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Historical Collections Division
AR 70-14, 1 AUG 2012

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HEXAGON



BYE-108849-72
Copy / of 6
24 May 1972

MEMORANDUM FOR THE RECORD

SUBJECT: Deep Sea Recovery of HEXAGON Recovery Vehicle 1201-3

1. On 10 July 1971, the third HEXAGON RV was lost. The parachute failed to reef before fully deploying, and it was snapped off at the swivel. The RV entered ballistically and impacted the water with a force of approximately 2600 g's and settled in 16,000 feet of water.

2. The decision was made to attempt the deep sea recovery of the RV primarily for the intelligence value of the film record and secondly to establish a capability for deep oceanographic recovery. There were several problems to be overcome, among them:

- a. The ability to locate the impact area accurately.
- b. The amount of damage caused by the impact and the corrosive effects from sea water.
- c. No object of this size had been actively searched for and located by sonar.
- d. The Trieste II had not gone below 10,000 feet.

3. The USNS De Steiger, under the direction of Dr. Fred Spiess, arrived in the search zone on 8 October and, after two weeks of search, located and successfully photographed the recovery vehicle. Attachment I has several of the photographs obtained from the search fish.

4. The Trieste II, supported by the White Sands and the Apache, under the command of Captain Packer, Commander Moody and Lt. Commander Bartels, made three recovery attempts: one on 3 November 1971, one on 30 November 1971 and the third on 25 April 1972. The third attempt was successful in locating and securing the film stacks; however, as the Trieste was surfacing, the film broke into pieces. Twenty-five feet was recovered. Attachment II gives a detailed chronology of the first two attempts. Attachment III gives the details of the third dive.

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SUBJECT: Deep Sea Recovery of HEXAGON Recovery Vehicle 1201-3

5. Analysis of the photographs from the Trieste II shows that the RV apparently broke up on impact and the film spools separated from the rest of the recovery vehicle. There were several other pieces of debris which were RV or takeup structure. There was very little evidence of corrosion. The film stacks were cut in several places and the cuts were the probable cause of the pieces of film breaking off and floating away. The photographs and a more detailed analysis is included in Attachment IV.

6. There are several lessons to be learned from this mission. Among them are:

a. The search/recovery should be an integrated operation. The first dive of the Trieste II was wasted since they were looking in the wrong location due to confused information from the search team.

b. The dependence on good weather severely hampered operations. The required mode of operation using the White Sands entails launching the Trieste II, then using 2-3 days of calm seas to gas and shot. The actual dive can be made under any but the most extreme weather conditions. From the first of December through March, good weather was very rare. A method should be worked out whereby the submersible can be completely readied and checked out independent of the weather.

c. The reliability of the Trieste II was relatively poor. There was a major subsystem failure on each of the three dives. On the first dive, the trail ball was inoperative and the Trieste was forced to operate on the bottom on its skegs, stirring up considerable silt, causing poor visibility and using considerable time. The second dive, the shot relief valves on one side failed to operate and the Trieste had a 15° list while on the bottom. The third dive, the mechanical arm failed to work, almost preventing operation of the recovery device. The on-board computer has never worked. Much more attention is required to the use of high reliability parts and extensive subsystem testing to assure confidence in any given operation.

d. The lack of mobility of the integrated operation unit (IOU) limited the number of dives. It was not possible to reach the recovery area in less than three days from Pearl Harbor at a speed of three knots; consequently, some good weather opportunities were lost. It also required the IOU to remain at sea for long periods of time, hoping for the weather to improve.

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SUBJECT: Deep Sea Recovery of HEXAGON Recovery Vehicle 1201-3

7. In summary, the significance of the objective of recovering the film for intelligence use was considerably reduced after the 1202 mission, and the motivating force became the demonstration of the capability to effect a deep sea recovery. This was successfully accomplished with the recovery of the two film stacks on the third dive. All of the men involved remained enthusiastic and determined throughout the many frustrations and are to be commended for their fine efforts.

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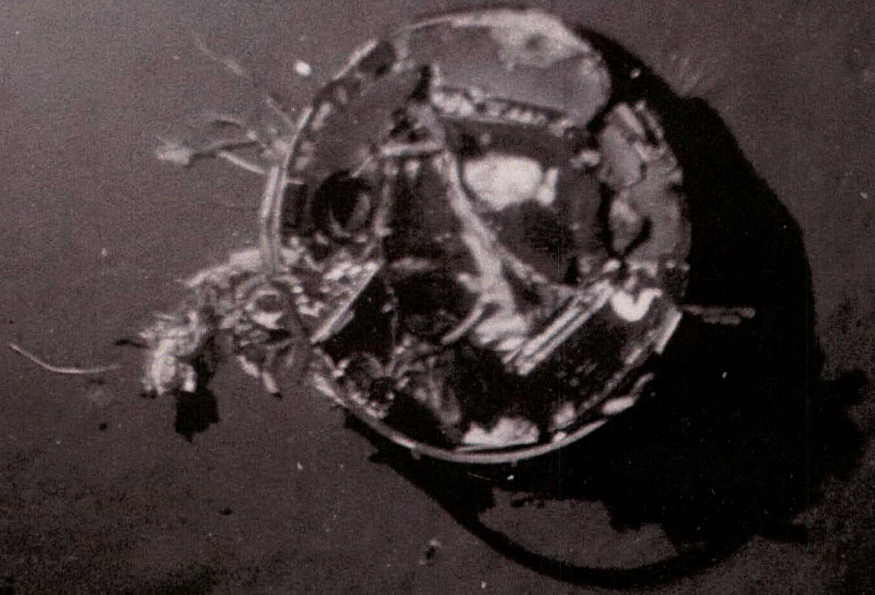
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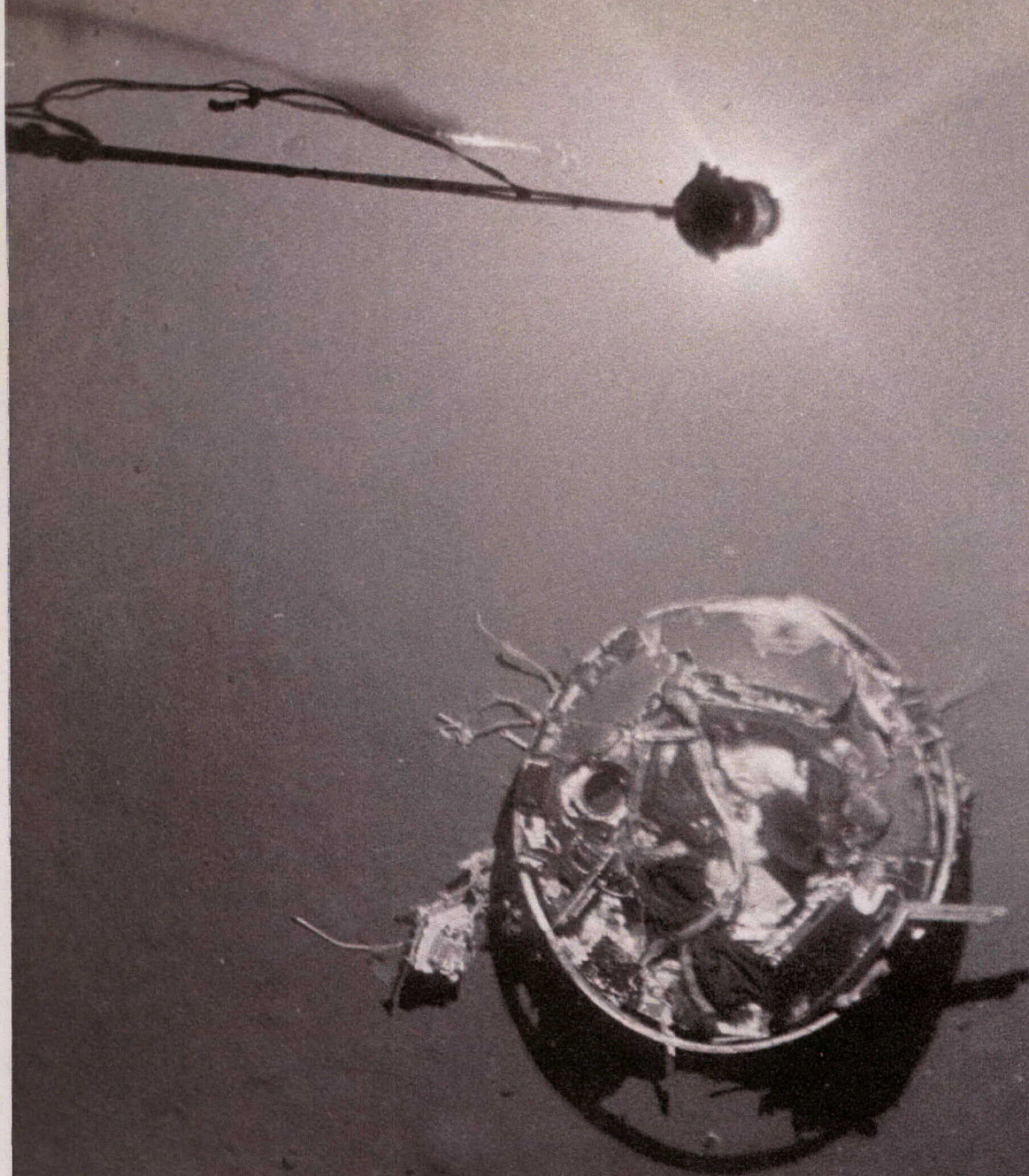
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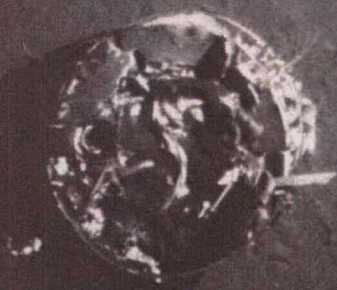
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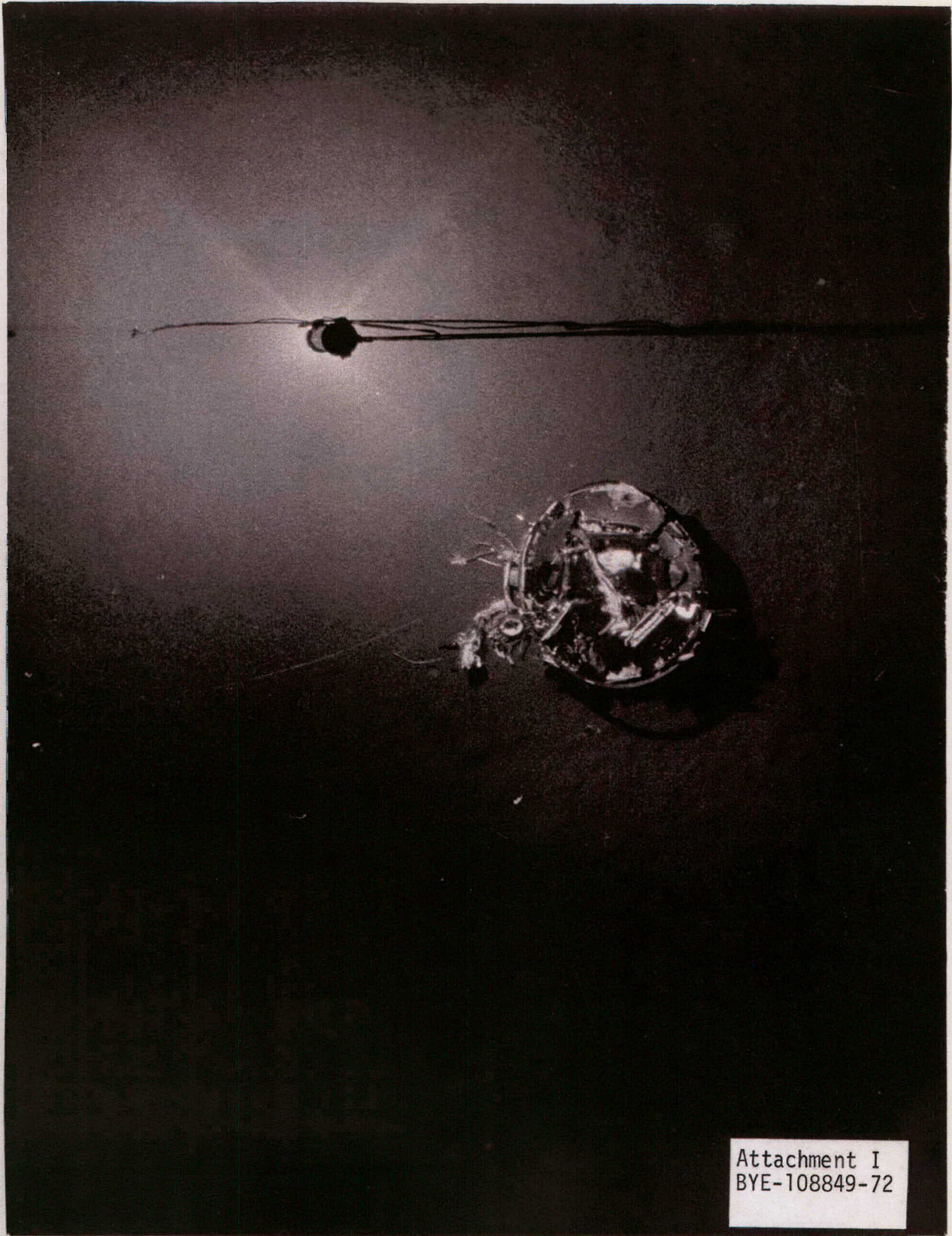
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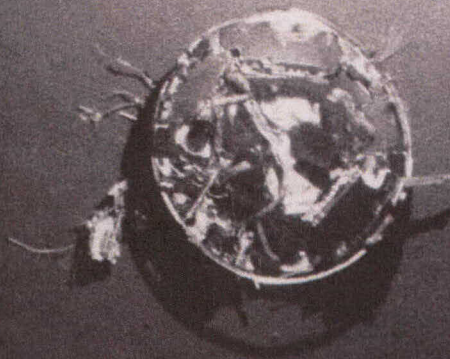
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ATTACHMENT II
to
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Cy 5 of 9
9 February 1972

MEMORANDUM FOR: Director of Special Projects

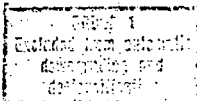
SUBJECT : Trip Report, RV-3 Recovery Operations

A. BACKGROUND

1. The in-air recovery of RV-3 was not effected on 10 July. Instead the RV, because of a parachute failure, made a ballistic trajectory into the open seas, hitting with an impact of about 2600 g's at about 310 miles per hour. Location of the impact was eventually calculated to be in a rectangular area about 1 1/2 miles in E-W direction by 8 miles in N-S direction geographically fixed with center at 24° - 48' N 162°01'W.

2. In view of the importance of the intelligence collection on this particular RV, the Navy was approached by NRO and OSP staff members to determine if they could provide deep submergence search and recovery. It was believed that the RV was at a depth of about 14,000 feet. The Navy agreed to arrange for the use of the search ship DeSteiger and the deep submerge submarine Trieste II which has a design operating depth of 20,000 feet. The intelligence community (NRO, OSP, EK, and SP-7) agreed that the effort would be worthwhile in that the material should be intact in the RV and about 50% of the imagery should be useable. The NRO agreed to fund Navy for the search phase and incidental equipment (recovery device, refrigeration unit, etc.).

3. The recovery device was designed and built, materials for a refrigerator to be built were procured, the USNS DeSteiger sailed from San Diego for the search area on 4 October and the Trieste with its mother ship White Sands (ARD-20) in tow by a fleet tug, Apache conducted recovery practice off San Diego with a dummy RV which was dropped in about 6500 feet of water. Recovery of the dummy RV was not successful because of Trieste equipment problems.



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SUBJECT: Trip Report, RV-3 Recovery Operations

4. Particular criteria applicable to this recovery operation were environment, light, and security.

a. Environment - To assure that the environment of the recovered RV would be kept as close to its humidity and temperature conditions on the ocean bottom and to meet the request of Eastman Kodak, a refrigerator capable of storing the RV in its sealed container (filled with clean sea water) and maintaining it at a temperature of 40°F was needed. The Navy first built a wooden box with 1 1/2 inch insulation and cooled by air-conditioning. This proved to be inadequate as the temperature could only be lowered to 55°F. Dry ice dropped by the Air Force was used in an attempt to lower the temperature but this lowered the temperature only to 48°F for about one day after which time it rose to 55°F. Upon return to Pearl Harbor after the first dive, the Navy made arrangements to lease a large commercial walk-in refrigerator which was most adequate for the task.

b. Light - To insure that the film would not become light struck as the recovered RV approached the surface, a black shroud to cover the RV and the recovery device was made. Divers would place this in position when the recovered unit was at about 80-100 feet depth. In addition, it was planned to bring the RV to the surface at night.

c. Security - To maintain security, five (5) Naval Officers were briefed and the crew was given the cover story that the Trieste was attempting to retrieve a Marine Physics Laboratory (MPL), a unit of Scripps Institute, instrumentation package, which was sensitive to light, temperature, and humidity conditions. The black shroud and recovery at night would also prevent viewing of the recovered RV by the crew of the White Sands. As there was a good probability that the divers who would position the shroud would see the film, the writer was prepared to have them sign inadvertent disclosure forms.

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SUBJECT: Trip Report, RV-3 Recovery Operations

5. The DeSteiger arrived in the search area on 8 October and, after several search runs, successfully found the RV on the last run, and marked its position by dropping two Deep Ocean Transponders (DOT's) and a Pinger. The RV was positively identified by underwater photography which indicated an excellent probability that the TU was still integral with the RV. DeSteiger arrived in Pearl Harbor on 22 October and returned to San Diego shortly thereafter.

B. INTEGRATED OPERATING UNIT (IOU) OPERATIONS

1. The Integrated Operating Unit (White Sands with Trieste aboard and in tow by Apache) sailed for the operating area on 11 October and arrived there on 1 November. Since weather and sea conditions were excellent, preparations for the Trieste dive began immediately. The dock of the White Sands was flooded, the Trieste was launched and placed under tow by White Sands. Supporting small boats were also placed in the water. Gas, power and shottng lines were rigged between White Sands and Trieste. It normally requires a period of about 2 1/2 days of good sea conditions to load Trieste with aviation gasoline (67,000 gallons), shot (32 tons) and conduct pre-dive checks. By 2200 on 3 November, Trieste has been gassed and shotted and pre-dive checks had started.

2. The White Sands, which has only station keeping power of its own, proceeded to the Ø DOT position (reported to be 160 yards north of the RV). The other DOT, designed No. 3, was reported to be 110 yards Northeast of the Ø DOT. The two DOT's had been previously located by the Apache, operating independently. Apache, in the meanwhile, launched two other DOT's in such positions as to remove the ambiguity in the directional readings as the submarine navigated on the bottom. Because of thermal layers and multi-directional subsurface currents, position of the DOT on the bottom can be quite different than the surface position at which the DOT is released. Each DOT had a different frequency of interrogation so that they could be individually identified. The estimated bottom

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SUBJECT: Trip Report, RV-3 Recovery Operations

location and frequency of each of the DOT's was:

<u>DOT #</u>	<u>Freq. (KHz)</u>	<u>Estimated Location</u>
0	12.5	160 yards north of RV
2	13.5	On Trieste
3	14.0	110 yards NE of 0
5	15.0	5330 yards SW of 0
8	16.5	5670 yards SE of 0

3. As White Sands approached DOT 0, final dive preparations were completed. The pre-dive check list was completed, the anti-chamber was filled with sea water, Trieste was released from tow, and the recovery hook was attached to Trieste's winch. At about 1815 Trieste commenced its dive. At 2000 Trieste reported her position as 300 feet above the bottom which was at 16,400 feet. Trieste relayed subsurface position data vis-a-vis each of the DOT's to White Sands and Apache who also kept position plots.

4. Trieste has an on-board computer for positional plotting and uses sonar ranging, dead reckoning and visual means (30 feet max.) for target location. To keep a constant distance above the bottom and for safety reasons, a trail ball can be lowered to a maximum of 150 feet. In the RV operations, the trail ball was planned to be kept about 15 to 30 feet below Trieste. The bathyscaph can make a maximum speed of 2 knots and can operate on the bottom from 6 to 11 hours dependent on power used. Battery capacity is 900 watt-hours. It displaces 70 tons and can lift up to a maximum of 5 tons from design depth (20,000 feet). Its Continuous Transmitting Frequency Modulated Sonar (CTFM) can range from 30 yards to 3000 yards dependent on the scale chosen. This sonar "looks" down at an angle of 15 degrees from the horizontal plane of the Trieste. Trieste also has underwater

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SUBJECT: Trip Report, RV-3 Recovery Operations

voice communications, doppler sonar, and integration unit (receiver/transmitter) for "talking" to the DOT's, camera installations and closed loop television for visual observation. The latter cannot be transmitted to the surface.

5. On this dive Trieste intermittently obtained a cluster of three targets on its sonar while above the bottom. However, since the trail ball was inoperative (could not be lowered) and the CTFM sonar had a 15° offset, visual observations of any of the targets was not made. Trieste frequently had to operate on the bottom on its skegs, stirring up the silt which further reduced possibility of visual sightings. During the course of the dive, it became apparent that there was a discrepancy in the reported relative location of the 0 and 3 DOT's. (After the dive it became quite apparent that the cluster of three targets intermittently observed was one DOT, the Pinger and the Payload.) At 0200 the dive was terminated and Trieste surfaced about 0345 on 5 November.

6. The sea conditions worsened after the dive, and it became quite dangerous to operate the small boats to service Trieste. The small craft were hoisted aboard White Sands and Trieste was taken in tow. During the next several days, weather and sea conditions remained uncondusive to further operations and it was decided to return to Pearl Harbor to repair external damage to Trieste caused by pounding seas. The IOU arrived in port on 16 November.

7. On 17 November a staff conference was held at Commander, Submarine Force, Pacific Fleet (COMSUBPAC) headquarters. The writer also met separately with COMSUBPAC, RADM Lacy. It was decided that the IOU would obtain additional support from SUBPAC's resources and return to the operating area for further recovery attempts. For example, an additional tow ship would sail from Pearl Harbor to join the IOU as soon as Trieste was launched, a walk-in refrigerator capable of stowing the RV in its container and chilling it to at least 40°F, and more shot and miscellaneous other parts and equipment were made available post haste.

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SUBJECT: Trip Report, RV-3 Recovery Operations

8. At 1300 on Sunday, 21 November, the task element left Pearl Harbor for the operating area. Enroute, tests of the Trieste revealed that one of her primary battery cells was grounded. Around the clock attention was paid to this problem which eventually proved to be minor - some wiring was hooked up erroneously. Bad sea conditions prevented the launch of Trieste until 29 November at which time the crew excelled, time-wise, in gassing, shotting, and conducting pre-dive checks of Trieste. At 1745 on 30 November the scaph commenced her second dive. All her equipment showed proper operation. On descent, Trieste listed to port about 25° (later it was determined that the starboard shot releaser, an electromagnetic device, leaked shot slowly, and the pilots reported that they had not control of the scaph until about a depth of 7000 feet).

9. When approximately 1000 feet off the bottom, Trieste commenced interrogating the DOT's. It was discovered that the submersible was about 5,000 feet from the DOT's closest to the payload (0 and 3 DOT's) and, hence, had to maneuver about two hours to be at the best estimated location of the RV. After driving to the target and descending to the bottom, the submersible searched the baseline between DOT's 0 and 3, making about four zigzagging runs. Several equipment problems showed up. The on-board computer power failed and dumped part of its memory. With the trail ball lowered to 35 feet, they could not see the bottom so it was winched into 10 feet. Ten feet proved to be unsatisfactory because the ball tended to angle to the stern on movement of the Trieste forward, thus pulling the scaph down. With the residual list, the port skeep started to drag the bottom. Attempting to lower the trail ball to compensate, it was found to be inoperative. Trieste thus had a difficult task steering a steady course. After being down about eight hours, the CTFM sonar picked up a target west of DOT 3 which Trieste immediately investigated. As they were approaching the target, it was lost on sonar at which point the crew tried to lose headway ASAP. As Trieste slowed, the crew saw the payload passing about two feet to the right of the starboard skeep. The scaph then started to maneuver

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SUBJECT: Trip Report, RV-3 Recovery Operations

to bring the payload in view again but the low voltage alarm flashed. The mechanical arm was tried in an attempt to drop a DOT next to the payload. However, because of low voltage and the port list, the arm did not function and the DOT could not be placed. With very little battery power left (four of the seventy-two cells were fully depleted and showed reverse polarity); it was decided that Trieste should surface which it did at 0415, on 1 December. Debriefing of the crew indicated that the RV had positively been sighted on this dive.

10. Again bad sea conditions prevented any further dives. After waiting about one week, it was decided to seek the lee of either Kauai or Oahu (to dock Trieste) when a gale force storm started to move into the area. It took approximately five days to travel about 100 nautical miles in that storm. Trieste now under tow by Apache (White Sands was towed by the Coucall, a submarine rescue vessel) took a pounding and needed to be docked and repaired prior to any further recovery attempts.

11. The OSP and Perkin-Elmer representatives left the White Sands at sea and proceeded to port. After it was ascertained that the task element would not return to the operating site until after the holiday period, tentatively 10 January, the writer returned to CONUS.

12. The IOU left Pearl Harbor for the third time on 12 January and arrived in the operating area early 15 January. Bad sea conditions again prevented the launch of Trieste and the element returned to Pearl Harbor arriving there on 5 February. After replenishment and crew rest and recreation, the IOU plans to return to the site leaving Pearl Harbor about 15 March.

C. FUTURE PLANS

1. The Navy plans to recover RV-3 if at all possible. The IOU will remain based in Pearl Harbor for the immediate future and will return to the operating site about 15 March. Decision was made to dry dock White Sands in Pearl Harbor for repair of two of its three

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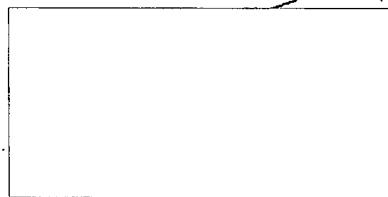
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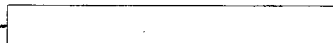

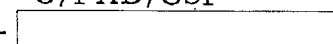

SUBJECT: Trip Report, RV-3 Recovery Operations

station keepers. As soon as the sea conditions permit, the Trieste will be launched and another dive made. The writer will leave for Pearl Harbor as soon as a positive commitment is made that Trieste will be launched or is, in fact, in the water. Since I can be in Pearl Harbor within 24 hours and arrangements have been made to be helicoptered to the IOU, this should provide sufficient time to be on the White Sands prior to Trieste's next dive. Once in the water it will take approximately 60 hours to prepare Trieste for diving.

2. The writer is prepared to brief either on the operation to date or upon conclusion of the recovery attempts.



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ATTACHMENT III

24 May 1972

MEMORANDUM FOR THE RECORD

SUBJECT: Trip Report - Recovery of 1201-3

Introduction

This trip report covers the period of 16 April to 26 April and is a detailed report on the activities associated with the successful recovery of the film stacks from RV-3.

Sunday, 16 April

Arrived at the airport in Honolulu and was met by Lt. Bazzel (USN) and Lt. Col. Tweedy (USAF), who took me to Pearl Harbor where the USS Safeguard was ready to leave. During the drive to the dock, Col. Tweedy was concerned with the problem of keeping the recovered film cool during the flight to E.K. I felt that it was a requirement, so the plan was to use dry ice to keep the shipping container cold. The Safeguard left the dock at 1730, about 45 minutes after I landed in Honolulu. The report was that the Trieste was in the water ready to dive. The Safeguard was to act as a standby tug if needed.

Monday, 17 April

Rendezvoused with the Apache/White Sands/Trieste late in the afternoon. The weather had turned bad (12-15 foot seas) and was too rough for a small boat transfer of personnel or any operations. The Trieste was gassed but the shot had not been loaded as yet and all dive preparations were suspended.

Tuesday, 18 April

The Safeguard received orders to proceed to Kauai for rendezvous and personnel transfer to their relief ship. The Safeguard was then to return to Pearl Harbor for other assignments. The Safeguard is a fleet salvage ship. It has several booms for towing or lifting, carries its own

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SUBJECT: Trip Report - Recovery of 1201-3

complement of divers and has its own machine shop. It is capable of 12-13 knots and is mainly noted for the amount of roll in rough seas.

Wednesday, 19 April

Had met the USS Bolster about 0100 halfway to Kauai, so she followed us back to Kauai for transfer. We transferred just after dawn, and the Bolster headed back for the recovery zone. The Bolster is the same class of ship as the Safeguard.

Thursday, 20 April

Rendezvoused with the Integrated Operating Unit (IOU) early in the morning. During all of the mission, complete radio silence was maintained due to a Russian ship about 100 miles south monitoring the radio traffic between Pearl Harbor and Guam. A sailor from the White Sands had been notified that his father was dying so he was transferred to the Bolster with divers manning the Boston Whaler (a small boat which floats like a cork, but can be flipped by the waves). We then headed back to Kauai to rendezvous for a helicopter transfer.

Friday, 21 April

Reached Kauai and put the sailor out in a small boat from which he was picked up by the helicopter. The Navy went to considerable effort to get this sailor home. The Bolster then headed back to the recovery zone.

Saturday, 22 April

Met the IOU again. The weather was still bad, but somewhat improved (10-12 foot seas), so I recommended that we transfer, which was successfully accomplished though we got wet.

Sunday, 23 April

The weather remained bad; however, the 24-hour forecast was predicting improvement.

Monday, 24 April

The weather had improved somewhat (8-10 foot seas) and though this was rougher than they had ever operated in before, we decided to check out the Trieste and recommenced preparations for the dive.

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SUBJECT: Trip Report - Recovery of 1201-3

Monday, 24 April (continued)

- 0700 Began checkout of the Trieste; started shotting operation.
- 0800 A ground was detected in the 28 volt power bus. If this is an internal ground in the battery as on the last mission, it would cause an abort.
- 0830 The shot hose collapsed.
- 1200 Short isolated to amp-hour meter and the meter was replaced. The mission could proceed.
- 1330 Shotting recommenced. The White Sands/Trieste was running with the seas to permit small boat operations and shotting.
- 2230 Shotting was completed. The IOU reversed course to return to the dive site.

Tuesday, 25 April

- 0600 Arrived at dive site. The number 1, 4 and 6 transponders (DOT's) were responding. None of the ones implaced by Dr. Spiess were active and only number 1 emplaced on the last dive was consistent.
- 0700 Commenced electrical pre-dive checkout on the Trieste.
- 0800 A wave broke over the hatch, both hatch covers were opened and many electronics were soaked. This would probably cause an abort. Rags and towels were taken out to the Trieste to soak up the water and dry everything.
- 0900 Started on electrical check.
- 0930 A short was located in the computer power supply. Fortunately, a spare was available so that it was replaced.
- 1230 A short was located in the inverter. This is redundant, so it was decided to go with one side.
- 1245 We had drifted out of the DOT hold and could not get a response.

Field

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SUBJECT: Trip Report - Recovery of 1201-3

Tuesday, 25 April (continued)

- 1500 Electrical checkout completed. Everything else is okay. A hydroplane was hung over the side and succeeded in picking up the number 1 DOT.
- 1600 The Trieste was cut loose for the final pre-dive checks with divers.
- 1700 Dive commenced.
- 1800 Trieste on the bottom. Directed to proceed due west on course 270°. Investigated sonar contact which was an old log. Reported a sonar contact which was a marker left by Dr. Spiess. The Trieste was proceeding in a mode of power, then glide, to preserve power. Several sonar contacts. Reported to be in a debris field. The pilots had not seen this before. Reported sighting an object about 3 1/2 by 3 feet described as the RV, with the nose in the silt and material coming out of a 1 foot diameter hole in the top. We instructed them to emplace a DOT and attempt to retrieve the object. The Trieste reported several attempts to engage the hook with no success. They then tried to use the mechanical arm, but it would not rotate. We instructed them to attempt to engage the hook again by putting slack in the cable, but taking longer this time. They reported success on the sixth attempt. They were then instructed to proceed to the surface slowly.

Wednesday, 26 April

- 0235 The Trieste surfaced and immediately reported that the payload had disintegrated in a cloud of silt with a few pieces falling through the tines of the hook. Everyone went from an emotional high to an emotional low in about one microsecond. Divers were put into the water and managed to retrieve some of the film.
- 0400 The pilots were returned to the White Sands for an extensive debriefing which was taped. The general consensus was that, in view of the fact that marine life had been seen and some of the iron shot from a previous dive had rusted, the corrosion had been very extensive and everything came apart.

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SUBJECT: Trip Report - Recovery of 1201-3

Wednesday, 26 April (continued)

1300 Lt. Cmdr. Bartels and I transferred to the Bolster to return to Pearl Harbor. The IOU was proceeding to Kauai to find a lee to reload the Trieste aboard the White Sands.



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ATTACHMENT IV

Analysis of Recovered Takeup

The photographs obtained by the Trieste II showed several pieces of debris and the film spools. Figures IV G and H show the original RV and takeup configuration. The gold foil of the canister is evident in several of the photographs. Figure IV A was the first piece of debris that was sighted. It appears to be a piece of the gold canister and part of the grey RV support pallet. Figure IV B was sighted next. Several of the black takeup support arms can be seen. The main portion of the gold canister is evident in Figure IV C as well as the film spools. Figure IV D is an outstanding picture of the film stacks, looking down at the stacks. The encoder (Figure IV I) and the A1 motor drive electronics (Figure IV J) can be identified. The white lettering which is the part serial number can be seen on the encoder. The beryllium takeup core is shattered and in pieces, though some of the machine finish is still shiny. The cables going from the motor drive electronics to the motor can be seen. The shaft broke off flush with the edge of the stack, probably at impact with the water. The upper RV structure that was seen in the Dr. Spiess photographs is a separate piece and is still on the ocean bottom.

Figure IV E shows that the stacks were recovered intact but Figure IV F shows them disintegrating as they are brought to the surface. Eastman Kodak analyzed the 25 feet of film that was recovered. They found that all of the physical properties had remained the same, but that the film had torn into 5 pieces, about one half the diameter of the core. This implies that the spokes between the A and B film stacks had cut into the film during impact, resulting in tears in the stacks that cannot be seen in the photographs. As the Trieste surfaced, pieces of the film flaked off due to the reduction of pressure and floated away.

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ATTACHMENT IV

PHOTOGRAPHS

WITH

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FIGURE IV A

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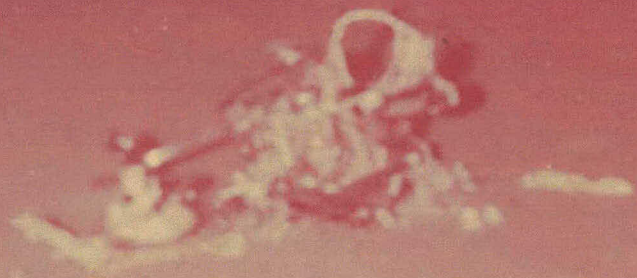
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FIGURE IV B



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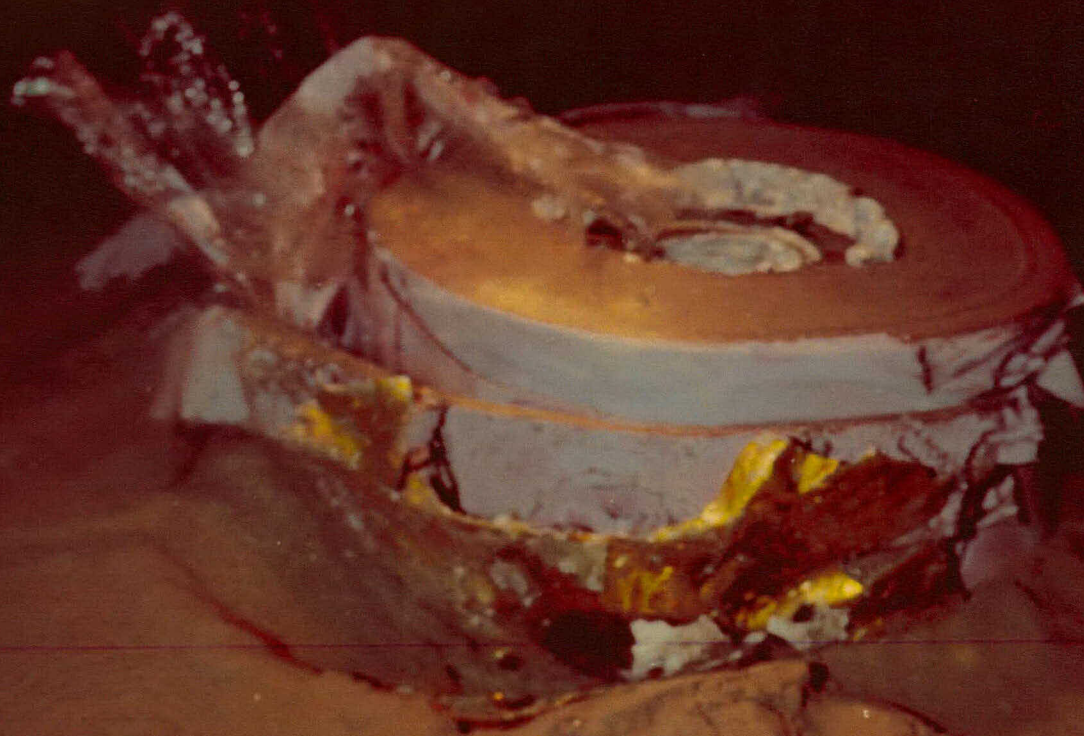
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FIGURE IV C

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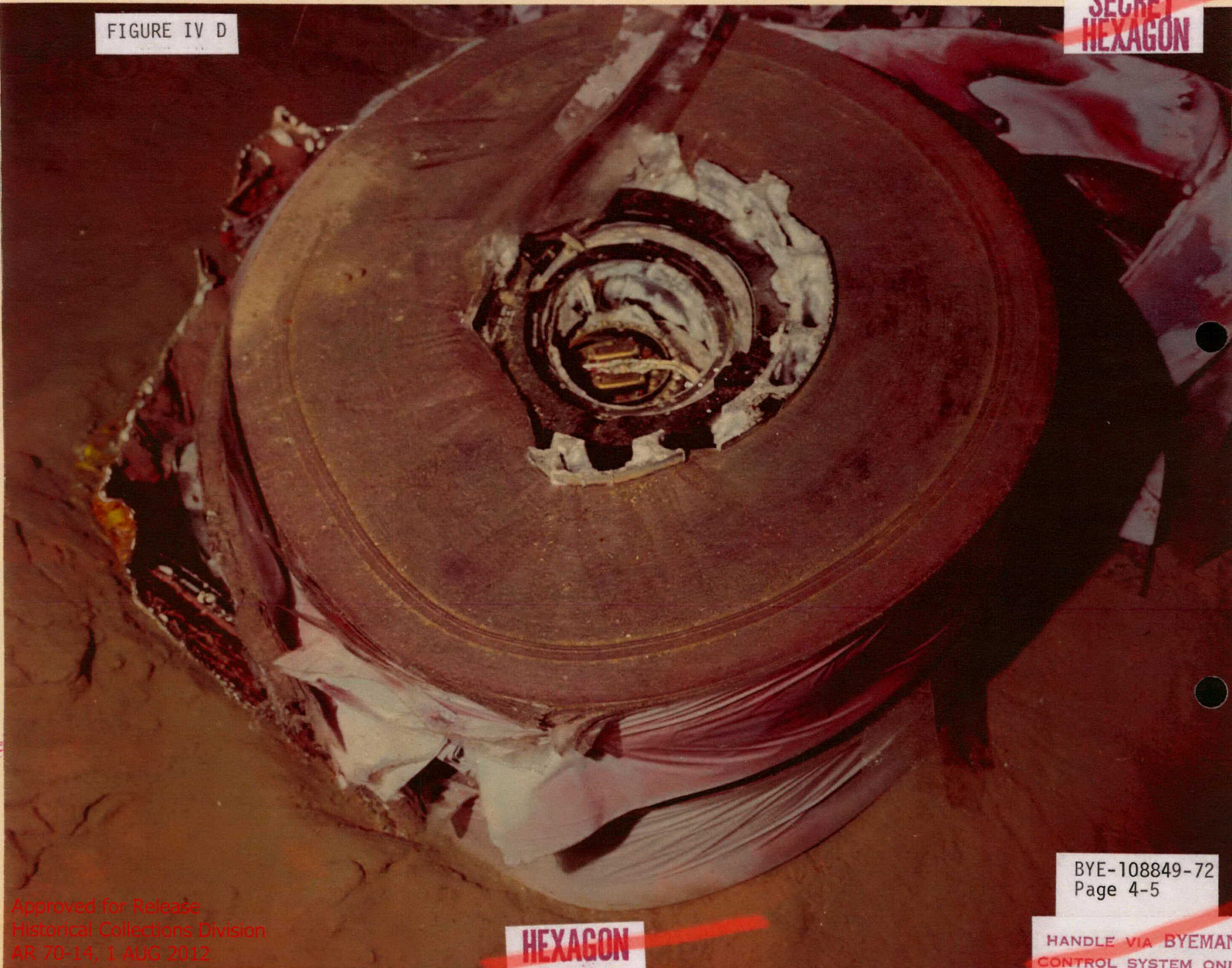
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FIGURE IV D

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FIGURE IV E



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FIGURE IV F



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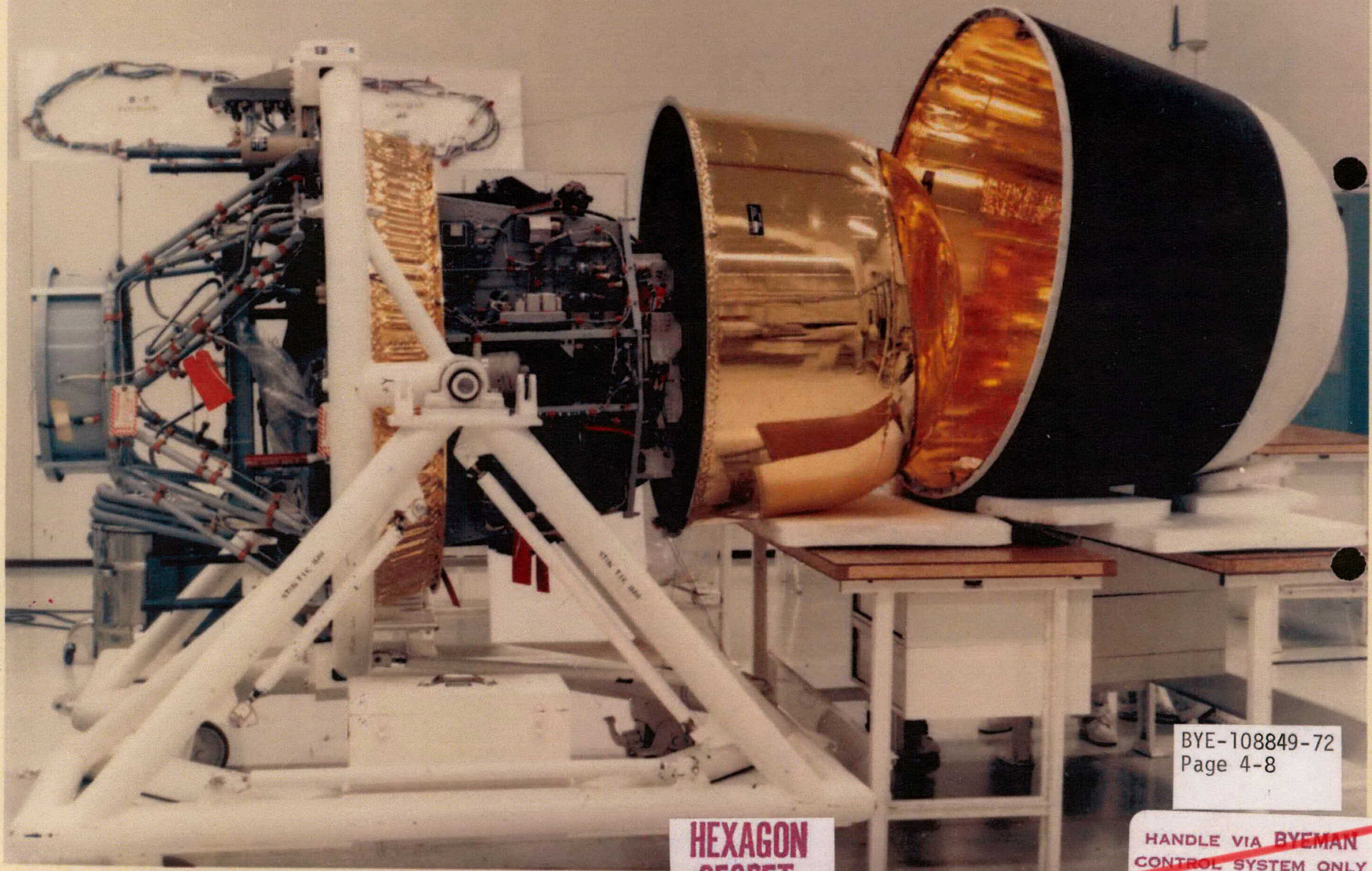
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FIGURE IV G



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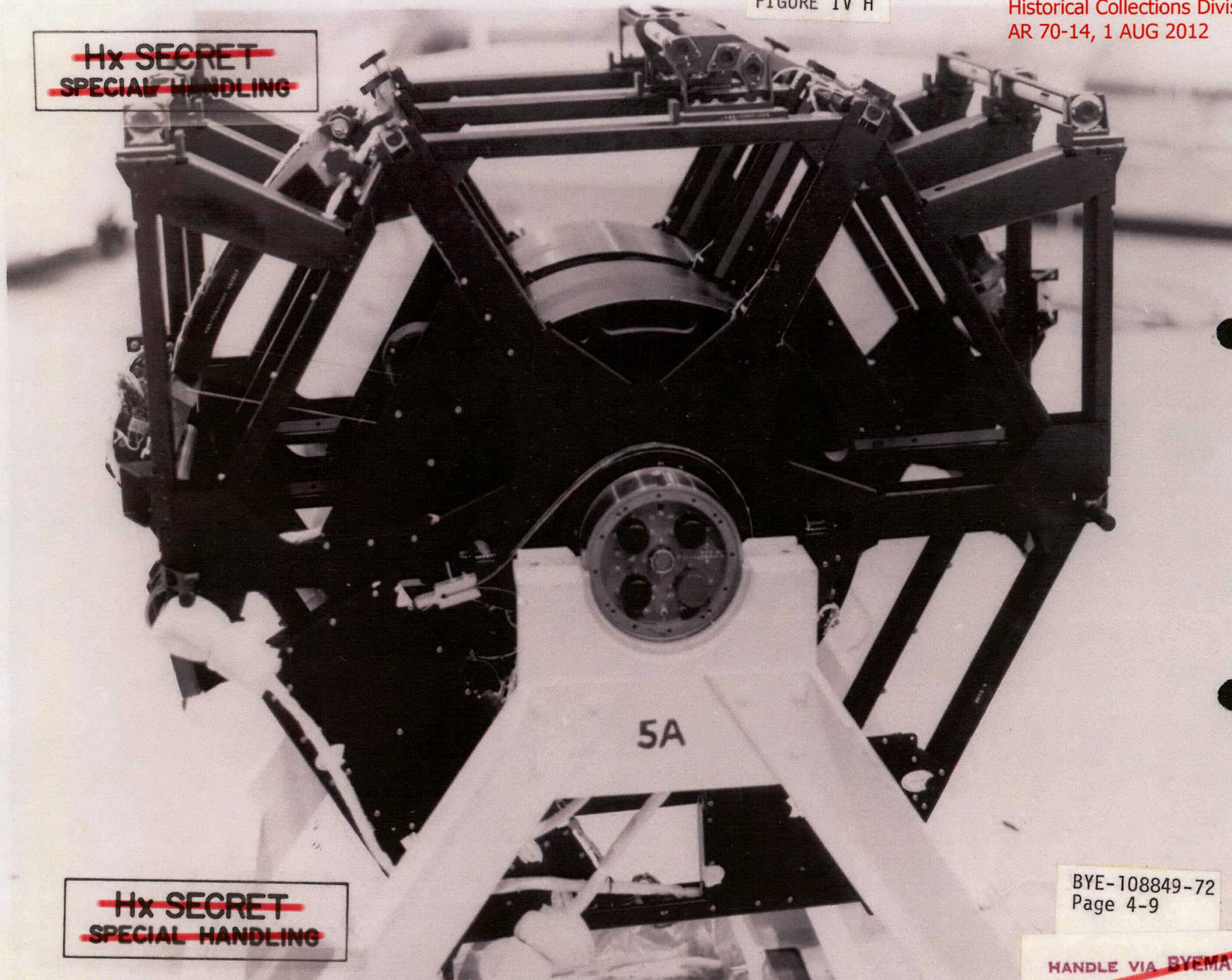
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FIGURE IV H

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~~SPECIAL HANDLING~~



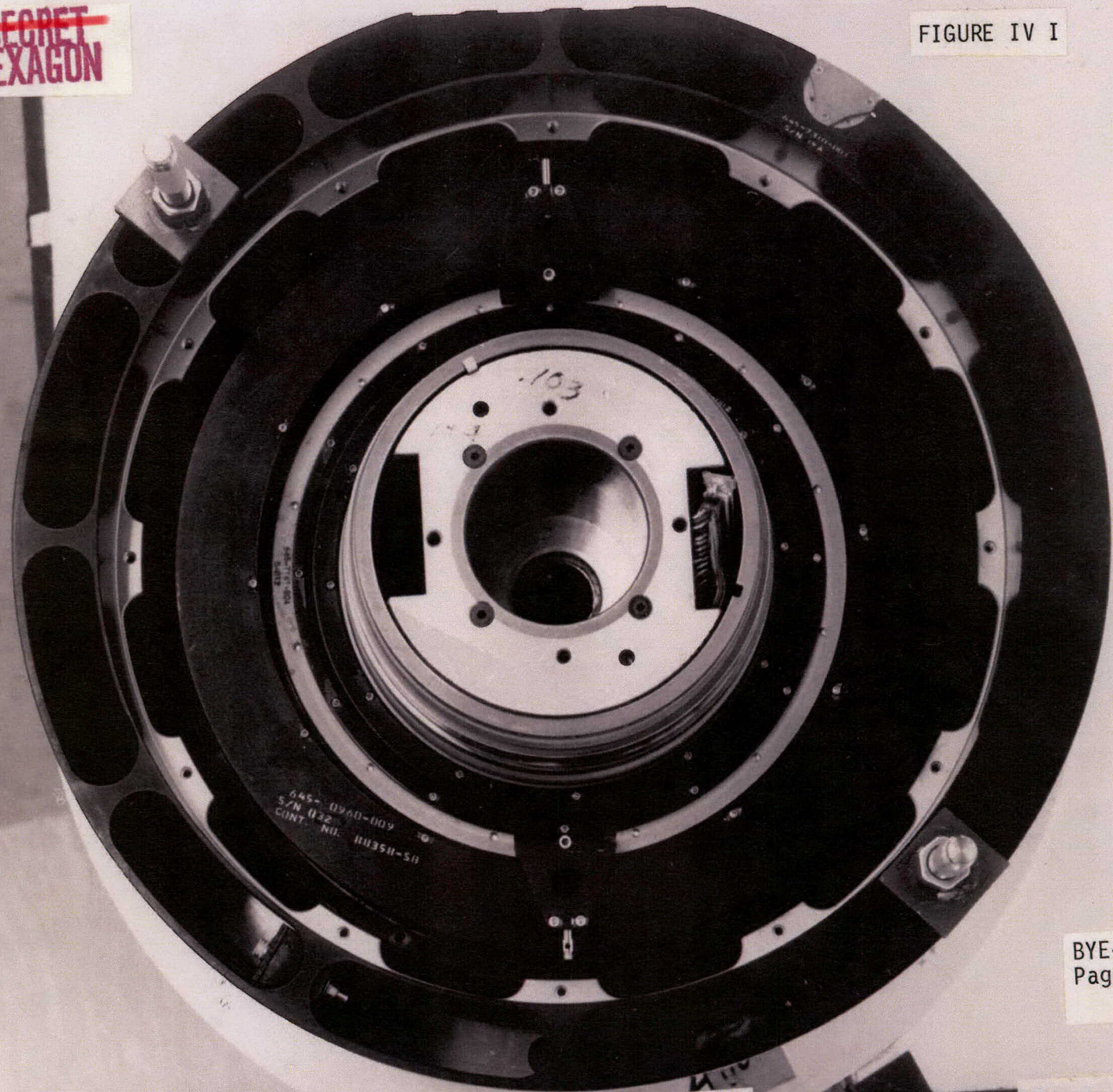
~~Hx SECRET~~
~~SPECIAL HANDLING~~

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FIGURE IV I



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FIGURE IV J



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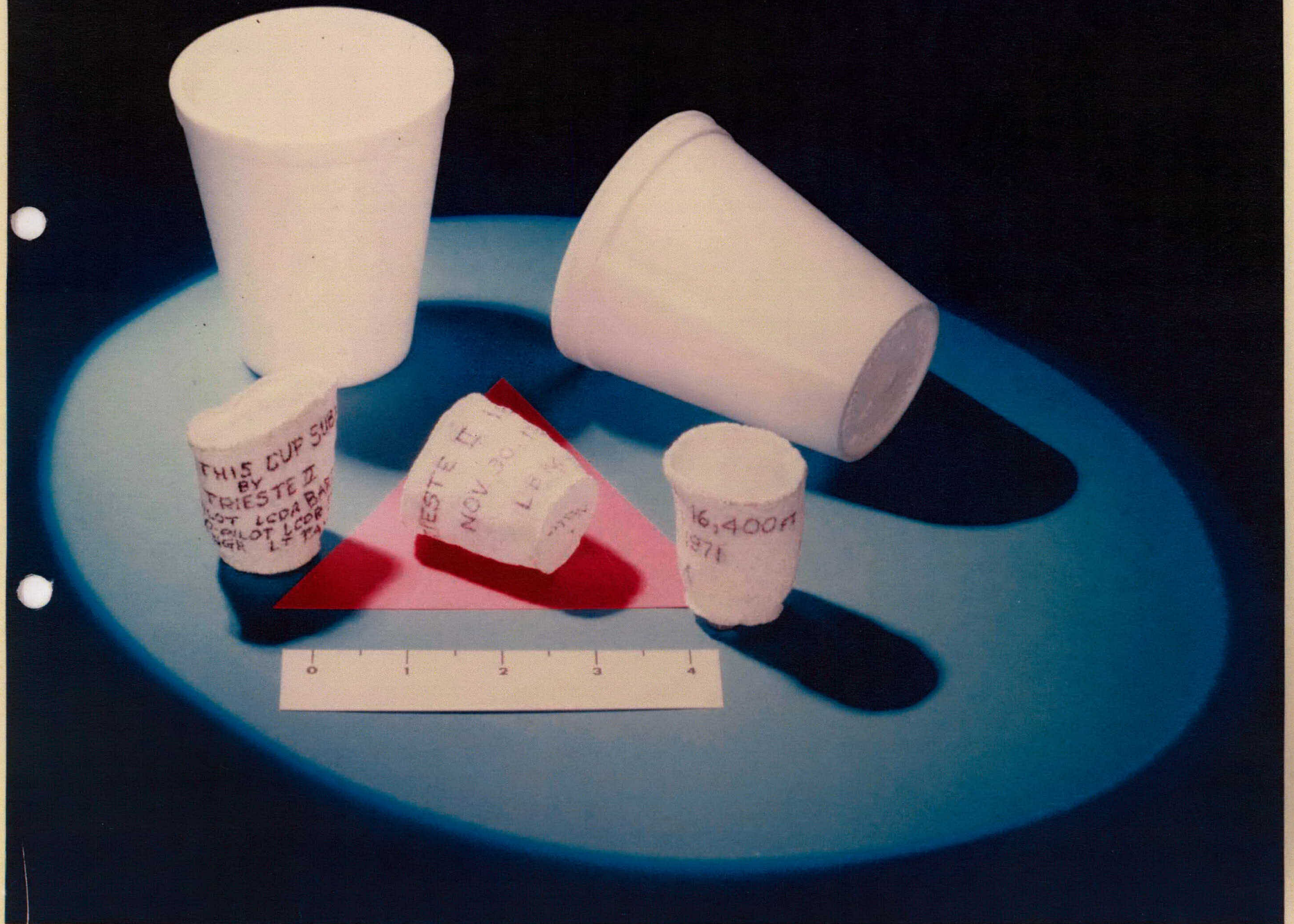
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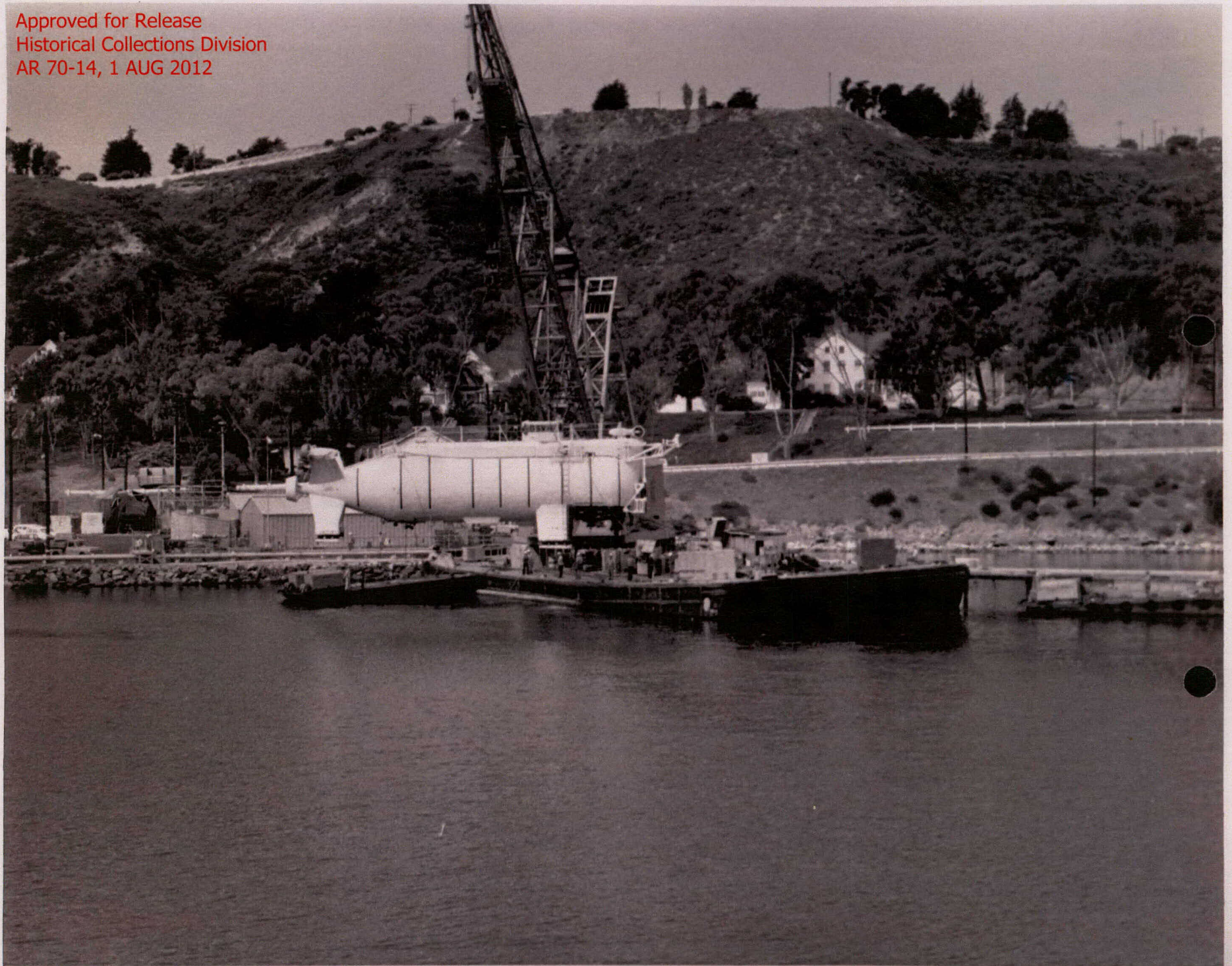
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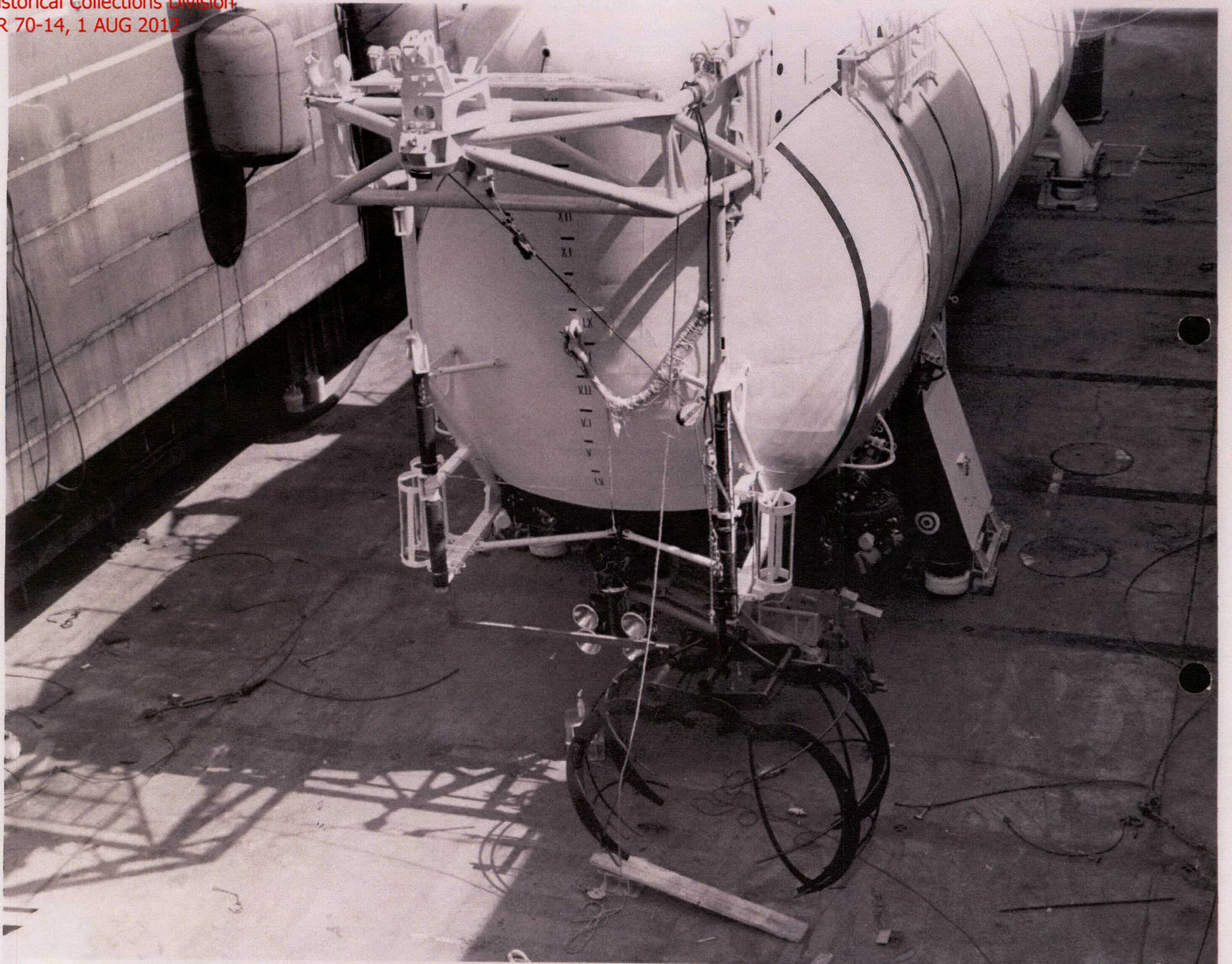
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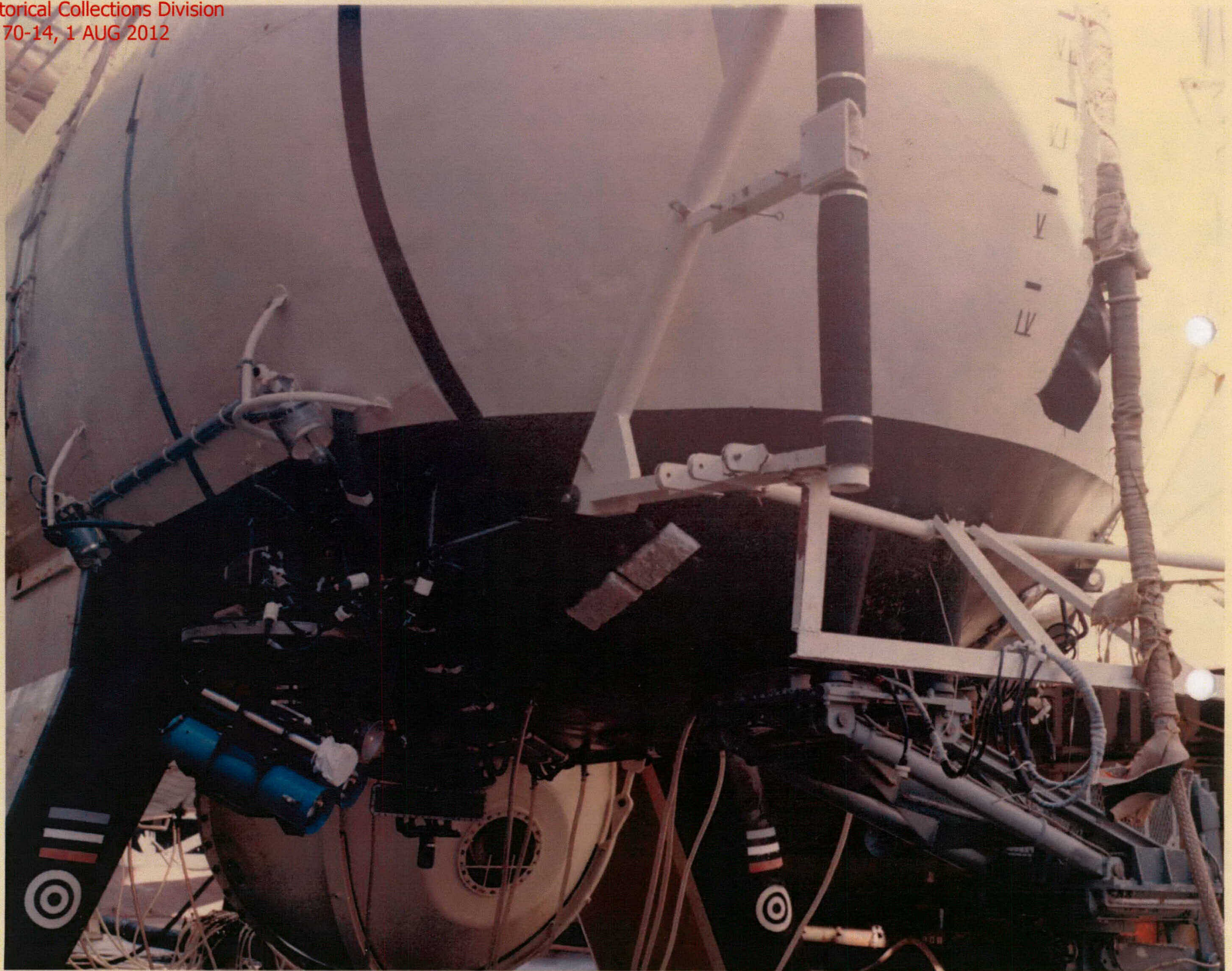
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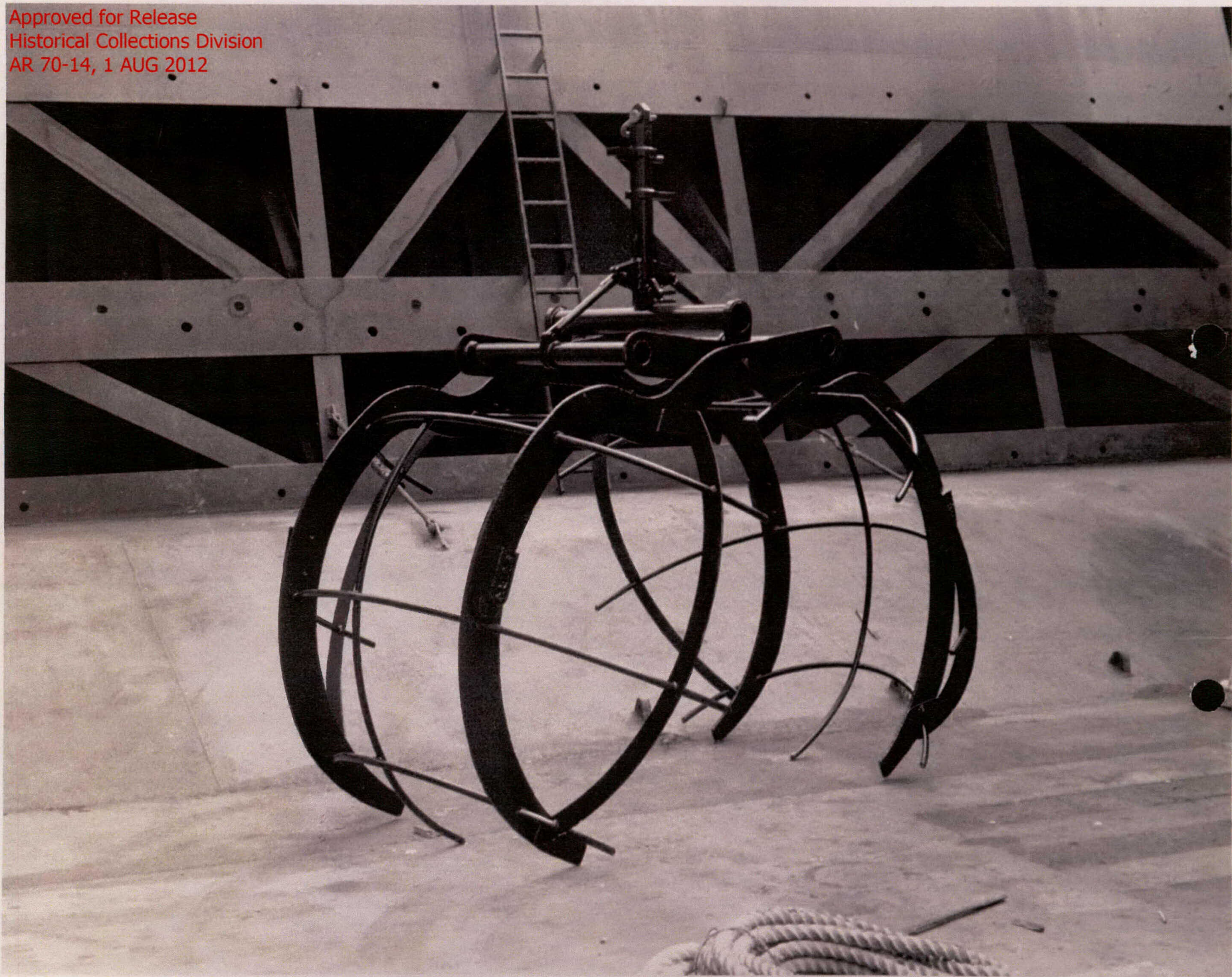
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