into manufacturable hardware. The design process has, in turn, revealed additional operational requirements. Four primary considerations for successful implementation are:

1. Simplicity of Operation - The design should be capable of performing with a minimum of control required of the operator. A purely mechanical device is preferable (no built-in electrical, hydraulic or other power source should be considered). The device will be activated by the manipulator on the Trieste II.

2. Reliability - The device must be as fool-proof as possible. It must be capable of multiple operation (open and close) while at the operating depth.

3. Flexibility of Operation - Because of the uncertainty of the payload status after water impact and its position on the ocean floor, the hook must be capable of accommodating whatever the combination of configurations and penetration into the mud may be.

4. Cost and Schedule - The fabrication cost and time required to build, assemble and test the apparatus must be minimized. Solidification of design requirements and firm interface constraints must be achieved as soon as possible to provide adequate fabrication and test time. The goal, of course, is to have a fully operational device on station on October 1, 1971.

III. RECOVERY PLAN

As a result of the first two meetings and subsequent effort and discussions with Headquarters the following recovery plan is proposed:

1. The Navy, with cooperation from the Air Force, determine the impact area as accurately as possible. Investigation of all available sources such as, from tracking data, telemetry, recovery ship position logs, recovery air craft flight recorders, etc. should be undertaken. The above data should be cross-checked against an analysis of the trajectory for compatibility. (It is assumed that this process is underway).

2. Using the above impact point as a reference and with the estimated water descent rates provided by SSC and MWC (see ME-45 dated 2 August 1971) and the Navy provided sea current information a prediction of the payload location on the bottom should be calculated.

3. The search vessel, after making whatever modifications to its instrumentation may be required, should be dispatched to search the area starting from the predicted resting point. The total area to be searched will depend largely upon the accuracy of the predicted water impact point. The drift of the payload in the water during descent is negligible as compared to the above accuracy. ($D = VT = .5\left(\frac{17.2}{60}\right) = .14$ nautical miles = 865 feet).

4. Once the payload has been located, photographs and/or televison imagery should be acquired so as to assess its condition and configuration. SSC proposes to support this on site assessment to verify the identification of the payload and to determine the compatibility of the retrieval plan and equipment with the remainder of the operation.

5. Assuming that the payload is essentially intact as predicted, the Trieste II will descend to the spot homing in on the marker transducer.

6. Using the manipulator on the Trieste II the payload will be extracted from the soft surface of the bottom. (It is predicted that the payload will be imbeded up to 80% in the soft silt of the ocean bottom).

7. The Trieste II will then be positioned so as to locate the "Hay hook" over the payload and the hook lowered and actuated to encircle the payload. A trial lifting test should then be performed within view of the crew to determine the adequacy of the hook grip on the payload. The gripping procedure can be repeated by opening the hook, droping the payload a short distance (6 - 8 feet) and repeating the gripping process. When it has been established that the payload is secure the curtain will be released protecting the unit and its contents from further exposure as the Trieste is raised to the surface.

While playing out the cable on the winch the Trieste II will be raised approximately 120 feet off the bottom. The payload will then be lifted by the cable and will ascend with the Trieste II suspended about 120 feet below the winch.

8. When the Trieste II reaches the surface a support ship will come alongside and divers will descend 120 feet to the suspended payload. operation for this phase is required - hence the the payload. The divers will first secure the bottom of the tubular curtain to completely enclose the payload into a bag having appropriate drain tubes to allow the sea water to escape when lifted above the surface.

The divers will transfer the payload from the cable of the Trieste II to a net suspended from the wench of the support ship. The unit can then be lifted out of the water and onto the deck of the support ship.

9. In order to minimize the size and weight of the recovery shipping container, it will be necessary to remove the lifting hook from the payload. This can either be accomplished on deck or in a enclosure within the ship. A one ton crane, with appropriate ropes or slings will be required to open the hook and remove the curtain.

10. The payload can then be lifted and placed into the waiting shipping container which is partially filled with sea water. The container will then be completey filled with sea water and a fungicide added to prevent bacterial growth during the trip to the despooling facility. This action is required to preclude the need for maintaining the unit temperature below 40°F for the entire trip. Assuming the shipping container to be 64 inch diameter by

61 inches high (a typical container which has been located by SSC) the estimated shipping weight loaded is 8,100 pounds. If the hook and curtain, etc. were not removed prior to loading into the container the volume of the container, and hence the weight of water required to fill it would be doubled.

11. The container is then sealed and transported via ship to Hawaii where it is loaded onto an awaiting Air Force aircraft for its flight to Rochester, New York.

12. At the facility the sealed container will be moved to the despooling area and the sea water drained and saved for use in the operation. The container can then be opened and the payload lifted clear. Suitable cranes and handling equipmemt, of course, will be required.

13. It is expected that the pressure canister will have to be cut away from the payload. Manual shears are planned. It is expected that since the shaft is broken, the mounting clamp need not be removed. The electronics in the shaft will be cut away and the RV equipment shelves pried apart with a special hydraulic spreader designed for the purpose by [redacted]. The will be separated from the structure of the RV and set up for removal of the TU structure from the stacks. This hardware also will be cut off using high strength shears. A hole, approximately 1 inch in diameter, will be drilled through the remaining electronics in the shaft. An axle will be inserted and the manually rotated for The sea water will be used to wet down the stack periodically.

14. The remainder of the recovery and processing operation will be accomplished manually by removing the in 2000 to 3000 foot lengths, maintaining the unit saturated with sea water and delivering the material, wet, for

IV. STATEMENT OF WORK

Perkin-Elmer proposes to support the recovery plan outlined in Section III of this proposal by providing the manpower, material, and facilities to:

1. Attend and provide technical liaison to planning and operational discussion meetings required to define the details of the recovery hardware herein proposed.

2. Provide technical support for the determination of the probable configuration of the payload as it rests on the bottom of the ocean.

3. Design, fabricate and test a lifting hook for use in the under-water recovery operation. Interfacing and operational details required to assure the compatibility of the hardware design with the Trieste II will be provided by HQS. The hook will be capable of:

   A. Multiple operation (open and close) at the operating depth estimated to be 14,400 feet.

   B. Lifting and containing the payload and its major internal components.

   C. Protecting the contents from significant exposure to sunlight as it is raised to the surface of the water and installed into the sealed shipping container.

4. Investigate the availability of a suitable shipping container for transporting the payload, immersed in sea water, to the despooling facility. The cost of such a shipping container is not included in this proposal.

5. Provide on-site technical support during the recovery operation. This effort will include evaluation, from photographs taken of the hardware on the ocean bottom, of the compatibility of the recovery method proposed. Identification of the payload and assessment of damage thereto prior to attempting actual recovery is assumed necessary for a successful operation.

6. Coordinate with the operation's force and provide instructions as to the operation of the hook and the scheme to transfer the payload from the Trieste II lifting cable to the net of the support ship.

7. Provide technical liaison and information to EK in support of the disassembly of the take-up structure and installation of an appropriate despooling axle.

8. Provide a summary report of the overall operation with emphasis on the affectivity of the technique employed, the hardware used, and the survivability of the photographic data recovered.

9. The schedule for the above effort shall be from July 27, 1971 to November 30, 1971. Milestones are as follows:

A. Initiate planning 27 July '71.
B. Hook design complete 27 August '71.
C. Complete fabrication of hook 23 September '71.
D. Complete hook test 27 September.
E. Commence on-site operational support 1 October '71.
F. Complete recovery operation 15 October '71.
G. Complete technical liaison at despooling facility 29 October '71.
H. Complete final report 30 November '71.

V. TASK DESCRIPTIONS

1.0 OPTO-MECHANICAL ENGINEERING

1.1 INTRODUCTION

The Opto-Mechanical Engineering Department will direct, coordinate, and manage all of the activity herein proposed. It will also perform the necessary customer, co-contractor, and other agency interface tasks. It will provide the "on-site" personnel required for the recovery operation. Within its operation it is also responsible for engineering, layout, and release of all the hardware involved.

1.2 OPTO-MECHANICAL ENGINEERING TASKS

1.2.1 Provide technical liaison to planning meetings as required.

1.2.2 Engineer, design, and release for fabrication the "hay hook".

1.2.3 Provide technical support for the fabrication and inspection of the hardware.

1.2.4 Prepare test plan and supervise testing of the hardware.

1.2.5 Coordinate shipment of the hareware to the operational site.

1.2.7 Provide on-site technical support for the recovery operation.

1.2.7 Provide technical support at despooling facility.

1.2.8 Write final report.

1.2.9 Investigate availability of appropriate shipping container.

2.0 SYSTEMS ENGINEERING

2.1 INTRODUCTION

The Systems Engineering Department will provide analytical support for the design of the hook hardware and recovery operations.

2.2 SYSTEM ENGINEERING TASKS

2.2.1 Calculate descent rate of payload after impact with the water.

2.2.2 Perform force flow analysis to determine loading of hook components. Several hook concepts will be analyzed.

2.2.3 Perform detailed stress and weight analyses of selected hook design.

2.2.4 Document the above analyses for incorporation into the final report.

2.2.5 Support test planning and witness testing of the hook.

3.0 MANUFACTURING

3.1 INTRODUCTION

The Manufacturing Department provides the necessary manpower, materials and facilities to fabricate and assemble the hardware.

3.2 MANUFACTURING TASKS

3.2.1 Fabricate and/or purchase all detail parts and hardware as described in the released "hook" drawing set.

3.2.2 Assemble the hook hardware.

3.2.3 Provide appropriate shipping crate.

3.2.4 Arrange for shipment to the operational site.

4.0 QUALITY ASSURANCE

4.1 INTRODUCTION

One hundred percent inspection of parts is not proposed for this one of a kind hardware fabrication task. Therefore, the hardware will be inspected at the assembly level only. Quality Assurance will, however, participate in the hardware testing.

4.2 QUALITY ASSURANCE TASKS

4.2.1 Inspect hardware for compliance with the intent of the design layout drawing (NOTE: The design layout drawing will be used as the final assembly drawing. Detail parts and components will be described by appropriate auxiliary views and/or separate drawings as required to facilitate fabrication and assembly, as required.)

4.2.2 Review and approve test plan.

4.2.3 Witness hook testing.

5.0 TEST DEPARTMENT

5.1 INTRODUCTION

The Test Department will provide the manpower and equipment required to perform a simulated, in air, loading test of the hook.

5.2 TEST DEPARTMENT TASKS

5.2.1 Prepare written procedures for test to be performed. It is anticpated that the tests to be performed will consist of a simple demonstration of the load carrying capability of the hook. The test procedures, therefore, will be simply a list of steps and/or operations to be performed using an appropriate load and crane.

6.0 TECHNICAL DOCUMENTATION

6.1 INTRODUCTION

The Technical Documentation Department is responsible for publishing the proposal and final report. They provide typing, editing, and illustrating support to the engineers who actually write the report.

6.2 TECHNICAL DOCUMENTATION TASKS

6.2.1 Edit, Type, and illustrate as required, the proposal and the final report.

6.2.2 Print and distribute the proposal and final report in accordance with security regulations.

6.2.3 Incorporate interim reports of the project activity into the monthly DMR.

VI. COST INFORMATION

VII. ATTACHMENTS

The attached illustrations show various hook concepts investigated during the design process. The recommended configuration shown in Figure 1 provides the best combination of simplicity of operation, minimum size and weight, fabrication cost and load carrying capability. It incorporates the desirable feature of increased gripping force with increased load. This is achieved through the use of a simple "ice tong" mechanism employing a pivit for the arms which is located so as to cause the lifting cable tension tend to close the hook. A latch arrangement is used to hold the hook in the open position and a spring force, released by the latch to close the arms.