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AFTER ACTION REPORT CH-47 RECOVERY USING D-PRAC(U)
HOVER SYSTEMS FEDERAL CORP EDDYSTONE PA JUL 85
DAAK70-85-C-0014

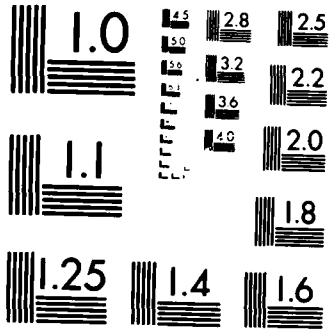
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MICROCOPY RESOLUTION TEST CHART
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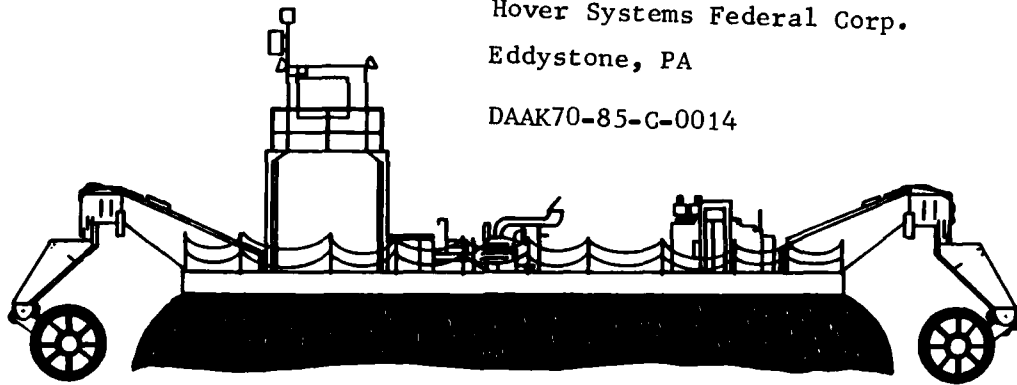
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AFTER ACTION REPORT

CH-47 RECOVERY USING D-PAAC

July 1985

Hover Systems Federal Corp.
Eddystone, PA
DAAK70-85-C-0014



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AFTER ACTION REPORT
CH-47D Helicopter Recovery Operation Using D-PAAC

INTRODUCTION

On 12 July 1985, a request was made through U.S. Army channels for use of the D-PAAC in a recovery operation for a crashed CH-47D. The aircraft had been on a test flight out of Boeing-Vertol plant airfield in Chester, PA, and had crashed in a fish and wildlife management area on the New Jersey shore of the Delaware river. It was imperative that recovery operations be conducted with minimal damage to the environment and as quickly as possible. The decision to use the D-PAAC was reached and actions to prepare for movement of the D-PAAC from its location at Duck, NC (US Army Waterway Experiment Station), to Chester, PA, and then to the crash site took place during the period 12-13 July 1985. This report will cover the period from 13-21 July and will address the period in three sections. The first will cover preparation and movement from Duck, NC, to Chester, PA. [The second will cover preparation at Chester, PA, and movement to the crash site. The third will cover operations at the crash site] and movement out of the area. It should be noted at the onset that the D-PAAC operated on cushions at all times unless otherwise noted.

PHASE I

On 13-14 July 1985, the D-PAAC was prepared for movement by taking on fuel, checking all operational functions, loading ISO container and provisioning for crew members (1 US Army civilian employee (Mr. Brian David, Project Engineer), 3 employees of Hover Systems Inc.). At 1100 on 14 July, the D-PAAC departed Duck, NC, under its own power, for movement north on Currituck Sound to a point on the Intracoastal Waterway (ref Enclosure 1) where it would be taken under tow by a commercial tugboat (Evelyn Doris - 1000 HP) which would tow it to Chester, PA. Water depths in the Sound prevented

the tug from leaving this waterway channel. The movement to the rendezvous point took approximately 10 hours at an average speed of 2.5 miles per hour. Rendezvous with the tug was accomplished at approximately 2100, 14 July 85. The tow was made up and the remaining portion of the trip started (ref Enclosure 2). During the portion of the trip through the Intracoastal to Norfolk, VA, 11 drawbridges and 1 lock were traversed with no difficulty. The tow length used for the waterway operation was approximately 50-70 feet. The D-PAAC "tracked" well with the tug throughout the tow operation. (It is assumed this is due to the cushion displacement of water acting as a keel for the craft.) A speed of 8 knots was maintained through the waterway. It was also found that complete wheel retraction allowed better towing. A stop was made in the Norfolk area to complete refueling of the D-PAAC. After refueling, the tow was resumed at a steady 8-9 knots with all gear retracted. An uneventful tow continued until approximately 1500, 15 July 1985 when winds began to pick up and reached 15-20 hours knots ESE with waves 3-5 feet in height. Storm continued until approximately 2130-2200 hours. On 16 July 85, the fan drive engine stopped five times because of fuel problems. No problem in off-cushion towing was experienced. The longest downtime was approximately 45 minutes. At approximately 1200 hours, 16 July 85, a malfunction of the hydraulic pump occurred (pump seal leak). It required the pump to be shut down except for limited (emergency) operation. At approximately 1705 hours, 16 July 85, as the tow entered the Delaware River from the Chesapeake-Delaware Canal, a heavy thunderstorm broke. Wind gusts to 40-50 knots with heavy rain struck. Heavy chop caused a rough ride. The hydraulic pump was restarted during the storm which lasted about 15 minutes. Once clear of the storm, the remainder of the tow to Chester, PA, which was reached at approximately 2215 hours, 16 July, was uneventful. This portion of the operation had taken some 60 hours in time and the D-PAAC had been moved 300 miles.

PHASE II

Beginning on 17 July 85, loading of the D-PAAC with equipment and supplies to be taken to the crash site was started. The prime item was a 50-ton crane which was placed aboard the D-PAAC. Time spent at the loading site was off-cushion except aboard the D-PAAC for brief test periods. For the D-PAAC deck surface to withstand the crane load, a pad to spread the load was designed and fabricated (ref Enclosure 3). The crane itself was placed on the pad by a 250-ton crane once the pad was installed. While loading of equipment and supplies continued, repair work on the hydraulic pump was being done. Loading and repair continued through 17-18 July with work completed at approximately 2130 hours, 18 July 85. All fuel tanks were topped off and the crew assembled for departure for crash site. At approximately 0320 hours, 19 July 85, the D-PAAC departed Boeing-Vertol dock area for the crash site. The payload aboard the craft at departure was about 48 tons (96,000 pounds). It must be noted that the craft original design was a 45-ton (90,000 pound) payload. As a timesaving measure, a small tug was used to move the D-PAAC from the loading area out to deep water where tow would be taken by a deep-water tug. Tow was transferred to the larger tug and travel to the crash site started. During the trip to an area adjacent to the crash site, the hydraulic pump was not operated on as it was not needed while under tow. Trip to area adjacent to crash site was uneventful. At 1120 hours, 19 July, tow was transferred from deep water tug to small tug. The small tug pulled the D-PAAC to within about a half mile of the crash site before it had to unhook. The D-PAAC reached the crash site under its own power but could not traverse the last 200 feet of terrain encountered without aid. The terrain presented no substantial footing for equipment and was of such a nature that walking personnel had to be very careful not to step off of "Duck" boards layed out for

support. The D-PAAC reached a point about 50-60 yards from its final position. To move the D-PAAC, the crane load line was run to some matting supporting a backhoe at the crash site. A lead block was rigged on the front of the D-PAAC and the crane was used to winch the D-PAAC to the crash site. The site was reached at 1450 hours, 19 July 85.

PHASE III

At the crash site, it was decided that the D-PAAC would continue to operate on-cushion because of the terrain. Once in position, recovery of the aircraft parts began immediately. Control of what was recovered and when was exercised by Boeing-Vertol personnel. From the D-PAAC aspect, the main concerns during this phase of the operation were to keep all systems required (lift and electrical) operational and take steps, if possible, to prevent "digging in" while on hover so that getting out would not be overly difficult. From 1450 hours, 19 July 85, until 1330 hours, 20 July 85, the D-PAAC remained on-hover with crew standing machinery and deck watch. No problems were experienced. At 1330, 20 July 85, all recovered parts had been loaded and secured. High waters on the site occurred at 1334 hours and preparations were made for departure at that time. At 1325 hours, 20 July 85, it was discovered that the prime mover for the hydraulic pump could not be started due to a dead battery. The unit was started at 1405 using the generator batteries. When all systems were operational, an attempt was made to move the D-PAAC using the wheels. Minimal progress was made (approximately 80 feet was traversed). The crane block was run out to act as a rudimentary anchor to pull against. Some progress was made by retracting wheels and using only crane pulling power. At 1600 hours, 20 July 85, progress stopped and water was falling. Subsequent to 1600, an anchor was rigged to pull against in the same manner the D-PAAC was

brought into the site. Pulling against the anchor brought no results (the terrain was such that a 1,000 lb. block and anchor set under 6 feet would not provide any resistance). Lower water was reached at 2000 hours, 20 July 85, while efforts to pull the D-PAAC out using the anchor-crane system continued. At 2050 hours, 20 July 85, a decision to await next high water was made. This was to occur at 0230 hours, 21 July 85. At this point, D-PAAC was close enough to creek to allow small tug to connect a tow line. At approximately 0100 hours, 21 July, a tow line was connected between the small tug and the D-PAAC. A coordinated pulling effort using the tug and crane-anchor system began. At 0150 hours, 21 July 85, the D-PAAC was anchored in deep water. During the period 0001-0300, trouble was experienced keeping the generator operating. It stopped several times cutting off all lights. Also, difficulty was experienced because the on-board anchor would not hold the D-PAAC against the swift current (6 knots). At 0550 hours, 21 July 85, anchor recovery was begun and completed at 0600 hours. The tug towed the D-PAAC to Weaton's landing on Stow Creek for offloading. All recovered parts were offloaded for ground transportation to the Boeing-Virtol plant. This was necessary because the craft could not be trimmed properly with all the wreckage aboard and also the lack of adequate freeboard when off-cushion. These two factors were considered major safety concerns. At 1330 hours, 21 July 85, the recovery operation using the D-PAAC was concluded. From the time the D-PAAC left the Boeing-Virtol dock until it was shutdown for offloading, it recovered parts, the lift fan and electrical systems operated some 55 hours. The hydraulic system operated approximately 20 hours during the same period.



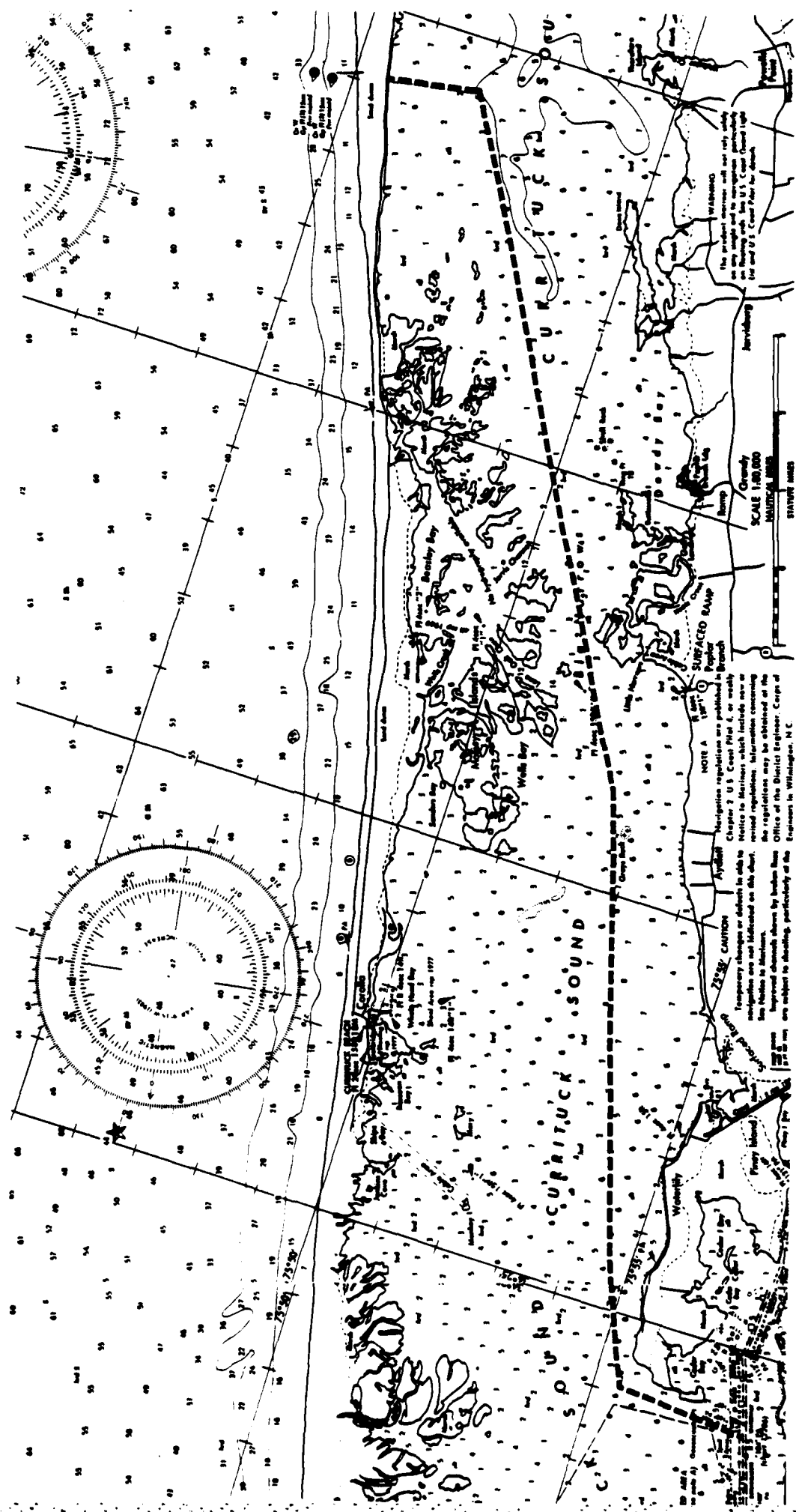
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CONCLUSION

Subsequent to 21 July, the D-PAAC was towed to the Boeing-Vertol dock and has been undergoing refurbishing. Repair of defective fuel lines and electrical wiring has been completed. Other problem areas have been corrected and the D-PAAC returned to par operation status. To complete the total use request, the D-PAAC is to be towed to Fort Belvoir where it will resume its roles as a test bed for LAMP-H concepts.

While it is impractical to draw definite conclusions from this operation, it appears that the concept of using an air cushion craft for heavy lift recovery operations in terrain which offers no other accessibility was partially validated. Also, the feasibility of towing an air cushion vehicle over water by conventional tug in an inland waterway operation was proven. It must also be concluded that improved propulsion means are required as well as some self-recovery capability (on-board winch) to improve useability of future craft similar to the D-PAAC. During the operation, the craft averaged 43 gallon-per-hour fuel consumption. Enclosures 4, 5, and 6 contain fuel logs, maintenance logs, and pictures showing pertinent information as captioned.

Incl 1



NOTE A
 Non-petroleum vapors are prohibited in Branch
 Chapter 7 U.S. Coast (N.C. 4, or nearby
 Notice to Mariners which indicate new or
 temporary changes or details in this chart.
 The regulations may be obtained at the
 Office of the District Engineer, Corps of
 Engineers in Wilmington, N. C.

CAUTION
 Temporary changes or details in this chart
 are not indicated on this chart.
 The regulations may be obtained at the
 Office of the District Engineer, Corps of
 Engineers in Wilmington, N. C.

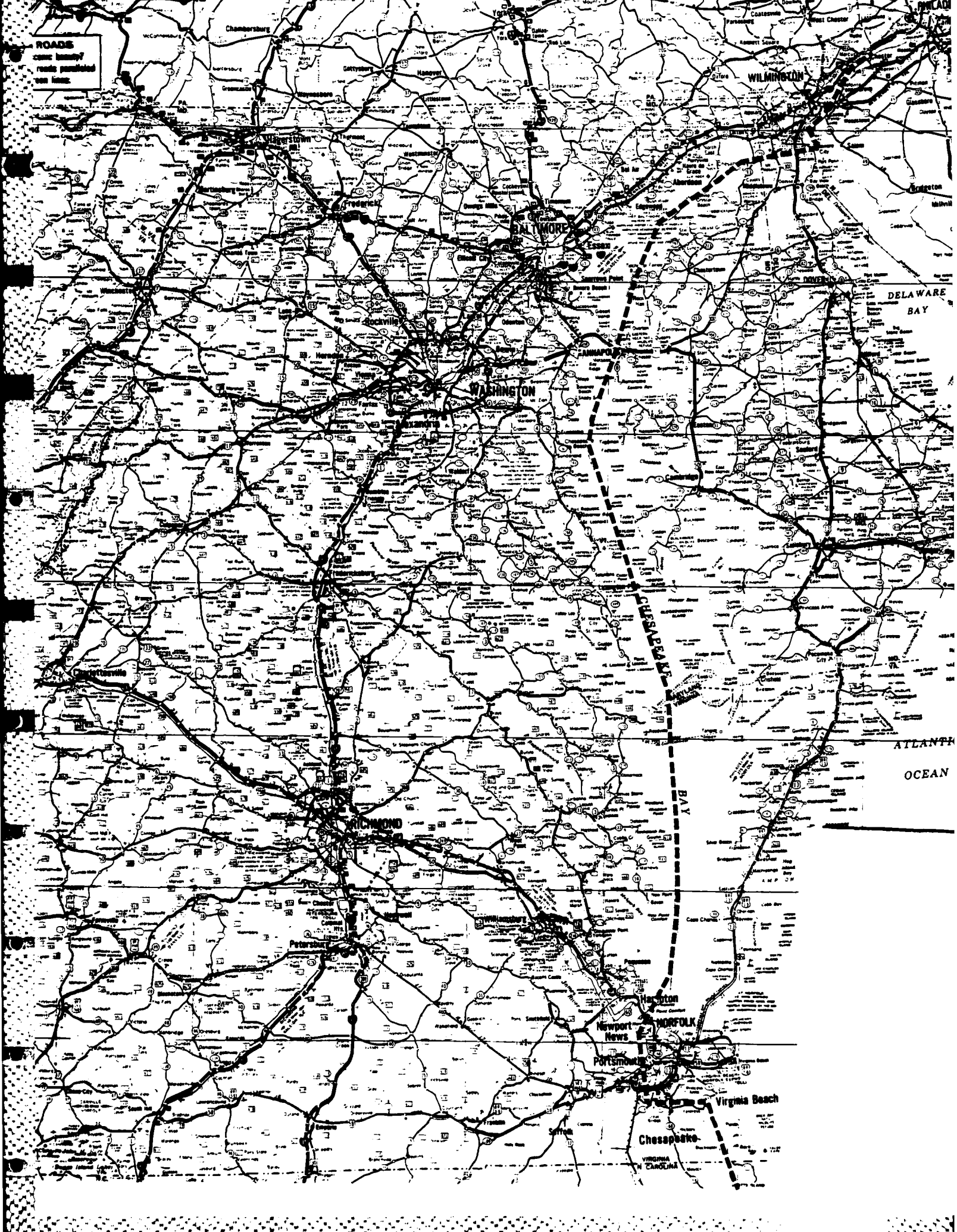
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 Office of the District Engineer, Corps of
 Engineers in Wilmington, N. C.

SCALE 1:80,000
 NAUTICAL MILES
 STATUTE MILES

Incl 2

ROADS
some heavy
roads parallel
to lines



DELAWARE BAY

ATLANTIC OCEAN

CHESAPEAKE BAY

WILMINGTON

WASHINGTON

BALTIMORE

RICHMOND

NORFOLK

PORTSMOUTH

Chesapeake

Virginia Beach

VIRGINIA CAROLINA

Incl 3

Incl 4

FUEL/OIL LOG

Fuel taken on

14 July 1985	694.4 gallons	#1 Diesel
15 July 1985	520 gallons	#1 Diesel
17 July 1985	680 gallons	#1 Diesel

Oil added

3 quarts of oil added to V-12 and to V-16 engines at 0900 hours 15 July 1985.

3 quarts of oil added to V-16 engine at 2200 hours 18 July 1985.

Fuel level measure

<u>Time/Date</u>	<u>Port Tank</u>	<u>Starboard Tank</u>
1200/14 July 85	930 gal	884 gal
1800/14 July 85	782 gal	805 gal
2300/14 July 85	759 gal	759 gal
0600/15 July 85	690 gal	690 gal
1200/15 July 85	1,058 gal	862 gal
1900/15 July 85	713 gal	766 gal
1000/16 July 85	736 gal*	604 gal

Record for Phase III of operation not dated.
Cannot determine when readings taken.

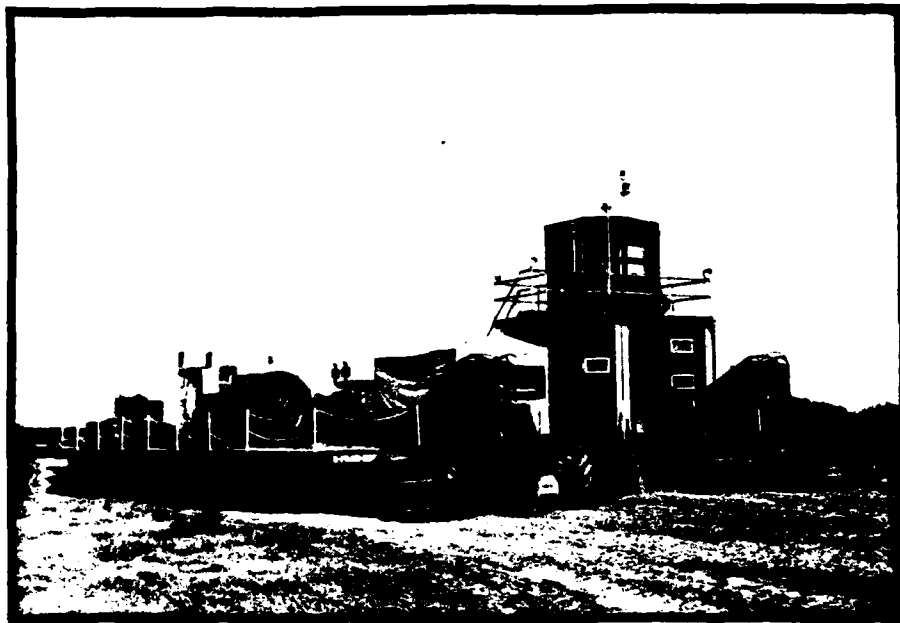
*Fuel transferred from Port to Starboard just prior.

Incl 5

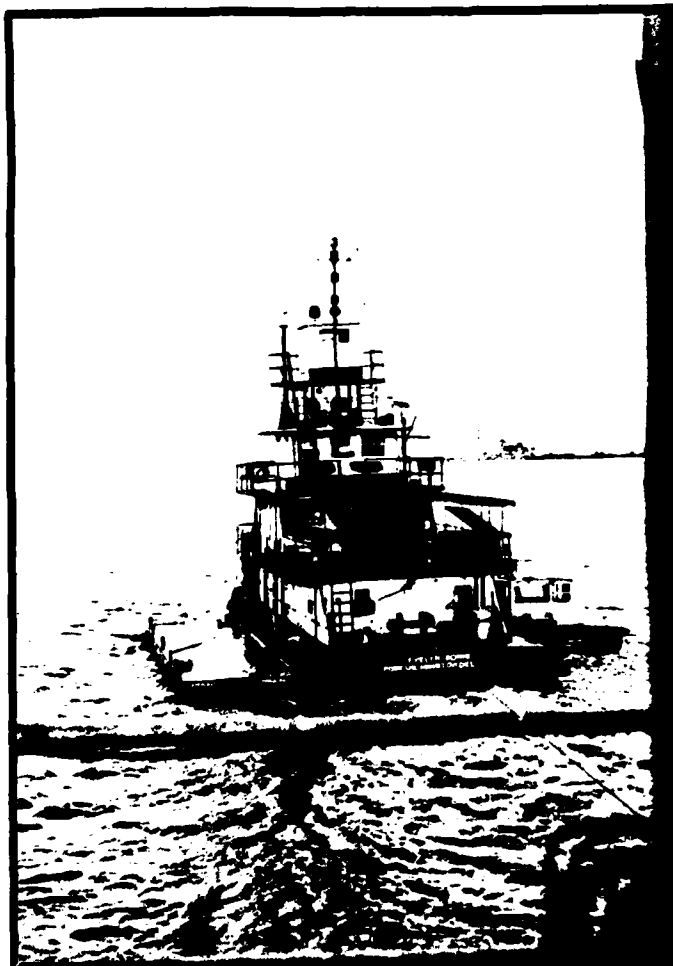
MAINTENANCE LOG

<u>Time/Date</u>	<u>Action</u>
22-2300/13 July 85	Padeyes rewelded (welds broken at disassembly).
0900/14 July 85	Frozen pin in aft starboard axle knee freed.
0700/15 July 85	Broken forward port axle guard removed.
1040/15 July 85	Faulty deck light switch replaced.
0215/16 July 85	V-16 engine stopped. Fuel filters changed.
0530/16 July 85	V-16 engine stopped. Fuel line collapsed. Line cut and reconnected.
0845/16 July 85	V-16 engine stopped. Rust in fuel line. Cleaned and reconnected.
1148/16 July 85	Hydraulic pump shut off. Hydraulic fluid in Bevinni reservoir. Possible seal blown.
1830/16 July 85	V-16 engine stopped after black exhaust discharge. Engine restarted without work.
1905/16 July 85	V-16 engine stopped. Alternative fuel supply delivery rigged. Engine restarted.
1600/17 July 85	Tear down of hydraulic power pac started. Seal replacement required. Work completed at 2000 hours 18 July 85.
2300/18 July 85	Loose return line fitting from hydraulic reservoir caused fluid loss. Fitting tightened.
0155/19 July 85	Distribution gear filter blow. Filter replaced (wrong filter).
1325/20 July 85	V-12 engine will not start. Dead battery. Changed batteries. Engine started.
2045/20 July 85	Deck lights out. Came back on with no repair.
0045/21 July 85	Lights out. Generator stopped. Restarted.
0100/21 July 85	Lights out. Generator stopped. Restarted.
0110/21 July 85	Lights out. Generator stopped. No restart. Worked on fuel lines. Restarted at 0130/21 July 85.
0245/21 July 85	Lights out. Generator stopped. V-12 stopped. V-12 restarted at 0550/21 July 85 without work.
0715/21 July 85	V-12 engine stopped. Restarted in five minutes.

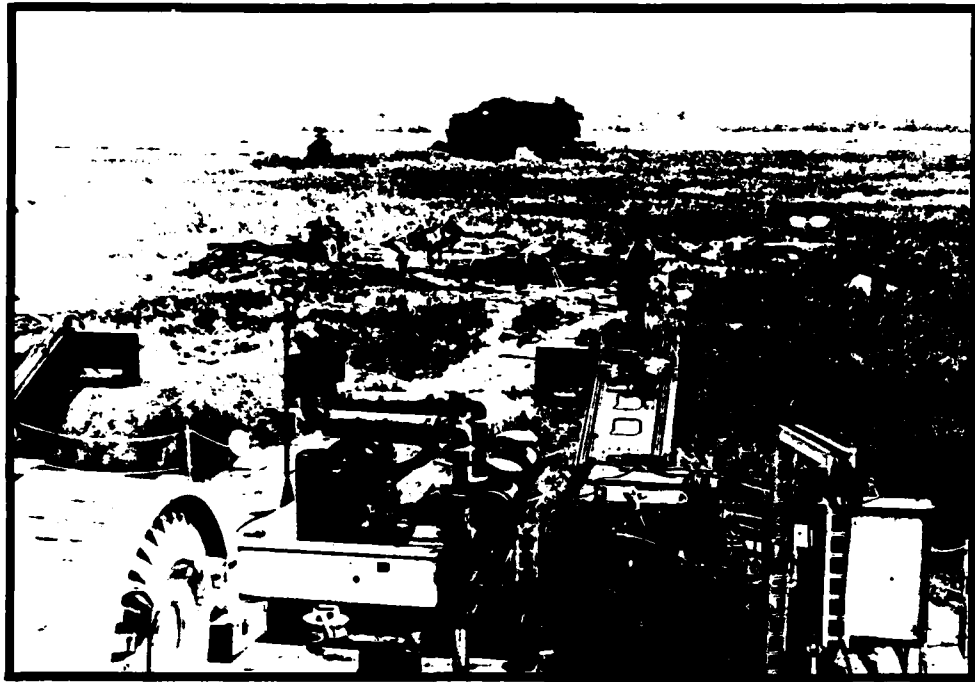
Incl 6



D-PAAC



TUGBOAT



CRASH SITE AND APPROACH



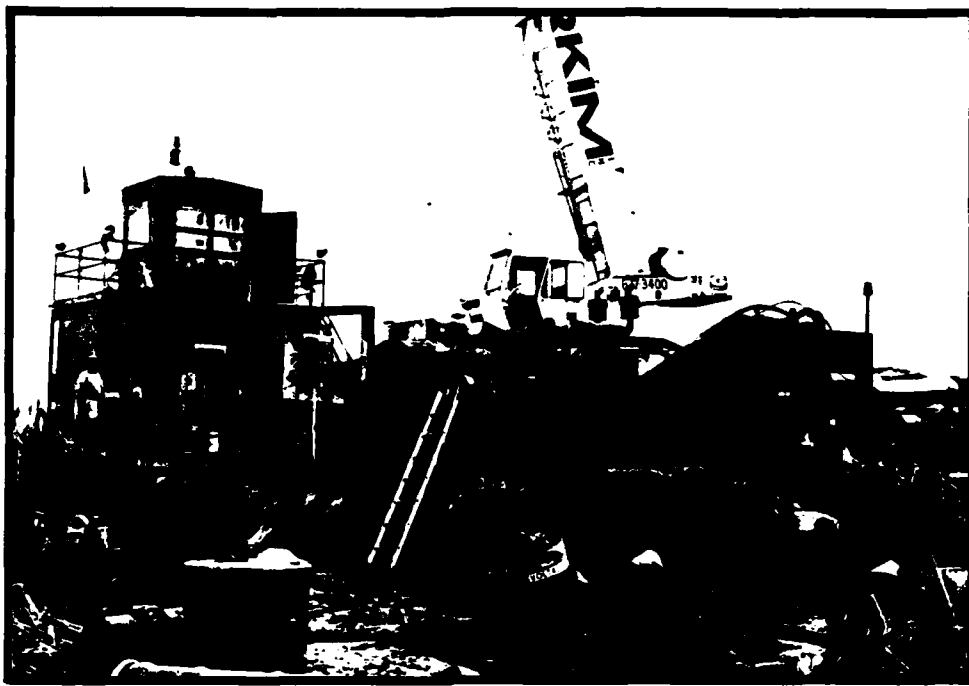
SITE CONDITIONS



50 TON CRANE ABOARD D-PAAC



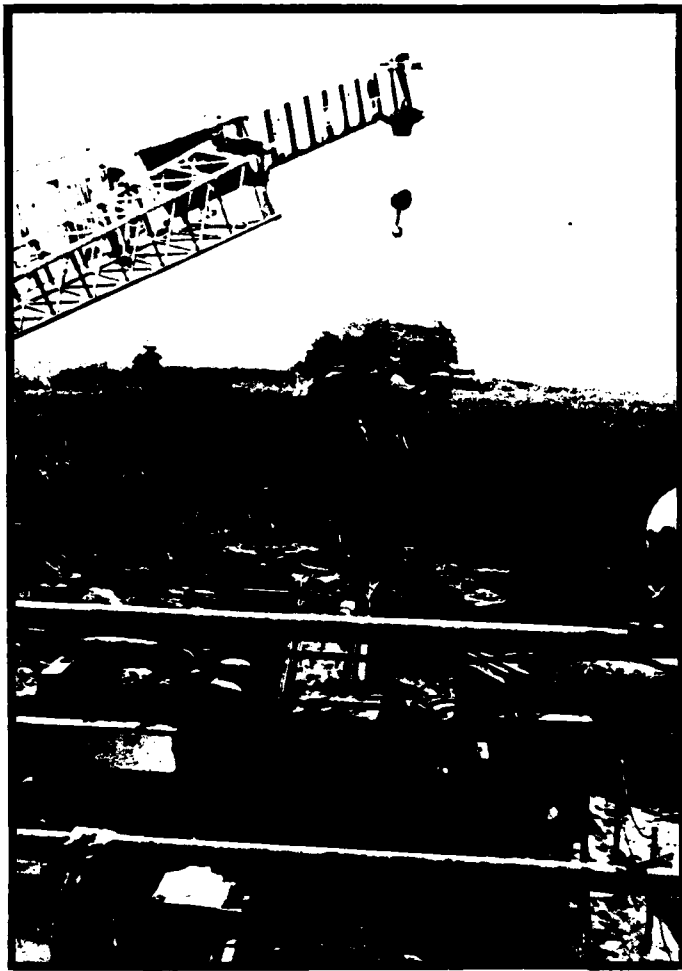
50 TON CRANE PAD



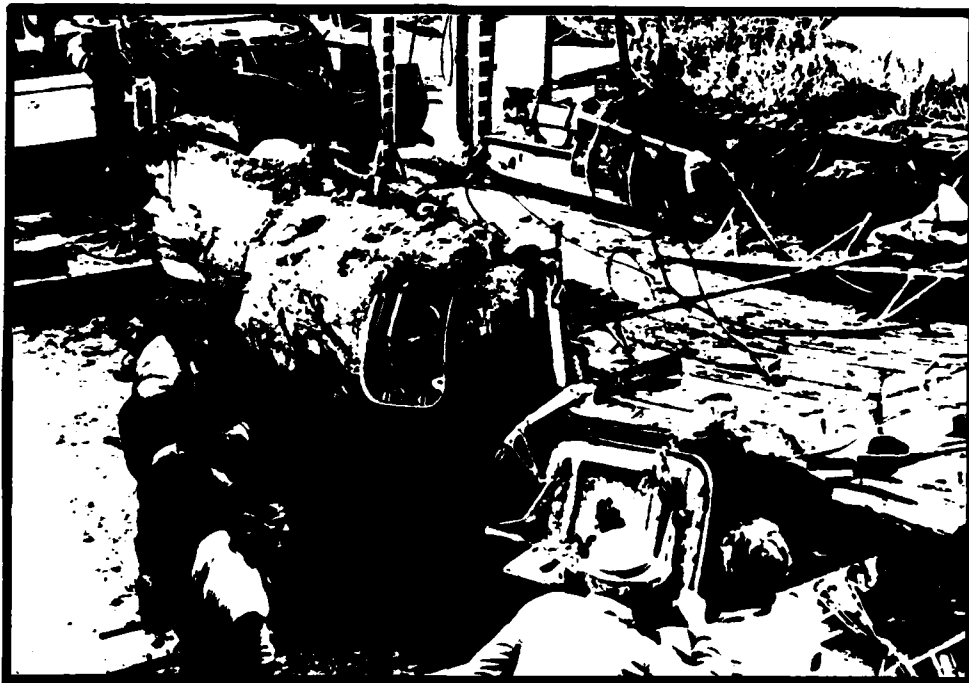
D-PAAC ON SITE



CRASH SITE AFTER RECOVERY



WRECKAGE RECOVERY



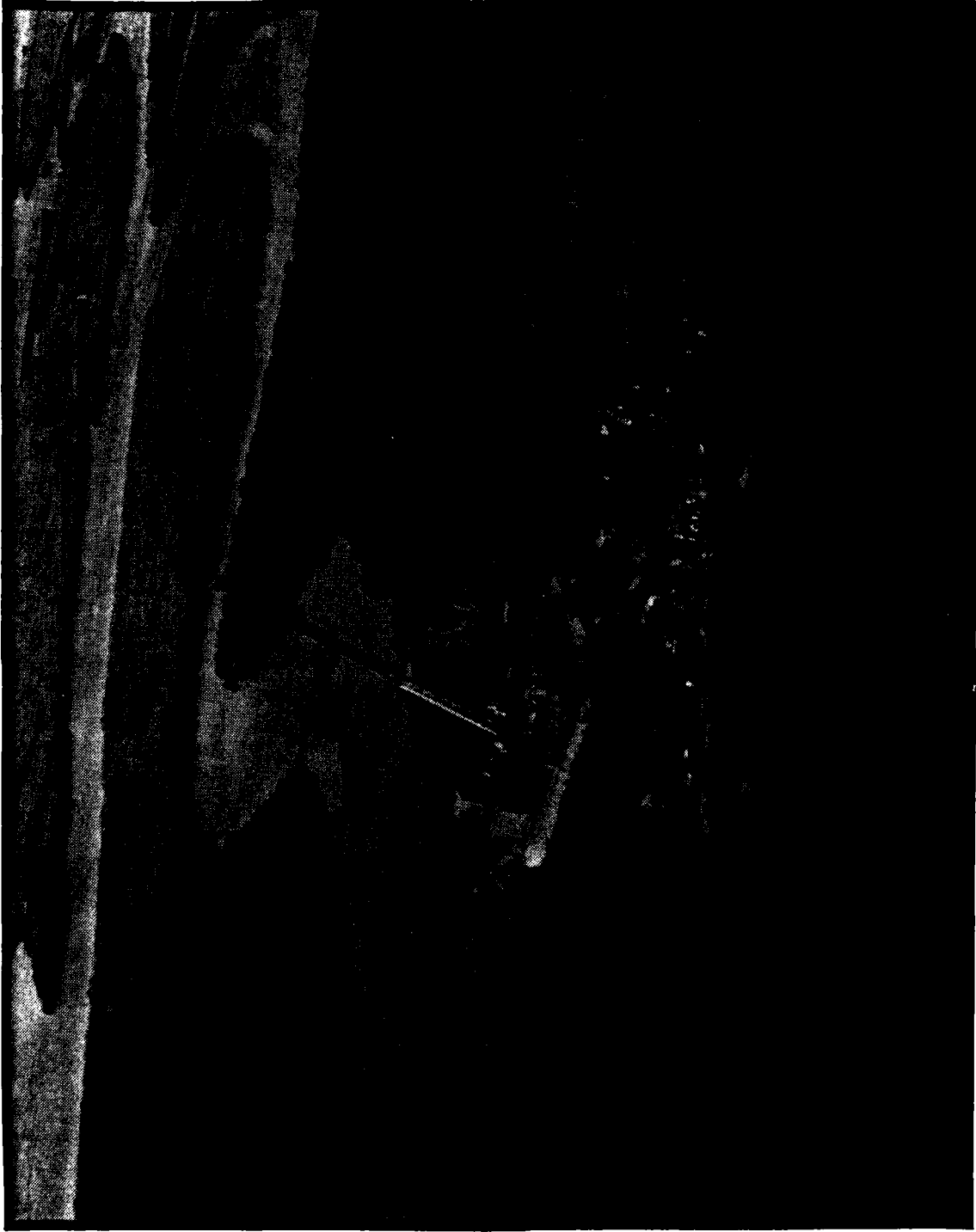
WRECKAGE ON DECK



SMALL TUG TOWING D-PAAC



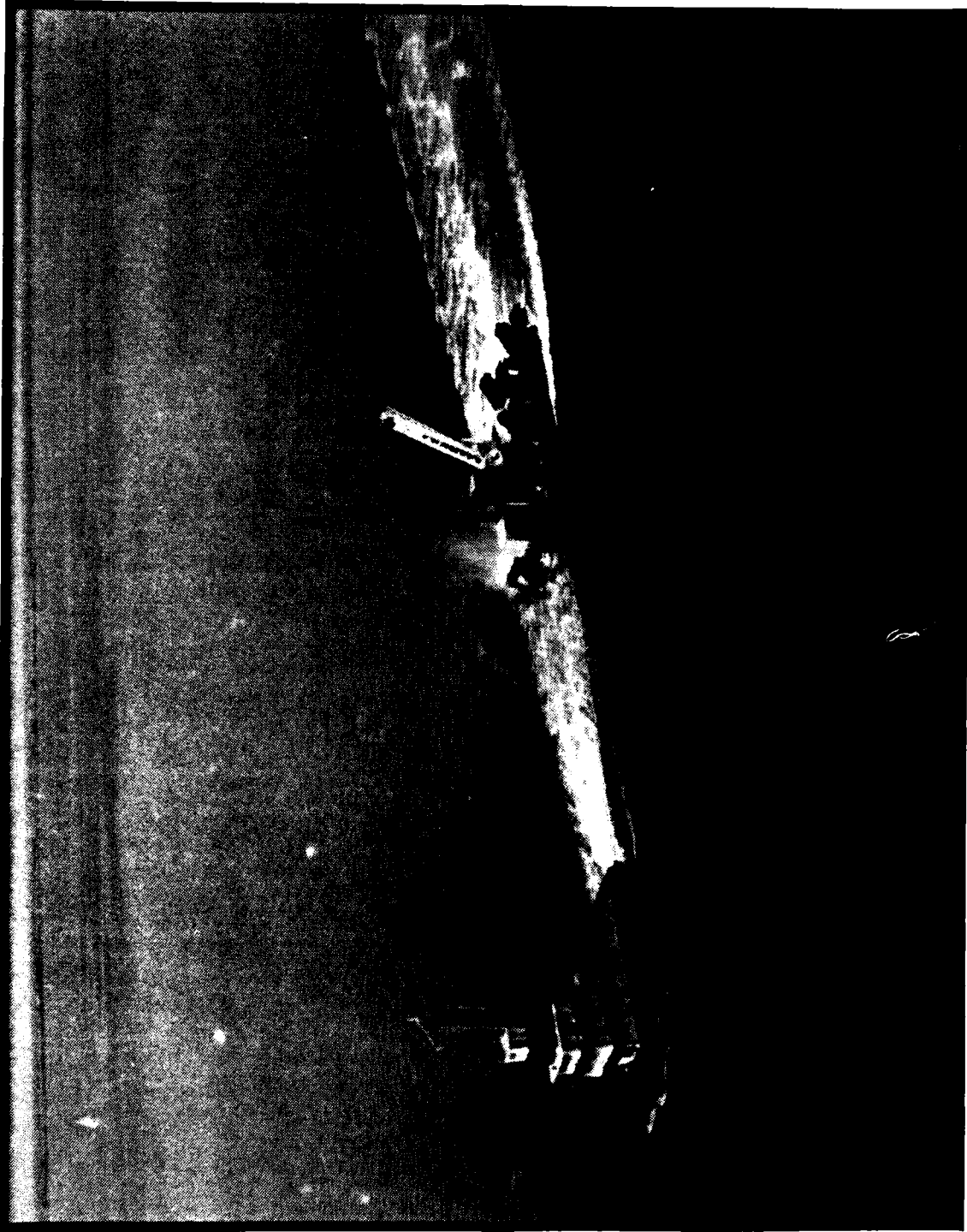
D-PAAC UNDERWAY



CRASH SITE (AERIAL VIEW)



D-PAAC AND HUSKY ON-SITE



D-PAAC UNDER TOW



WORK SITE CONDITIONS

END

FILMED

1-86

DTIC