Suez Canal Clearance Operation, Task Force 65

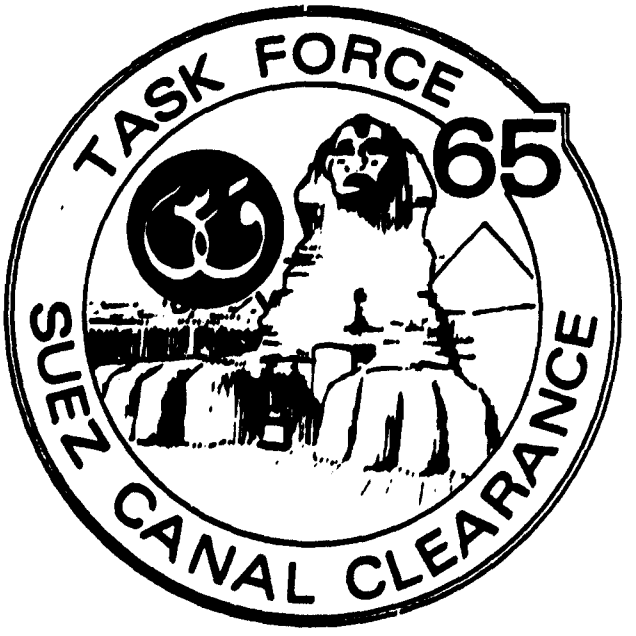
Task Force 65
Norfolk, Virginia

May 1975

FINAL REPORT

SUEZ CANAL CLEARANCE OPERATION

TASK FORCE 65



MAY 1975

DEPARTMENT OF THE NAVY
COMMANDER NAVAL INSHORE WARFARE COMMAND
ATLANTIC
NAVAL AMPHIBIOUS BASE, LITTLE CREEK
NORFOLK, VIRGINIA 23520

From: Commander Naval Inshore Warfare Command, Atlantic/Commander Task Force SIXTY—FIVE
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1. This report provides the documentation of the Suez Canal Clearance Operations NIMBUS STAR, NIMBUS MOON, and NIMROD SPAR undertaken by Task Force 65 during the period 11 April to 15 December 1974. Under the terms of two bilateral agreements between the Government of Egypt and the U. S. Government, U. S. Forces were employed to sweep the Suez Canal of influence mines (Operation NIMBUS STAR), advise and assist in clearance of unexploded ordnance from the Canal and adjacent land areas (Operation NIMBUS MOON), and remove ten designated wrecks from the Canal (Operation NIMROD SPAR). The report discusses mission background, operational accomplishments, logistical support, technical methods and equipments, environmental factors and provides conclusions and lessons learned.

K. J. CARROLL
Rear Admiral, U. S. Navy

Distribution:
See Appendix E

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EXECUTIVE SUMMARY

INTRODUCTION. On 22 October 1973, international negotations brought to a close the prolonged conflict that had existed in the Suez Canal Area since June 1967. During this period the 160 kilometer long canal remained closed to normal ship traffic. Ten ships had been intentionally sunk to block the channel. Land areas adjacent to the canal were fortified and mined, and the canal itself was strewn with quantities of potentially hazardous unexploded ordnance items.

In April 1974, the Government of the United States and the Government of the Arab Republic of Egypt entered into an agreement whereby the U.S. would provide assistance in the clearance of the Suez Canal.

The U.S. and Egyptian Governments finalized a second agreement on June 11, 1974 by which the U.S. agreed to salvage or remove ten designated sunken wrecks from the canal using contractor assets as deemed necessary.

Commander Sixth Fleet issued plans which established Task Force 65 and provided guidance for minesweeping (Operation NIMBUS STAR) the provision of training and advisory assistance for land and water explosive ordnance clearance (Operation NIMBUS MOON) and the removal and salvage of the ten designated wrecks (Operation NIMROD SPAR). D-Day for commencement of the overall clearance mission was 11 April 1974. The Task Force was comprised of units drawn from all branches of the U.S. armed forces; Army, Navy, Air Force and Marine Corps.

Separate arrangements to provide assistance in the clearance of ordnance from the Suez Canal were made between the Egyptian Government and the Governments of the United Kingdom and France. While each national force reported through its normal chain of command, overall operational coordination was exercised by Commander Task Force 65.

NIMBUS STAR. U.S. Navy mine countermeasures forces were employed to conduct navigationally controlled minesweeping operations against bottom placed influence fuzed ordnance and mines in the Suez Canal, its major contiguous waters and approach channels, to ensure that future EOD clearance and salvage operations could proceed with safety. On 22 April 1974, units of Mobile Mine Countermeasures Command and Helicopter Mine Countermeasures Squadron TWELVE using RH 53D Sea Stallion helicopters, commenced the sweep of the waterway. By 29 April, airborne mine countermeasures operations were completed in the northern stretch of the canal from Ismailia to Port Said and its approaches. The southern reaches of the canal including approaches and anchorages in the Suez Bay were swept by 30 May. During the course of operation NIMBUS STAR over 7,616 linear miles of sweep track were flown encompassing an area of over 120 square miles.

NIMBUS MOON (LAND). U.S. Army Explosive Ordnance Demolition Forces were organized from 29 U.S. based commands to provide training and advisory assistance to Arab Republic of Egypt (A.R.E.) Army personnel who cleared all unexploded ordnance located 250 meters either side of the canal. In a three phase procedure, commencing on 29 April, over 1500 A.R.E Army personnel were trained in EOD techniques. Clearance of land mines from the canal banks was reported as 100 percent complete on 3 July 1974. U.S. personnel functioned as advisors only during actual clearance operations. The A.R.E Army reported that they cleared a total of 686,000 anti-tank and anti-personnel land mines in the operation. In addition, they recovered and destroyed 13,567 hazardous unexploded ordnance items. The clearance operations encompassed over 30 square miles of land area. Training was provided in July to two additional brigades on basic demolition procedures and use of mine detectors. NIMBUS MOON LAND operations were complete and remaining U.S. Army EOD personnel returned to CONUS on 25 July 1974.

NIMROD SPAR. The task of removing ten designated wrecks from the canal channel was undertaken by the Murphy Pacific Marine Salvage Company under the direct supervision of the U.S. Navy Supervisor of Salvage. Work commenced on 29 May as teams of divers began to cut away the superstructure of the SS MECCA the largest, 6700 ton, wreck blocking the channel. Additional salvage assets including two large heavy cranes and two heavy lift craft were brought to the canal zone. Survey, trim and rigging and lift operations were conducted simutaneously at multiple locations along the canal. Heavy cranes THOR and ROLAND were employed first in the northern reaches of the canal to remove sections of the MECCA and ISMAILIA, and then near the southern terminus of the canal to clear the DREDGE 22, TUG BARREH and tanker MAGD. They then proceeded to the northern end of the Great Bitter Lake to salvage the dredge 15 SEPTEMBER, the only wreck whose reuse was desired. The heavy lift craft CRANDELL and CRILLY were employed to lift and remove the four wrecks from the central region of the canal; DREDGE 23, Tug MONGUED, Dredge KASSER and a Concrete Caisson. All salvage operations were completed by 19 December 1974.

NIMBUS MOON (WATER). Clearance of ordnance from the waters of the Suez Canal was an international effort combining U.S., British, French and Egyptian Forces under the coordination of CTF 65. British minehunters with small object detecting sonar and divers cleared the channel working south from Port Said to Port Taufiq. They were flanked on the slopes of the channel by teams of British and French EOD divers who searched from the high water mark to the canal channel edge. An independent group of Egyptian divers also searched the eastern slope.

As this overall group worked North to South, U.S. EOD divers trained A.R.E. Navy divers in diving, underwater search and demolition. When training was completed, a joint force of U.S. sonar search operators, diving advisors and A.R.E. Navy EOD divers began clearing the canal working northward from Port Taufiq. Navigationally controlled sonar search with diver followup was conducted in the center channel with teams of divers searching the slope areas. The U.S. and Egyptian teams worked North to the midpoint of the canal then shifted their base of operations to Port Said and worked South.

This overall strategy resulted in two complete search and clearance passes over the entire canal. Based on observed distribution of contacts, a third complete diver search of the canal slopes was conducted by French and Egyptian Forces, and French and British minehunters reswept the channel. Rechecks of certain areas by divers, near bridges or other obstructions and in regions where fighting was the heaviest, will continue for some months using Egyptian and French divers and a small team of U.S. Navy EOD advisors. The central portion of the Great Bitter Lake, where water and sediment conditions plus large amounts of litter on the lake bed made acoustic or magnetic search with diver followup impractical, will be chain and net dragged by the Suez Canal Authority prior to future dredging operations.

By close of TF 65 operations over 8500 ordnance contacts had been disposed of. Approximately 7500 of these contacts were located in the canal proper with over 96 percent being located in the first two complete search passes. About 1000 ordnance items were located and destroyed in anchorages, approaches and harbor basins outside the canal. The 8500 contacts listed above amounted to over 60 tons of ordnance material. Among the items were ordnance from WWII, and the Conflicts in 1956, 1967 and 1973. Over 50 types of ordnance were found ranging in size from 2000 lb bombs to small anti-personnel bomblets and hand grenades. One item located and destroyed was a 2000 lb German air dropped mine of WWII vintage. In addition to these items, over 200 tons of unexploded ordnance was recovered from boats, barges and other vehicles removed from the canal. One barge alone contained about 175 tons of unidentified ordnance items. Contact was made with over 700 major non-ordnance items ranging from barges and vehicles, such as tanks and trucks, to pontoon bridge sections and aircraft engines. Positions of these items were marked for later removal by the Suez Canal Authority.

Over 74 percent of ordnance items cleared from the canal proper were found on the slopes in

less than 6 meters of water. Significant amounts were found in clusters of ten or more identical items, indicating that accidential or intentional dumping was the most probable cause of entry into the waterway.

SUMMARY. For over eight months the units of Task Force 65 worked seven days a week to clear the 160 kilometer long Suez Canal of obstacles and ordnance hazards. The clearance operation was completed almost four months earlier than had been initially estimated with an unblemished safety record which saw no major injury or fatalities among U.S. personnel assigned. As the Task Force disbanded on 15 December, the canal was ready for restoration of navigational and communication aids and the maintenance dredging necessary for its reopening as a vital artery of world commerce. This had been accomplished while working under the most austere conditions with personnel exposed to a combination of harsh desert conditions amplified by existance in an area devastated by prolonged conflict where sanitation and public health conditions were a constant threat to personal welfare. Even under these conditions Task Force personnel conducted themselves ashore in the finest tradition of ambassadors, establishing positive bonds of friendship with the people of Egypt. The tremendous human effort involved, coupled with the strong bonds engendered by people from several nations working side by side, contributed to the peace and stability of the Middle East and reflected great credit upon all personnel assigned.

Chapter I

MISSION BACKGROUND

Between June 1967 and October 1973, a prolonged state of conflict existed in the Suez Canal area. During this entire period the canal remained essentially closed to normal ship traffic. Ships were sunk to block the channel, and both banks fortified, with adjacent land areas being mined against both personnel and vehicles. In addition to those ordnance and non-ordnance items intentionally placed in the canal, an unknown amount of potentially hazardous material entered the canal inadvertently as the conflict ensued. On 22 October 1973, when international negotiations culminated in cessation of the conflict in the area, a vital world artery, 160 KM long, lay clogged with the debris of war. Clearance of hazardous materials and large barriers were needed before normal restoration of the canal and re-opening to ship traffic could be implemented.

The events leading up to the formation of Task Force 65, the authority and task assignments for operation and the mission objectives of phases of the Suez Canal Clearance operation are covered in this chapter. Operational accomplishments, Logistics Support, and Technical Considerations are covered in the following chapters.

AUTHORITY

Early in the international negotiations which lead to the cessation of the hostilities mentioned above, the issue of clearance of the Suez Canal and its environs began to emerge. In April 1974, the Government of the United States and the Government of Egypt entered into an agreement whereby the U.S. would provide assistance in the clearance of the Suez Canal including minesweeping of the canal and its approaches, and training and advisory assistance to personnel of the Arab Republic of Egypt in enabling them to carry out detection and disposal of unexploded ordnance situated in or adjacent to the Suez Canal. It was understood at that time that the U.S. Government could not guarantee that all hazardous objects would be located and removed or rendered harmless. This agreement was finalized on 25 April 1974, and is provided as Appendix A-1.

Continuing discussions concerning the overall clearance of the canal led to an additional bilateral agreement between the U.S. and Egyptian Governments concerning the salvage and or removal from the Suez Canal of designated sunken vessels and other hazards to navigation. Under the terms of that agreement, U.S. forces would carry out this clearance making use of such contractors as deemed necessary. This agreement was finalized on June 11, 1974 and is provided as Appendix A-2.

Separate arrangements to provide assistance in the clearance of ordnance from the Suez Canal were made between the Egyptian Government and the governments of the United Kingdom and France respectively.

Following the consumation of these international agreements, all parties concerned continued to work together to shape an operational scenario which would be well coordinated and insure the common goal of a thorough canal search for and clearance of hazardous ordnance items.

TASK ASSIGNMENT

On 10 April 1974, COMSIXTHFLT issued OPLAN 4371 which established Task Force 65 and provided initial operational guidance for the conduct of minesweeping operations in the Suez Canal and its approaches (Operation NIMBUS STAR) and the provision of training and advisory assistance to Arab Republic of Egypt forces in clearing land mines and unexploded ordnance from the canal banks and its contiguous waters (Operation NIMBUS MOON). RADM McCauley was designated Commander Task Force 65 reporting directly to

RADM BRIAN McCAULEY, USN

RADM KENT J. CARROLL, USN

COMSIXTHFLT with command relationships following the normal chain through CINCUSNAVEUR and USCINCEUR to the JCS. D-Day for commencement of NIMBUS STAR/MOON operations was 11 April 1974.

On 21 June 1974, with Operation NIMBUS STAR completed and following a change of command at which RADM K. J. Carroll assumed command of Task Force 65, COMSIXTHFLT issued OPLAN 4371A which superseded the earlier plan. This plan provided continued guidance for the conduct of on-going Operation NIMBUS MOON and in addition, provided guidance and the basic chain of command for U.S. forces to remove designated sunken vessels or other hazards to navigation from the canal (Operation NIMROD SPAR). It designated the Supervisor of Salvage to conduct such salvage operations under the technical and fiscal management of the CNM reporting to CTF 65 for coordination. COMSIXTHFLT OPLAN 4371A NIMBUS MOON/NIMROD SPAR is included as Appendix B.

OBJECTIVES

NIMBUS STAR. To conduct navigationally controlled minesweeping operations against bottom placed influence mines in the Suez Canal, its major contiguous waters, and approach channels using U.S. Navy operating forces to insure that further EOD clearance operations could proceed with safety.

NIMBUS MOON LAND: To train Arab Republic of Egypt Army personnel in explosive ordnance demolition and land mine clearance techniques and provide advisory assistance to these forces in clearance of unexploded ordnance from the land areas on both sides of the canal to an average distance of 250 meters.

NIMBUS MOON WATER. To train Egyptian personnel in underwater ordnance search and clearance and to provide advisory assistance in clearing unexploded ordnance from the Suez Canal and its contiguous waters.

NIMROD SPAR. To conduct salvage operations to remove ten designated sunken wrecks or other hazards to navigation from the Suez Canal.

ORGANIZATION

The basic organizational diagram of Task Force 65 is shown in Figure 1. The following is a brief discussion of major task groups and support elements assigned. Data on the individual ships which operated as a part of the Task Force are provided in Appendix C.

COMMANDER TASK FORCE SIX FIVE AND STAFF. RADM Brian McCauley, Commander Mine Warfare Force, was designated CTF 65 during the planning stages and for initial operations following D-Day, 11 April 1974. On 3 June RADM Kent J. Carroll, Commander, NAVINSWARLANT relieved as CTF 65. Early staff support was provided by COMMINEWARFOR. From June through completion of operations, staff support was provided by NAVINSWARLANT augumented with personnel from the attached flagship and the office of Naval Research.

TG SIX FIVE POINT ONE. This Task Group, comprised of personnel from Mobile Mine Countermeasures Command, Charleston, S.C. and units of Helicopter Mine Countermeasures Squadron TWELVE, was operational from D-DAY through 30 May 1974, conducting the NIMBUS STAR operation. TG 65.1 was commanded by Captain Felix Vecchione, USN, Commander Mobile Mine Countermeasures Command.

TG SIX FIVE POINT TWO. This Task Group, composed of Royal Navy forces under the command of Commander D. Husband, RN, was operational from 7 April to 1 November 1974. Forces assigned included the support ship HMS ABDIEL, three minehunters, HMS MAXTON, WILTON and BOSSINGTON, and a detachment of the Fleet Clearance Diving Team.

TG SIX FIVE POINT THREE. This designation was given to the three successive helicopter squadron detachments assigned during the course of Task Force 65 operations. Detachments were assigned from HMM 261 and HMM 162 of Marine Air Group 26 and HC-6 Det 9 from NAS, Norfolk, Virginia.

TG SIX FIVE POINT FOUR. This designation was given to personnel from COMFAIRMED and various other commands who supplied cargo handling and local logistics coordiantion for the entire Task Force.

TG SIX FIVE POINT FIVE. Task Group 65.5, Commanded by Captian David McAnulty, USN, was comprised of U.S. Navy EOD personnel provided by a number of CONUS based EOD commands, NAVAID Support personnel from the U.S. Naval Oceanographic Office, teams of data analysis personnel, and a large detachment of A.R.E. Navy Divers. Task Group 65.5 was operational from D-Day to the end of Task Force 65 operations.

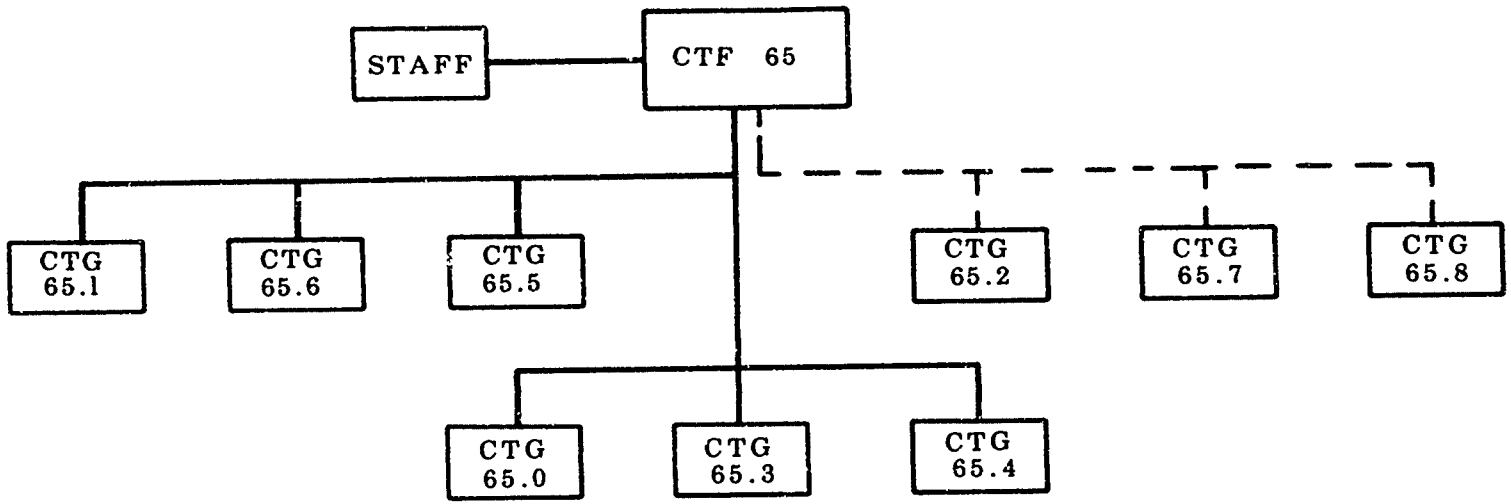
TG SIX FIVE POINT SIX. This Task Group was operational from D-Day until 24 July 1974, and conducted operation NIMBUS MOON LAND. Personnel were assigned from over 29 U.S. Army posts within CONUS under the command of LTCOL Vincent A. LoPresti, USA, and LTCOL Deryl A. Sisson, USA, respectively.

TG SIX FIVE POINT SEVEN. This Task Group was comprised of all personnel and support elements conducting OPERATION NIMROD SPAR, and was commanded by Captain Huntley Boyd, USN, Supervisor of Salvage. The Task Group was operational from 27 May to the completion of Task Force 65 operations.

TG SIX FIVE POINT EIGHT. This Task Group, composed of French Navy forces under the command of Commander J. Bottini, FN, was operational from 20 June to the completion of Task Force 65 operations. Forces assigned, included teams of Demining Divers and supporting minesweepers, GARDENIA, GIROFLEE, AJONC, and LILAS, and two minehunters CERES and CALLIOPE.

TG SIX FIVE POINT ZERO. This Task Group designation was assigned to the four successive flagships which supported Task Force 65, USS IWO JIMA (LPH-2), USS INCHON (LPH-12), USS BARNSTABLE COUNTY (LST-1197) and USS BOULDER (LST-1190).

TASK FORCE SIX FIVE ORGANIZATION



TG 65.1 U.S. MINE COUNTERMEASURES FORCES (OPERATION NIMBUS STAR)
TG 65.2 BRITISH MINEHUNTERS, SUPPORT SHIP AND FLEET CLEARANCE DIVING TEAM
TG 65.3 U.S. HELO DETACHMENT
TG 65.4 COMFAIRMED DETACHMENT (LOGISTICS)
TG 65.5 U.S. WATER CLEARANCE GROUP WITH EGYPTIAN DIVERS (EOD)
TG 65.6 U.S. ARMY LAND CLEARANCE ADVISORS (OPERATION NIMBUS MOON LAND)
TG 65.7 U.S. SALVAGE GROUP (OPERATION NIMROD SPAR)
TG 65.8 FRENCH WATER CLEARANCE GROUP
TG 65.0 FLAGSHIP

Figure 1.

PRESIDENT SADAT greeting Senior Commanders of Task Force 65. From left to right: RADM A. FOUAD, A.R.E. Navy; RADM K.J. CARROLL, USN; CDR D. HUSBAND, RN; CDR J. BOTTINI, FN; and COMMODORE RAGAEI MOUSSA, A.R.E. Navy.

COMSIXTHFLT visits NIMBUS MOON Operations. From left to right: RADM FOUAD, A.R.E. Navy; VADM MURPHY, COMSIXTHFLT; CAPT D. McANULTY, CTG 65.5; and RADM K.J. CARROLL, CTF 65.

CHAPTER II

OPERATIONAL ACCOMPLISHMENTS

AREAS TO BE SEARCHED

The Suez Canal, its contiguous waters including approaches and anchorages, and the directly adjacent land areas presented a large and very difficult area to be searched and cleared. The overall canal area, shown in Figure 2, stretches some 180 KM from the sea buoy at the Mediterranean entrance to the end of the dredged channel in the Red Sea. In addition to major sunken ships, the canal floor was littered with the debris of war plus that left by passing ships over the years. The canal shores had been modified in major ways during the conflict. Steep sand embankments up to 30 meters in height were pushed up on both sides. Many canal navigation markers were either destroyed or covered by sand embankments and significant sand had entered the canal. Of the four major cities & towns along the canal, all were damaged in varying degrees. Damage ranged from minor in Ismailia and Port Said to essentially total obliteration in Port Taufiq. Most of the civilian population had been evacuated for extended periods. Intensive fighting along both banks necessitated a cautious approach to all land and water covered areas. The canal bottom ranged from silty in the northern section becoming sandy to sand with rock out-crops to the south. Port areas had thick silt layers with poor visibility. The canal traverses three lakes where marshy shorelines and high salinity and detrital layers added difficulty to object detection and safe clearance.

Initial sweeping against influence fuzed ordnance and mines (Operation NIMBUS STAR) encompassed a water covered area greater that 120 square miles. In Operation NIMBUS MOON LAND, over 30 square miles of land area were searched and cleared of both mines and other explosive ordnance.

The canal and its contiguous waters presented an area of over 60 square miles for underwater search and clearance. Much of that area, on the slopes of the canal in harbors and lakes, or where contacts were located by other sensors, had to be physically inspected by divers to find, identify, and destroy unexploded ordnance items.

MAJOR OPERATIONAL CONSTRAINTS

ADVISORY ROLE. The terms of the U.S. agreement with the Government of Egypt limited U.S. forces to training and advisory roles in the actual clearance of unexploded ordnance from the canal waters and adjacent land areas. Exceptions to this limitation were the airborne minesweeping phase (NIMBUS STAR), and the salvage operations (NIMROD SPAR). This necessitated an intense training program for A.R.E. Army Forces in the mine hunting and EOD techniques, and the training of Egyptian Navy divers in search methods, equipment usage and underwater EOD techniques. The close training required, followed by field operations in a highly hazardous environment, put strong emphasis on overcoming language barriers as methods and safety concepts were presented. U.S. Forces were strictly prohibited from diving on ordnance. British and French Forces were not so constrained, and their EOD personnel directly conducted in-water search for and disposal of underwater ordnance items.

SAFETY OF PERSONNEL. Safety of personnel was of paramount importance throughout the operation. Due to the broad area of fighting and the extensive use of minefield, all land areas were intitally suspect. The airborne minesweeping operation was conducted primarily to ensure the safety from influence fuzed ordnance and mines for the follow-on search and clearance of all unexploded ordnance from the canal and its underwater slopes.

CLEARANCES AND COORDINATION. The area to be searched was still considered a war zone. Major A.R.E. Army units controlled and maneuvered within the area. The canal was

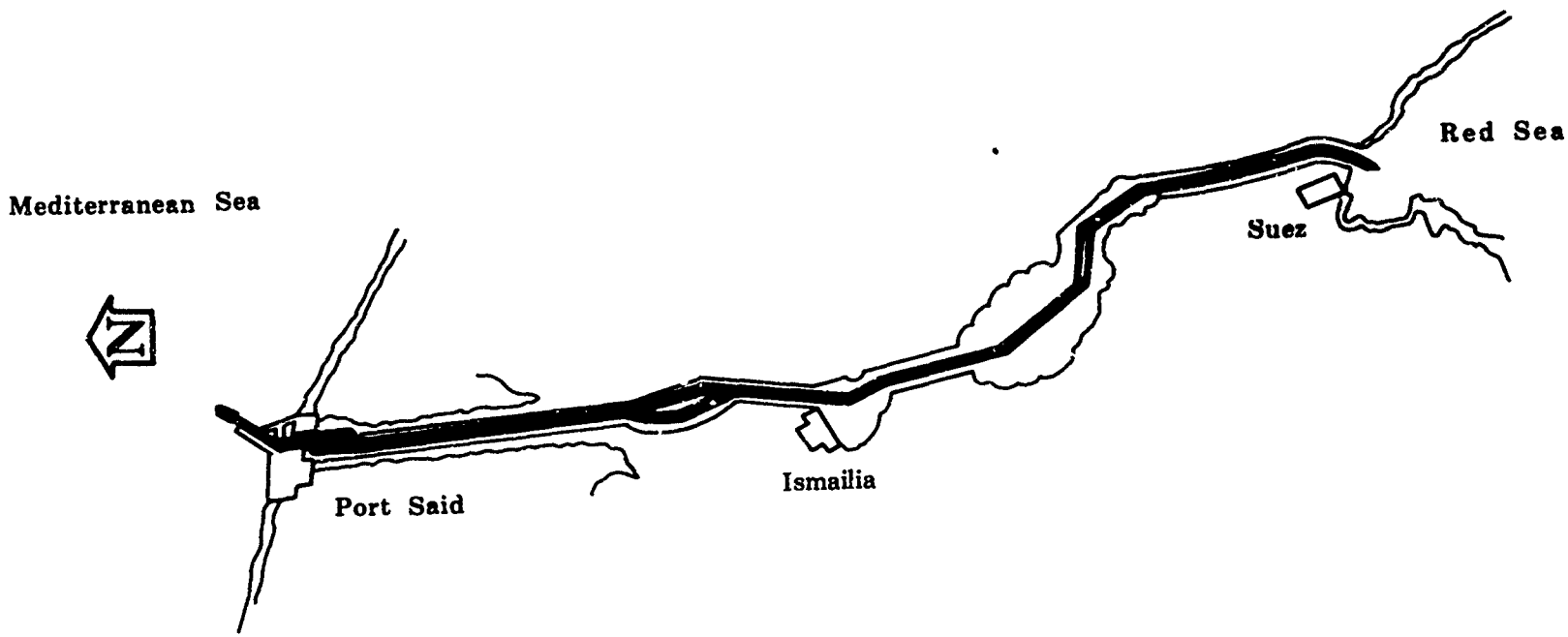
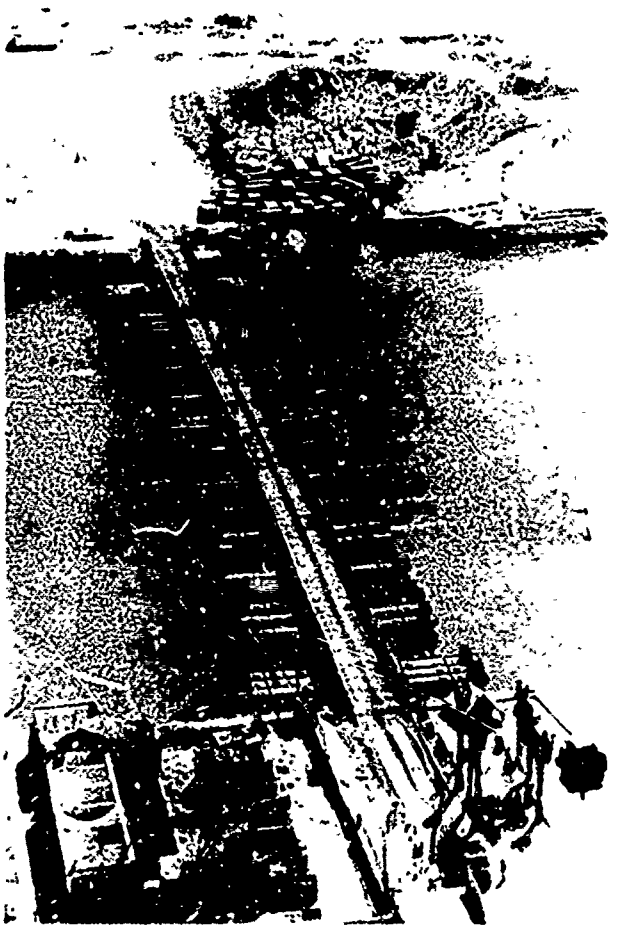


Figure 2.

blocked at many points by military logistics lines. Entry, travel, and operations were strictly controlled. Close cooperation between CTF 65 Forces, the Suez Canal Authority, and the A.R.E. Army was required to allow clearance of personnel and vehicular movements, establishment of navigational aid sites, aircraft corridors and flight schedules and canal transits by vessels. Initially, movement control was very tight and many delays in obtaining clearances for operations resulted in slow progress. Cooperation by all personnel improved this situation rapidly, especially for personnel and vehicle traffic. An aircraft corridor was established which covered the length of the canal. With proper notification and prior clearance, aircraft in support of Task Force missions were permitted to fly the canal from Port Said to Deversoir in a corridor 500 meters on the west bank to 9 KM on the east bank. From Deversoir south to Port Taufiq, the corridor narrowed to 500 meters either side of the canal waters. Maximum altitude was limited to 1000 meters and VFR daylight operations only. A10 KM zone was established around Ismailia under local control of Ismailia tower. Clearance for routine helo and fixed wing A/C support normally worked well except in periods when Egyptian forces were called to a Condition I readiness posture. This type of interruption was, however, minimal. Vessel transit along the canal which necessitated A.R.E. Army Forces to open bridges and other supply lines, continued to present a problem throughout TF 65 operations. Many delays were encountered when previously cleared vessels arrived at bridges (Figure 3) only to wait for extended periods. Clearance for the establishment of NAVAID sites also required significant lead time.



Typical pontoon bridge across the Suez Canal.

PONTOON BRIDGES

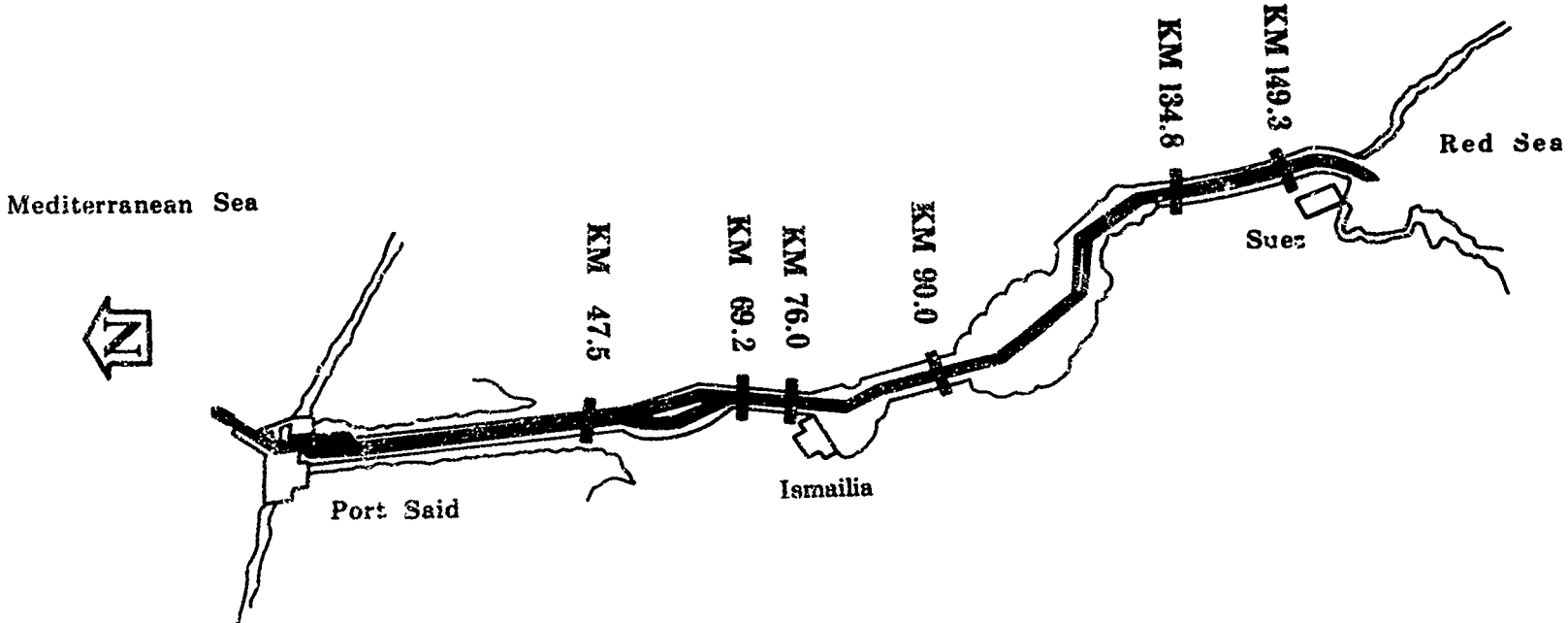


Figure 3.

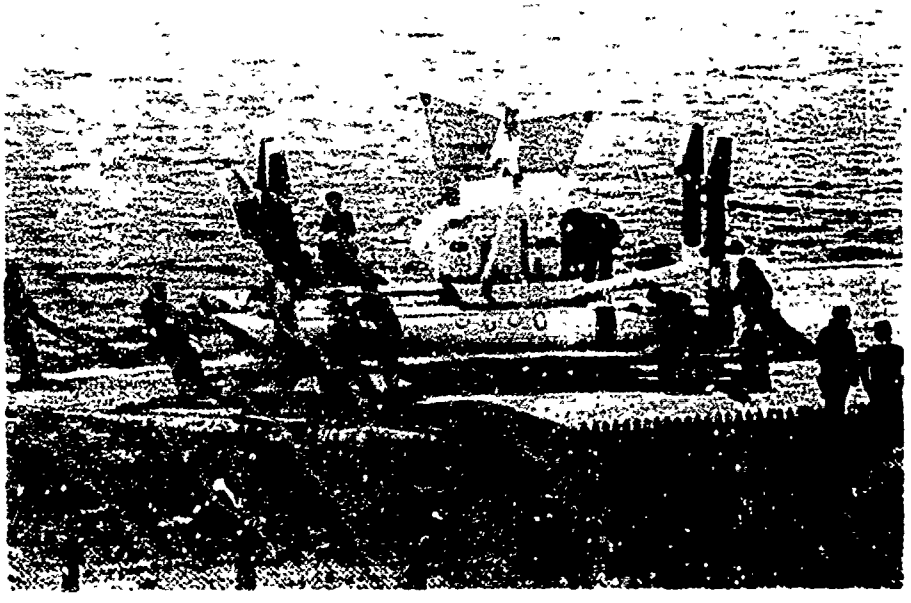
DEPENDENCE ON IN-COUNTRY SUPPORT. It was agreed that the Suez Canal Authority (SCA), the formal agency of the Egyptian Government which controls and operates the Suez Canal, would provide berthing, messing, and general transportation support to all elements of Task Force 65 billeted ashore. This support was to be provided within the limits of their capabilities. Three areas of operations evolved which required billeting ashore. These three areas were Port Said and Port Taufiq, both centers for EOD and Salvage operations, and Ismailia, the Task Force headquarters and supply system center. Personnel and equipment transportation between these three areas and Cairo was required. Arrangements were made in Cairo for temporary billeting of personnel in transit to and from Egypt via commercial air carriers.

The initial facilities available ashore were extremely limited. As had been previously mentioned, the cities involved had been abandoned and in the center of a war zone for several years. Great effort was expended by the SCA to provide habitable berthing and acceptable messing facilities as rapidly as possible. Transportation assets were marshalled from available vehicles in various states of repair. Pilot boats were made available to serve as sonar search boats, buoy location boats, magnetometer search boats and for some diver support. Assets such as floating cranes were very limited. Existing communications facilities were marginal to non-existent.

Although continued cooperation and effort to upgrade messing and berthing and to supply vehicular assets continued through the Task Force mission, this reliance on available in-country assets, which had been severely damaged by years of conflict, was a significant constraint.

NIMBUS STAR (SUMMARY)

Operation NIMBUS STAR involved the sweeping of the entire 160 KM length of the Suez Canal and its approaches at Port Said and Suez Bay to establish the absence of live influence fuzed ordnance and mines which might endanger later diving and salvage operations as well as future dredging or shipping. Sweep operations were conducted by a coordinated team from



Ground crew members of the Mobile Mine Countermeasures Command push a Magnetic Minesweeping Sled into the waters of Lake Timsah.

Helicopter Mine Countermeasures Squadron (HM) Twelve, from Norfolk, Virginia, working in consort with personnel and minesweeping equipment of the Mobile Mine Countermeasures Command from Charleston, South Carolina. Both units were airlifted to the Eastern Mediterranean by aircraft of the U.S. Air Force Military Airlift Command. Major surface support units were the USS IWO JIMA (LPH-2) and USS INCHON (LPH-12), with U.S. Marine Corps air support units HMM-261 and HMM-162 embarked.

Operations of TG 65.1 commenced on 11 April as C-5 aircraft landed in Cairo with AMCM Unit Alpha and equipment. Personnel and equipment were convoyed to Ismailia where a headquarters for TF 65 was set up in the SCA Headquarters building and a heliport constructed to facilitate the arrival of the RH 53D Sea Stallion minesweeping helicopters. Navy EOD personnel from Charleston, South Carolina, deployed with the initial field party to clear the Ismailia airfield, buildings and water approaches to permit AMCM forces to safely stage and deploy mine countermeasures equipment. On 12 April the first C-120's arrived in Ismailia carrying COMFAIRMED command post personnel and equipment. The runway was improved and regular aircraft logistics and SAR services were implemented.

By 22 April, with buildup of U.S. forces for NIMBUS STAR operations in-country nearly completed, the IWO JIMA arrived Port Said with RH 53D minesweeping helicopters and CH 46F helicopters for SAR and logistics.

RH-53 SEA STALLION helicopter towing a MARK 105 Magnetic Minesweeping Sled through the Suez Canal during OPERATION NIMBUS STAR.

AMCM Unit Alpha began sweeping operations in Lake Timsah and northward into the canal. Unit Bravo, operating from the Port Said waterfront, swept the harbor and then proceeded southward into the canal. By 29 April, AMCM operations were completed to the north of Ismailia and sweep operations shifted to the southern half of the canal. Landing and AMCM staging sites were set up at Deversoir, near the Great Bitter Lake and at the extreme southern end of the canal on the Egyptian naval base at Adabiyah. Operating from these staging areas, the southern portions of the canal and the Suez Anchorages were swept by 30 May.

During the course of NIMBUS STAR over 7,616 linear miles of sweep track was flown encompassing an area of over 120 square miles.

NIMBUS MOON LAND (SUMMARY)

Task Group 65.6 was organized from assets of the U.S. Army Forces Command and was tasked to provide training and advisory assistance to Arab Republic of Egypt (A.R.E.) Army personnel involved in minefield and unexploded ordnance clearance along both banks of the Suez Canal.

On 11 April 1974, Army personnel from 29 Posts assembled at Fort Belvoir Virginia. This force was given ten days of refresher training at Fort Belvoir, Virginia, and at Indian Head, Maryland, including briefing by State Department personnel, field clothing issue, equipment checkout and deployment processing. On 20 April, the main body arrived in-country and training of A.R.E. Army forces was underway on 29 April. The basic concept employed was a three phase training program designed to maximize the number of personnel trained in the shortest possible period as follows:

From left to right: LTCOL D. SISSON, USA, CTG 65.6; MAJOR GENERAL ABD EL SATAR, A.R.E. Army; and RADM K.J. CARROLL, USN CTF 65 review demonstration of ordnance clearance proficiency by A.R.E. Army personnel.

PHASE I: Sixty-three U.S. Army personnel trained 173 officers from 12 A.R.E. Army Engineer (mine clearance) and 2 Engineer [Explosive Ordnance Disposal (EOD)] Battalions on U.S. minefield clearance and EOD procedures and equipment.

PHASE II: Officers trained during Phase I returned to their basic units and, with assistance from U.S. advisors, provided training to 1500 personnel from their own units.

PHASE III: A.R.E. Army Engineer Battalions conducted landmine field clearance and EOD operations with assistance from U.S. advisors. U.S. Army personnel served as advisors only and did not engage in actural clearance operations. Each A.R.E. Battalion was initially advised by a six-man battalion advisory team (BAT). As A.R.E. Army units technical proficiency increased, U.S. Army advisory effort was phased out incrementally and redeployed to CONUS. Number of A.R.E. personnel trained by function was as follows:

Engineer (minefield clearance)	1000
Explosive ordnance Disposal	500
Detector Maintenance	8
Total	1508

Typical ordnance removed during NIMBUS MOON LAND operations.

A.R.E. Army personnel demonstrate use of minefield clearance tools.

Throughout the operation, U.S. advisory personnel were impressed by the knowledge and technical expertise displayed by the A.R.E. Army officers. This factor was, to a large extent, the reason for completion of the mission in less time than originally planned. Another factor contributing to early mission completion was the fact that A.R.E. Army Battalions began clearance operations on 12 February 1974, while planning had been based on the starting date being after the arrival of NIMBUS MOON LAND personnel and completion of training.

A.R.E. Army personnel cleared mines and unexploded ordnance located 250 meters either side of the canal. Total area searched was over 30 square miles. Mine clearance on the banks was reported as 100 percent completed on 30 June 1974, with EOD clearance for the same area reported 100 percent complete on 3 July. The A.R.E. Army reported that they cleared a total of 686,000 anti-tank and anti-personnel land mines in this zone. In addition, they recovered and destroyed 13,567 unexploded ordnance items.

On 2 July, additional training on basic explosive ordnance demolition procedures and use of mine detectors was requested for one brigade of the A.R.E. Second Army and one brigade of the Third Army. This training by U.S. Army advisors was completed on 16 July. This supplemental training permitted A.R.E. forces to leave one trained engineer company in each of their three major operational sectors to:

(1) Continue check sweep operations as required.
(2) Clear future identified problem minefields.
(3) Escort Suez Canal Authority personnel to work areas along the canal.

Special problem areas encountered were Hyacinth covered minefields bordering Lake Timsah, and minefields which were overgrown with bamboo. Various methods were tested and utilized in clearance of these vegetation choked areas. Methods ranged from extensive countercharging to effect sympathetic detonation, to use of vegetation removal techniques.

The overall land clearance operation was extremely hazardous. A.R.E. Army sources reported a total of 20 fatalities and 40 injuries to Egyptian officer and enlisted personnel during the actual clearance operation. It should be noted that these casualties occurred prior to formal EOD and Engineer training by U.S. Army personnel. No Egyptian personnel casualties were reported during the time U.S. Army advisors were in-country; however, an additional 46 fatalities were informally reported to have occurred during follow-on minefield clearance not related to NIMBUS MOON LAND operations. There were no major injuries or fatalities among U.S. advisory personnel.

NIMBUS MOON LAND EQUIPMENT

The following is a list of equipment turned over to A.R.E. Army Forces by the U.S. Army as a gift from the United States to the Government of the Arab Repubulic of Egypt.

ITEM	UNIT COST	NUMBER	TOTAL COST
Amplifier	$245.00	8	$1,960.00
Demolition Set	197.00	48	9,456.00
Kit Dearmer, .50 Caliber	192.25	9	1,730.25
Kit, Impact Wrench	507.00	9	4,563.00
Kit, Rocket Wrenches	444.75	9	4,002.75
Kit, Improved Explosive Dev.	165.00	4	660.00
Detecting Set, Mine, AN/PR 5-7	272.00	160	43,520.00
Detecting Set, Mine, AN/PSS-11	329.00	160	52,640.00
TOTALS	Various	407	$118,432.00

On 22 July, $118,432.00 worth of explosive ordnance detection and disposal equipment was transferred to the Arab Republic of Egypt. This equipment and the significant training of personnel provided a greatly enhanced in-country capability to deal with unwanted unexploded ordnance. The last of Task Group 65.6 personnel and equipment were retrograded from Egypt on 25 July 1974. Operation NIMBUS MOON LAND was completed.

NIMROD SPAR (SUMMARY)

A separate bilateral agreement was executed between the U.S. and Egyptian governments concerning the removal of ten designated wrecks or other hazards to navigation which were blocking the Suez Canal. The ten wrecks, listed in Table 1, were intentionally sunk in the canal fairway by Egyptian forces to block usage of the canal during the prolonged period of conflict. The U.S. Navy, specifically the Supervisor of Salvage, was tasked to carry out the provisions of the agreement utilizing contractors as deemed necessary. The sunken vessels and other objects to be removed from the canal were to be moved to agreed dumping areas designated by the Government of Egypt through the Suez Canal Authority.

Under the provisions of U.S. Code Title 10, the Supervisor of Salvage (SUPSAL) is directed to maintain a ready U.S. Salvage capability. One mechanism used to meet this mandate is retainer contract, awarded through competitive bidding, with commercial salvage firms. The Murphy Pacific Marine Salvage Company, already under retainer contract to the Supervisor of Salvage, was selected to perform the Canal Clearance Operation. The contractor was under the direct supervision of SUPSAL who then reported through the Naval Material Command to the U.S. State Department, and for coordination to Commander Task Force Sixty-Five.

The immediate priority for salvage operations was to clear a navigable channel in the northern reaches of the canal to permit passage of Task Force support vessels from Port Said to Lake Timsah (Figure 4). The two wrecks of immediate concern were the ISMAILIA at KM 6.4 and especially the SS MECCA at KM 7.2, the largest wreck obstructing the canal. On 27 May, the first party of SALVORS (29 contract personnel and two C141 loads of equipment) arrived in-country. Work on the first cutting of the MECCA superstructure commenced on 29 May 1974. As soon as sufficient personnel and equipment arrived, a detailed survey of all ten wrecks blocking the canal was started. Heavy salvage craft including heavy cranes from Germany and heavy lift craft (YHLC'S) from Subic Bay, R.P.,were readied and commenced transit to the canal. The detailed survey and charting of all ten wrecks was completed in late July. EOD searches around each wreck and in two designated wet dump areas, one in Suez Bay and one in the Great Bitter Lake, were also completed using qualified divers from CTG 65.5. A dry dump area, on the east bank of the canal at KM 3, and a wet dump area, in the outer basin of Port Said harbor, were also designated by the SCA.

Table 1.

DESIGNATED VESSELS FOR SALVAGE REMOVAL

WRECK	POSITION	WEIGHT	LENGTH
ISMAILIA	Km. 6.40*	1500 tons	280 feet
SS MECCA	7.18	6700 tons	438 feet
BUCKET DREDGE NO. 23	72.00	1600 tons	191 feet
TUG MONGUED	81.50	1200 tons	165 feet
DIPPER DREDGE KASSER	81.50	1200 tons	125 feet
CONCRETE CAISSON	87.00	3800 tons	203 feet
CUTTER DREDGE 15 SEPTEMBER	98.20	2000 tons	200 feet
TANKER M/T MAGD	156.90	2400 tons	358 feet
TUG BARREH	158.00	1200 tons	165 feet
BUCKET DREDGE NO. 22	158.10	1200 tons	175 feet

*Measured from Km/0 at Port Said.

As work progressed on the MECCA and ISMAILIA, and more equipment and personnel arrived in-country, operations were conducted simultaneously at many points in the canal. Movements of two trim and rig teams, 80 ton SCA cranes, heavy cranes and heavy lift craft were orchestrated to take maximum advantage of the special capabilities of each craft or group. The general concept of operations was to employ the heavy cranes ROLAND and THOR in the northern section of the canal to lift MECCA and ISMAILIA sections to dry dump at KM 3, and to parbuckle DREDGE 23 at KM 71.9. YHLC's CRILLY and CRANDELL were first employed in the midsection of the canal removing TUG MONGUED, DREDGE KASSER, and DREDGE 23 to wet dump in the Great Bitter Lake. Heavy crane THOR arrived in Port Said after transit from Hamburg, Germany on 13 August 1974. The second heavy crane, ROLAND, arrived Port Said on 15 September 1974. The two YHLC's owned by the Navy, but operated by Murphy Pacific Marine Salvage, arrived Port Suez on 22 August 1974 after a 6,000 mile transit from Subic Bay R.P. Use of the YHLC's to lift and carry the wrecks in the midsection of the canal to the GBL wet dump area was paced by the earliest date Egyptian forces could dredge the earthen causeway at Deversoir to an acceptable depth and width.

Upon completion of the removal of all but one section of the MECCA (which required additional lightening) in the northern end of the canal, the heavy cranes proceeded south to lift the three wrecks blocking the channel near Port Taufiq. While cutting crews sectioned the tanker MAGD into two main pieces, the heavy cranes lifted the tug BARREH and DREDGE 22 to wet dump in the Suez Bay. They then double lifted the stern and bow sections of the

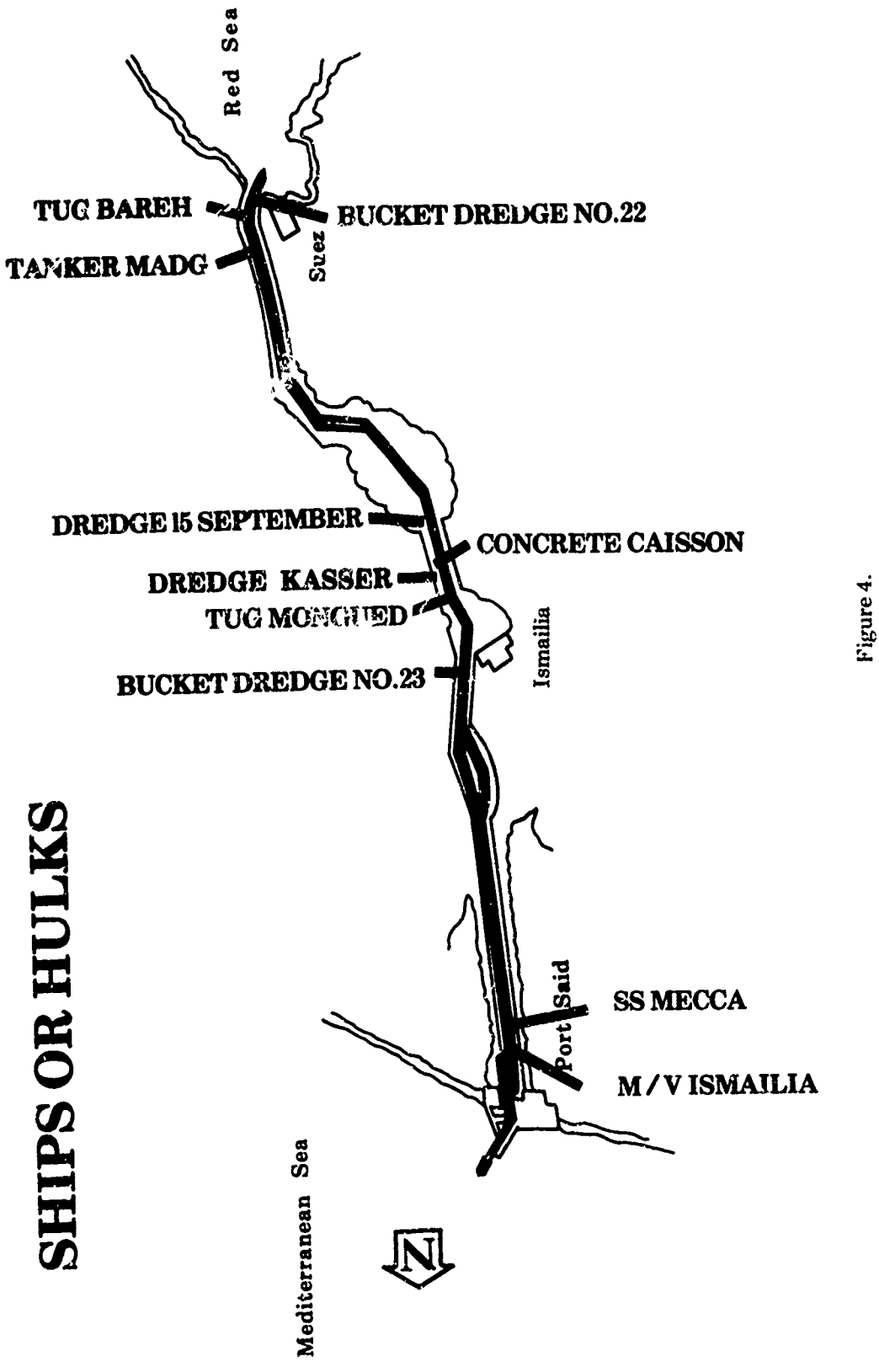

SHIPS OR HULKS
Red Sea
TUG BAREH
TANKER MADG
BUCKET DREDGE NO.22
Suez
DREDGE 15 SEPTEMBER
CONCRETE CAISSON
DREDGE KASSER
TUG MONCHED
BUCKET DREDGE NO.23
Ismailia
SS MECCA
Port Said
M/V ISMAILIA
Mediterranean Sea
N

Figure 4.

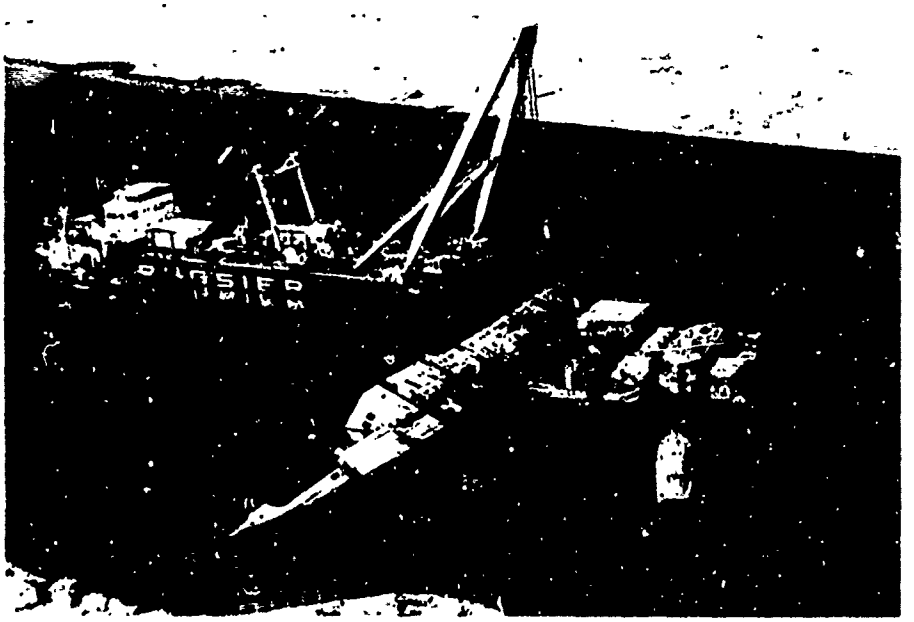
tanker MAGD to wet dump in mid-November. Having completed removal of the BARREH, DREDGE 22 and MAGD, the cranes proceeded northward to parbuckle and double lift the dredge 15 SEPTEMBER at the northern entrance to the Great Bitter Lake. This wreck was the only one whose rehabilitation was desired by the SCA. The heavy cranes then transited the canal northward removing the final section of the MECCA before taking departure for Hamburg on 19 December 1974.

In the center section of the canal the CONCRETE CAISSON at KM 87 had been cut in half for a planned ballasted lift of each section by the YHLC's. While rigging for the first lift in early October, the deeper section of the caisson settled further into the canal floor making a ballasted lift impractical. After additional cutting, five 150 ton pieces were removed from the top of the western half caisson section by means of the YHLC gantry cranes. After shuttling these sections to wet dump in the Great Bitter Lake, the YHLC's were used to conduct tandem stern gantry crane lifts of the remaining western section from its depression onto the normal canal bottom for later removal by the heavy crane THOR. The second eastern caisson section was then removed to wet dump using the YHLC side lift method. This completed work for the YHLC's and they left the canal area to return to upkeep and other duties as assigned.

SS MECCA. SS MECCA was a 6700 ton passenger ship 438 feet in length with a 60 foot beam. The ship had been sunk across the canal channel by explosive charges and rested on its starboard side. The bow was 10 meters from the western bank while the stern reached to within 55 meters of the eastern bank.

Salvage diver prepares for OXY-ARC cutting on hull of SS MECCA.

Salvage operations commenced on 29 May. The initial task was to remove the superstructure using oxy-arc and explosive cutting with lifts by an 80 ton floating crane. This was completed by 29 June. Initial problems with oil removal were solved by persistance and pumping. Explosive and oxy-arc cutting on the main hull continued through the summer with sections being removed by heavy cranes to dry dump at KM 3. Ten cuts were made dividing the wreck into 11 pieces for lift. Heavy lift cranes Thor and Roland made double lifts on three pieces as shown in Figure 5. In October when lifting the final section for the first time, one chain sling completely pulled through the section. It was decided to further lighten the section by removal of structure and machinery. Heavy cranes returned to lift the final section after operations were completed in the southern and central region of the canal. The final section of SS MECCA was lifted to dry dump on 18 December.



Heavy Crane THOR in position for lift of a section of SS MECCA.

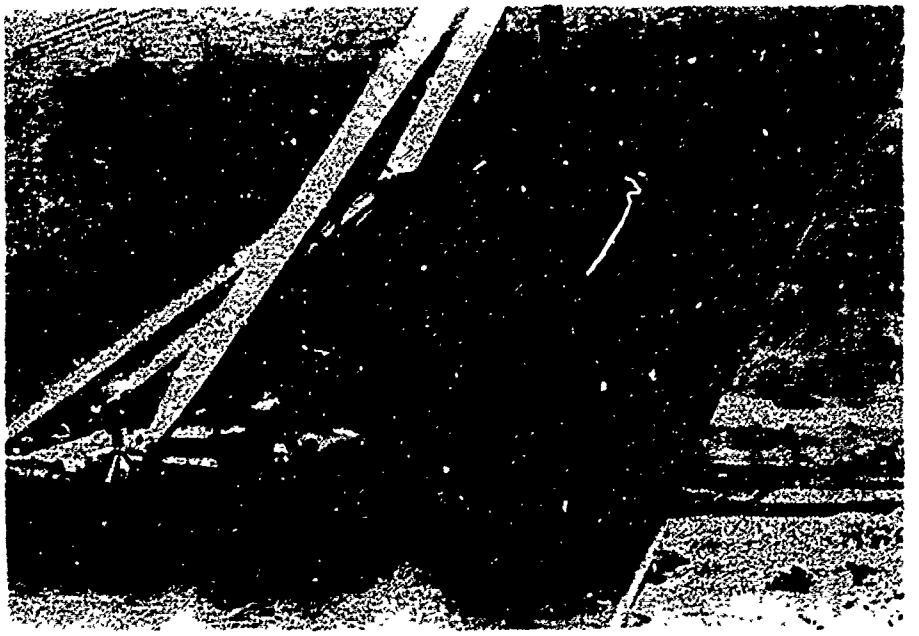
ISMAILIA. This small cargo ship weighting 1500 tons, length 345 feet, beam 44 feet, was scuttled by explosive charges and sunk across the channel axis at KM 6.4. She came to rest in an upright position in about 49 feet of water. The wreck was first cut into five 200 ton sections using explosive and oxy-arc cutting. This was completed on 28 June. Three lifts of sections to dry dump were made by heavy cranes in August. In October, final sections were removed to dry dump. The final section was dry dumped at KM 3 on 11 October 1974. This was the fourth wreck to be completely removed from the canal.

BUCKET DREDGE NO.23. DREDGE NO. 23, built in 1926 by the French, was a 1295 ton bucket dredge 191 feet long. DREDGE 23 had been sunk to block the canal once before during the 1956 conflict and had been salvaged and returned to dredging operations. This second time she was scuttled by explosive charges at KM 72. The wreck was lying on its starboard side on the west slope of the canal, oriented across the channel. Initial trim and rig on DREDGE 23 commenced on 6 September 1974. Early work included removal of Ladder and Buckets. On 29 September 1974, heavy cranes THOR and ROLAND parbuckled the dredge in preparations for lift by the YHLC's. YLHC's commenced lift operations on 5 October 1974. Three lifts were required before the dredge was finally placed in the wet dump area in Great Bitter Lake on 9 October 1974. This was the third wreck to be completely removed from the canal.

Figure 5. Heavy Cranes ROLAND and THOR double lift MECCA stern section.

TUG MONGUED. TUG MONGUED was sunk across the channel just south of Lake Timsah at KM 81.5. She lay upright, blocking the western side of the channel with her stern slightly on the western slope. The MONGUED weighed 1200 tons with a length of 165 feet and a beam of 32 feet. Trim and rig teams commenced work rigging messengers for YHLC lift on 4 August. The YHLC's were positioned for the first lift on 26 August 1974. A total of 4 lifts were required before she was placed in the wet dump area on 12 September 1974, in the Great Bitter Lake. This was the first wreck to be completely removed from the canal. Timing with the Egyptian dredging operation at the Deversoir causeway was critical. YHLC's waited in the canal, with TUG MONGUED slung beneath, for two days while the dredges completed cutting to the required fairway depth of 14.2 meters (46.9 ft.).

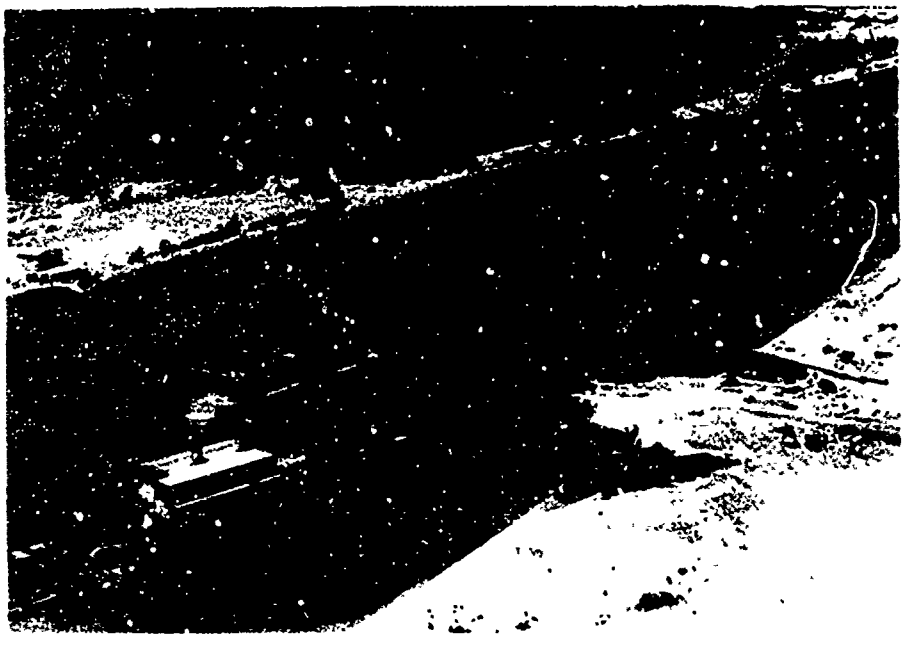
DIPPER DREDGE KASSER. The scuttled dredge KASSER, weighing 1200 tons, 138 feet long with a beam of 44 feet, lay suspended off the bottom by two spuds, the rock crusher and shovel. The wreck lay on a cross channel heading slightly southeast of the TUG MONGUED, blocking the eastern portion of the channel at KM 81.5. Parts of the upper rigging were above the waterline. Initial trim and rig began on 2 August. Work proceeded on removing spuds, shovel, and rock crusher and assorted riggings to prepare the dredge for lift by YHLC's. The YHLC's commenced lift operations on 14 September 1974. A total of three lifts were required before the dredge was placed in the wet dump area in the Great Bitter Lake, on 25 September. This was the second wreck to be completely removed from the canal.



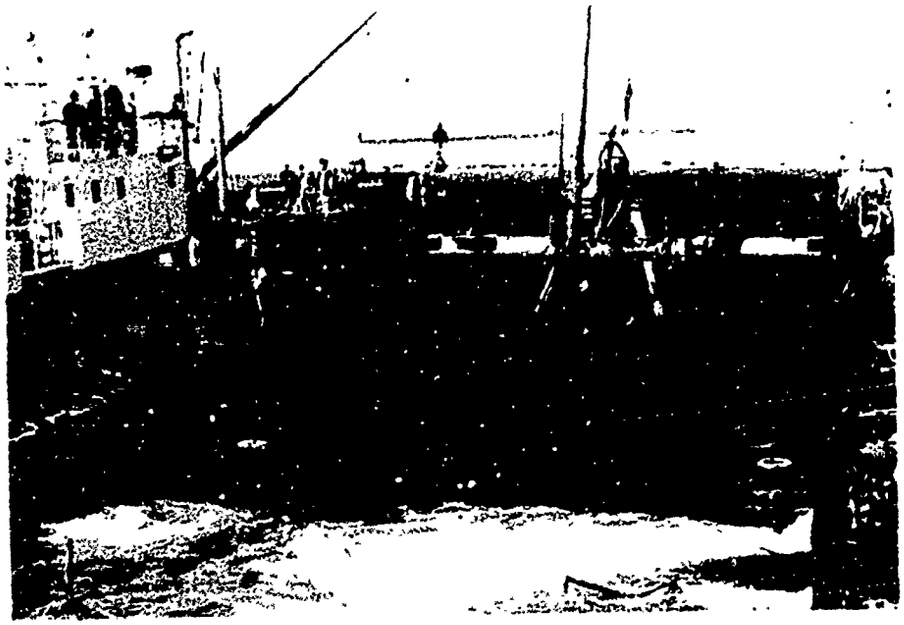
Heavy Crane THOR deposits bow of ISMAILIA adjacent to dry dump area at KM3.

YHLC's CRILLY and CRANDELL in position for lift of DREDGE 23.

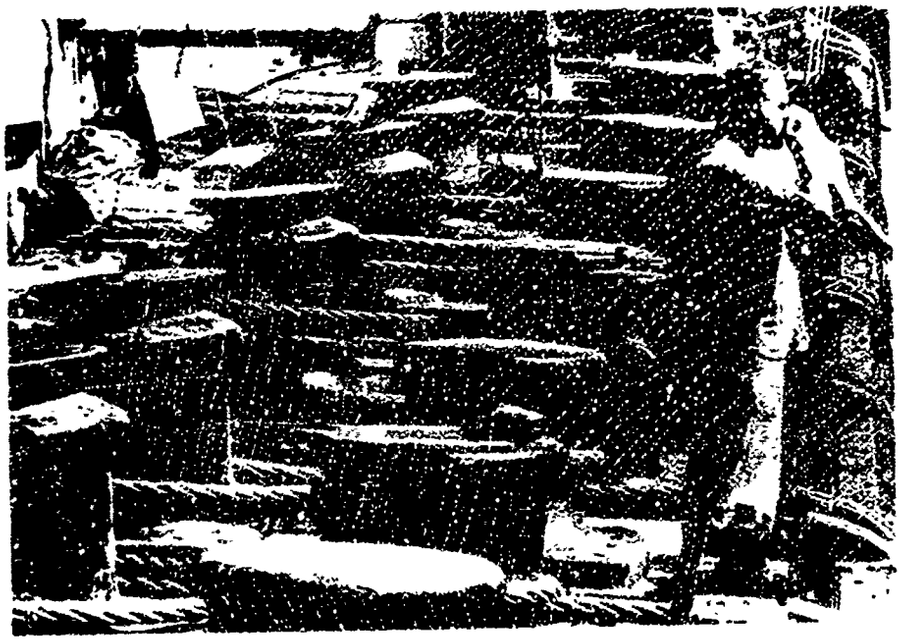
YHLC ballasted down for first lift of Tug MONGUED.



Dredging activity underway at the Deversoir Causeway Site.



YHLC's lifting Dredge KASSER

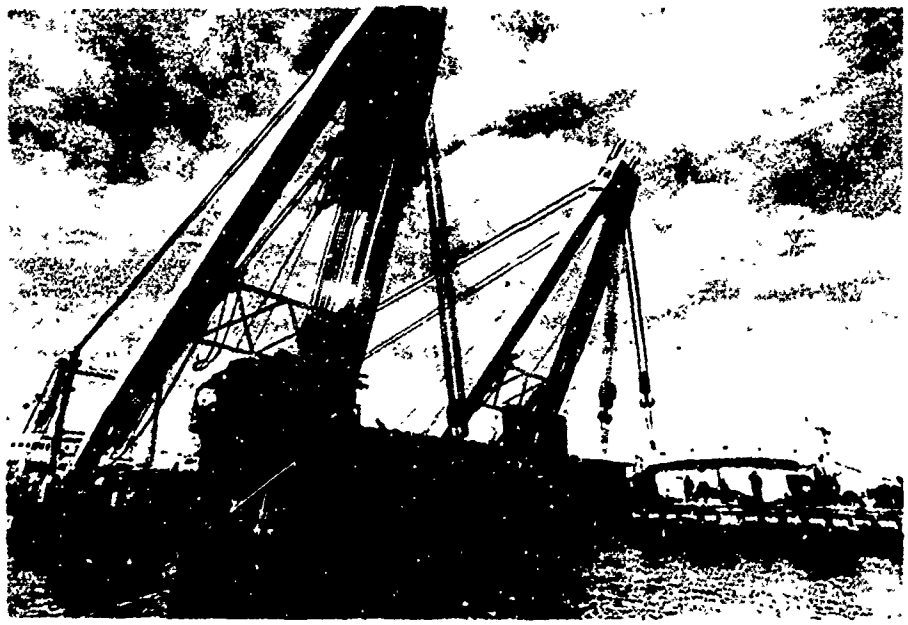


Lifting wires in place on YHLC for ballasted lift.

CONCRETE CAISSON. The CONCRETE CAISSON was a rectangular steel reinforced box-like structure 203 feet by 44 feet by 40 feet. The CAISSON had been scuttled by explosive blasting of the ballasting valves. It lay on its side, across the canal axis at KM 87. The structural integrity of the CAISSON and extent of any damage was initially difficult to determine as the structure contained a large amount of mud. The plan was to cut the CAISSON into two halves for lifts by the YHLC's. Explosive cutting was successful in removing concrete, but oxy-arc cutting was required to sever the extensive reinforcing rods. Much demudding was required. YHLC's were positioned for the first lift of the deeper section in late October. As lifting wires were passed and the YHLC's moored over the deeper section, the degree of scouring increased causing this portion of the CAISSON to settle further into the canal floor frustrating the utility of ballasted YHLC lift. The position of this section blocked further attempts to remove the second higher half. Cuts were planned to divide the upper portion of the western caisson section into smaller pieces of about 150 tons. Five such pieces were removed by the YHLC's utilizing their stern gantry cranes. After shuttling these smaller pieces to wet dump in the Great Bitter Lake, the YHLC's returned for tandem lift, again using the stern gantry cranes, on the lightened deeper section. The deep section was removed from its settled position to the normal floor of the canal close by on 23 November. The YHLC's commenced work on the higher eastern section and, using the ballast method, lifted it to wet dump on the Great Bitter Lake. The lift crane THOR then removed the western section to wet dump on 20 December. This was the last wreck to be completely removed from the canal.

YHLC's positioned over the Concrete Caisson during first lift attempt.

DREDGE 15 SEPTEMBER. The DREDGE 15 SEPTEMBER was scuttled without the use of explosives at KM 98.2. Inspection of the 2000 ton, 200 foot long dredge revealed no major structural damage. The dredge was lying on its port side parallel to the axis of the channel. Rig for parbuckle by heavy cranes commenced on 9 November. Following lightening, the heavy cranes ROLAND and THOR rigged for a double lift in an attempt to salvage the dredge for Egyptian authorities. Significant patching and dewatering was required during the course of the salvage operation. On 6 December the wreck was clear of the canal and turned over to the SCA for futher restoration. This was the eighth wreck to be completely removed from the canal fairway.



DREDGE 15 SEPTEMBER being salvaged by Heavy Cranes.

TUG BARREH. The 1200 ton, 165 ft. long tug BARREH was lying upright on the western slope of the channel at KM 158. The stern remained above water. Although purportedly scuttled by explosive charges, inspection after some demudding in the trim and rig phase, revealed the charges had not detonated and structural damage was minimal. Following rigging to prevent the tug from slipping into deeper water the wreck was double lifted by the heavy cranes ROLAND and THOR. The wreck was placed in the Suez Bay wet dump area on 8 November, the sixth obstruction to be cleared from the canal.

BUCKET DREDGE NO.22. The BUCKET DREDGE NO. 22 was explosively scuttled at KM 158. The 1200 ton, 175 foot long wreck was capsized on an eastern portion of the center channel. Trim and rigging of the wreck commenced on 15 October. The dredge was righted on 27 October and lifted by heavy cranes on 3 November. The dredge was wet dumped in the designated dump area in Suez Bay on 4 November. This was the fifth wreck to be completely cleared from the canal.

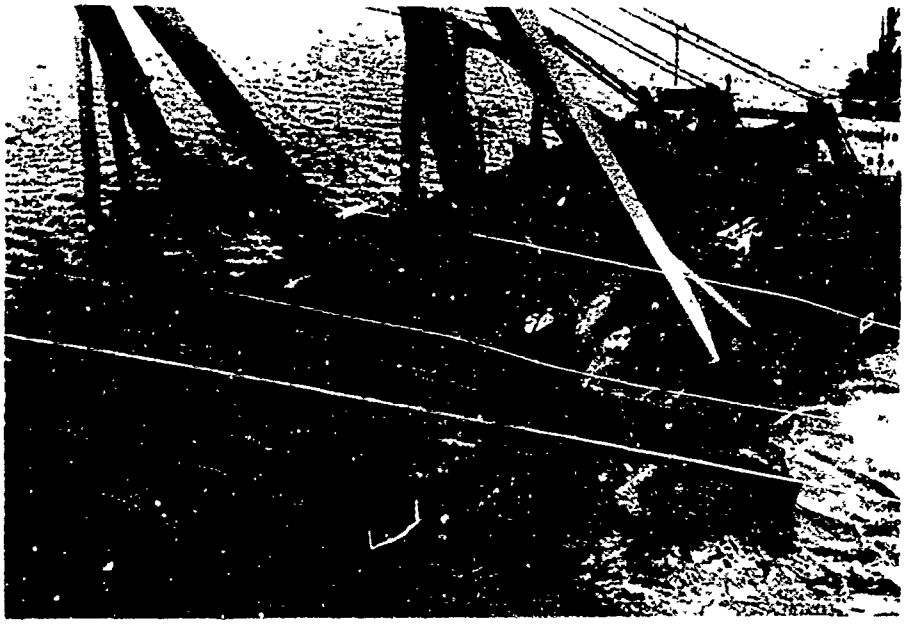
TANKER MAGD. The 358 foot long, 3200 ton tanker MAGD lay on its starboard side in line with the canal axis at KM 156.9. Plans were initiated to remove the superstructure and cut the tanker into two sections. On 6 November explosive and oxy-arc cutting on the major hull cut was completed and the stern section rolled 15 degrees toward a vertical position. The heavy cranes ROLAND and THOR double lifted the after section of the tanker to wet dump on 14 November. The heavy cranes then rigged for parbuckle and then lift of the forward section. The forward section was wet dumped in the Suez Bay designated dump area on 23 November. This was the seventh wreck to be completely cleared from the canal.

NIMBUS MOON WATER

GENERAL PLAN. As stated in Chapter I the mission of Operation NIMBUS MOON WATER was to advise and assist the Government of Egypt in clearing unexploded ordnance from the entire length of the Suez Canal, its anchorages, approaches and contiguous waters. The execution of the mission was carried out by a joint effort of forces from four nations: The United States, Great Britian, France, and Egypt. As in all other aspects of the canal clearance

operation, safety of personnel was paramount. All forces cooperated under the coordination of CTF 65 to design and execute a thorough search of the target area and effect destruction of all unexploded ordnance detected.

DREDGE 15 SEPTEMBER after salvage



Tanker MAGD being lifted by Heavy Cranes THOR and ROLAND.

TRAINING. Since U.S. Forces were limited to an advisory and assistance role, with strict prohibition against diving operations on ordnance items, an intensive training program to develop A.R.E. Navy Forces diving capabilities and underwater EOD capabilities was the initial step required. This training commenced on 21 April during the time NIMBUS STAR operations (minesweeping) were being carried out. This training was a parallel effort to that conducted by Army advisors in NIMBUS MOON LAND but smaller numbers of Egyptians were trained and the emphasis was on underwater operations. Qualified instructors from EODGRU TWO provided classroom and practical diver training. Instructors from NAVEOD SCHOOL, Indian Head, provided training on EOD, including detection, identification, and disposal. Following training, Egyptian divers were integrated with U.S. EOD advisors and organized into functional units. At the same time, U.S. personnel from NAVEODFAC, Indian Head, Maryland, were intensively testing the sonar search and navigation systems to be employed in order to develop operational techniques which would yield the highest probability of detection and localization of unexploded ordnance (UXO's) targets for diver investigation and disposition. Tests were conducted in CONUS and on site in the canal. Additional detail on both sonar and navigational trails and diver methods is provided in Chapter IV on Technical Methods and Equipments.

USN EOD personnel train A.R.E. Navy divers at Port Said.

DOUBLE SWEEP CONCEPT. Forces available for Operation NIMBUS MOON WATER were composed of three British minehunters, a British Fleet Clearance Diving Team, a French Diving Team with support ships, Egyptian EOD diving groups, and a U.S. water clearance group with EOD personnel, side scan sonar, magnetometer and precision navigation capabilities. In most canal areas, with the exception of the Great Bitter Lake and certain harbor areas, sonar search using either the British minehunting sonar or the U.S. Forces 100 KHZ side scanning sonar was effective in object location along the bottom of the canal below the 8 meter contour. Tests conducted by U.S. EOD personnel showed that the only effective means of searching the canal slopes above the 8 meter contour to the high water mark was complete search by divers. This was also the case in certain harbor areas where jetties and piers limited sonar performance. This multinational assemblage of capabilities was divided into task groups and each group accepted areas of responsibility for search and clearance. To assure a thorough search of the canal it was agreed that each area of the canal would be searched at least

twice by separate groups. Daily reporting by each task group of areas searched, contacts located and contact disposition was established. Task group progress and further assignment of area responsibilities was coordinated by CTF 65. The basic plan called for thorough search by either sonar or divers as applicable, visual inspection of all potential ordnance contacts, and identification and destruction of ordnance items. Non-ordnance items were marked or plotted for follow on removal by the SCA. Magnetometer search was conducted in areas where water conditions degraded the effectiveness of sonar performance in contact detection. A multiple search was conducted in areas where high concentrations of ordnance were found during the first two searches. Magnetometer search was conducted in areas where water conditions degraded the effectiveness of sonar performance in contact detection. A multiple search was conducted in areas where high concentrations of ordnance were found during the first two searches.

CONDUCT OF OPERATIONS. In this section a narrative description of the area of responsibility, methods used and chronology of operations is discussed by major task groups. Additional detail on technical methods and equipment is provided in Chapter IV.

British Water Clearance Group (TG 65.2). Forces in this task group consisted of three minehunters HMS WILTON, MAXTON, and BOSSINGTON with support ship HMS ABDIEL, and the Fleet Clearance Diving Team. Each minehunter was equipped with advanced minehunting sonar and an integral EOD diving group. The Fleet Clearance Diving Team consisted of 14 divers and operated independently from the minehunters utilizing the Egyptian vessel NADA, provided by the Suez Canal Authority, as a support platform.

The minehunters were assigned to search and clear the entire floor of the canal between the 8 meter contours, and assigned approaches and anchorages. The three vessels commenced operations in Port Said harbor on 7 April working southward along the canal. By 25 June HMS WILTON had transited Deversoir at KM 97. Minehunters continued southward completing the canal channel proper early in September. From September to October, the British units searched and cleared the extended anchorages in Suez Bay and Port Said. In October HMS MAXTON and WILTON conducted a third search in the vicinity of El Kantara and south to Lake Timsah in areas where high ordnance densities had been observed in the first searches.

The basic search and clearance method used by the minehunters was to anchor the ship at both the bow and stern and commence a 360 degree search using the minehunting sonar. Search was conducted in overlapping sectors at selected frequencies to maximize location and classification of contacts. If a contact was detected, divers were vectored to the contact to identify the object and, if found to be an ordnance item, effect disposition by the most suitable method. After completing one area, the minehunter would move on to the next set such that acoustically searched areas would overlap in order to maximize probability of detection.

The Fleet Clearance Diving Team (FCDT) was initially assigned to search and clear the area along the Canal West Bank slope from the 3 to 8 meter contours. An independent group of Egyptian EOD divers were assigned to the East Bank slope over the same depths. Working southward from Port Said, the FCDT completed the west slope coverage by 8 July. They were then assigned to assist the Egyptian team in clearing the remainder of the east slope. FCDT operations on both banks were completed early in September and the team was retrograded out of country. The basic search method employed was a jackstay search with spacing based on visibility. Contacts were indentified and disposition taken as appropriate for ordnance items. Most ordnance items were countercharged in place.

French Water Clearance Group (TG 65.8). French forces joined TF 65 on 20 June 1974. Initial assigned assets included support ships, GARDINIA and GIROFLEE and 17 EOD trained divers (two officers & 15 enlisted). French forces were initially assigned to search and clear all unexploded ordnance from Port Said to Ismailia. Upon completion of this task the French forces assumed the additional responsibility of clearing the same depth areas of the canal slopes southward from Ismailia to Port Taufiq.

This task was completed by mid September. Units of Task Group 65.8 conducted search and clearance of unexploded ordnance in harbor basins around Suez Bay in late September and October. In early October GARDINIA and GIROFLEE were relieved by AJONC and LILAS. French forces were also employed to conduct a recheck (third search) of the canal slopes (both banks) from the high-water mark to the bottom break working northward from KM 160 until they met a group of independent Egyptian EOD divers searching the same depth zones southward from KM 134. This was an area of very intense fighting and this third search was felt warranted to insure the most thorough degree of clearance possible. This task was completed on 30 October as French and Egyptian divers met at KM 150.

Fleet Clearance Diving Team personnel from TG 65.2 clear ordnance from the canal slopes.

French EOD divers then commenced a recheck (third search) of the canal slopes (both banks) from the high-water mark to the bottom break working southward from KM 10. This effort commenced on 2 November and was completed in mid December when French EOD divers met with Egyptian divers (who had been working northward from Lake Timsah) at KM 35. Search methods employed by French divers were essentially the jackstay diver search pattern, with spacing based on visability.

In mid November French minehunters CERES and CALLIOPE with the support ship LORIE arrived in-country to augment AJONC and LILAS. These minehunters commenced a complete recheck of the canal channel floor working southward from KM 12. This check search was completed on 21 December.

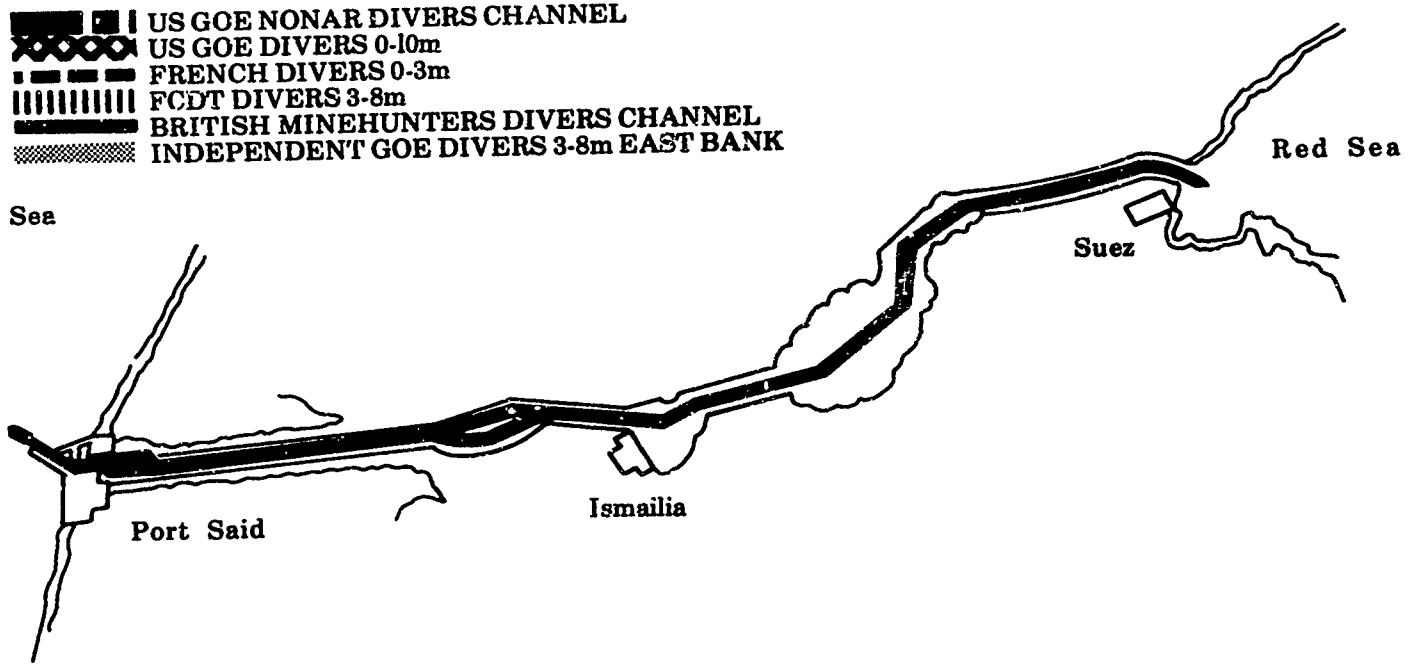
U.S. & Egyptian Water Clearance Group (TG 65.5). This task group was composed of U.S. Navy EOD personnel, U.S. Navy Navigational Aid Support Teams, search analysis specialists, and Egyptian EOD trained divers. Using assets supplied by the SCA, a sonar search boat, a buoy implantation boat, a magnetometer search boat and a diver support barge were outfitted. U.S. personnel conducted precision sonar and magnetometer search operations, and marked contacts with buoys. Following extensive training by U.S. EOD personnel at Port Said, Egyptian divers with U.S. advisors were divided into teams to do the required diving, contact evaluation and disposition of unexploded ordnance.

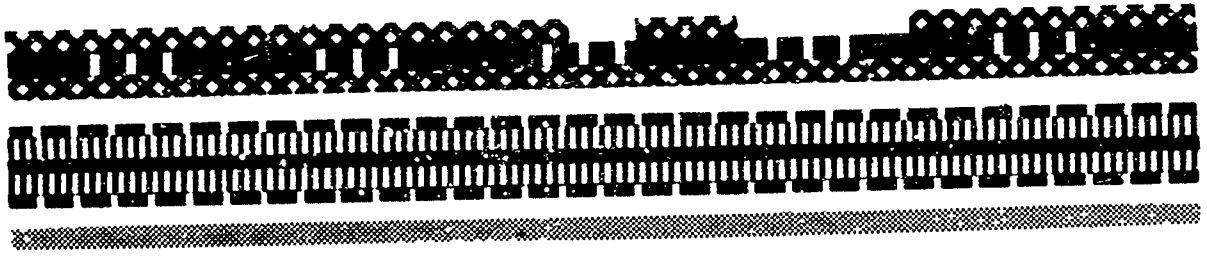
French EOD Divers of TG 65.8 at work searching and clearing ordnance from the canal slopes.

TG 65.5 commenced search and clearance operations in early May at the Southern terminus of the canal at Port Taufiq working North. Sonar search with follow-up diving on contacts located was carried out on the bottom of the canal below the 8 meter contour. Divers searched the entire canal slopes on both banks from the high-water mark to the 10 meter contour. Sonar search was completed northward to Deversoir and slope and bottom diving clearance was completed North to KM 117, the lower end of the Great Bitter Lake, by late July. Throughout this period, diving operations were hampered by approximately 1-4 knot tidal currents. Diving was limited to periods of slack or near slack water. In August 1974, TG 65.5 shifted operations to Port Said. Commencing with a complete search and clearance of Port Said Harbor and some approach areas, the task group moved South down the canal. Sonar search to Deversoir was completed in early October with diver follow-up on all contacts completed to this same point by late November.

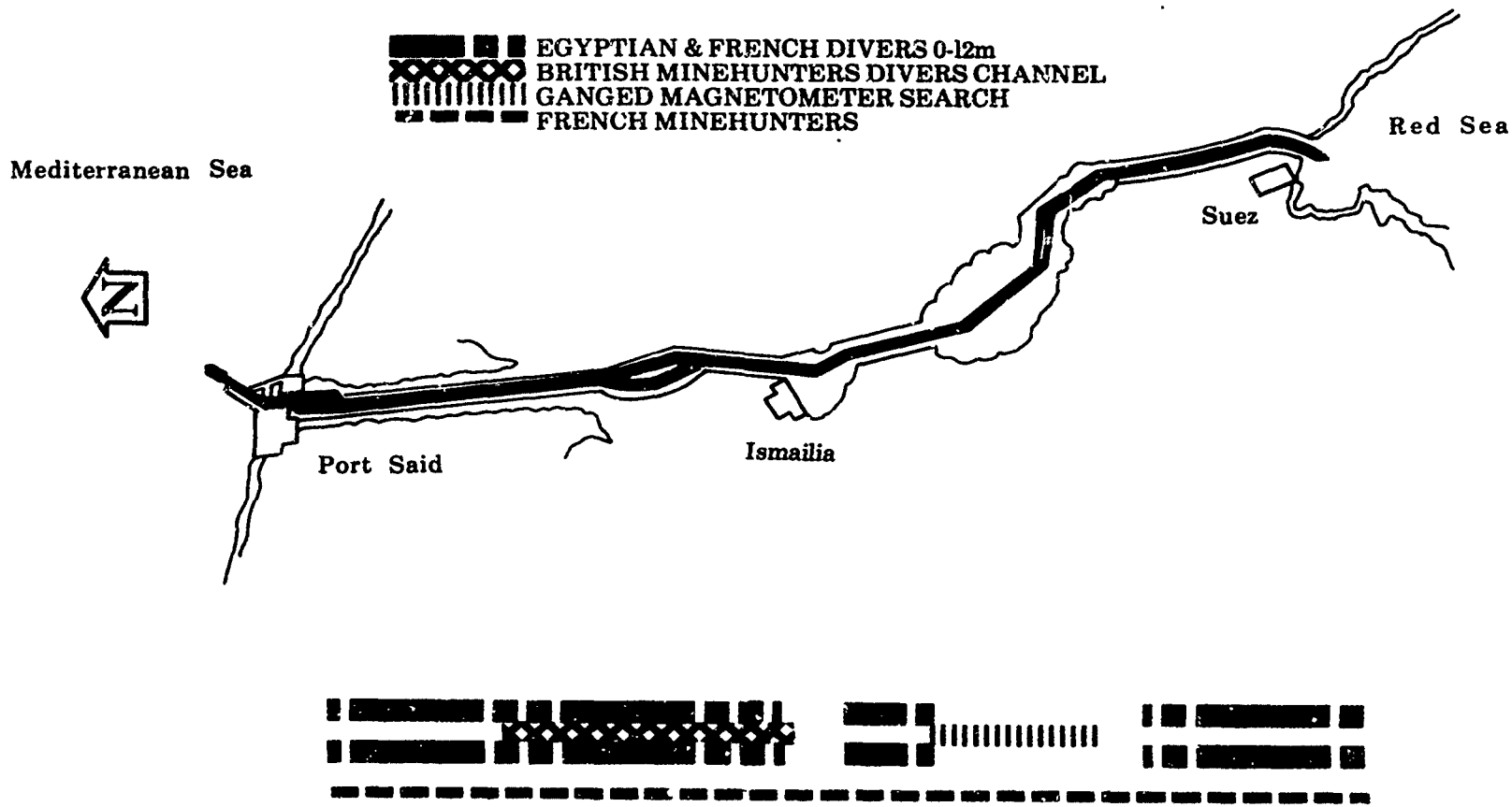
The basic clearance method used by TG 65.5 was a highly integrated three step operation. The sonar search boat towing a 100 KHZ Klein side scan sonar with precision navigation from a Cubic DM 40 navigation system first ran a series of tracks down the canal channel designed to insure a high probability of sonar coverage and object detection. Sonar contacts were evaluated, positions computed and local X-Y coordinates developed so that the buoy implantation boat could position a marker on each contact. Buoys were accurately positioned using the same Cubic navigation system. EOD divers then followed up on each contact in the channel using either circle line search or jackstay search patterns. Divers identified and disposed of unexploded ordnance. Slope areas were searched by divers using the jackstay method. When the density of sonar contacts in the channel was high, the entire channel was also searched by the jackstay procedure. This was the case, for example, over the area from KM 67 southward through Lake Timsah to Deversoir at KM 97. The entire sonar and diver search, evaluation of contacts and final degree of clearance, was subjected to a continuing daily evaluation by civilian contractor personnel assigned to the task group. The overall combination of sensor, navigation, divers and analysis was considered a balanced search system. Additional details on sonar methods, equipment, and effectiveness, and details on the search analysis and navigation system employed, are provided in Chapter IV.

MOON WATER - PASS 1 & 2





MOON WATER - PASS 3 & 4



In addition to the acoustic sensors system, TG 65.5 also employed magnetometer sensor systems to search for ordnance-like contacts. During August and September, continuing trials were made using a single towed magnetometer both in the Port Taufiq area and in the Northern stretches of the canal. The presence of large amounts of scrap ferrous material in the canal and the extensive use of sheet pile in the banks frustrated the use of a magnetometer in the canal proper to distinguish ordnance contacts from the large amount of metal debris in a manner to permit reasonable diver follow up effort. Further magnetometer search in the canal proper was abandoned.

A special ganged magnetometer was developed and tested in CONUS. This system arrived in-country in early October. It was used to conduct precise navigationally controlled search of the Great Bitter Lake channel and anchorage area. The Great Bitter Lake had proved a difficult area for effective sonar search due to the presence of very saline bottom water layers. Based on initial search data, the ganged magnetometer system proved very effective at detecting and localizing magnetic contacts in the Great Bitter Lake. However, the initial area searched indicated a very large number of ferrous contacts would be found in the Great Bitter Lake, possibly as many as ten thousand. Diver investigation of initial contacts identified no UXO's. Initial diving also identified the magnitude of several problems as follows: (1) In most areas of the lake, ferrous contacts were buried in the sediment. Search with a Mark 10 detector or probe was required. (2) In a significant portion of the lake, this difficulty was compounded by the very dense high salinity layer which covered the bottom. Divers needed to wear up to fifty five pounds total weight in order to penetrate this layer. Once in the layer, visibility was zero and contacts were again buried in soft sediment. The odor of hydrogen sulfide was very strong and if water entered a divers facemask, eye and nasal passage irritation was immediate. (3) With the large amount of weight required, divers had to be tethered for safety. The combination of circle search line, buoy line, tether, zero visibility, and no communication with the surface, created a hazardous situation for open circuit scuba equipped divers. (4) Information provided by BUMED indicated the observed dissolved hydrogen sulfide level exceeded recommended safety limits.

USN EOD Advisors with A.R.E. Navy EOD Divers preparing for a Jackstay Search.

The combination of a potentially high number of non-ordnance contacts due to ferrous litter present, plus the extreme diving difficulty, dictated a reevaluation of methods to effect further clearance of this portion of the Great Bitter Lake. It appeared at that time that hard hat diving on all of the magnetic contacts in the area of interest in the Great Bitter Lake would require many months of effort with little return in actual clearance of ordnance items. Ganged magnetometer search was continued to confirm the high density of ferrous contacts in the area. Diving follow-up on contacts within the contaminated high salinity and soft silt layers was suspended pending completion of further investigations. The Suez Canal Authority experimented with mechanical means of mixing or dispersing the layer in late October. These attempts were abandoned and the SCA finally opted to use a net drag sweep through the area prior to future dredging operations. Further magnetometer search was also terminated. Additional details on the magnetometer systems are provided in Chapter IV under "Technical Methods and Equipments."

Independent Egyptian Divers. A.R.E. Navy EOD Clearance divers, working from the Egyptian Navy Salvage ships MAX and DEKHELA, searched and cleared ordnance from the entire length of the canal on the east bank from the 3 to 8 meter contour. They also countercharged many contacts in the fairway located by British Minehunters. This diving group consisted of 12 officers and 45 enlisted personnel. Starting in early May from Port Said, they worked southward reaching the terminus of the canal at KM 160 on 28 August.

Cluster of projectiles rigged for countercharging.

During the month of September they searched both slopes of the canal over the 0-12 meter depth contours from Lake Timsah south to Deversoir.

In October, the group started at KM 134 and worked southward searching both slopes of the canal 0-12 meters until they joined the French forces at KM 150. This completed the third search of the southern portion of the canal. On 2 November this group started searching north from KM 78 as the French forces started south from KM 10, both groups searching 0-12 meters on both banks of the canal. When these groups met at KM 35 early in December, the third check search of the slopes was completed.

A.R.E. Navy divers employed standard jackstay and circle line search patterns. Equipment used was open circuit scuba with wet suit protection as required. Daily diving duration was governed by visibility, current, and water depth. Ordnance contacts identified were either countercharged in place or removed ashore for disposal using standard EOD methods.

CONTACTS AND DISPOSITION

The multiple searches of the canal proper, searches in the basins of Port Said and Suez Bay, and in associated approaches and anchorages, located over 8500 unexploded ordnance contacts. Included in these contacts were many lots of small arms ammunition, in excess of 25,000 rounds, recovered from intact containers, barges, trucks, tanks, armored personnel carriers and other vehicles. From the aspect of total explosive weight removed, all items found were overshadowed by the contents of one sunken barge which contained over 175 tons of unexploded ordnance.

A.R.E. Navy divers removing ordnance from a cluster found in shallow water.

About 7500 ordnance contacts were located in the canal proper. Table 2 illustrates the percentage of each category of ordnance for these items. A very high percentage of the ordnance was located on the canal slopes, vice the channel, with the density increasing toward the shallower water. Aproximately 74% of all ordnance items in the canal were found in water shallower than six meters as illustrated in Figure 6.

About 15% of the items found in the canal were small bomblets. In most cases the observed distribution indicated defective containers or improper deployment. A high percentage of ordnance items found was in clusters of 10 or more items of the same type indicating accidental or intentional dumping. For example, 250 anti-personnel mines were found in one spot on the Eastern Canal slope near the hulk of an overturned boat. The total number of ordnance items located per kilometer is shown in Figure 7. These totals include ordnance found in clusters. The general distribution of ordnance correlated directly with areas along the canal where fighting was the heaviest during the period of conflict. As discussed in a preceding section, three or more separate searches were conducted in high density areas. Figure 8 shows the total number of items located per kilometer less clustered items. The comparison of these two graphics, coupled with the fact that most ordnance was located in less than six meters of water, shows

that relatively little ordnance found its way to the canal channel proper with most being intentionally or accidentally dumped in the shallow margins.

Table 2.

APPROXIMATELY 7,500 UNEXPLODED ORDNANCE ITEMS FOUND WITHIN CANAL PROPER

TYPE	APPROXIMATE PERCENT OF TOTAL
Bombs	(less than) 1
Rockets	5
Anti-Tank Mines	6
Projectiles	8
Mortars	11
Anti-Personnel Mines	11
Bomblets	15
Miscellaneous*	43

*Included in miscellaneous are such items as grenades, scare charges, demolition charges, and unit lots of small arms ammunition in excess of 25,000 rounds recovered from containers and vehicles.

Most of the ordnance found in the canal either had not been armed, or was fired but was dud. Some ordnance was buried and some undoubtedly still is, particularly near the banks where sand from shore embankments has been pushed or had fallen into the canal.

Explosives are still being thrown into the canal for fishing purposes in unknown numbers. Every operational task group observed and documented explosives being thrown into the canal primarily by A.R.E. Army personnel. The use of explosives in proximity to task force divers were an obvious safety hazard, however, the fact that these actions were observed throughout task force operations is indicative of a more widespread problem. Task Group Commanders also reported finding groups of very new, unused small ordnance items (such as RPG-7's) close to the waters edge in the canal that appeared to have been very recently and intentionally thrown in the water.

Figures 9 and 10 illustrate by type and total the ordnance items located in the basins of Port Said harbor, the basins and ports in Suez Bay and the major anchorage areas searched, both off Port Said and in the Suez Bay. Included in these figures are the tabulation of non-ordnance items located in each general area. Of note is the high density of non-ordnance contacts in the Suez Bay Anchorages compared with the very low number of ordnance contacts. Table 3 breaks down the total of approximately 100 ordnance items found outside the canal proper by major category.

Over 700 non-ordnance items were located in the overall Canal clearance as shown in Table 4. In addition, a very large amount of scrap metal, wire rope chain, concrete blocks and other debris was located. The Suez Canal Authority worked steadily to extract these mechanical items from the canal using salvage divers and floating cranes. Over four large loads were removed from Port Said harbor alone.

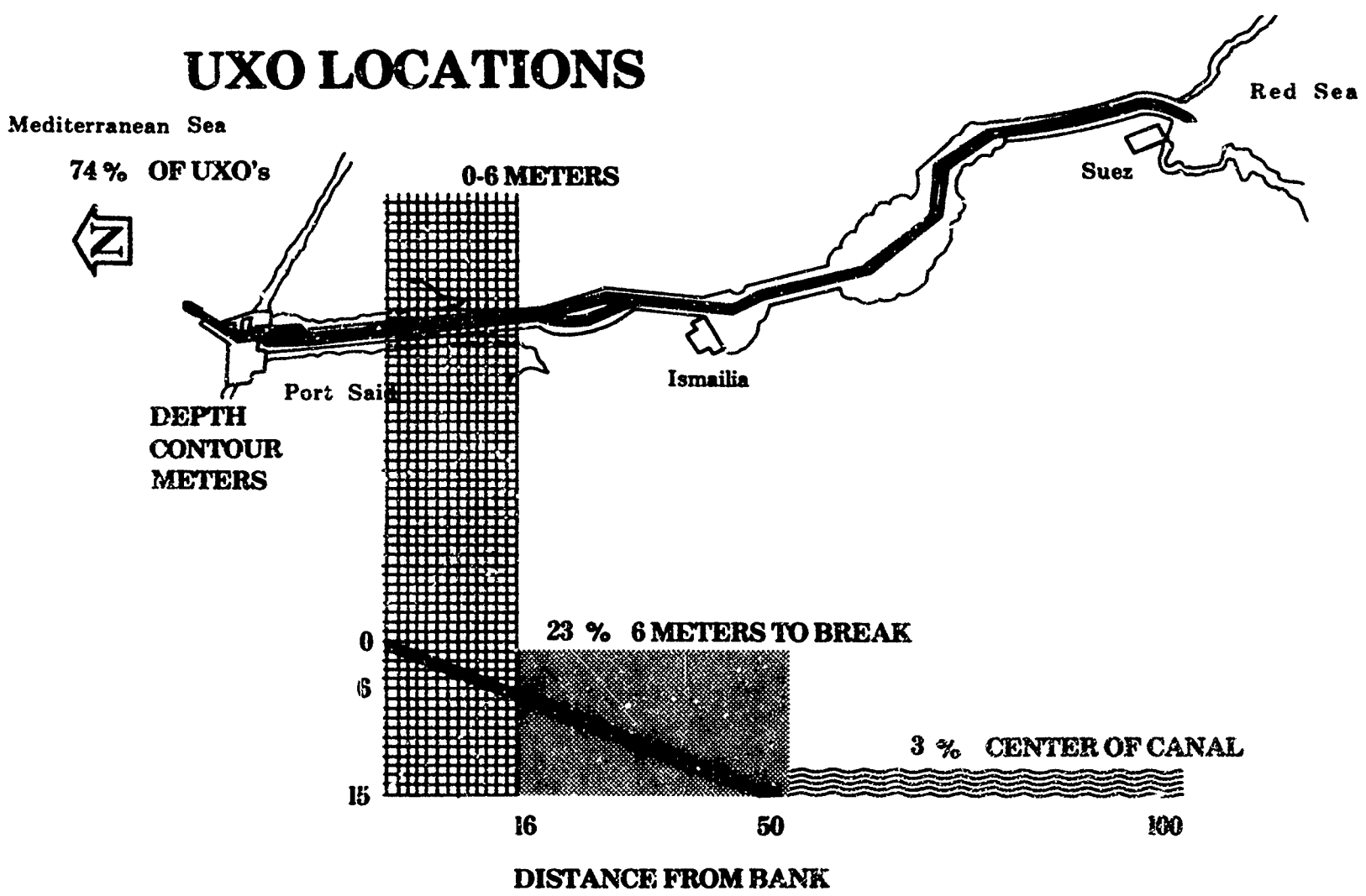

UXO LOCATIONS
Mediterranean Sea
74 % OF UXO's
0-6 METERS
Red Sea
Suez
Ismailia
Port Said
DEPTH
CONTOUR
METERS
0
6
15
23 % 6 METERS TO BREAK
3 % CENTER OF CANAL
16
50
100
DISTANCE FROM BANK

Figure 6.

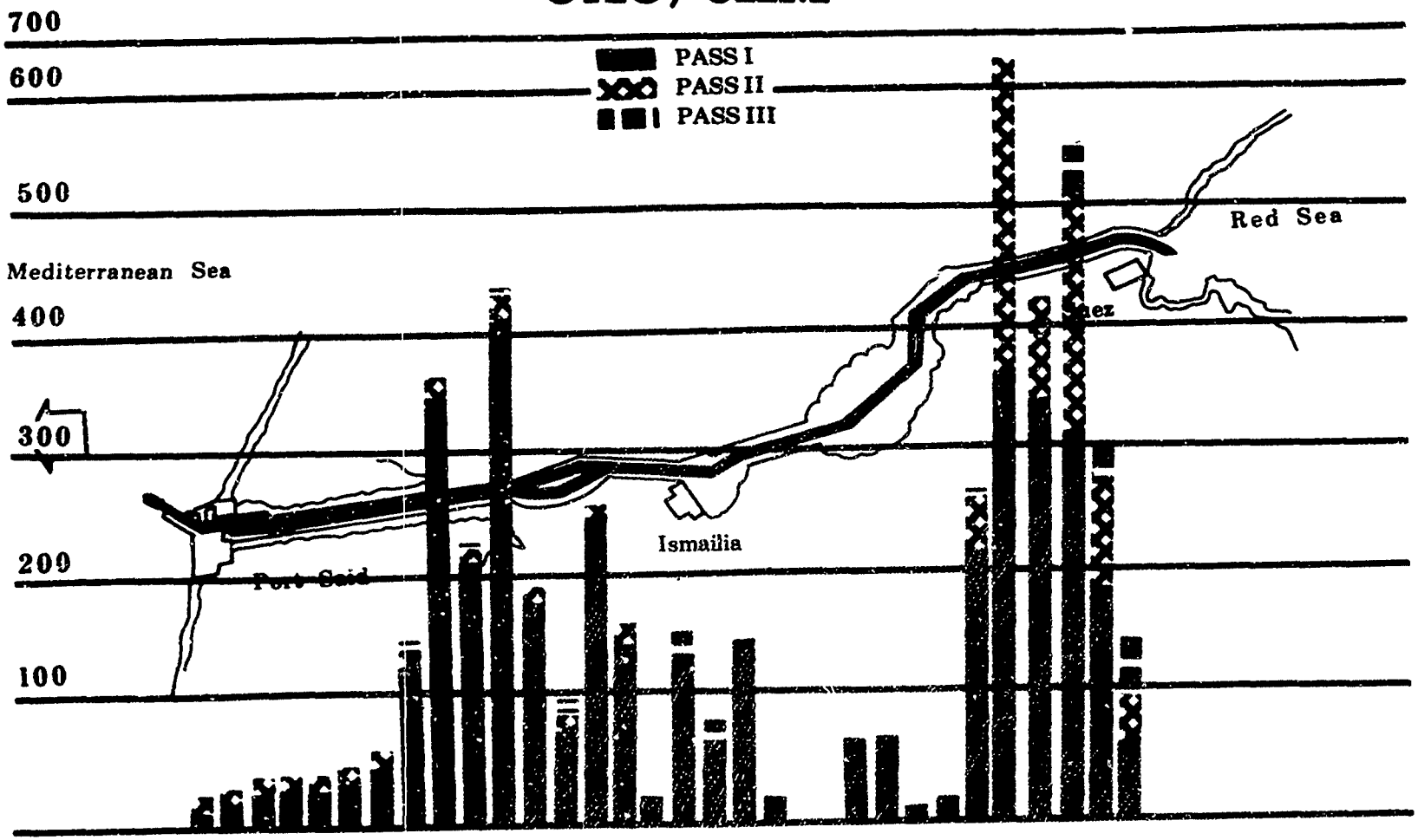

UXO/5KM
700
600
500
400
300
200
100
PASS I
PASS II
PASS III
Mediterranean Sea
Red Sea
Ismailia
Port Said

Figure 7.

UXO/ 5KM LESS CLUSTERS

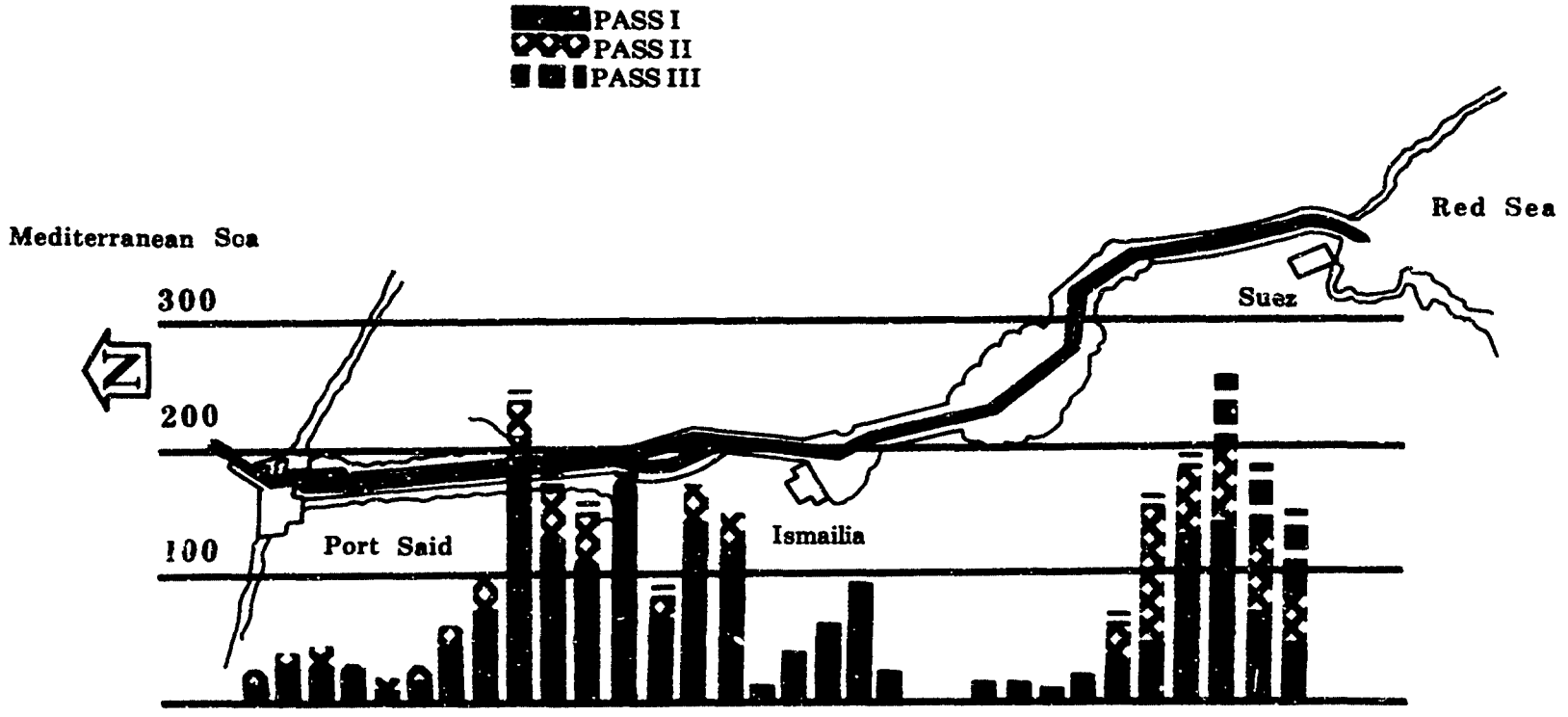


Figure 8.

Underwater photo of a typical cluster of ordnance items found.

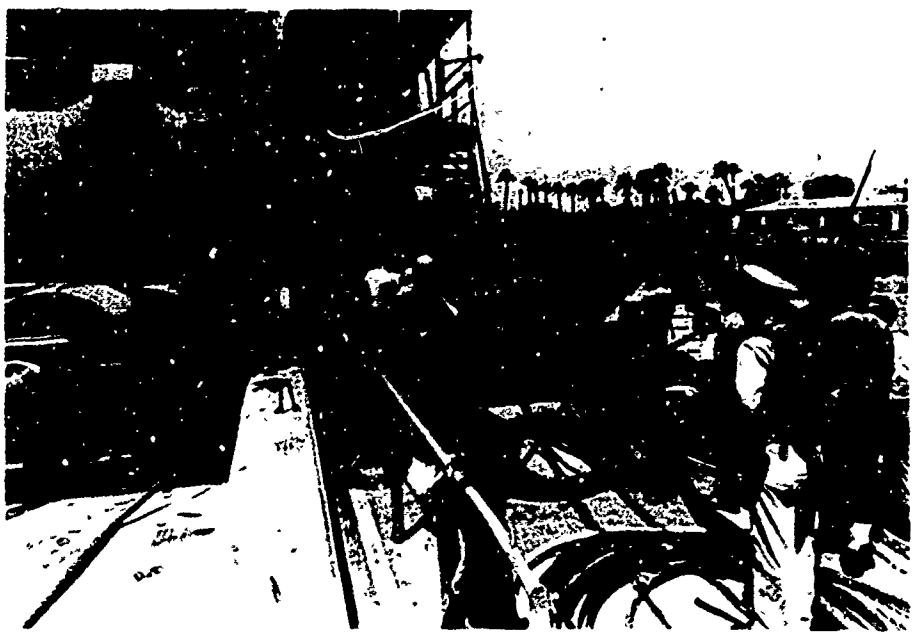
US Marines from USS INCHON join A.R.E. Navy Honor Guard in a ceremony at the Tomb Of The Unknown Egyptian Sailor.

RELATED TASK FORCE ACCOMPLISHMENTS

An unstated but equally important mission of U.S. components of Task Force 65 was to build, through individual and group contact, positive Egyptian American relations, enhancing trust between our respective peoples. This obligation was carried out in the finest tradition by our Soldiers, Sailors, Airmen, and Marines throughout the span of Task Force 65 operations.

On 6 June, President Sadat visisted CTF 65 operations in Port Said and officially recognized in a speech "our people can cooperate together for the benefit of peace and prosperity."

On 6 June, a detachment of U.S. Marines from USS INCHON participated in a joint U.S. Egyptian memorial ceremony at the tomb of the unknown Egyptian Sailor in Alexandria.



Fire fighting party from USS BARNSTABLE COUNTY LST 1197 battles fire on Suez Canal Authority Dredge.

On 18 June when a massive fire broke out aboard an Egyptian cargo ship moored in Alexandria harbor, USS INCHON (LPH-12) provided a fire fighting assistance team to assist local authorities. In the afternoon-long assault on the fire in engineering and cargo spaces, a U.S. Navy third class hospital corpsman was personally responsible for saving the lives of three Egyptians overcome by smoke inhalation.

On 5 August a major fire broke out on a large Suez Canal Authority dredge moored at a shipyard at Ismailia. A 44-man fire fighting team from the USS BARNSTABLE COUNTY (LST-1197) came to the aid of Egyptian firemen. Within 40 minutes the fireparty had extinguished the fuel fed fire, saving the vessel. Suez Canal Authority personnel praised the 'marvelous cooperation' between Americans and Egyptians and expressed their appreciation for the assistance.

At the Task Force dispensary in Ismailia, a U.S. Navy doctor and two corpsmen made it a practice to help local citizens who came requesting emergency medical attention. A U.S. Marine Sargeant provided translation assistance and much goodwill was established between the U.S. Forces and the local population.

The Suez Canal Authority requested technical advice on the latest developments in oil spill clean up and recovery. Information on U.S. research and available systems was provided. To continue this technical communication on environmental matters a dialogue was established between the SCA and the Office of the Oceanographer of the Navy. It is hoped that this will foster a long-term positive relationship.

In late July, the SCA requested CTF 65 assistance in conducting a detailed bathymetric survey of sections of the canal. Major silting, (bank slumping) and destruction of navigational aids were potential problems for planned SCA dredging of the canal following Task Force 65 clearance operations. Precision depth indicating equipment was obtained, and starting in mid-September, U.S. personnel worked jointly with Egyptian counterparts from the SCA to collect the much needed data. Results of this cooperation were of significant importance toward optimized dredging and hence timely reopening of the canal to world trade.

At Ismailia Task Force 65 forces conducted themselves while ashore in a most commendable manner throughout the operations. Personnel were invited to several social and entertainment events sponsored by Egyptian authorities. The multinational gatherings promoted further the spirit of cooperation and friendship fostered by daily working side by side.

Overall, these many opportunities to interact, shared with pride by the men of Task Force 65, have contributed significantly to the strenghtening of U.S. Egyptian relations and is a direct assist to peace and stability in the Middle East.

Crew members of the USS BARNSTABLE COUNTY "Man The Rail" in honor of Egyptian President ANWAR EL SADAT. The President (in white boat) was touring Lake Timsah, on the Suez Canal, to study the canal reopening efforts.

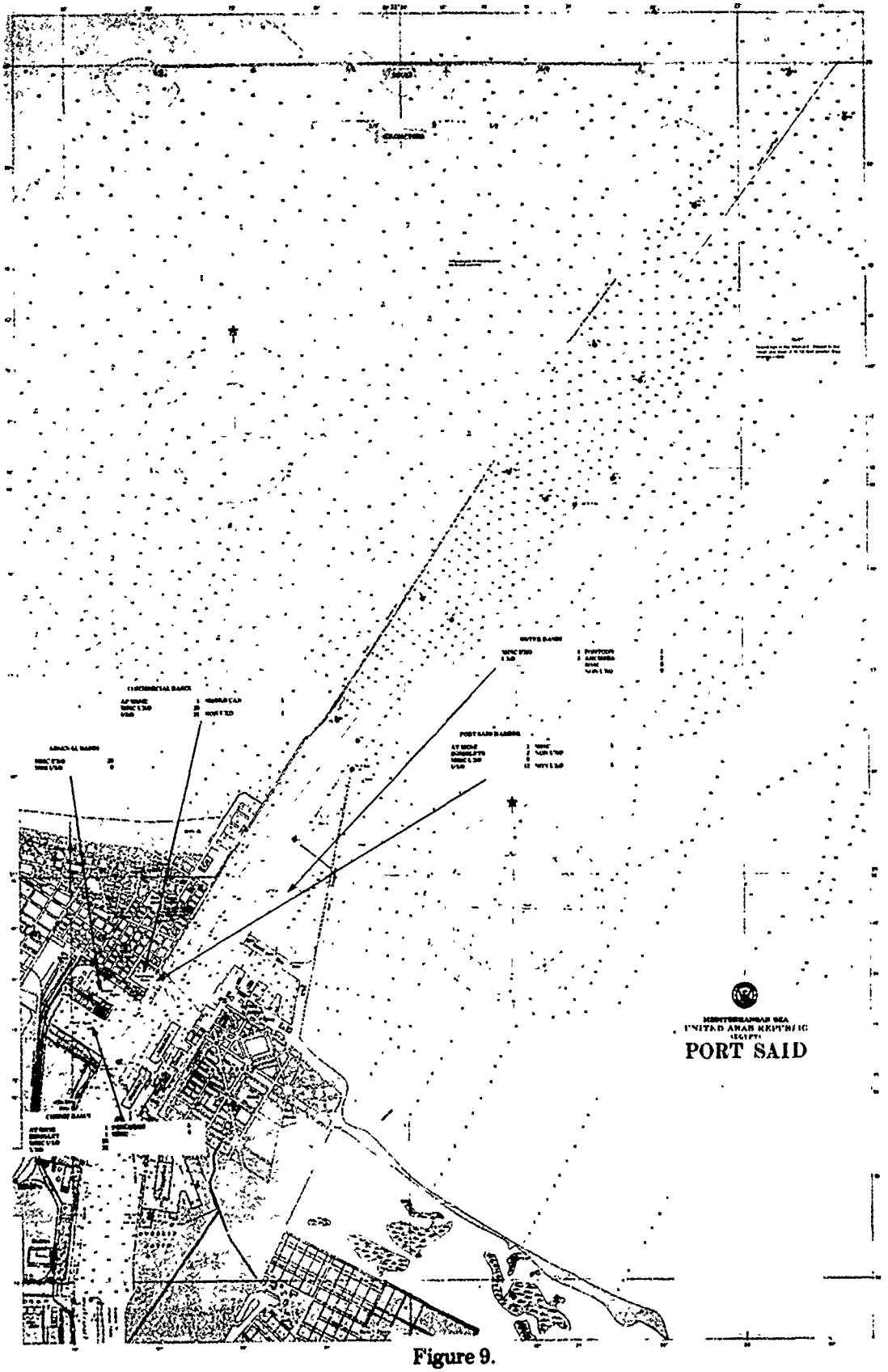


Figure 9.

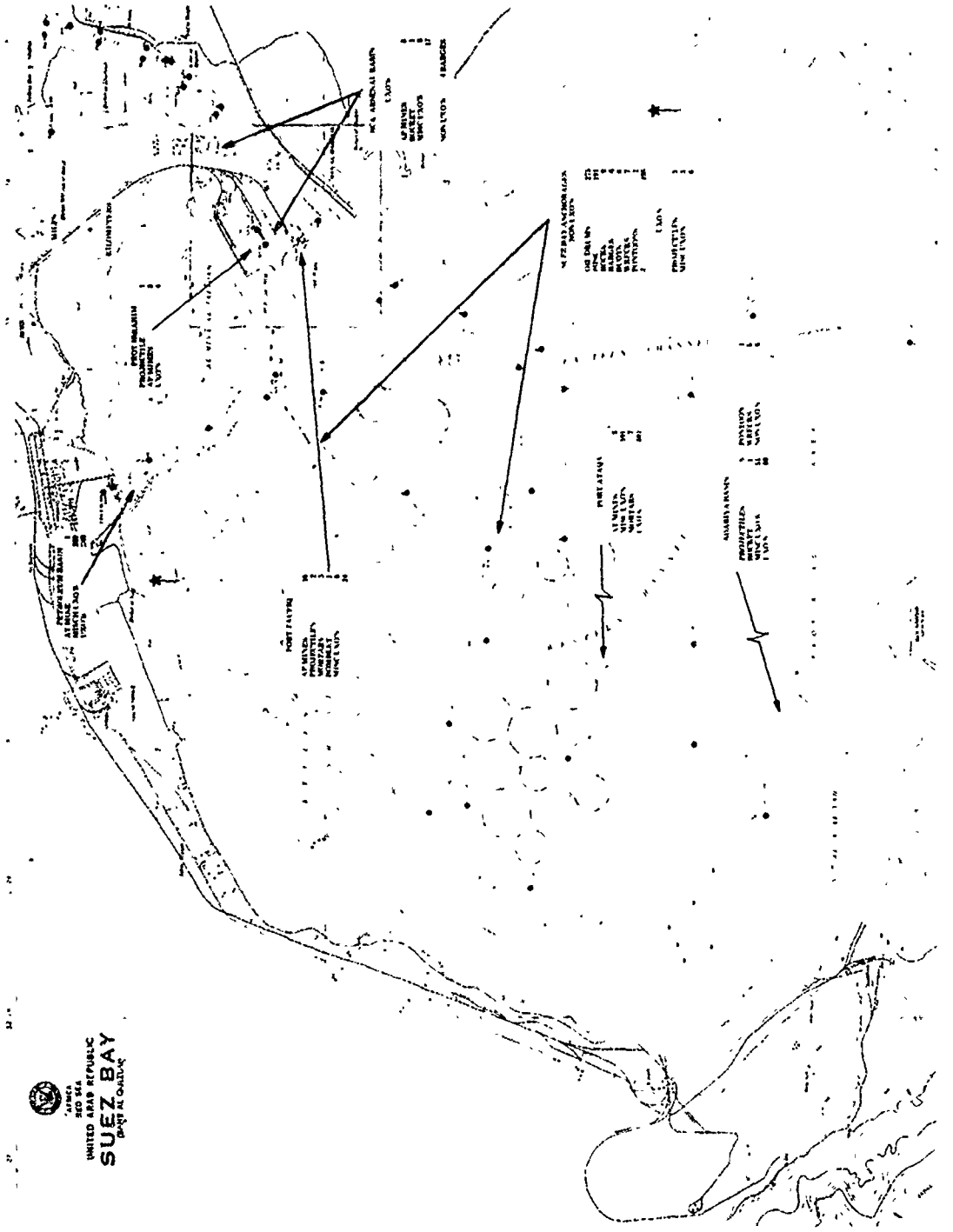


Figure 10.

Table 3.

APPROXIMATELY 1000 UNEXPLODED ORDNANCE ITEMS
FOUND IN HARBORS, BASINS AND ANCHORAGE OUTSIDE OF CANAL

TYPE	NUMBER
Bombs	0
Anti-Tank Mines	6
Anti-Personnel	22
Rockets	2
Mortars	12
Projectiles (75 mm)	14
Bomblets	4
Miscellaneous	1011
TOTAL	1071

Table 4.

APPROXIMATELY 700 MAJOR NON-ORDNANCE ITEMS LOCATED

ITEM TYPE	WITHIN CANAL* PROPER	OUTSIDE CANAL IN HARBOR BASINS AND ANCHORAGES
Pontoon Bridge Sections	105	13
Trucks	14	0
Amphibious Vehicles	19	0
Tanks	8	0
Boats and Barges	80	22
Navigational Aids	74	13
Large Anchors	40	3
Aircraft Wreckage	14	1
Oil Drums	38	244
TOTALS	392	296

*as of 15 November 1974.

NIMBUS MOON WATER EQUIPMENT

The following is a list of equipment turned over to the A.R.E. Navy and/or the Suez Canal Authority by the U.S. Navy as a gift from the United States to the Government of the Arab Republic of Egypt.

Item	Unit Cost	Number	Total Cost
Twin Bottle Open Circuit Scuba	$180.00	48	$8,640.00
Scuba Regulators	100.00	48	4,800.00
HP Air Compressors	1,575.00	12	18,900.00
Face Masks	9.90	58	574.20
Wet Suits	188.00	83	15,604.00
Swim Fins	15.00	58	870.00
40HP Evinrude Outboard Engines	800.00	10	8,000.00
TOTALS	Various	317	$57,388.20*

*Added to the $118,432.00 worth of equipment provided the Arab Republic of Egypt at the conclusion of NIMBUS MOON LAND gives a total equipment gift of $175,820.20 in support of the extensive training conducted.

Chapter III

LOGISTIC SUPPORT

INTRODUCTION. At the onset of Task Force 65 operational planning, it was established that all in-country operations would be austere from the standpoint of logistic support. It was agreed that the Suez Canal Authority (SCA) would provide messing, berthing and vehicular transportation for all Task Force 65 personnel ashore. Medical, Supply, Cargo Handling, Communications and Aircraft Support were provided by a combination of U.S. Army, Marine Corps, Navy and Air Force assets from many different commands both in Europe and CONUS.

FACILITIES. The Suez Canal Authority was tasked by agreement to provide messing, berthing and office facilities for all personnel billeted and working ashore. It is important to note that as the operation commenced, these facilities had to be developed as quickly as possible in an area which had extensive war damage and had been abandoned by the civilian population for over seven years. Requirements for messing, berthing and office space existed in Port Said, Ismailia and Port Taufiq. Billeting for transiting personnel, arriving and departing by commercial air, was required in Cairo. Resources to achieve minimal levels, by western standards, of messing and berthing were extremely limited.

PORT SAID. Billeting and messing was accomplished by SCA contract arrangement with local hotels. Operational space was provided in the SCA port authority complex. A local SCA representative was designated to deal with their contractors and provide such other coordination as requested. A U.S. medical corpsman was positioned to monitor sanitation. U.S. forces could exercise no direct control over contractor performance. Facility habitability, food quality and sanitation were continual problem areas, but steady improvements were realized during the course of operations. The local water supply never reached minimal acceptable standards. At the peak of operations over 100 U.S. personnel were billeted ashore in Port Said. This number included U.S. Army, Navy, and Air Force personnel and civilian personnel from the Murphy Pacific Marine Salvage Company under contract to the Supervisor of Salvage.

ISMAILIA. Ismailia was the hub of TF operations. Office space was provided in the SCA Headquarters building for CTF 65, staff, and liaison officers from the British, French and Egyptian Navies and the U.A.R.E. Army. Existing private villas were converted into quarters, and messes established using a contracted catering service based in Cairo. Direct contact with senior SCA officials was established to influence contractor performance. Office facilities to support the Supervisor of Salvage and COMFAIRMED DETACHMENT Ismailia, were provided in other local buildings. A building was provided for dispensary, and hangar runway facilities were provided for fixed and rotary wing aircraft operations. Overall, habitability conditions in Ismailia were better than at any other operational site. Water quality, although not consistantly meeting western standards, was considered safe over most of the period of operations. Daily monitoring of messing and berthing being provided insured a continued, all be it slow, improvement over the period of operations. Rate of improvement was hampered by the real lack of in-country resources and by the fact that the contract caterer, one of the best quality in-country, did not need the business. Self help projects to upgrade habitability were instituted by Task Force personnel whenever possible. At the peak of operations over 120 personnel were quartered in Ismailia. Office facilities ranged from marginal to very good.

PORT TAUFIQ. This small city, located at the southern terminus of the canal, had been almost totally demolished during the conflict. Berthing was provided in an SCA building with messing provided by an SCA contract with the one existing local hotel. Sanitation and the level of public health was the worst experienced in any major operating area. Water quality and sewage facilities never met U.S. standards.

Despite continued monitoring, food quality and handling was marginal. For extended periods personnel in this region subsisted on C-rations. Improvements were made, but local customs and a very real lack of resources precluded major change. At the peak of early operations over 60 U.S. military and civilian personnel were quartered in Port Taufiq. Later in the operational period, U.S. personnel again returned in numbers to Port Taufiq. A new arrangement for messing, using a field kitchen staffed by a catering service as in Ismailia, improved greatly the food sanitation standards and reduced the risk to U.S. personnel.

CAIRO. In Cairo the SCA provided a block of rooms in a local hotel to provide temporary lodging for transiting personnel. Incoming personnel were met at the airport by SCA expediters who provided much needed assistance through customs and baggage claim. Their continued expert service was a significant plus in personnel movement into country. A small CTF 65 representative detachment was maintained in Cairo at the U.S. Embassy. Their function will be discussed separately.

FACILITIES SUMMARY. By directive, TF 65 agreed to utilize host government provided messing and berthing facilities ashore. It is important to note that the Egyptian Government and particularly the Suez Canal Authority, worked extremely hard to provide task force personnel western standards of facilities. They were forced by circumstances to start providing this support in a severely war devastated environment where potable water, electric power, sewage treatment and refrigeration were at a premium. Continuous cooperation and close monitoring resulted in messing and berthing considered extremely limited and austere, but certainly optimal considering available resources and knowledge of western standards of living, health and sanitation. The host government was justifiably proud of the support provided.

LESSON LEARNED. On-site inspection and evaluation of proposed messing and berthing facilities by specially trained environmental preventative medicine teams and qualified personnel from NAMRU-3 in Cairo should have been carried out before agreements were made on messing and berthing. Any agreement should have contained some provision for strong U.S. influence over mesing and berthing conditions in the area of sanitation and public health.

SUPPLY SUPPORT. On 12 April 1974, C 130 aircraft arrived in Ismailia carrying COMFAIRMED command post personnel and equipment. Although in the course of operations personnel were rotated into this unit from CONUS, the command post, designated CTG 65.4, was the artery of the task force logistically. From initial deployment to final retrograde, COMFAIRMED support was an essential element in successful mission completion. CTG 65.4 handled all cargo, mail, personnel movements, coordination of SCA provided vehicles, monitoring and allocation of FT funds, and command support for the dispensary at Ismailia.

FOREIGN CURRENCY ACCOUNT. COMNAVSEASYSCOM authorized CTF 65 use of Foreign (FT) Currency Account. This fund totalled 200,000 United States Egyptian Pounds (approximately $360,000 U.S.). Accounting and custody of the FT Account was the responsibility of the Disbursing Officer, Navy Medical Research Unit, Cairo. Pertinent CTF 65 directives established responsibility within the Task Force for signature authority, accounting and usage policies. Obligations essentially fall within three major categories:

a. Commercial airline reservations for personnel to, from and within Egypt.
b. Per Diem entitlements in Egypt.
c. Local purchase of materials essential for Suez Canal Clearance Operations.

Task Group Commanders were encouraged to utilize the FT Account whenever feasible.

CARGO. Following the massive initial staging of C-5 aircraft into Cairo and overland staging into Ismailia, regular C-130 re-supply flights were set up between Naples and Ismailia. A cargo handling detachment from NAVCHAPGRU at Cheatham Annex, Virginia, handled

Suez Canal Authority headquarters building bordering Lake Timsah, Ismailia, Egypt.

incoming and outgoing cargo. VERTREP capability was established using CH 46 helicopters with the CTF 65 flagship anchored in Lake Timsah. Cargo was distributed to task force operation areas at Port Said and Port Taufiq by truck and helicopter airlift. Smooth cargo flow was interrupted by the drain on aircraft resources brought about by the CYPRUS incident in July - August 1974. Backlogged cargo in Naples was expedited by additional C-130 aircraft flights as available assets increased following the incident. Cargo incoming via commercial air to Cairo was land transported to Ismailia for further distribution.

MAIL. Due to the widely diverse number of commands providing personnel for NIMBUS STAR/MOON and NIMROD SPAR operation, mail was arriving from many European areas and CONUS. Task force mailing address was not identified until after D-Day and a subsequent change was made. All mail, including that from CONUS via FPO New York, was being staged out of Naples on C-130 flights to Ismailia. Due to these factors, mail deliveries and pickup was irregular with lack of deliveries up to a week not uncommon. To alleviate this impact on morale, better promulgation of the correct task force address was achieved and CONUS mail via FPO New York was staged directly by commercial air carrier into Cairo. Three scheduled deliveries per week were achieved with terminal distribution out of Ismailia by helo to Port Said and Port Taufiq.

PERSONNEL. Initial arrival of personnel was by special mission aircraft into Cairo and by fleet units attached to CTF 65. Further deployment and rotation of personnel was made using the regular scheduled C-130 flights Naples to Ismailia and also by commercial air into Cairo. Extensive use of FT funds was made to purchase commercial air tickets and minimize expenditures of programmed fleet assets.

FLAGSHIP LOGISTIC ROLE. Personnel aboard the CTF 65 flagship USS BARNSTABLE COUNTY (LST 1197) and her relief, USS BOULDER (LST 1190), anchored Lake Timsah, were a major element in the total number of personnel assigned TF-65. In addition to normal re-supply staging for consumables used by CTG 65.7 civilian contractor personnel aboard the heavy lift cranes ROLAND and THOR and the two YHLC's. The flagship also provided secure communications which will be discussed separately.

TRANSPORTATION LOGISTICS

SURFACE TRANSPORTATION. All ground transportation was coordinated by CTG 65.4. By agreement, the SCA was to supply vehicles as assets would permit to move personnel and equipment within the canal zone and to and from Cairo. Considerable daily coordination was required to meet requirements. While host country vehicle assets were adequate in number, maintenance and repair were continual problems due to limited in-country resources. Heavy duty trucks, mini-buses and jeeps were in marginal condition when assigned. When repairs were required, replacement vehicles were extremely scarce and repair slow. Regular shuttle-bus service to Cairo was initiated and proved successful in transporting personnel, mail and light equipment.

Port Said Harbor with SCA Building in the foreground.

AIR TRANSPORTATION. Commencing in April 1974, with the start of operation NIMBUS STAR, two successive helicopter squadron detachments with CH-46 aircraft,were assigned ashore as TG 65.3. The primary mission of the helicopter detachments was MEDEVAC SAR stand-by, daily 0700-1900, with a 15-minute alert to reaction time. This period was established to blanket the hours when field operations were prohibited since the

canal zone was designated a free-fire area at night by Egyptian Authorities. TG 65.3 secondary missions included daily logistic runs, to dispersed units, VIP, Public Affairs, personnel transfers and utility support to all members of TF 65. TG 65.3 also provided for a daily CTF 65 Air Operations Duty Officer responsible to CTF 65 for the scheduling, clearing (via Egyptian Authorities) and control of all U.S. flight operations within the canal zone. This Air Operations Officer also served as airborne MEDEVAC coordinator.

Initial helo support forces ashore in the canal area consisted of two U. S. Marine Corps CH-46 aircraft, 8 officers and 21 enlisted men from HMM 162 deployed aboard USS INCHON. The detachment was shore based at Ismailia. On 2 August, the Marine detachment from HMM 162 was relieved by U. S. Navy HC-6 Detachment 9, deployed from NAS Norfolk, Virginia. HC-6 Det 9 deployed with two CH-46 aircraft, 6 officers and 21 enlisted.

Daily scheduled flight operations included at least one logistic flight from Ismailia to Port Said to Ismailia. Personnel, mail, movies and cargo were transported to and from these locations on a scheduled basis. As required, when incoming C-130 flights brought cargo destined for CTF 65 flagship, helo transfer of necessary cargo between Ismailia airfield and the flagship was accomplished by internal helo transshipment or VERTREP. The VERTREP capability proved very beneficial to overall task force mission accomplishment permitting rapid transfer of perishable stores from the C-130 to the flagship at a period when local Egyptian Army maneuvers, plus the Cyprus incident, precluded a normal scheduled underway replenishment for the flagship off Port Said. Air temperatures at the airfield during this period exceeded 100 degrees F. Much damage to perishable stores could have resulted without the rapid delivery capability.

MEDEVAC drills were held throughout the course of operations, without warning, with seven and eight minute reaction times recorded. One actual MEDEVAC took place on 12 September with reaction time of 6 minutes. MEDEVAC aircraft was on site waiting for the patient when transferred to shore at Deversoir. Helicopter services were provided to SCA technical engineers to permit them to evaluate the overall damage to navigation aids along the canal and to familiarize SCA Chief pilots with changes which had occurred in bank and flow configuration.

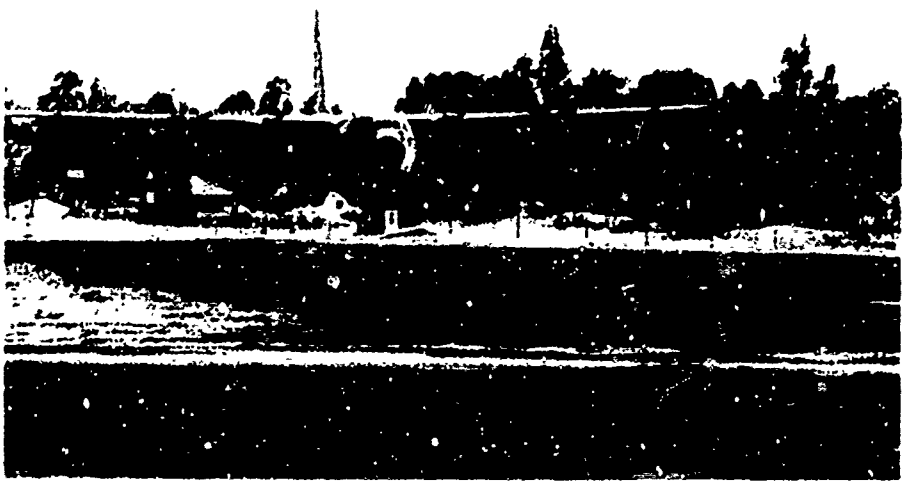
Major problem areas encountered during aircraft operations centered on pre-deployment coordination, re-supply, and lack of in-country assets. The CH-46 aircraft is very versatile in types of missions which can be performed and was ideal for the NIMBUS STAR/MOON support mission. However, these aircraft normally deploy on SERVLANT ships which provide support functions to the HELO DET in the areas of admin/personnel support/aircraft supply and communications. Years of planning have made the SERVLANT ship and CH46 a highly effective coordinated team. TG 65.3 had to completely rely on limited in-country assets and NAF Naples Supply Support via C-130 flights. A more viable supply line and a larger deployment pack up of support equipment and spares is required for the independent and isolated status encountered in this type of operation. For example, one aircraft was down for 16 days awaiting replacement of one bolt in the flight control mechanism. VERTREPS equipment should be provided to insure full operational capability and the inclusion of multi-radio capability (UHF, FM, HF) could be extremely beneficial in the MEDEVAC mission when dealing with a composite group of forces from many nations which do not have common radio capabilities.

COMMUNICATIONS. CTF 65 Forces were scattered along the entire 160 KM length of the canal from Port Said to the Port Taufiq and in Cairo. In-country communications between task groups was essential to MEDEVAC, logistics, command and control, and administration. Local telephone services were either not available or marginal at best. Communication was also required with higher echelons of command throughout the European Theatre and in CONUS.

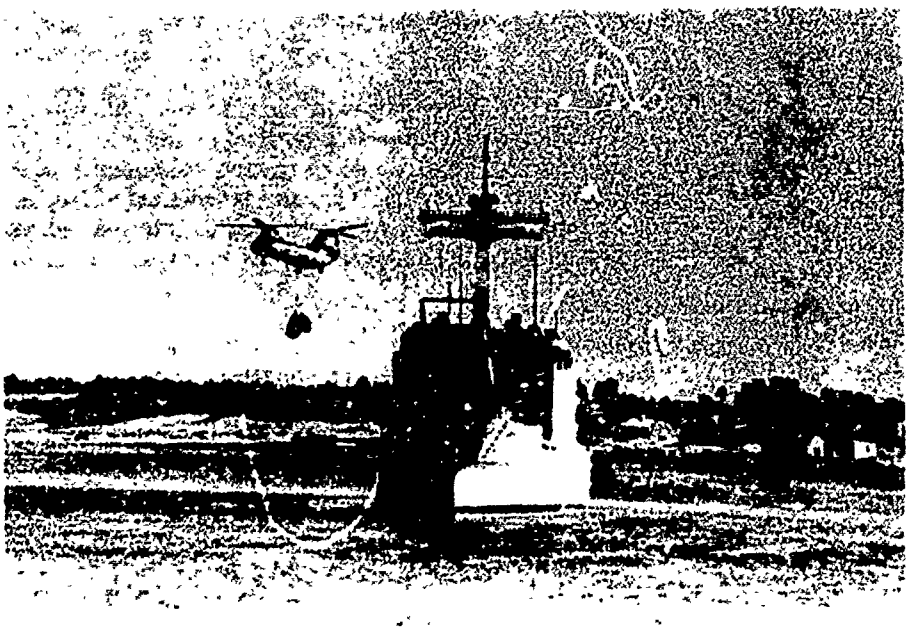
COMMUNICATIONS

SHIPBOARD COMMUNICATIONS. The task force flagships, USS INCHON, USS BARNSTABLE COUNTY and USS BOULDER, provided CTF 65 with access to the worldwide defense telecommunications system via a full period (duplex) high frequency termination with Naval Communications Station Greece. An attempt was made at one point to shift this termination to the Naval Communications Unit at Asmara, Ethiopia. Due to poor propagation conditions, this attempt was unsuccessful and termination was shifted back to Greece. Aside from this brief period, reliability of communications was considered very good throughout the operation. Due to the relatively high traffic volume and the small normal complement of communicators on the two LST's, three RM volunteers, obtained each month from various SIXTHFLT units, were required. This augumentation allowed for a three section watch bill and full accomplishment of preventative maintenance. This was extremely important due to the isolation from repair resupply facilities. Flagships assigned provided for storage and control of materials where adequate security ashore could not be established due to the nature of local facilities provided.

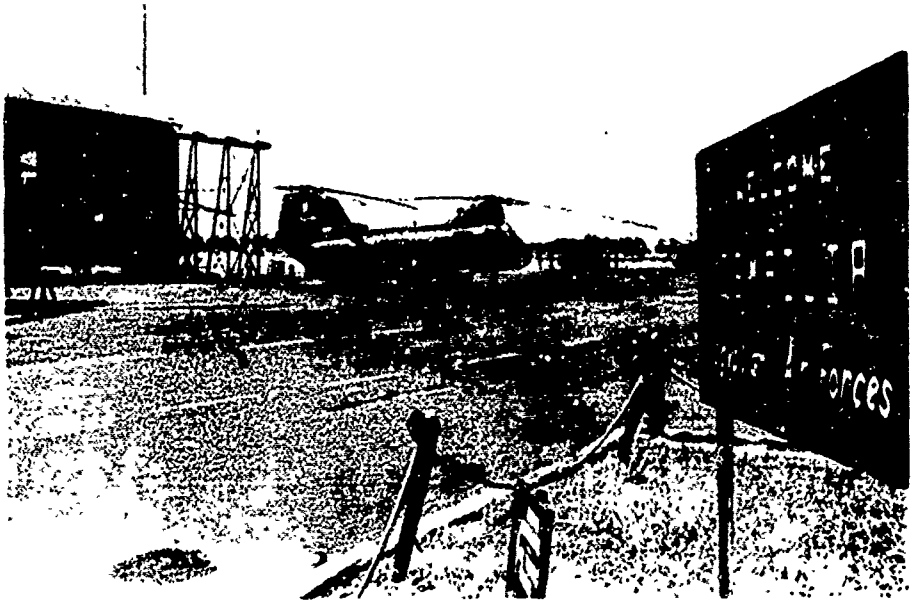
COMMUNICATIONS ASHORE NIMBUS STAR. Communications support for Operation NIMBUS STAR was provided by the U.S. Air Force 2nd Mobile Communications Group from Germany. Initial facilities provided consisted to two communications centers, one linking Ismailia and Nea Makri, Greece, by half duplex land line and a second half duplex land line circuit between the American Embassy, Cairo and Nea Makri. A voice radio network was established between Cairo, Ismailia, Port Said and Port Taufiq. The Air Force also provided communications for the airfield tower at Ismailia, a TACAN for Port Said and the flight following Suez Control MEDEVAC net. Task groups 65.1 (Mobile Mine Countermeasures Forces) and 65.6 (Army EOD Advisors) provided their own internal communications using VHF, HF, FM and AM radios.



US Navy C-130 Logistics Flight Landing at Ismailia.



CH-46 HC 6 DET 9 VERTREPS USS BARNSTABLE COUNTY anchored in Lake Timsah.



CH-46 of TG 65.3 on MEDEVAC Alert at Ismailia.

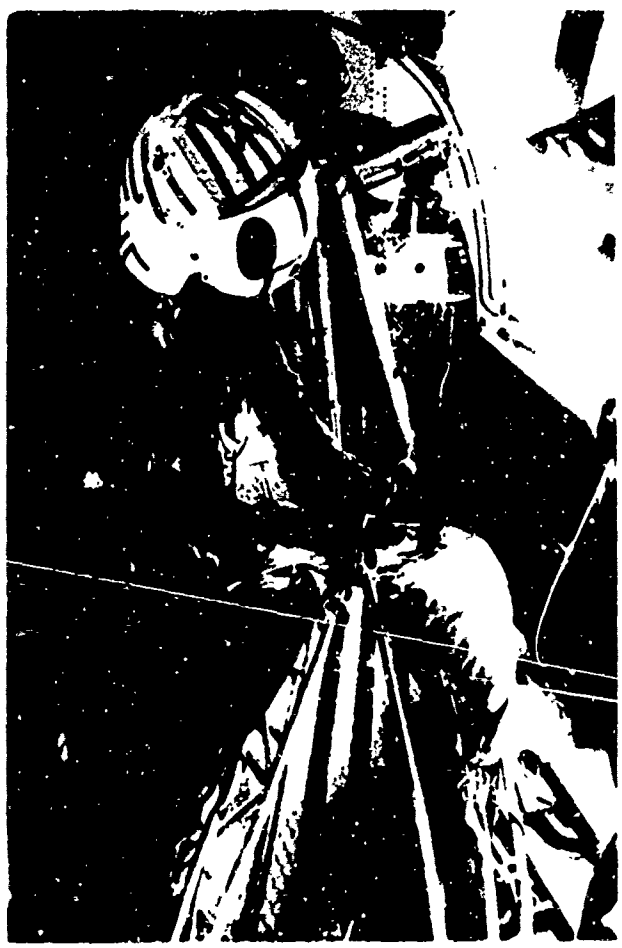
COMMUNICATIONS ASHORE NIMBUS MOON/NIMROD SPAR. A U.S. Army element from the 7th Signal Brigade, located in Germany, provided shore based communications support for operation NIMBUS MOON/NIMROD SPAR. Services provided included the operation of the communciation center linking Ismailia and Nea Makri, Greece; three radio teletype stations linking Ismailia, Port Said and Port Taufiq; and communications

equipment and operators for the flight following Suez Control-MEDEVAC Net. Air Force personnel continued to provide and man TACAN at Port Said and tower control at Ismailia airfields.

TELEPHONE AND AUTOVON. Two wire Autovon circuits were initially installed between CTF 65 Headquarters Ismailia and Camp Darby, Italy, and also between the American Embassy Cairo and Camp Darby. In an effort to upgrade the quality of Autovon service, the circuits were changed from two wire to four wire and terminated at Naples, Italy, vice Camp Darby. The transition took well over two weeks due to internal delays in the Egyptian Ministry of Telecommunications and the nature of Naples Autovon equipment.

PROBLEMS AND LESSONS LEARNED.

Shore Based. Two major problem areas were encountered. The use of Egyptian leased teletype equipment and lines caused a variety of problems resulting in circuitry and equipment outages. In this case, the use of locally supplied and serviced equipment did not provide for the level of operational reliability desired. A second problem was the changeover from USAF to U.S. Army communications at the midpoint in the overall clearance operation. Although each service provided professionally competent communication support, the switch in established communication prompted a period of unneeded readjustment and some degradation of services during the turnover period.



Helicopter crewman preparing for MEDEVAC Mission.

General. One unexpected problem encountered was a duplication of termination with the World Wide Defense Communications network by both shore and afloat units. When the CTF 65 Flagship was located at Port Said and the shore based facility was located in Ismailia this was not a factor. With the arrival of the Flagship at Lake Timsah duplication existed. This was remedied by terminating the U.S. Army tie with Nea Makri at the earliest possible date. In-country teletype and MEDEVAC nets were maintained. A second problem, not uncommon in high level interest field situations, could be termed message precedence escalation. At the commencement of operations, there was a legitimate need for high priority message traffic to expedite the flow of personnel and equipment to the operational area and commence the task at hand. The requirement for widely disseminated daily SITREPS also occurred in this time period. To produce such high priority reports on a long term operation required that Task Group feeder reports also be at a high priority. The effect continued to snowball until almost all messages were Priority or above. At this point, the utility of the precedence system is destroyed. This phenomena is very hard to break in originators both within and external to the operational area. It should be an important consideration in establishing reporting and communications guidelines for future operations of this type.

MEDICAL SUPPORT. The medical mission of NIMBUS STAR/MOON, NIMROD SPAR was originally organized with the main consideration being surgical support in the advent of trauma related to mine explosions, explosive ordinance demolition or diving mishaps. Initially, this support consisted of a surgical team aboard the USS INCHON (LPH-12) equipped with operating suites and MEDEVAC helicopters. The ship was anchored off Port Said. A medical dispensary for treatment of minor illness was established in Ismailia. Qualified independent duty Corpsmen were attached to Army and Navy EOD teams. At this initial stage in operations, backup support consisted of the following: UN Hospital, initially located at the Cairo airport, under the management of the Canadians, for surgical support for mass casualties; PMU-7 Naples Italy for preventative medicine support in the way of sanitation and pest control; and NAMRU-3 in Cairo for expertise in diseases endemic to the Canal area. Although these two special Navy facilities were available, they were utilized, initially, for little more than informal advice. As the operation progressed, and some units retrograded following completion of NIMBUS STAR/NIMBUS MOON LAND phases, the original medical support concept underwent re-evaluation and revision. Three separate areas of the medical support mission, Public Health and Preventive Medicine, Dispensary and Sick Call, and Emergency Care and MEDEVAC, are discussed below:

PUBLIC HEALTH AND PREVENTIVE MEDICINE. As operations proceeded, it became apparent that the overwhelmingly documented problem area was not in the area of trauma, but rather in public health. Infectious disease, sanitation, and messing and berthing problems occupied the vast majority of the time of the Medical Officer and his staff. The largest single problem area confromted was the diarrheal/constitutional syndrome known locally as the "Pharaohs Revenge" and probably representative of cases of Amoebic, Shigella, other Salmonellas and "Travellers" diarrea. Only a few personnel were seriously ill with this syndrome, but almost all personnel assigned suffered some discomfort, often repeated, and significant work time was lost due to this. Weight loss was common. Hepatitis is endemic to the canal area but only four cases, epidemiologically unrelated, were diagnosed. At the direction of BUMED, malaria prophylaxis was instituted for all personnel, with eight week follow up prescribed after return to home duty station. Two individuals were hospitalized following return to home duty station with the diagnosis of paratyphoid fever, possible contracted in this area, as the disease is endemic. Alcohol related problems were relatively uncommon and other drug problems consisted entirely of alleged hashish smoking among some personnel. No proof was obtained and no charges filed. This incidence was considered minor in view of the open availability of hashish and other hallucinogenic drugs on the black market. Incidence of veneral disease was negligible, only three cases were treated, only one case contracted in-country.

The most serious public health problems were encountered in the conflict ravaged city of Port Taufiq where virtually all aspects of the living conditions were totally unacceptable for U.S. personnel. Initial vigorous attempts to improve the situation, while living off the economy, met

with failure due to lack of facilities and a basic lack of knowledge of Western sanitary practices. During the second major use of this city for Task Force operations, a caterer was contracted to established field kitchens under the supervision of the Murphy Pacific Corporation Sanitation Officer and the Task Force Medical Department.

Living and messing conditions in Port Said were marginal during the entire operation and attempts to improve them met with varied success. The only two cases of severe diarrhea, requiring medical evaluation, occurred at Port Said. The water supply was never considered potable in either of these two cities.

The best living conditions were found in Ismailia. Unlike the other two cities, the water supply remained potable except for a short period of time. Sewage, fly and mosquito control and the cleanliness of messing and berthing areas were generally acceptable.

The strain on limited local facilities were exacerbated over the period of Task Force operations by the rapid increase in civilian population from essentially zero to several hundred thousand in Port Said and Suez City, and to a lesser degree in Ismailia. This occurred without a concomitant improvement in public utilities, thus the overall drain on local facilities tended to worsen with time despite vigorous U.S. efforts.

In late August, a team from PMU-7, Naples, which included a physician, medical entomologist and microbiologist, visited the Task Force units and provided recommendations. A Preventative Medical Technician assigned to the Task Force proved to be an invaluable aid in coordination of self help projects and in monitoring messing facilities for diagnostic confirmation were not readily available despite the proximity of NAMRU-3 in Cairo. Education of the Egyptian Staff responsible for messing and berthing proved to be a long, frustrating project. Despite good intent, their lack of understanding of Western sanitary standards posed a constant hazard to the health of U.S. personnel.

It was the unanimous opinion of all medical officers assigned to Task Force 65 that the initial decision to subsist entirely off a war shattered economy had been a mistake. The time, effort and resources spent to monitor and upgrade the civilian contractors capabilities to provide barely acceptable conditions never was really enough to overcome the constant threat to the health of U.S. personnel posed by the poor sanitation. The fact that more personnel did not get seriously ill was more attributed to good luck than skill. It is strongly recommended that in the future before contractors or agreements for local messing and berthing for U.S. personnel are accepted, qualified experts evaluate the quality of food, sanitation, and capabilities, of the local economy to meet acceptable standards. Early and continued use of technical assets such as PMU-7 and NAMRU-3 should have been mandatory.

DISPENSARY AND SICK CALL. The dispensary, located in Ismailia, designated as a major aid station to be staffed by two physicians and at least six corpsmen, functioned for the majority of the mission as a sick call and minor drug dispensary with one physician and two corpsmen. Following departure of the surgical team aboard the LPH early in the operation, the existing dispensary became the center of medical support for the Task Force but lacked facilities to perform even minor laceration repair or any therapeutic maneuvers other than the prescription of medications, injections, recommend medical care at another location or MEDEVAC. Supply support was generally good but there were chronic shortages of some medications due to long delays in shipment and the unexpected high prevalence of gastrointestinal disease. On two occasions the dispensary was broken into and the supplies of medicine, especially antibiotics and drugs for symptomatic treatment of gastrointestinal illness, were stolen. This aggrevated the supply problem.

The U.S. Dispensary, Ismailia saw all Task Force 65 personnel including U.S. Military and civilians under contract. The relationship of the civilian contractor to the medical mission and the degree of responsibility to them was never clearly stated. An additional function developed once this dispensary was opened in Ismailia. For purely humanitarian reasons, if an Egyptian came to the dispensary with a medical emergency, he was treated like anyone else. Word of mouth spread and soon the number of Egyptian nationals seen began to surpass the number of

U.S. personnel, and supplies were becoming short. Thus, facilities were limited to Suez Canal Authority employees working directly with U.S. personnel. A U.S. Marine, born in Egypt and fluent in Arabic, was temporarily attached to the dispensary to serve as an interpreter. More complicated and chronic problems were referred to the local hospital. Like all facets of Task Force 65, a significant unstated part of the overall mission was to further humanitarian relationships. People who came seeking help were aided and advised to the best of existing medical capabilities. Patient census for June - September and breakdown of sick call categories is shown in Table 5.

TABLE 5

DISPENSARY STATISTICS.

PATIENT CENSUS MONTH	U.S. PERSONNEL	UAR PERSONNEL
June	126	51
July	133	201
August	140	138
September	113	138
TOTAL	512	528
SICK CALL CATEGORIES		
Gastrointestinal	214	51
Trauma	43	48
Respiratory Infection	36	21
ENT/Dental	30	32
Genitourinary	6	14
Other (dermatitides, minor infections and illnesses, dressing change, etc.)	186	338

With rare exceptions UAR personnel listed are all SCA employees. Women, children and others were seen only on a humanitarian basis for emergencies. Occasionally, British and French sailors were seen; few in number.

Following the departure of the LPH, the responsibility that was carried by the Ismailia Dispensary was out of proportion to the supply and staffing. The dispensary should have been supplied as well-equipped emergency room with minor surgical capabilities and life-support equipment to hold medical and surgical emergencies for a period up to 24 hours. The sick bay of the Task Force Flagship, anchored in Lake Timsah, provided adequate space for patients on the sick list and a duplicate facility ashore was not needed. In future operations with a wide spectrum of forces including civilian contractors, the obligations and responsibilities of the medical department should be clearly delineated.

MEDEVAC AND EMERGENCY CAPABILITIES. OPLAN 4371 designated the emergency capabilities of the Task Force to rest of the surgical team located in the LPH support ships with a helicopter MEDEVAC system to assure adequate mobilization from any point along the canal. With the departure of LPH support early in the operation, surgical team support was lost to the Task Force. An excellent helicopter MEDEVAC capability existed in Ismailia, but no adequate receiving facility remained at the terminus of the MEDEVAC chain. Due to the physical/logistical and political realities of the situation, reliable rapid MEDEVAC to Naples or Cyprus was impossible. On 30 April, the Senior Medical Officer proposed that Task Force 65 emergencies, both medical and surgical, be handled by the newly set up UNEF hopsital at Ismailia which was entirely staffed by Poles. The hospital was full service hospital

with full surgical capabilities. On or about 9 June, an agreement with the UNEF hospital was reached in which they agreed to care for Task Force 65 emergencies on a humanitarian basis, with total management of personnel admitted being in the hands of the hospital staff. The MEDEVAC link to this terminal facility consisted of the helicopters based in Ismailia and one ambulance van located at the Dispensary for transportation from the airfield to the hospital. Helicopter operations were prohibited after dark and communications along the MEDEVAC Net left much to be desired. The arrangement with UNEF hospital and the MEDEVAC system has several shortcomings.

1. The Task Force dependence on the hospital was such that we had to utilize them for lowgrade surgical and medical problems that a well-equipped dispensary should have been able to handle.

2. The agreement remained tenuous, subject to bilateral cancellation, leaving the Task Force without any surgical support.

3. U.S. Medical personnel had to relinquish all control over patients for which they were ultimately responsible.

4. Standards of medical care, although appearing adequate could not be monitored.

5. All helicopter MEDEVAC capability ceased at dusk and MEDEVAC communications especially where local phone links were a part of the system, was never beyond doubt.

An effort was made to position ambulance vans at Port Said and Suez City to provide for 24-hour MEDEVAC to Ismailia, backing up the daytime helicopter capability. It should be noted that diving and other routinely hazardous operations were restricted to daylight hours when helicopter support was available. Overall, MEDEVAC emergencies were few and relatively minor due to the care and professionalism of field personnel. In the future it appears unwise to depend on a foreign medical facility for total surgical support of U.S. personnel.

PUBLIC AFFAIRS. From the very beginning, public affairs was recognized as an essential element of U. S. participation in the NIMBUS STAR/MOON operations. On D plus TWO, a total of twenty U. S. Navy personnel were in-country working solely on Public Affairs. These consisted of five PAO's, led by a commander, one photographic officer, eight enlisted photographers (still and motion picture), and six journalists. As expected, the early operations attracted a lot of press attention. Large groups of press media representatives were bused to the canal area for briefings, interviews, and helicopter rides up and down the canal and out to the flagship off Port Said. These visits were coordinated by the senior PAO, located in Cairo, working directly with the Egyptian Ministry of Information and communicating with Ismailia, Port Said and the flagship, by teletype and voice radio. These arrangements allowed press embarkation to be conducted smoothly, with fairly precise timing and tight control.

The Public Affairs organization was cut back by two thirds on May 10th, resulting in a considerable loss in level of story output. All five of the Public Affairs Officers were retained to facilitate continued coordination and cooperation for press visits to the operational areas.

On June 3rd, when NIMBUS STAR operations formally ended, and the Change of Command was held, the Public Affairs organization phased down to only one PAO and one photographer. PAO personnel were based in Ismailia with no Navy PAO Liaison in Cairo.

The small size of the remaining PAO staff, coupled with the remoteness from the primary normal location of the press, Cairo, and difficulties of communication, considerably reduced the effectiveness of the organizational effort and reduced the number of press visits that could be solicited and coordinated. Coordination problems resulted due to lack of a U. S. Task Force PAO representative in Cairo. The Egyptian Ministry of Information many times sent journalists to the canal with absolutely no advance warning to the Task Force PAO. This tended to make interviews ad hoc, lacking the smoothness and efficiency previously provided.

To partially alleviate the problem of unexpected visits, the CTF-65 PAO tried to work with the Ministry of Information Foreign Press Desk to send notice of impending visits, and to conduct such visits only on four days of the week: Saturday, Sunday, Wednesday and Thursday. This schedule allowed the PAO organization to have more flexibility in its work, being able to visit remote Task Force locations of the Canal, without the fear that members of the press would show up back at Ismailia. Another problem experienced was strictly a function of host government lack of internal coordination. Ministry of Information personnel in Cairo would send media correspondents into the Canal zone promising aircraft flights without clearing these flights with A.R.E. Army authorities. U. S. PAO personnel were then caught in the middle.

The duties of the Public Affairs Organization in accordance with OPLAN 4371 were:

1. Provide timely information for external and internal press release concerning U. S. military activities, consistent with national objectives and security requirements.

2. Coordinate PAO activities with the Egyptian government (through the Ministry of Information).

3. Assist newsmen in covering the operations, and generating news and feature material for press release.

Releases produced by the NIMBUS MOON/NIMROD SPAR PUBLIC AFFAIRS staff included Fleet Home Town News Center stories on Task Force personnel, and photo features on various aspects of life on the canal. Any milestone events or fast breaking newsworthy events were covered by message release through COMSIXTHFLT, CINCUSNAVEUR, CINCEUR, and CHINFO, for public release. During the NIMBUS MOON/NIMROD SPAR operations alone, the PAO hosted over 200 media visits and made over 100 news releases.

PROBLEMS ENCOUNTERED. In addition to the above mentioned coordination problem with the Ministry of Information, a primary problem was one of time and talent during NIMBUS MOON/NIMROD SPAR. Because the photographic personnel supplied to the Task Force were not the trained photojournalists requested, they were unable to adequately formulate stories to accompany their photographs. Due to time constraints, and the neccessity of remaining available in Ismailia to handle press visits, the lone PAO was unable to spend the neccessary research time to develop the number of stories which could have been done during operation.

LESSONS LEARNED. Although there was a real drop in the "current news" value of the NIMBUS MOON operation once the initial U.S. forces had been established in-country, the scale down to PAO, one photographer and no PAO representative in Cairo was too severe. Resources were then too thin to adequately generate feature stories from operations spread over the length of the canal and still host visiting media representatives. These items are stressed since the presence of a well-coordinated PAO effort tends to reflect favorably on the visiting media representatives concept of the overall Task Force coordination.

CTF SIX FIVE LIAISON OFFICE CAIRO. A small detachment with one officer and two enlisted men was established at the American Embassy in Cairo. During the NIMBUS STAR buildup phase and during Task Force 65 retrograde COMFAIRMED, air shipment personnel were also present. The work of CTF Liaison Office Cairo fell into five general areas: (1) Liaison for CTF 65 with the American Ambassador to Egypt and USDAO Cairo, (2) meeting incoming CTF personnel at Cairo Airport, (3) liaison and assistance for all CTF personnel when in Cairo area, (4) coordination of ground transportation for CTF 65 personnel from Cairo to the Canal, and (5) making plane and hotel reservations for incoming, outgoing and R&R personnel.

Daily coordination was established with the SCA to provide temporary billeting for transiting personnel and shuttle bus transportation from Cairo to the Canal Zone. The SCA expediter worked through the Cairo Liaison Officer and arriving CTF 65 personnel were met by SCA and Navy personnel.

Cairo liaison personnel also handled clearances and cargo loading and unloading as well as passenger and cargo manifests for U.S. military aircraft arriving in Cairo. As necessary, VIP visits and Cairo press briefings were coordinated by the Liaison Office. Due to the unreliability of telephone communications in country, the presence of a Liaison Office in Cairo was mandatory. Over 300 personnel were met, temporarily housed and transported to the canal zone. All aircraft reservations using FT funds were handled directly from Cairo. Normal message traffic could flow to and from Cairo documenting reservations, clearances and arrivals of personnel and equipment. Unescorted baggage and equipment arriving via commercial air was handled by Cairo Liaison Office personnel.

PERSONNEL AND ADMIN SUPPORT. Assigned organic units such as the flagship EOD teams and CTF 65 staff, individually handled personnel records and administrative support needed, but in general, records were maintained by the parent command. Disbursing support was handled by the flagship. Control and documentation of personnel in country was maintained by CTF 65 staff, Ismailia. Examinations for advancement in rate were channeled via the flagship FFT to Task Group Commanders. The turnover of personnel, diverse origin of parent commands and remote location of operations, precluded the establishment of one personnel administration center. Commercial air travel funding for personnel was handled by CTF 65 Liaison Office Cairo with FT fund authorization emanating from CTF 65 staff or CTG 65.4.

Average Daily Number of U.S. Personnel In-Country Suez Canal Clearance Operation Task Force 65

MONTH	FLAGSHIP	MILITARY ASHORE	CIVILIAN	TOTAL
April	900	275	30	1,205
May	800	321	45	1,166
June	222	213	52	487
July	212	170	66	448
August	200	144	171	515
September	207	139	192	538
October	202	128	216	546
November	207	113	214	534
December*	210	86	167	463

NOTE: Above Figures do not include the three periods when two flagships were present in the canal zones during turnover.

*As of 5 December. After this period rapid retrograde of personnel and equipment continued until 15 December and the disestablishment of Task Force 65.

Chapter IV

TECHNICAL METHODS & EQUIPMENTS

INTRODUCTION. The contents of this chapter describe in moderate detail the general scenario of clearance operations presented in Chapter II. Types of equipment, and a brief description of the methods used for sonar search, diver search, magnetometer operations and navigational systems are outlined. A rigorous basic discussion of the principles, electronics, and field operations of equipments used, has not been attempted. No discussion of mine countermeasures equipments and methods employed or salvage techniques and equipments used is presented. These topics will be subjects of separate reports prepared by the cognizant technical commands as required.

SONAR SEARCH. The basic tool for ordnance search over the central channel of the Suez Canal, and in approaches and anchorages, was underwater acoustics. U. S. forces of Task Group 65.5 and British and French minehunting forces employed active acoustic sensors to search and localize ordnance-like contacts in the canal fairway and anchorages. Contacts so located were followed up by diver inspection, identification and disposition as required. The various segments of the canal provided a number of acoustic environments depending on water mass characteristics, bottom configuration, and sediment characteristics. These details are provided in Chapter V, Environmental Analysis.

BRITISH MINEHUNTING SONAR. British units were equipped with the Mark I Acoustic Mine Hunting System. Three minehunting vessels, HMS BOSSINGTON, HMS MAXTON and HMS WILTON, equipped with this acoustic equipment, searched the main channel of the canal and selected anchorage areas. The primary acoustic element of the Mark I system is the Sonar Type 193, a scanning, short range, high resolution, multi-frequency sonar. This hull-mounted sonar system is designed specifically to provide high detection capability against small metallic contacts. System effectiveness was proven in the canal environment by conducting detection tests against a planted field of inert ordnance items ranging in size from a BLU-45 anti-tank bomblet to a 250 lb. bomb. The basic search method employed by the minehunters consisted of series of a 360° active sonar searches from a stopped or anchored position. The entire 360° area was scanned several times in small 4-8 degree sectors with the transducer being trained about by hand. Contacts were further classified acoustically by examination at alternate frequencies and pulse lengths. When a contact was classified as "ordnance-like," the sonar remained locked onto the contact and a small boat (Gemini) was called away and vectored over the contact by means of an acoustic reflector suspended below the boat positioned in the line of sound between the sonar transducer and the target. The Gemini is directed from the operations control center where sonar information displays both the target and the acoustic reflector.

With the acoustic reflector positioned and anchored in proximity to the contact, divers swam down to the contact, made final identification and took disposal action as appropriate. In the canal environment, this equipment provided a reliable detection range of about 300 meters. A high degree of search effectiveness was achieved by both multiple (four) circular scans of the search area at each anchor position, and by the positioning of anchor sites only 150 meters apart to insure minimum 50% overlap with the last search area. Each ordnance contact investigated and disposed of by all British forces was assigned a mine reference number. This specific numbering provided a ready reference system to records of identification and position of the item in the canal, and was most beneficial in final data analysis. It is strongly recommended that such a standard numbering system be used by all task units if a large multinational search

operation such as this is ever encountered again. Each task group or unit can be allocated a block of numbers.

The larger size and open sea system design of the minehunters and the Mine Hunting System Mark I made them the best task force asset for the search of outer anchorages at both Port Said and Suez Bay.

U.S. SIDE SCAN SONAR SYSTEM

EQUIPMENT. Two side scan sonars were used by U.S. personnel to conduct an acoustic search of the canal channel. Seaward Incorporated employees searched the canal from Port Taufiq to the southern section of the Great Bitter Lake using an EG&G side scan sonar. Except for the Great Bitter Lake, the remainder of the canal channel, harbors, and approaches were searched by Navy EOD units attached to CTG 65.5 using a Klein Side Scan Sonar System, Model 400.

The Klein system consists primarily of a towfish, Model 402A, with transducers, a Model 401 dual channel recorder, and accessory towing equipment. The towbody, shown in Figure 11, sends out short high frequency (100KHZ) high intensity (124 db peak) sound pulses originating from parallel transducers which are linear arrays of piezoelectric ceramics. The system employs a narrow horizontal beam-width (3/4 degree to the 3db point) and a large vertical beam-width (20 degrees angled down 10 degrees from the horizontal) to give high resolution coverage of the insonified area.

The trigger pulse which keys the transducer originates from the recorder subsystem, shown in Figure 12. The recorder contains the basic dual channel writing mechanisms which makes a permanent graphic record of the return signal from each side of the towfish. The record is made by an electrosensitive (electrochemical) technique on special sonarfix recording paper. The return signals (two channels) from the towfish pass through electrodes on either side of the recording paper inducing a chemical reaction which darkens the paper proportional to the signal strength. Based on range scale selected, (75, 150, or 300 meters) the recorder subsystem synchronizes and keys the initiation of the transmit signal. The resultant record represents a continuous acoustic image of the bottom to the right and left of the towfish track. Contacts appear as darkened areas, those with some height above the bottom generating light shadow zones.

The overall unit is designed for portable field use. The towfish is relatively small in size, 49 inches in length by 12 inch maximum diameter, and weighs only 31 lbs. The recorder subsystem weighs 100lbs. and is splash resistant for open deck operation. The system can operate from a DC (23-30 volts) or AC (115 or 220 volts, 60 cycle) power supply. A built-in event marker can be synchronized with time or navigational inputs. The Klein 400 system was used in conjuction with a cubic autotape DM 40 navigation system with processor and plotter subsystems described below under NAVIGATION.

Predeployment Tests. While side scan sonar systems have been employed to detect a wide variety of underwater targets ranging in size from intact ships to basic seafloor geological features, predeployment testing of the combined sonar-navigation package was conducted in CONUS to verify the effectiveness against small ordnance targets in a shallow water environment and to gain experience on the type of search design which would give high probability of detection against this class of target. From 1 April through 4 April 1974, tests of the EG&G and Klein side scan sonars were conducted at the Solomons Island Test Facility in Maryland by EOD Facility and Seaward, Inc. personnel along with analysts from Daniel H. Wagner Associates. Fourteen test objects ranging from a 1000 lb. bomb to 155mm projectile were placed in shallow water (12-2m depth), and runs were made at a vairety of lateral ranges to determine the detection capability of the two sonars. Tests indicated the feasibility of using

side scanning sonar to detect ordnance in the Suez Canal, and initial search design and search effectiveness analysis methods were developed.

Field Tests Suez Canal. Upon arrival in country, additional testing of the overall sonar-navigation and diver followup system began in the canal environment. The entire system was tested against a variety of ordnance targets ranging in size from BLU-45 bomblets through a 250 lb. general purpose bomb. The canal testing program had the dual purpose of evaluating equipment performance and the training and evaluation of EOD technicians who would operate the system.

Analysts from Wagner Associates working in conjunction with Seaward and EOD Facility personnel developed a plan for continous analysis of the search effort and calculation of search effectiveness probabilities.

Search Method. One must recognize that the overall search and clearance method employed, involved a system much more complex than the side scan sonar alone.

In brief, the side scan was hung from the side of a 40-foot SCA pilot boat at amidships, on the starboard side, even with the antenna of the cubic navigation system. Track line spacing was planned to achieve probability .9 of detecting a BLU-45 target in the given environmental condition of that sector of the canal. Tow speeds were from 4-5 knots. Sonar records were

Figure 11. U.S. Navy EOD Technician prepares Side Scan Sonar Towfish for search operation.

carefully annotated and matched with navigational data. At the end of a day's run sonar and navigational data was returned to CTG 65.5 headquarters where contacts on the sonar recording were identified, and slant ranges from towbody position computed. On-scene analysts then computerized this data and developed a plot contact positions for cluster analysis. X-Y coordinates of the plotted contact clusters within the NAVAID net were generated by a second computer program. These X-Y coordinates were then used as inputs to the navigation system on the buoy boat. Marker buoys were dropped at the location of each designated sonar contact or cluster of contacts. Divers followed up on these buoyed positions for final contact identification and disposition as required.

Search Analysis. As can be appreciated from the foregoing discussion continuing analysis of sonar, navigational and diver follow-up data was an integral part of the field operation in order to insure a high probability of ordnance detection and clearance using the available systems in the given environment. A team of contractor personnel from Wagner Associates provided this technical analysis support to CTG 65.5 throughout the operational search of the canal. Search planning and evaluation was done on a daily basis, based both on system tests, whenever new environmental conditions were encountered, and on the daily sonar, navigational and diver follow up data. The types of analysis conducted are summarized as follows:

(1) Planning and analysis of sensor tests: Whenever a new sensor or new environmental conditions were met, on-site tests of the sensor's detection and localization capability were planned and the results analyzed.

(2) Search track planning: Using test results, continual planning of track spacing was performed to achieve high search effectiveness under the given environmental conditions and for the sensor employed.

(3) Testing diver effectiveness: Tests were designed and performed to estimate the divers ability to find contacts.

Figure 12. Side Scan Sonar Recorder and precision navigation and plotting equipment as installed on the Sonar Search Boat.

(4) Computer plotting of contacts: Each day, sonar records were annotated to prepare inputs for computer plotting of contacts. Contacts plots were prepared using programs developed for the Wang 720C computer and Wang 712 plotter.

(5) Preparation of Diving sheets: Contact Plots were examined to determine clusters of contacts suitable for diving. A series of dives, including circle lines and jackstays, were planned by the CTG 65.5 diving officer to cover the contact clusters, and buoy locations for these dives were prepared for the buoy boat. The analysis of contact scatter made in (1) was used to determine the length of line used for circle line and single line jackstay searches.

(6) Recording results of Dives: The results of dives were recorded on the contact sheets and the location of salvable items marked for later recovery.

(7) Calculation of Search Effectiveness: For each 250-meter section of the canal, the sonar and diver effort was combined with the test results obtained in (1) and (2) to compute search effectiveness probability (SEP). SEP in this operation was defined as the probability that a BLU-45 located in that 250-meter section would have been detected and removed by the combined sonar diver effort in that area.

The technical discussion of the various analysis methods employed, including derivations of the statical considerations, will be the subject of a separate technical report issued by the EOD Facility in Indian Head, Maryland.

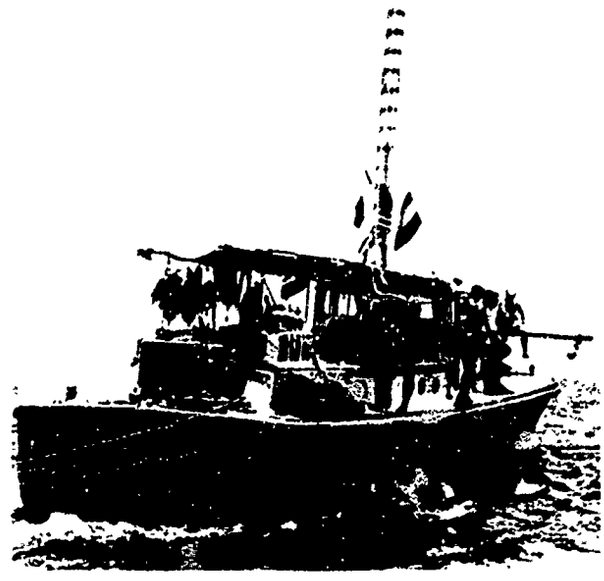
Constraints. The major constraints to side scan sonar search encountered during the canal clearance operation stemmed from the properties of the water masses encountered and the nature of the canal floor. Local variations in sound speed and sediment type were to a large extent compensated for by testing the system in various areas of the canal and altering search track spacing to achieve the desired statistical level of coverage. As discussed in Chapter V, some environmental areas such as the Port Said Harbor and the Great Bitter Lake, were unsuitable for acoustic sensor utilization. In addition, the area, from KM 65.7 south to the Deversoir causeway, was found to contain so many sonar contacts that it was necessary to perform a bank-to-bank jackstay in that area. In general the side scan sonar system employed was reliable and found easy to use by operational EOD personnel in a harsh field environment.

A constraint on the analysis effort was the need to transfer large amounts of data manually from sonar and cubic autotape records to the computer. In areas of heavy concentrations of contacts, this hampered the ability of the analyst to provide timely feedback on the effectiveness of the search effort. In future operations where large numbers of contacts are expected, consideration should be given to automating this step in the data handling.

DIVER EQUIPMENT AND METHODS: Regardless of the sophistication of search sensors employed to locate ordnance items along the main Suez Canal channel, EOD trained divers were the ultimate and most important element in the overall canal clearance operation. As was previously discussed, in addition to diving on contacts in the main channel, divers alone searched the entire slopes of the canal, two complete times, and painstakingly combed the basins of Port Said, Port Taufiq and other basins ringing Suez Bay. The total human effort expended by Egyptian, American, British, and French Divers is the most dramatic single statistic of the operation. Diver equipment and methods are discussed below.

BRITISH WATER CLEARANCE. British divers were broken into two categories; members of the Fleet Clearance Diving Team, and groups of divers attached to each Minehunter. All divers were qualified specialists in underwater explosive ordnance clearance.

Equipment. British divers utilized the Clearance Diving Breathing Apparatus MK II, a semi-closed-circuit mixed gas system. Gases used were nitrogen and oxygen. Diver suit configuration varied from full wet suit to minimal swimwear dependent on the nature of the dive, water temperature, and bottom conditions expected.



Sonar Search Boat at work in the Suez Canal.

Method. Fleet Clearance Diving Team personnel, searching the canal bank slopes from 3 to 8 meters depth, employed a single line jackstay search method using from 4 to 6 divers at a time. Diver spacing was governed by visibility conditions which varied from area to area along the canal. Dive duration was governed by length of proposed jackstay, water depth, and current. Ordnance items located were identified and countercharged, singly or in lots, using conventional EOD methods. It is estimated that the 14 FCDT members swam over 165 miles for a total of 1200 hours of diving time.

The six divers attached to each Minehunter were an integral part of the object location, identification and neutralization system. When a target was located, a small boat was vectored out to the position over the target using an acoustic reflector positioned in the sonar beam. Divers then swam down to locate the contact and effect identification and disposition as required.

FRENCH WATER CLEARANCE. French demining Divers searched the banks of the canal from 0-3 meters, designated harbor basins and areas as assigned and a third search of canal slopes from the high water mark to bottom break. All divers were qualified specialists in underwater ordnance demolition.

Equipment. French divers utilized two life support systems; conventional open circuit SCUBA, and the DC 55, a semi-closed-circuit mixed gas system. Gases were nitrogen and oxygen. The DC 55 was used extensively in canal bank search while the SCUBA equipment was preferred for diving in harbor basins and around wreckage.

Methods. French divers employed conventional single line jackstay search methods along the canal banks using two to four divers depending on visibility. Ordnance items identified were removed or countercharged in place, using conventional EOD methods. Diver protection varied from full wet suit to swimwear depending on water temperature, depth, and expected bottom conditions. It is estimated French divers swam over 200 miles and a total of 3000 hours of diving time. In areas of poor visibility, some use was made of a hand held magnetic ordnance detector. French divers were supported from 136-foot minesweep type vessels.

US/GOE WATER CLEARANCE. By direction, U.S. EOD divers were to provide technical training and advisory assistance to A.R.E. Navy divers to do EOD clearance diving in the Suez Canal. U.S. divers were prohibited from actual search and clearance diving on live ordnance. Due to these restrictions, a major training and equipping period was required in order to build an effective US/GOE water clearance team.

Training. An initial evaluation of A.R.E. Navy EOD diving capabilities indicated significant training on both EOD methods and basic diving was required. About 100 A.R.E Navy divers were divided into two classes for three weeks of classroom and practical training. Qualified instructors from NAVEODSCOL, Indian Head, Maryland, provided formal classroom instruction on the detection, location and recognition of explosive hazards. The training also included basic demolition techniques for ordnance disposal. Qualified instructors from EODGRUTWO, Fort Story, Virginia, provided formal classroom and practical training in the following areas:

- Endurance Swimming
- Diving Physics
- Diving Equipment
  - Personal Swimgear
  - DA Aqua Master Regulators
  - Twin 90 Diving Bottles
- Air Compressors
- Outboard Motors
- Small Boat Operation
- Underwater Search Procedures
  - Circle Line Search
  - Jackstay Search (both single line and four corner)
  - Electronic Search Equipment
    - MK 9 and MK 10 Ordnance Locater
    - H 512 Pinger Receiver
- Diving Equipment Maintenance Procedures

Following this initial period, A.R.E. Navy divers were divided into functional teams and assigned U.S. counterparts for diving operations and continued on-the-job training.

Equipment. U.S. and A.R.E. Navy EOD divers were equipped with standard open circuit SCUBA equipment using DA Aqua Master regulators, Twin 90 Diving Bottles and full wet suits. Diving operations were staged from a barge which was converted into a diving locker. Divers were transported to dive sites in small craft; generally collapsible rubber boats with small outboard motors. MK 9 and MK 10 ordnance locating devices were available to check areas of extremely poor visibility and suspicious holes of entry in the sediment for potentially buried ordnance.

FIELD METHODS. Two basic diver search methods were employed. In the canal channel, on contacts located using the side scan sonar and marked by the buoy boat, two or more divers typically conducted a standard 10-meter circle line or single line jackstay search to locate and identify the contact. In harbor areas, such as Port Said harbor and its basins, and along the slopes of the canal from 0-15 meters depth, four corner jackstay searches were employed using 4 to 8 divers depending on visibility conditions. This type of jackstay search was also conducted in the canal channel when the density of acoustically located contacts was very large. As an example of effort expended, the entire harbor of Port Said and its many basins were searched by this jackstay method. This segment of the operation involved 49 divers working 25 days averaging 2.5 diving hours per day for a total of 3062.5 diving man hours. Daily number and duration of dives varied from location to location in the canal based on water depth, current, visibility conditions and density of contacts.

CONSTRAINTS. Several problem areas were experienced throughout diving operations. These areas can best be broken into the following groupings; diving capability, logistics, environmental factors, and human factors.

Diver Capability. Although A.R.E. Navy divers received a comprehensive course in EOD diving and related equipment, it was highly condensed, and initial diver qualification was considered minimal. Subsequent on-the-job training by USN EOD advisors resulted in a reasonably effective diver search operation by the A.R.E. Navy personnel assigned.

Logistics. The length of the supply line from CONUS made replacement of defective or worn materials a very slow process. Egyptian divers worked with virtually no logistics backup and with limited tools and spare parts.

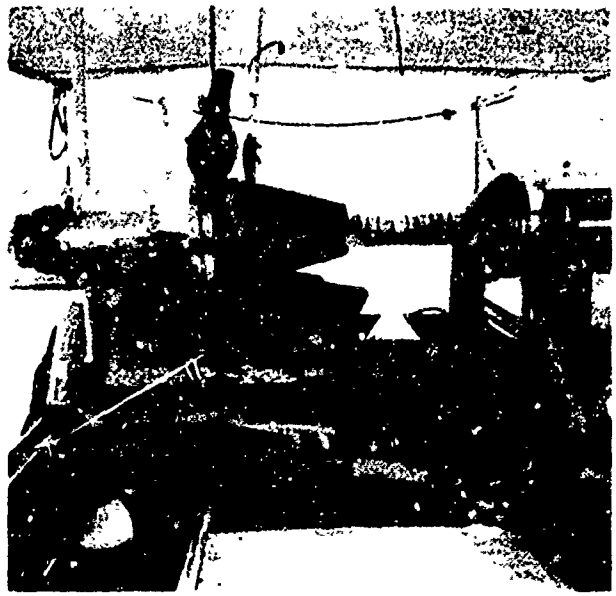
Environmental Factors. In the southern portion of the canal, strong tidal currents limited diving operations to under two hours per day. In Port Said, portions of the northern stretches of the canal, and in the lakes, poor to zero visibility slowed diver search. In the total jackstay search of Port Said, depth versus bottom time allowable per man per day became a limiting factor.

Human Factors. Environmental and living conditions had a noticeable effect on diver performance. U.S. EOD divers suffered a 18-20% loss in working manhours due to illness, mostly gastrointestinal, during the initial months of operation. This was reduced to 11% midway in the operation when the base of operation was shifted from Port Taufiq to Port Said. Egyptian EOD divers consistently experienced an 18% loss of working manhours due to illness. Conditions contributing to this high loss of diver time are discussed in Chapter III under MEDICAL.

MAGNETOMETER OPERATIONS. Early in operational planning it was felt that magnetometer sensors would be useful in the Suez Canal clearance operations as an ordnance location tool, expecially for potentially buried ordnance items. At that point, little was known about the general magnetic background field along the canal. In addition, the use of a towed magnetometer as a large area search tool against small ordnance targets, was not routine.

The basic principle employed by a magnetometer is that metallic objects disturb the earth's magnetic field in the immediate vicinity of the object. This disturbance or change in the earth's normal ambient magnetic field is detected by the magnetometer, processed through filtering circuits, amplified and displayed on a chart recorder.

Both magnetometer sensors employed in the canal were atomic spin resonance magnetometers. Their operation is based on the light absorption properties of a given gas (in this case, helium or cesium vapor) subjected to certain light stimulus, (optical pumping), radio frequency excitation, and the earth's magnetic field. A gas lamp and polarizer is used to generate a beam of polarized radiation. This beam is directed through an absorption cell to an infrared detector. The absorption cell contains the gas (helium or cesium vapor), some of which is maintained in a metastable state by application of high frequency excitation. The earth's magnetic field imposes a force on the excited gas atoms to force each atom into different energy sub-levels (precession). The rate or frequency of atomic precession is called the Larmor frequency and is related to the earth's magnetic field intensity. Changes in Larmor frequency cause a change in the amount of light absorbed by the excited gas which results in a voltage level change in the infrared detector. This voltage change drives a variable frequency resonance oscillator connected to a coil around the absorption cell. Measurement of the resonant frequency of the oscillator provides a method of measuring the total megnetic field strength. This is referred to as an electro-optical oscillator system. This system measures total field strength only. It does not measure the directional components.



Towfish housing the single unit Magnetometer.

SINGLE UNIT MAGNETOMETER OPERATIONS. In late July, personnel of NAVEODFAC began in-country tests of a single sensor towed magnetometer. The magnetometer employed was an AN/ASQ-81 metastable helium instrument manufactured by Texas Instruments, Inc. Operations commenced with a detailed series of tests. Tests were designed to evaluate the search and location capability of the system against ordnance targets in the canal environment. Initial testing commenced in Suez Bay after an area had been located which was fairly magnetically clean. Four target ordnance items, ranging in size from a BLU-45 bomblet to a 250 lb. general purpose bomb, were planted in a test field and multiple runs conducted. In September, testing was shifted to Port Said approaches and finally into the northern portion of the canal. Two major problems were encountered, one a function of the sensor system and the other a function of the environment.

The first is that the AN/ASQ-81 magnetometer measures total field strength, and thus provides no directional or range information when passing through a contact field. Direction and range information must be derived from multiple offset passes near the contact of interest and by precise information on sensor position.

The second problem effecting the use of a magnetometer within the canal is the very high magnetic background of the canal environment. Vast stretches of canal slope are lined with steel piling limiting a magnetic search to the canal channel. The bottom and slopes are also littered with metallic debris, both large and small.

Early in October, after significant testing and effort, use of the single towed magnetometer as an effective search tool within the canal was abandoned. The large amounts of ferrous material within the canal would have required that several searches be conducted at different sensitivities with a salvage effort to remove all metal detected. Assets were not available to conduct this in a rational finite time frame and the expected results in additional ordnance clearance was low.

GANGED MAGNETOMETER SENSOR SYSTEM. When it was discovered that the occurence of high density layers in the Great Bitter Lake reduced the effectiveness of acoustic sensors in that area, other options for ordnance contact location were explored. The Great

Bitter Lake, unlike other areas of the canal, did not present bank slopes lined with sheet piling and the salt layer underlying the lake presented little in the way of geological magnetic background. The degree of expected diving difficulty brought about by reduced visibility and increased buoyancy in the salinity layer and fluid sediments required a sensor system which would permit accurate contact location thereby reducing required diver effort.

It was decided in late July to develop a ganged magnetometer sensor system which could achieve a higher degree of localization of contacts than the single unit magnetometer described above. Fabrication of the systems was conducted by the Naval Coastal Systems Laboartory (NCSL) located in Panama City, Florida. The system was developed around four Varian cesium-vapor split beam magnetometers. As constructed in the ganged system, these units have a sensitivity of 1 gamma and can be operated in 7 settings, 1, 2, 5, 10, 20, 50 and 100 gamma full scale. Individual magnetometers were housed in fin stabilized tow bodies 8½ inches diameter and six feet long made of PVC. The four units were suspended for tow behind four 12-foot fiberglass small boats. The tow bodies were designed to fly 10 feet above the bottom, being depressed by 150 lbs. of lead weight which would tow on the bottom. The four boats were held at fixed distances by 20-foot spreaderbars of four-inch aluminum I-Beam.

Signal processing was accomplished in a processing unit aboard the primary tow boat with permanent graphic record output from a four-channel brush recorder. A fifth tow body, utilizing an identical magnetometer, was streamed in the center of the ganged tow at a depth of three feet. This magnetometer provided a reference or background reading which was electronically subtracted from the signal of the four deep towed sensors before display. Thus the four deep sensors were acting in conjunction with the reference sensor as a general magnetic background. This mode of operation was designed to filter out large magnetic disturbances such as passing ships so that small anomalies caused by ordnance would not be overwhelmed by large changes in magnetic background.

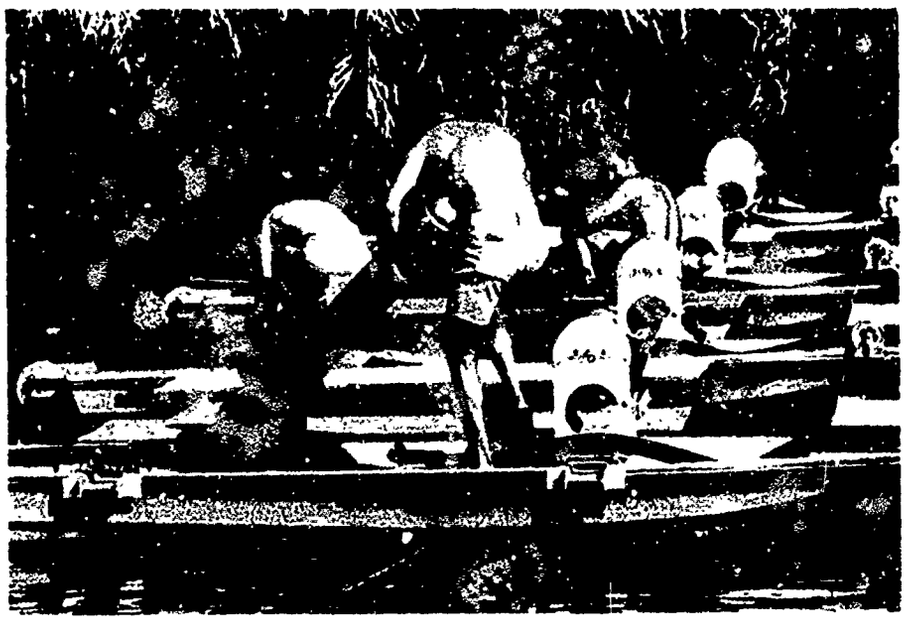
Directional information along ship track was obtained using a cubic autotape navigation system. The fixed spacing of four parallel magnetometers coupled with signal processing provided directional information on contact position athwart ships track. Tow speed for the ganged system was approximately 3½ knots. Plan and section views of the system are shown in Figures 13 and 14.

Testing of the ganged system was conducted in Panama City during late September. The equipment and technical support personnel commenced operations in the Great Bitter Lake early in October. An initial series of tests was conducted against a planted field of various ordnance items ranging in size from a BLU-45 bomblet to a 100Kg bomb. Estimates from the test data indicated that the systems had a maximum range of approximately 12 meters against a 155MM projectile with an average detection probability of .88 over this range. Track spacing was then based on these values to achieve probability .90 of detecting a 155MM projectile. Estimates of total system error indicated that 95% of the time a diver could be placed in the water within an elipse centered on the true contact position having axes 14 meters along and 20 meters across track respectively. Thus a standard 10 meter (radius) circle line search would have high probability of covering the true contact position.

Based on a survey by the ganged magnetometer of selected areas of the Great Bitter Lake, it was estimated that over 9,000 dives and approximately six months of effort would be required to examine all ferrous contacts located with the ganged sensor system. As a result of the large number of contacts and the high degree of diving difficulty expected, it was recommended to the SCA that they clear the lake by the use of a net drag and salvage divers, as discussed in Chapter III under Contact and Disposition.

SEARCH ANALYSIS. The analysis group from Wagner Associates performed many of the same functions in support of the ganged magnetometer search as were performed for the sonar search. Analysts participated in the planning and evaluation of the magnetometer tests,

presented track spacing recommendations for the ganged magnetometer system based on the test results, devised programs for computer plotting of ganged magnetometer contacts and assisted in preparing estimates of the number of dives required to clear the Great Bitter Lake of ordnance-like objects. Methods for computing search effectiveness probability for the ganged magnetometer were also prepared.



Assembly of the Ganged Magnetometer Sensor System.

NAVIGATIONAL AIDS

CHARTS AND CANAL NAVAIDS. The Suez Canal Authority provided CTF 65 units with detailed charts of some areas of the canal based on soundings taken as late as 1964. Other charts available included NAVOCEANO Chart 2431 (No. 56082) 9th edition revised February 13, 1967. Soundings were based on 1920 data with corrections from British data circa 1961. NAVOCEANO Chart 5435, 6th edition March 18, 1968, based on a British chart compiled in 1963 updated to 1965, covered the Suez Bay and canal approaches. British Hydrographic chart 233, compiled on the latest information available in 1966, was also available. Topographic information was based on Army Topographic Command Map series P773 Edition 1-AMS compiled in 1958.

Extensive damage had been done to the closely spaced canal navigational aids once relied upon by canal pilots. It is estimated that over 50 such navigational aids had been destroyed. Along large stretches of the canal, high sand embankments established during the period of prolonged conflict, obscured prominent features and landmarks.

NONELECTRONIC METHODS. French, British Fleet Clearance Diving Team and Egyptian divers used available charts, buoys, kilometer markers and land marks to conduct jackstay searches of the canal slopes. Areas were occupied fairly continuously and jackstays laid back-to-back along the entire length of the canal.

British minehunters used available charts, radar, sextant and pelorus bearings to existing navigational aids, and prominent charted features to position sonar search along the length of the canal and in the ports, anchorages and approaches. Available kilometer markers were considered the best references for tying sonar search data in with charts of the canal.

GANGED MAGNETOMETER SYSTEM

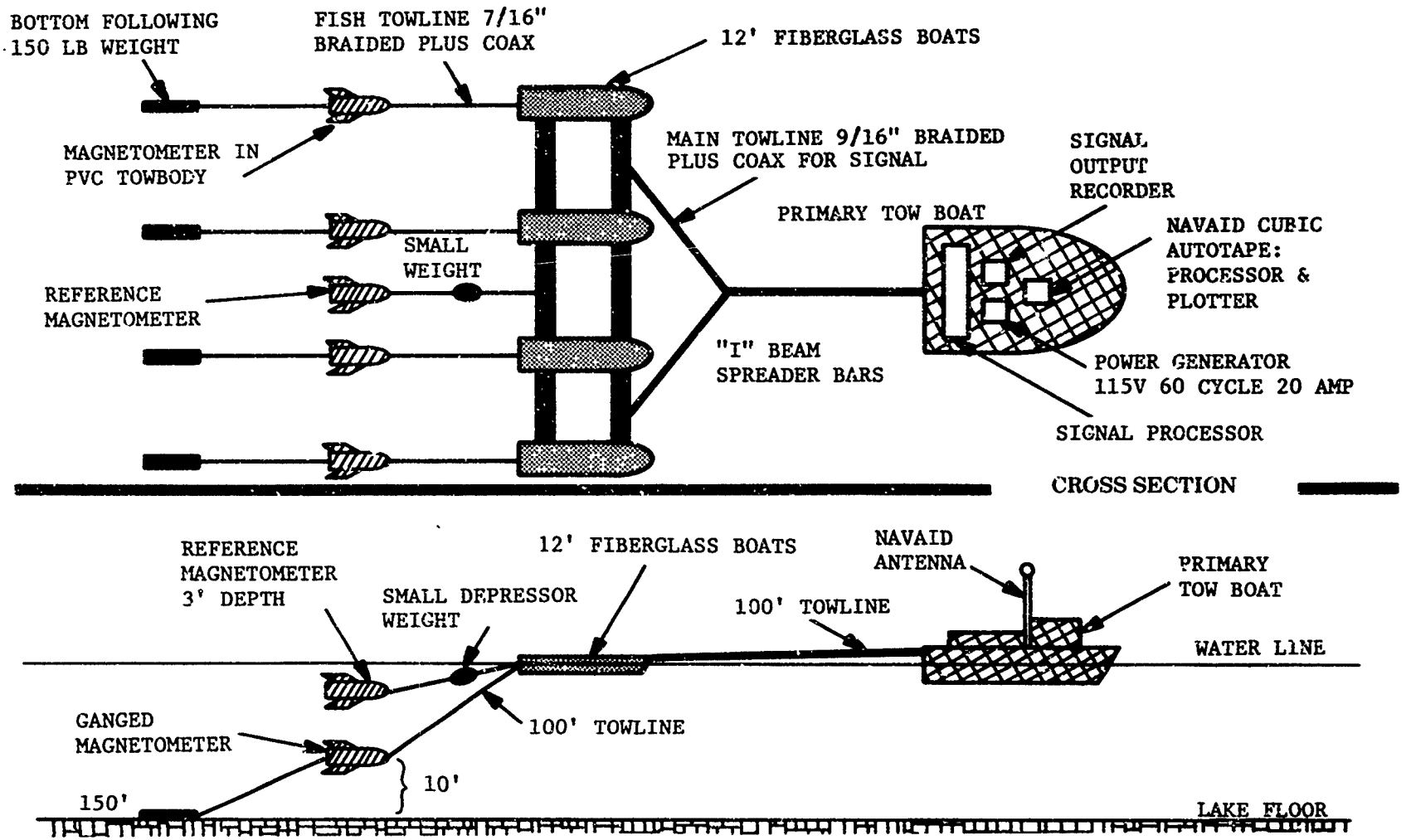


Figure 13.-14.

ELECTRONIC POSITIONING METHODS

NIMBUS STAR. U.S. Mine Countermeasures Forces employed in the minesweeping of the canal, utilized a Raydist-T-Navigation system to conduct precise area sweeps. Raydist-T is a continuous-wave, phase comparison, hyperbolic navigation system consisting of four fixed reference station transmitters at known locations and a mobile receiving station on each user craft (RH-53 Sea Stallion minesweeping helicopters). The receiving station is completely passive and contains receiving, indicating and recording equipment. The transmitters operate in pairs with one transmitter at either end of a baseline, one designated carrier-wave (CW), and the other single side band (SSB). The transmitted signals produce a family of hyperbolic lines of position between each station pair. Since receivers aboard the aircraft are passive, the system can accommodate multiple users.

The system provides two methods for user aircraft to follow a desired track. The first is for the user to follow a selected hyperbolic LOP when it coincides with the desired sweep path. This is suitable to open water areas such as approach channels and large areas such as the Great Bitter Lake. The second option is to preselect tracks and use the on-board plotters as a steering indicator. A length of plotter paper prepared in advance with a line preplotted on it in the way it would be drawn by the plotter if the aircraft traveled over the desired sweep path. As the helicopter is moving through the area, with the plotter operating, the aircraft is steered to keep the indicator on the preplotted sweep path. This method allowed for planning of sweep path to achieve desired sweep effectiveness against classes of bottom implanted influence mines. This method was well suited for use within the confines of the canal channel. Results obtained were highly satisfactory with respect to system performance and reliability. At moderate ranges repeatable positioning accuracy equals about three meters.

NIMBUS MOON WATER. An electronic precision navigation system, the cubic DM 40A Autotape, was employed by U.S. EOD forces to position acoustically and magnetically detected contacts in the canal channel and to mark these contacts for diver follow-up. The autotape DM 40A is a solid state line-of-site microwave sytem which operates in the S Band (3000 MHZ). The compact range-range system measures distances from the survey craft to each of several land based responders. Manufacturer's stated accuracy is 0.5 meter over moderate ranges, 10-30KM. Autotape systems employ an active transmitter receiver on the survey craft and responder sites on the shore. Each receiver transmitter responder set is a single user system. Three boat units and six responders were employed during the Suez Canal search operations. Peripheral equipment, including a system processor, plotter, and steering indicator unit, allowed the sytem to be operated in alternate modes to fit the need of controlled search or precision marking of observed contacts.

In the search mode, autotape positions were generated as the search vessel ran preplanned tracks to ensure search overlap based on the range of the sensor in use, thus achieving high detection probabilities. Tracks were plotted, and acoustic or magnetic contacts marked. Following sensor print out and analysis and computation of slant range from sensor to contact, X-Y coordinates of each contact were generated. The marking boat, with a cubic autotape system, including processor and steering indicator, would then insert these X-Y generated system positions and return to the contact and mark it with a buoy for diver followup.

Overall system error from detection to contact marking varied from system to system and area to area in the canal. Typically, 95% of the time, the sonar system was able to place a diver within an elipse centered on contact location and having axes, 19 meters along and 13 meters across track when using the criterion of two or more detections of the same contact in a cluster to call for a dive. The corresponding elipse for the gang magnetometer had axes 14 meters along and 20 meters across when using a single detection to call a dive.

Because the cubic system requires line-of-site transmission between the user craft and responders, obstacles along the canal bank provided occacional problems. This was most

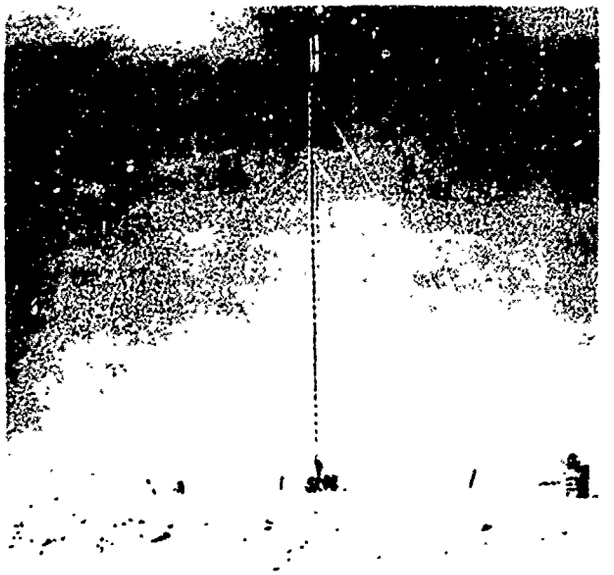
pronounced in the Port areas such as Port Said with many tall buildings, and in the northern area of the canal between EL KANTARAH and Ismailia where large sand fortifications up to 30 meters in height had been erected for weapon emplacement. These problems were circumvented by repositioning NAVAID responder sites. Time consuming difficulties were encountered in obtaining clearance for navigational aid sites from A.R.E. Army Forces. A list of sites occupied is shown in Table 6.

The autotape system proved effective and reliable for use in this type of operations. No major problems were encountered with the basic ranging subsystem. The units proved rugged and maintenance free over a six-month period in a hot and dusty environment. Minor problems experienced were attributed to battery power sources or overheating of responders placed in direct desert sunlight. Improved monitoring of batteries and shielding of responders from direct sunlight alleviated these minor problems. Minor problems encountered in the information processor and indicator subsystems were traced to overheating of circuit boards in the PDP 1100 series computer. Continued operation in an open desert environment required that the system processor space be air conditioned.

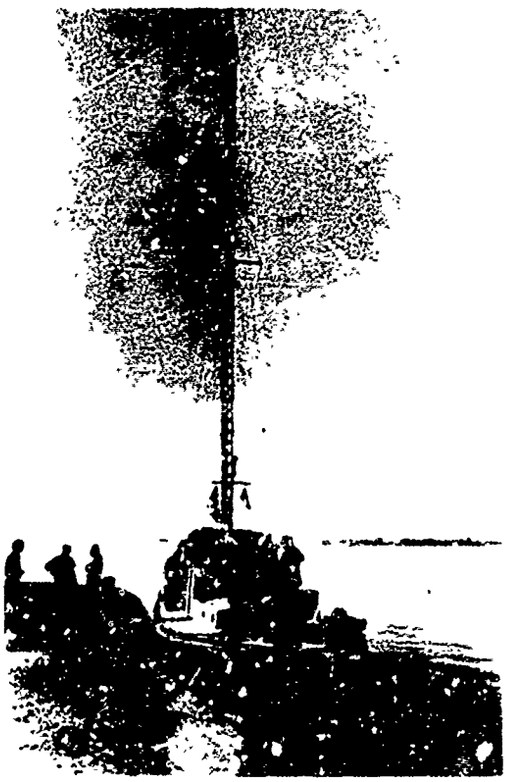
The overall system was not complex and was easily run by operational U.S. EOD technicians. Portability and reliability were important features as transponders had to be moved along the canal and transmitter receiver units switched between available platforms. Some vandalism occurred at unguarded NAVAID towers during hours of darkness, primarily as a source of nylon line.

Experience to date indicated that development of the Autotape system to permit multiple users for a single set of responders would provide increased flexibility for multi-unit operations. A data printout capability with the system processor to determine probable causes of malfunctions would also be beneficial.

Cubic Tripod Responder Site.



Cubic Responder mounted on a mast to gain range.



Cubic Tra. ;itter-Receiver Antenna on the Sonar Boat.

Table 6.

POSITIONS OF CUBIC AUTOTAPE TRANSPONDERS SUEZ CANAL CLEARANCE OPERATION

SITE	GRID POSIT.	REMARKS
1	36R VV231626	Map Sheet 578711 Series P7..', West of Port Said
2	36R VV377561	Map Sheet 578711 Series P773, East of Port Said (Port Fouad)
3	36R VV361605	Map Sheet 5787 I Series P773, East of Port Said Breakwater
4	36R VV257318	Map Sheet 5787 III Series 773 at KM 29
5	36R VV293106	Map Sheet 5785 II Series P773 at KM 66
6	36R VU301939	Map Sheet 5786 II Series P773 at KM 66
7	36R VU217651	Map Sheet 5785 IV Series P773 Deversoir
8	36R VU210653	Map Sheet 5885 IV Series P773 Geneifa
9	36R VU433387	Map Sheet 5884 IV Series P773 Geneifa South
10	36R VU533343	Map Sheet 5884 IV Series P773 Shalufa
11	36R VU582224	Map Sheet 5884 IV Series P773 Tower EL KUBRI
12	36R VU577117	Map Sheet 5884 IV Series P773 Port Taufiq Granite Wall
13	36R VU583131	Map Sheet 5884 IV Series P773 Ten Story Bldg.
14	36R VU564169	Map Sheet 5884 IV Series P773 Water Works
15	36R VU552127	Map Sheet 5884 IV Series P773 Refuel Pier
16	36R VU467062	Map Sheet 5884 III Series P773 Quarry Southwest of Suez Bay

Chapter V

ENVIRONMENTAL ANALYSIS

INTRODUCTION. The Suez Canal ranks as one of the most impressive changes man has imposed upon geography. The idea of joining the Mediterranean and the Red Sea by a navigable waterway through the Isthmus of Suez, dates back to the era of the early Pharoahs about forty centuries ago. The first canal was, in fact, constructed during the reign of Senousret III, Pharoah of Egypt, 2000 years BC, joining indirectly the two seas via the River Nile and its branches. This early canal, often neglected and left to fill up with sand, was successively re-opened to navigation by Darius I, Ptolemy II, Emperor Trajain and the Caliph Omar Ibn El Khattab after the Islamic Conquest. The excavation of the present canal began on April 25, 1859, with the official opening to navigation on 17 November 1869. The present canal allows a free exchange of water between the Red Sea and the Mediterranean. This shallow 16m and narrow (200m) bridge between these two seas is a unique and dynamic environment and has served as a pathway for some faunal migration. Details on the sediments, water masses and meteorological conditions and the impact of these environmental factors on TF 65 clearance operations are treated below.

SEDIMENTS. Between Port Said harbor and the Gulf of Suez, the Suez Canal runs through soils which are characterized by three general regions:

NORTHERN REGION. At Port Said and the surrounding area, the formation is the result of thousands of years of silt and clay sedimentation by the Damietta branch of the Nile River and other older branches which existed to the East of this present branch. This silt and clay formation extends southward along the canal to about KM 40. The slopes of the canal in this region are about 4 to 1. The harbor and basins of Port Said are layered with salt silt which extends to a depth in excess of 10 feet in some basins. The lands bordering the canal in the region south of Port Said are marshy. Visibility for diver search was extremely limited in the Port Said harbor and southward over the first 10 KM of the canal proper.

CENTRAL REGION. At about KM 40 a mixed sediment of silt and fine sand begins. In this central region of the canal, between Kantara and Kabrit, sediments consist of fine to coarse sand. Visibility improves considerably, and the sediment is well packed. Slopes in this central portion of the canal are about 4 to 1. In this region, the eastern bank of the canal is open desert stretching into the Sinai. Along the western bank, the Sweet Water Canal provides the necessary water for an agricultural strip. Exceptions to this general sediment pattern in the central region are the three lakes traversed by the channel: Lake Timsah, the Great Bitter Lake and the Little Bitter Lake. These will be discussed separately.

SOUTHERN REGION. The third major region of the canal extends south of the Little Bitter Lake to the terminus of the canal at Port Taufiq. Over this segment, the sandy sediment gives way to layers of dispersed rock varying in texture from soft sand stone to frequent hard rock outcrops. Canal slopes in this area are about 3 to 1.

All along the canal, except within the three lakes, the banks are protected by revetments of rock and sheet piling to reduce erosional damage caused by the waves generated by transiting vessels.

LAKE TIMSAH. The city of Ismailia, population about 250,000, borders the western margin of Lake Timsah. Heavy agricultural drainage, local sewage outfalls and plant detritus entering the lake have contributed to a layer of thick soft sediments up to seven feet deep. Poor visibility impacted on diver search operations and the amount of soft sediment made staged lifts on the TUG MONGUED and DREDGE KASSER, using the YHLC's more difficult. At a station occupied in Lake Timsah by Naval Coastal Systems Laboratory (NCSL) scientists,

using a sound velocity probe which weighed only 20 lbs. in air, contacted the bottom with almost no impact velocity yet penetrated five feet. During the second lift of the TUG MONGUED, sediments up to seven feet deep were encountered.

GREAT BITTER LAKE. The Great Bitter Lake occupies an area of about 90 square miles. The underlying formation is a salt deposit. Suez Canal Authority engineers have taken solid salt cores up to 60 feet in length. The formation probably developed over geologic time as Red Sea waters filled and were evaporated from this area. Scientists from NCSL occupied 28 stations in the GBL in July 1974. Of 28 bathymetric soundings taken, 26 measured depths exceeding those charted on U.S. Navy Oceanographic Office Chart 2431, by an average of six feet. Depth increases up to 14 feet were measured. Exceptions were two stations sampled on the eastern edge of the anchorage area where measured depth agreed with charted depth. Significant dredging of the area in 1962 and possible dissolution of the underlying salt layer probably account for the observed difference from the reference chart. The central portion of the Great Bitter Lake is covered with a layer of very soft sediments. At all stations occupied in this central area the sound velocity probe mentioned above penetrated the sediment to an average depth of 2.3 feet. The sediment layer appeared to be in a highly saturated or semi-fluid state. One sediment sample collected in the central southern portion of the land had a water content of 68 percent of total weight. Water mass phenomena observed, which may correlate with this sediment layer in the central basin, are discussed under water mass properties.

The shallower areas in the Great Bitter Lake exhibited varying bottom characteristics, ranging from quite firm in the wet dump area in the northwest corner to soft sediments bordering the central basin especially on the eastern margin.

WATER MASS PROPERTIES: An exchange of water between the Red Sea and the Mediterranean takes place through the Suez Canal. This exchange through the canal is of negligible importance to the water and salt budget of either larger body of water. The flow of water is complicated by the fact that the canal traverses the Bitter Lakes, the bottoms of which consist of layers of salt which are gradually being dissolved, and by the large evaporation potential of the Great Bitter Lake itself. This increases the salinity of waters in the canal to a concentration above that of the Red Sea or Mediterranean waters. In October-December the salinity at the surface of the canal to the north of the Great Bitter Lake has been described as high as 50.00 0/00 and at the bottom to be above 55.00 0/00. The flow through the canal is reportedly determined by three factors: (1) the difference in sea level between the Red Sea and the Mediterranean Sea, (2) the prevailing local winds, and (3) the great salinity of the canal water due to the solution of the salt layers of the Bitter Lakes and its evaporation potential. The most important factor appears to be the differences in sea level. The sea level is higher at Suez on the Red Sea than at Port Said on the Mediterranean except in July to September, and because the difference in sea level dominates, the surface flow is directed from the Red Sea to the Mediterranean in all seasons except July-September, when it is reversed. The highly saline bottom water flows from the Bitter Lakes towards the Mediterranean in all seasons, and from July to December an outflow of this water to the Red Sea also takes place. These conditions prevailed in the canal before the recent conflict as reported by Sverdrup Johnson and Flemming in the The Oceans (1946).

During the recent conflict, many physical changes in the canal were effected. Incomplete barriers, the hulls of scuttled vessels, existed at ten sites along the canal, impeding flow at each point to a limited extent, especially in the deep part of the main channel. For a period of seven years there was an absence of mixing action caused by the transit of deep draft vessels whose screws commonly reached to within ten feet of the bottom. During this prolonged period, dredging in the canal was not conducted. Another significant change came in October 1973 when one combatant force erected an earthen causeway across the canal at Deversoir. This barrier, 70 meters thick at the base and 15 meters across the top, acted as an earthfilled dam, completely blocking the normal flow. The Deversoir causeway was located at the northern end of the Great Bitter Lake at KM 97.

It appears that this combination of factors engendered changes in the normal circulation and water mass characteristics described by Sverdrup Johnson and Flemming. In the lower reaches of the canal from Kabrit to Port Taufiq, strong tidal currents were encountered. Divers estimated velocities up to four knots with periods of slack or near slack water of only 1½-2 hours duration. This was a major limitation to effective diving. In the Kabrit bypass, current velocities entrained plumes of sediment from the shallow areas along the channel restricting visibility. To the north of Deversoir, above Lake Timsah the flow was very sluggish with a small tidal component. Average flow in this region was northward to the Mediterranean.

The Great Bitter Lake presented a complex and entirely unexpected layering phenomena. Early sonar search indicated that the channels and anchorages in the Great Bitter Lake were almost devoid of contacts. Divers encountered a density layer above the bottom through which penetration was exceedingly difficult. After adding significant extra weight, divers were able to penetrate this extremely dense layer system where visibility quickly became zero and a strong presence of hydrogen sulfide was noted. Initial measurements of the layer indicated very high salinities. This fact led to consideration that sonar search techniques being used were really not effective in this portion of the GBL. During the period of 17-22 July 1974 a scientific team from NCSL conducted a series of measurements in the Great Bitter Lake and adjacent waters to investigate this anomalous layering and to ascertain the effect on clearance operations. Parameters measured included sound velocity, temperature, salinity, conductivity, bottom strength, light transmission, dissolved sulfides, depth, and bottom roughness. A total of 37 environmental stations were occupied, 28 on the Great Bitter Lake, two on the Little Bitter Lake and seven in land cut sections of the canal.

In the central portion of the Great Bitter Lake a three layer system was observed. The temperature and salinity in the upper part of the water column averaged 84.9 degrees F and 44.2 parts per thousand respectively A surface heating effect was noted daily over the uppermost 2 to 3 feet. At about 40-foot depth, a sharp layer of detrital matter, .5 to 2.0 feet thick was encountered which was floating on a 2 to 6-foot layer of extremely saline water averaging in excess of 125 parts per thousand. Visibility decreased markedly below the detrital layer. Below the high salinity layer, a very fluid soft sediment layer 1.5 to 3.8 feet thick was encountered as described in the section above on sediments. Interstitial water in this fluid sediment layer was highly saline, in excess of 200 parts per thousand, 7.5°F colder than the overlying water, and with dissolved sulfide concentrations in excess of .50 ml/l.

This central area of the Great Bitter Lake presented at that time a very complex environment in which to conduct acoustic detection and follow on diver search. From the samples taken it was concluded that not only would any acoustic signal be severely refracted and attenuated over much of the area of interest in the GBL, but that ordnance burial in the fluid sediment layer was highly probable. In addition, increased diving difficulty in the density layer coupled with very reduced visibility complicated the picture. The high concentration of H_2 S would add to diver problems.

The barrier at Deversoir was far from static. Suez Canal Authority personnel immediately began to remove the causeway using cutter dredges and cranes starting in May 1974. By early September the causeway had been opened 70 meters in width to a depth of 14.5 meters. Considerable flow across the barrier was being observed. Over 93% of the causeway had been removed by October 1974. In mid-September British divers made a planned series of dives in the Great Bitter Lake to observe density layer and visibility changes. Their report confirmed that conditions observed were much the same as seen in July. In October, search in this area was performed using a ganged magnetometer system with diver followup. Details are provided in Chapters II and IV. Since there appears to be no immediate dredging problem in the Great Bitter Lake, i.e., present depths are greater than the limiting depth of the canal to the north and south, consideration should be given to delaying a final check search action in this region until natural processes and shipping traffic are given a chance to dissipate the high salinity layer. Once the causeway at Deversoir is completely removed, natural flushing and the turbulence caused by shipping traffic may mix the high salinity layer causing it to disappear, and may remove much of the fluid bottom material. If this occurs, the success of detection of

unwanted items should improve and a final check search can be made at this time.

METEOROLOGICAL CONDITIONS. The entire zone bordering the Suez Canal is an area of high evaporation and low precipitation. Rainfall averages less than 1.5 inches annually usually occuring in the months of December to May. Daytime temperatures in excess of 98 degrees F are common during the summer months but relative humidity is low, 9 percent, and a light afternoon breeze is common. Maximum daytime high recorded is in excess of 120°F. Backradiation is high during the night hours and predawn temperatures fall to about 70 degrees F in the summer months. Most fresh water for agricultural use is obtained by a network of canals originating at the Nile River. Except for a strip along this source of fresh water, highly arid sand desert conditions exist. At Port Said and Suez Bay early morning conditions usually include low haze which reduces visibility and makes coastal navigation hazardous in an area where coastal relief is low and not many prominent landmarks exist. Winter temperatures in the area range from average daytime highs of 70 degrees F to nightime lows of 50 degrees F.

The most important single meteorological condition which impacts upon the canal are the strong seasonal equatorial wind patterns which drive sand into the canal. Toward the end of November strong winds are experienced known locally as Mu Knessa, the "Broom." Near the end of March comes Awa, the "cat's noise," and occasionally more violent winds known as Khamsin, the "wind of fifty days." The Khamsin usually last only a few hours at a time, but engenders classical sand storm conditions literally sand blasting external structures and forcing fine sand into even well protected equipments.

During the worst week of record, in 1911, sand storms deposited an estimated 105 million cubic feet of sand into the canal. Under these naturally occuring conditions, continual maintenance dredging of the canal is required.

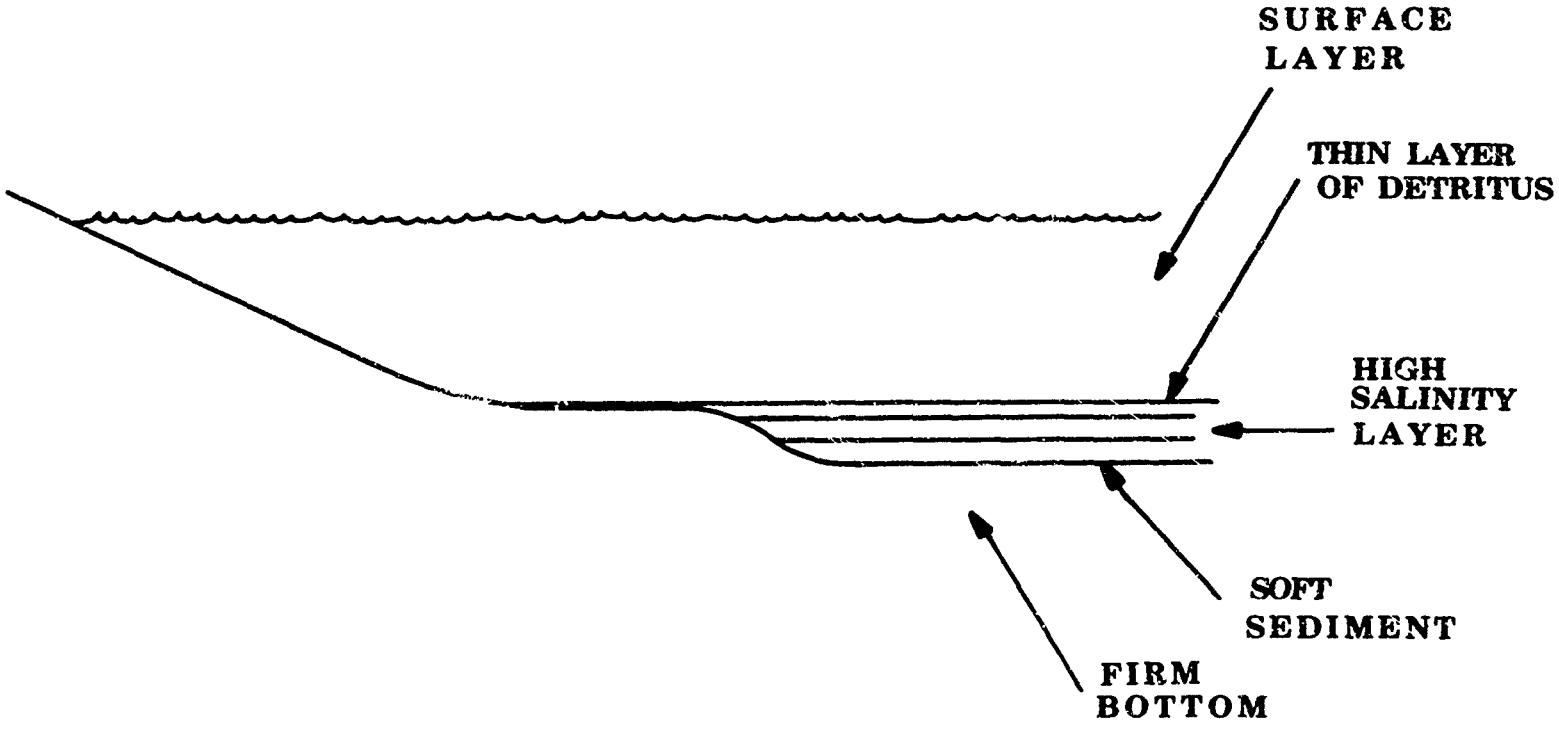
BIOMEDICAL ENVIRONMENT. All task force personnel were subjected to a tropical environment during billeting, messing and normal operations ashore. Both salvage and EOD divers were working in an aquatic environment not greatly dissimilar from routine conditions encountered in their normal diving operations, except for the conditions in the high salinity layer in the Great Bitter Lake described above.

MARINE ENVIRONMENT. The canal, its approaches and anchorages have a characteristic shallow water marine ecosystem not unlike that of the Red Sea. Within the canal rates of fouling appear quite high with the normal encrusting foulers, such as barnacles, predominating. The number of noxious marine species is quite low. Sharks occasionally enter the canal but the incidence is very low and resulting hazard negligible. In the Suez Bay a somewhat larger shark incidence was observed with frequency characteristic of the Red Sea. Hydrogen sulfide generated by decaying organic matter in the high salinity layer of the Great Bitter Lake reached levels up to 580 PPM and provided a potential hazard for open circuit SCUBA divers in that area. No noxious invertebrates were observed in the canal.

PUBLIC HEALTH ENVIRONMENT. A wide range of diseases are observed in the area of the Suez Canal. Malaria, paratyphoid, hepatitis, yellow fever and cholera are considered endemic. Potential for amoebic dysentery and other infectious diseases was a constant problem due to local sanitary practices and contamination of the water supply. Almost all personnel assigned suffered from recurring diarrhea and abdominal cramps sometimes accompanied by chills, fever and vomitting. A moderate incidence of fungal skin infections was observed especially during the summer months. These conditions receive much attention throughout task force operations, as discussed in Chapter III.

LESSONS LEARNED. In retrospect, it is apparent that an initial environmental reconnaissance survey of the canal should have been conducted immediately following NIMBUS STAR minesweeping operations. The survey should have been carefully planned to gain information necessary for ordnance search and salvage operations. As a minimum, the following parameters should have been examined:

GREAT BITTER LAKE



(1) Salinity/conductivity/sound velocity profiles at key points along the canal. This would have been in support of sonar search and would have keyed areas where problems could be expected.

(2) Sediment profiles at key points in the canal and at projected areas where salvage operations would need data for YHLC lifting operations. This data would also have been valuable to predict areas of probable ordnance burial.

(3) Visibility measurements to aid in predicting diver search difficulty.

(4) Current measurements to predict impact on diving and salvage.

(5) Precision bathymetry, especially in areas to be used and transited in salvage operations.

(6) Photorecon check on topographic changes since last map series issued to delineate man-made features that would mask NAVAID signals.

(7) Biomedical evaluation of proposed messing and berthing facilities to permit enlightened negotiation and planning for supply support required.

Eventually all these measurements were required to some degree and taken piecemeal during the operation, often by crude improvised methods. In any operation the environment is always a factor and one which cannot be altered by the operational commander and will ultimately be faced in the field. In future operations, overall planning should include a carefully planned environmental reconnaissance survey.

Chapter VI

CONCLUSIONS & LESSONS LEARNED

INTRODUCTION. Task Force 65 units remained in-country for over eight months completing the missions outlined in OPLAN's 4371 and 4371A. The following discussion covers the evaluation of the effectiveness of the clearance of ordnance from the Suez Canal, discusses remaining risk and provides lessons learned.

EVALUATION OF EFFECTIVENESS OF CLEARANCE Every effort has been made to achieve as thorough and effective a search and clearance of the Suez Canal of unexploded ordnance items as possible with the tools at hand and in the given environment. The non-visual sensors (acoustic and magnetic) employed were tested in the canal environment to insure effectiveness against a variety of expected ordnance targets. The fundamental tool in the entire operation was the highly trained EOD qualified diver. The entire canal was searched twice by independent groups. Search results were analyzed and third and fourth searches were conducted in areas where high concentrations of ordnance had been observed.

The vast majority of ordnance items located in the canal were found on the slopes of the canal often in very shallow water. A very significant amount of these ordnance contacts located were either bomblets, in clusters, or what appeared to be caches of ordnance intentionally or unintentionally dumped in the canal. For example, 250 anti-personnel mines were found in one spot on the East bank near the remains of an overturned boat.

The general distribution of ordnance correlated directly with areas along the canal where fighting was the heaviest. Four separate searches were conducted in such areas where large concentrations of ordnance were located on the first two searches.

It must be recognized that some ordnance undoubtedly remains in the canal. It was recognized from the start that no finite search would produce 100 percent clearance. It was clearly stated in the bilateral agreement between the U.S. and A.R.E grovenments that "the Government of the United States cannot guarantee that all hazardous objects will be located and rendered harmless." The original amount of ordnance in the canal is an unknown that prohibits meaningful assessment of a percentage value for the number of ordnance items remaining. Based on the observed data, the remaining ordnance should provide no significant hazard to normal ship traffic, especially in the main channel.

It is probable that some ordnance remains buried the sediment, especially in soft sediment areas and where sand has entered the canal from slumping or grading of the banks. However, most ordnance, even large air dropped items, were found proud of the bottom indicating low velocity upon sediment impact. It is felt that there is a low but real hazard remaining to dredge operations mainly from small ordnance items buried in the sediment along the canal slopes. The likelihood of large ordnance items remaining is low, as is the likelihood of any significant ordnance in the canal channel. No further search at this time with the forces and tools available to CTF 65 will significantly reduce this risk to dredge operations. Recommendations concerning equipments and methods to be imployed which would contribute to personnel and equipment safety during dredging were made to the Suez Canal Authority. In support of this, equipment was procured and advisory assistance given to permit the fabrication of chain and net drags designed to sweep the channel and lakes for partially buried items and specifically for nonordnance hazards remaining. This operation was conducted by the Suez Canal Authority.

It should be noted that throughout the operations of TF 65 in the Suez Canal area, Task Groups have reported observing additional ordnance being thrown in the canal by Egyptian Nationals for the apparent purpose of fishing. It is felt that this practice, if left unchecked, will

quite probably introduce new unexploded ordnance items in the canal to the same order of magnitude as that left following the search effort.

LESSONS LEARNED. The purpose of this section is to highlight certain areas which have appeared as either problems, or areas where future study appears necessary in the interest of improved capabilities to response to similar missions. Items discussed are not ranked in priority order. A wider and more detailed discussion of lessons learned will be provided in individual reports on the various segments of the operation, including mine countermeasures, salvage and EOD clearance, by the cognizant commands. Initial after action summary of NIMBUS STAR operations has been provided by COMINEWARFOR letter serial 1025 of 9 July 1974.

OPERATIONAL AREA. The following items were directly related to operations:

(1) COMMAND ARRANGEMENTS. CTF 65, reporting in the normal European command structure, exercised operational control over all U. S. forces assigned to NIMBUS STAR/MOON and acted as coordinating authority for NIMROD SPAR operations. The Supervisor of Salvage (CTG 65.7) reported to OPNAV for technical and managerial (including fiscal) control. CTF 65 maintained direct liaison with the American Ambassador, in Cairo. Separate bilateral agreements were made between the Egyptian Government and the Governments of the United Kingdom and France; however, once in-country, the local commanders of both nation's forces agreed to be integrated into the TF 65 organization for purposes of coordination. All operations were coordinated by CTF 65 through the A.R.E. military and the Suez Canal Authority (SCA), however, these two agencies more often than not had divergent opinions and conflicting priorities. While this command worked, it was through individual effort, rather than by organizational design. Future clearance operations should ensure that the Task Force Commander exercises operational control over all U. S. forces assigned. Further, when other nations are involved and close coordination is required, consideration should be given to designating a combined Task Force Commander. Additionally, the host country's priorities and command organization should be clearly defined far in advance of any deployment of forces.

While publicly, CTF 65 assumed operational control of the multinational forces assigned, control of non-U.S. forces has been more one of coordination control than direct operational control. In addition, different languages and methods of operation, and separate unilateral ties between Egypt, France,and the United Kingdom, were daily obstacles to overcome. Tactful persuasion therefore, has been the key factor to effectively steer clearance efforts in an atmosphere of harmony and expanding good relations. Operating with local A.R.E. groups in a country still technically at war, but not in combat, provided continuing frustrations. There has been a lack of continuity of many personnel assigned, and the SCA, A.R.E. Army, and A.R.E. Navy have different priorities The result has been significant time lag in many decisions.

Assignment of Sixth Fleet Task Force designator to U. S. clearance forces facilitated logistic and administrative support from Sixth Fleet assets. Due to the nature of the clearance operations conducted, a great deal of technical advice and assistance was required from CONUS sources. On occasion, requests for technical advice assistance were delayed while they were passed up the chain of command. In future operations of this type "direct liaison authorized" should be granted for exchange of technical information between the Task Force and CONUS commands and activities.

(2) OPERATIONAL CAPABILITIES. Although AMCM and Salvage will be subject of separate reports, the availability of mine clearance and salvage equipment hardware is worthy of comment. The U. S. Navy's AMCM capability proved available and viable. The U. S. Navy Supervisor of Salvage is capable of coordinating and supervising the necessary contractual services for equipment/hardware to conduct any size salvage operation on a world wide basis.

The U.S. Navy, however, has no satifactory fully developed operational equipment in inventory suitable for large area underwater search for and classification of items of ordnance size. Existing sensors, both acoustic and magnetic, were incorporated into specially tailored quick reaction systems with commerical equipment, and performed as well as could be expected in the extremely difficult canal environment. Adequate classification capability and high operating reliability, without specialized personnel, are not yet satisfactory. RDT & E programs for further optimization and rapid operator training are required as outlined below.

(a) Side Scan Sonar Range-Range Navigation Search System. A new tool has been introduced into the operational EOD community for the search of large areas for relatively small ordnance items. The basic navigation system and sonar search system were commercial "off the shelf" items and proved fairly simple to use and maintain by operational EOD personnel. Much was learned both by operations and in data analysis. The existing equipment is not yet what could be called an optimal, operational system for general fleet introduction to EOD Groups. Further development, test and evaluation with the goal of producing a fully operational system, should be considered.

(b) Magnetometer Operations. Deployment of two magnetometer systems to the canal area as small ordnance item search systems, developed a significant data base on use of this type of sensor. While the systems deployed were more complex and farther from being "off the shelf" than the acoustic system employed, the use of the magnetometer for large area EOD search was certainly well tested. Additional development, test and evaluation should be considered with the goal of providing an operational search system perhaps tied to the acoustic system discussed above.

(3) ENVIRONMENTAL DATA. It is apparent that an initial environmental reconnaissance survey of the canal should have been planned and executed immediately following NIMBUS STAR minesweeping operations. The types of data required are discussed in detail in Chapter V. Eventually all these measurements were required and taken piecemeal during the operation, often by crude improvised methods. Future operations should include a well-planned environmental reconnaissance survey.

(4) DATA REPORTING AND ANALYSIS. The language barrier, plus differing search and ordnance identification systems used by the separate units of the multi-national task force, made final data analysis difficult. It is recommended that in future operations care be given early in the operation to establish a common contact identification and reporting system, which includes assignment of reference numbers to each ordnance contact, and that data analysis at the task force level be well planned and commence at the onset of operations.

LOGISTICAL AREA. The following items in the broad category of logistical support impacted on the overall mission accomplishment.

(1) MESSING AND BERTHING ASHORE. Health and sanitation have been a continuing problem throughout the operation. The United States Government had earlier agreed to accept Government of Egypt furnished messing and berthing, in spite of the fact personnel would be operating from three war damaged cities where potable water, sewage treatment and refrigeration ranged from questionable to unsatisfactory. Local food handling was far below U.S. standards, as was the personal hygiene of the staff. NAMRU-3 reports indicate the canal area to be a public health disaster. Continuing efforts to improve the situation have been required, and have met with some success, as is indicated by the minimal number of cases of a serious nature. Significant loss of efficiency has resulted, however, from a very high incidence of gastro-intestional infections. All personnel involved should be carefully monitored for long term effects.

In any future such operation, on-site inspection of messing and berthing facilities and capabilities of the host government to provide adequate support, by qualified public works and medical personnel, especially experts in public health and the endemic medical problems of the

local area, should be carried out prior to entering into agreement for the messing and berthing of U.S. personnel ashore in a war-torn area. Even under operations where austerity is a planning consideration, this area requires indepth consideration before entering into agreements. It is recommended that any future agreements with a foreign government for provision of messing and berthing to U.S. personnel include some provisions for monitoring and control to ensure adequate standards are maintained.

(2) MEDICAL SUPPORT. Several lessons learned and recommendations have been suggested by staff medical officers as follows:

Dispensary facilities, supply and staffing should be at the level of an emergency room with minor surgical capabilities and life support equipment to hold medical and surgical emergencies for 24 hours.

Planning should insure that adequate use is made of medical expertise in the theater of operation to outline public health conditions and provide assistance in maintaining health care and environmental medicine.

Planning should provide for ballanced facilities to handle both trauma and tropical public health problems.

Care should be taken to avoid establishing a MEDEVAC network with no termination to adequate care facilities under U.S. supervision.

The role of medical mission support to civilian contractor personnel should be clearly defined.

(3) SUPPLY SUPPORT/COST ACCOUNTING. Supply support was provided by Commander Fleet Air Mediterranean, the assigned Flagship and the Suez Canal Authority. Regularly scheduled C-130 flights from Naples to Ismailia were the lifeline of the Task Force. This became painfully apparent whenever higher priority commitments and/or downed aircraft precluded scheduled flights. The assigned Flagship provided the majority of services and comfort items and served as the staging area for salvage contractor-related consumables. The Suez Canal Authority provided all road transportation, shop and office space. These latter three items were considered adequate but in most cases not up to U.S. standards. Helicopter support has been invaluable and should be considered a necessary integral part of all such operations.

OPNAV assigned limitations on obligations for NIMBUS MOON and NIMROD SPAR incremental costs thru December 1974, to be initially financed on an unfunded reimbursable basis under O&MN budgets of Chief of Naval Material, Commander in Chief, Atlantic Fleet, Commander in Chief, U.S. Naval Forces Europe, Commander Naval Telecommunication Command and Bureau of Medicine and Surgery and OPN budget of Chief of Naval Material. CTF 65 was not directly involved in the funding or related cost accounting. However, Naval Sea Systems Command authorized CTG 65.7 for NIMROD SPAR and CTF 65, for all other operations, to use United States owned Egyptian pounds and provided operation procedures to be used to administer and control the Foreign Currency (FT) Account. These funds have been authorized to be used to defray in-country costs, e.g., local purchase of material, per diem entitlements, air transportation, contractor services, indigenous payrolls, etc. CTF 65 and CTG 65.7 would approve all documents, submit same to NAMRU-3 for payment, and provide monthly reports to Naval Sea Systems Command. The FT account proved to be an invaluable tool in the day-to-day canal clearance management, particularly in the area of local support.

Appendix A-1

BILATERAL AGREEMENT NIMBUS STAR/MOON

EMBASSY OF THE
UNITED STATES OF AMERICA

No. 78

Cairo, *April 13, 1974*

Excellency:

I have the honor to refer to the recent discussions between our governments regarding the proposed assistance by the United States in the clearance of mines and unexploded ordnance from the Suez Canal, and to prepare that such assistance be governed by the following agreement.

1. The Government of the United States will, subject to the availability of funds, and otherwise in accordance with the laws of the United States, assist in the clearance of the Suez Canal as follows:

a. A special United States force (hereinafter referred to as the "Force") established for those purposes shall, in cooperation with the appropriate authorities of the Arab Republic of Egypt and, as may be agreed, the Armed Forces of the United Kingdom, carry out minesweeping operations in the Suez Canal.

b. The Force shall also provide training and advisory assistance to personnel of the Arab Republic of Egypt with a view to enabling the latter to carry out detection and disposal of unexploded ordnance situated in or adjacent to the Suez Canal but the Force shall not itself carry out such operations.

c. The provisions of this agreement governing the presence of the Force in the Arab Republic of Egypt shall be applicable until the termination of the activities of the Force referred to in sub-paragraphs A and B above and consequent departure of the Force.

2. The Government of the Arab Republic of Egypt will provide such assistance as may be necessary for safety of the Force and its members in carrying out the activities referred to in paragraph 1.

3. The Government of the United States will make every effort to ensure that the activities of the Force referred to in paragraph 1 are carried out in such a manner as to render the Suez Canal and its environs safe for further clearance activities and subsequent operations; however, the Government of the United States cannot guarantee that all hazardous objects will be located and removed or rendered harmless.

4. The Government of the Arab Republic of Egypt waives any and all claims against the Government of the United States, and agrees to indemnify and hold harmless the Government of the United States against any and all claims by others, whether governments or private parties, arising out of any acts or omission of the Government of the United States, the Force or its members in the conduct of the activities referred to in paragraph 1.

5. In accordance with such procedures as may be established under paragraph 9 hereof:

a. Vessels and aircraft assigned to or supporting the Force may freely enter and depart territorial waters, ports and airfields of the Arab Republic of Egypt, without payment of fees or charges.

b. Members of the Force will be allowed freedom of movement within the Arab Republic of Egypt, other than areas the Government of the Arab Republic of Egypt may designate as restricted areas, and freedom of entry to and agrees from the Arab Republic of Egypt.

6. Members of the Force will respect the laws, customs and traditions of the Arab Republic of Egypt, and will abstain from activities inconsistent with the spirit of this agreement. The Government of the United States shall take necessary measures to that end.

7. Members of the Force shall be immune from the criminal, civil and administrative jurisdiction of the Arab Republic of Egypt unless, in a particular case, the Government of the United States elects in writing to waive such immunity. The Force and its members and property belonging to either, shall be exempt from all forms of taxation. customs, and other regulations, except as may be agreed pursuant to paragraph 9.

8. The term "Members of the Force" means members of the Armed Forces of the United States and persons serving with or employed by the said Armed Forces, including contractor personnel, while in the Arab Republic of Egypt in connection with the activities referred to in paragraph 1 above. All members of the Force shall be furnished with appropriate identification, which shall be produced, upon demand, to the appropriate authorities of the Arab Republic of Egypt.

9. Supplementary arrangements between the appropriate authorities of the two governments may be entered into as required to carry out the purpose of this Agreement.

If the forgoing is acceptable to the Government of the Arab Republic of Egypt, I have the honor to propose that this Note and your Note in reply confirming acceptance will constitute an Agreement between our respective governments.

Accept, Excellency, the assurance of my highest considerations.

Hermann Fr. Eilts

His Excellency
Dr. Mohamed Abdel Kader Hatem,
Deputy Prime Minister,
and Acting Minister of Foreign Affairs
Cairo

MINISTRY
OF FOREIGN AFFAIRS
THE MINISTER

Cairo, *25 April 1974*

Mr. Ambassador,

I have the honor to acknowledge receipt of your Excellency's letter dated 13th of April 1974 regarding the proposed assistance by the United States Government in the clearance of mines and unexploded ordnance from the Suez Canal.

The Government of the Arab Republic of Egypt, whilst welcoming the assistance proposed by the United States, noted with appreciation that members of the force will respect the laws, customs and traditions of the Arab Republic of Egypt, that they will abstain from activities inconsistent with the spirit of these arrangements, and that the Government of the United States shall take necessary measures to that end.

The Government of the Arab Republic of Egypt wishes, furthermore, to signify its understanding as to some of the points raised in the aforementioned letter:

1. Desirous to ensure the safety of the American force and its members while carrying out their activities in Egypt, the Government of the Arab Republic of Egypt shall spare no effort, as far as possible, in providing assistance for the safety of the force in conformity with the regulations issued by the Egyptian authorities.

2. The Governments of the Arab Republic of Egypt and of the United States of America waive any and all claims against each other for damage to property, or for death or injury to any member of either party in the course of his activities in the clearance of the Suez Canal, or by any other act or omission for which either of the parties is legally responsible. Claims (other than contractual claims and those waived by the Arab Republic of Egypt) arising out of acts or omissions of a member of the force of the United States Government done in the performance of his official duty, or out of any other act, omission or occurrence for which the force of the United States Government is legally responsible, will be dealt with by the Egyptian Government and in all cases settled at the cost of the Arab Republic of Egypt. Claims in respect of acts or omissions of a member of the force of the United States Government arising otherwise than out of or in the course of his duty in Egypt may at the discretion of the United States service authorities be dealt with and settled by such authorities.

3. The Government of the Arab Republic of Egypt, while recognizing the freedom of entry and departure as referred to in subparagraphs "A" and "B" of paragraph "5" of the above mentioned letter, wishes to stress the following.

a. Prior authorization is necessary for entry of aircraft and vessels assigned to or supporting the force to the port airfields of Egypt and to Egyptian territorial waters and for the departure of such aircraft from Egyptian airfields. Reasonable notification shall be given prior to departure of vessels supporting the force from ports and Egyptian territorial waters.

b. Freedom of entry and departure is recognized to members of the force, in accordance with arrangements to be agreed upon with the Egyptian competent authorities.

4. The Government of the Arab Republic of Egypt agrees to grant immunity from criminal jurisdiction to the members of the force as provided for in your letter. However, the Government of the Arab Republic of Egypt reserves its position to undertake the following:

a. On the event of violation to Egyptian laws or regulations by a member of the force, Egyptian authorities may take him into custody without subjecting him to ordinary routine arrest. In such a case Egyptian authorities shall deliver the offender immediately to the nearest authority representing the force.

b. When a member of the force is taken into custody, Egyptian authorities may undertake a preliminary interrogation in the presence of a representative of the United States Government.

c. While handing over the offender, Egyptian authorities shall inform the command of the force of the charge sustained against him together with a copy of the preliminary interrogation.

d. The command of the force shall carry out a detailed investigation with the offender and shall deliver a copy of the inquest to the Egyptian competent authorities.

e. The command of the force and the Egyptian authorities shall assist each other in carrying out all necessary investigation concerning offenses committed by a member of the force including producing witnesses, collecting and presenting evidence, seizing and handing over items connected with the offense.

5. Members of the force shall not be subject to the civil jurisdication of Egyptian courts in matters related to the carrying out of their official activities.

6. Members of the force may wear the Uniform and insignias of the United States Armed Forces when within the operation zones. Outside these areas, they will wear civilian clothes.

7. All members of the force shall be furnished with appropriate identification cards issued by Egyptian competent authorities. Such cards shall be produced upon demand, to the authorities of the Arab Republic of Egypt.

8. The term "Members of the Force" as defined in paragraph "8" of your letter does not include Egyptian individuals serving with or employed by the force.

If the above points are acceptable, your letter of April 13 and this letter constitute an agreement between our two governments for the execution of activities related to United States assistance in the clearance of mines and assistance in clearance of unexploded ordnance in the Suez Canal area.

Accept, Mr. Ambassador, the assurance of my highest consideration.

Ismail Fahmy
Minister of Foreign Affairs

Appendix A-2

BILATERAL AGREEMENT NIMROD SPAR

MINISTRY
OF FOREIGN AFFAIRS
THE MINISTER

Cairo, *June 11, 1974*

Mr. Ambassador,

I have the honour to acknowledge receipt of your letter of today's date which reads as follows:

"I have the honour to refer to the recent discussions between our governments regarding the proposed assistance by the United States in the salvage and/or removal from the Suez Canal of sunken vessels and certain other hazards to navigation, and to propose that such assistance be governed by the followings provisions:

1. The Government of the United States will, subject to the availability of funds, and otherwise in accordance with the laws of the United States, effect the removal from the Suez Canal of those vessels and other objects designated in Annex A hereto, and of such other objects and hazards to navigation in the Canal as may hereafter be mutually agreed which the Government of the Arab Republic of Egypt cannot remove without assistance. Except with respect to any vessel as to which it is jointly determined that salvage is possible, all vessels and other objects removed from the Canal shall be moved to agreed dumping areas designated by the Government of the Arab Republic of Egypt within its territory.

2. The Government of the Arab Republic of Egypt shall provide all necessary assistance as far as possible to enable the Government of the United States to carry out the operation efficiently. In particular, the Government of the Arab Republic of Egypt shall provide a navigable access to the site of each object to be removed; provided all available information as to the location, character and condition, and other characteristics of the areas of the canal in which the operations are to be conducted; provide for the payment of such local costs as may be agreed; and provide for the security as far as possible of the personnel and equipment engaged in the operation.

3. The United States Navy, shall, under the general policy guidance and responsibility of the Embassy, carry out the operations referred to in paragraph 1 above, and may, after due consultation, make use of such contractors, other than Egyptian nationals, as it deems necessary and advisable in carrying out the work. The Suez Canal Authority, and such other authorities or agencies as the Government of the Arab Republic of Egypt may designate, shall be responsible for carrying out the obligations of the Government of the Arab Republic of Egypt under paragraph 2 above.

4. The arrangement presently in force with respect to the assistance of the Government of the United States in the clearance of mines and unexploded ordnance from the Suez Canal shall also be applicable, <u>mulatis mutandis</u>, to the operations comtemplated by the present arrangement. In particular, but with limiting the generality of the foregoing, the provisions of the arrangement concerning liability for claims shall apply in full to the operations referred to in paragraph 1 above. Members of the Armed Forces of the United States and persons serving with or employed by the said Armed Forces, including contractors and contractor personnel, other than Egyptian nationals, while in the Arab Republic of Egypt in connection with the operations referred to in paragraph 1 above, shall be covered in all respects by the provisions applicable to the "members of the force" under that arrangement.

If the foregoing is acceptable to the Government of the Arab Republic of Egypt, I would appreciate your written concurrence therein.

Accept, Excellency, the assurance of my highest consideration."

In reply, I have the honour to inform you that the foregoing assistance is acceptable to the Government of the Arab Republic of Egypt who therefore concur that your letter and present reply shall constitute an agreement between the two governments which shall enter into force on today's date.

I avail myself of this opportunity to renew to you, Mr. Ambassador the assurance of my highest consideration.

Ismail Fahmy
Minister of Foreign Affairs

The following are the vessels and other objects which the Government of the United States has agreed to remove from the Suez Canal:

Name	location
M/S "ISMAILIA"	km. 6.50
S/S "MECCA"	7 40
BUCKET DREDGER NO. 23	72.00
TUG "MONGUED"	81.50
DIPPER DREDGER "KASSER"	81.50
CONCRETE CAISSON	87.00
CUTTER DREDGER "15 SEPTEMBER"	98.20
TANKER M/T "MAGD"	156.00
TUG "BARREH"	158.00
BUCKET DREDGER NO. 22	158.05

Appendix B

COMSIXTHFLT OPLAN 4371A

TASK ORGANIZATION: ANNEX ALFA

1. SITUATION:

a. General. The Suez Canal, and its land environs are suspected of containing mines and other unexploded ordnance (UXO). The Government of Egypt (GOE) has requested assistance from the United States in training and advising Egyptian personnel in explosive ordnance disposal (EOD), land mine clearance operations and in removal of designated shipwrecks from the Suez Canal. The United States had agreed to provide training and advisory assistance in clearing land mines and explosive ordnance all along the Suez Canal banks and in its contiguous waters. An additional commitment has been made by the United States to the GOE for the removal of designated shipwrecks from the Suez Canal. NIMBUS MOON personnel are already in-country and functioning in instructor and advisor roles. This plan outlines the Task Force 65 role in NIMBUS MOON/NIMROD SPAR.

b. Enemy. The presence of hostile forces is not contemplated, nor is it contemplated that hostile action will be taken or threatened to prevent the execution of the action prescribed herein.

c. Friendly. In addition to those friendly forces indentified in USCINCEUR OPORD 4371.

(1) Commander Naval Inshore Warfare Forces, Atlantic Fleet (COMNAVINSWARLANT):

(a) will report to COMSIXTHFLT and assume command of MCM Task Force 65 (CTF 65) on or about 3 June 1974.

(b) assume OPCON of EOD forces (both USN and USA).

(c) provide command and control of operating forces assigned, including UK forces.

(d) act as coordinating authority for salvage operations being conducted to remove shipwrecks from the Suez Canal.

(2) Supervisor of Salvage, U.S. Navy:

(a) will conduct salvage operations to remove designated shipwrecks from the Suez Canal. Technical and management (including fiscal) control will be provided by the Chief of Naval Material through U.S. Navy channels.

(b) will report to CTF 65, who will coordinate operations under this plan.

d. Assumptions.

(1) Advisory efforts will be conducted in a non-hostile environment without intervention by any nations, and U.S. military will not be required in a combat role.

(2) The GOE Armed Forces will be responsible for:

(a) the actual clearance of unexploded ordnance from the land area on both sides of the canal to an average distance of 50 meters from the waters edge.

(b) the clearance of unexploded ordnance from the canal.

(c) clearance of land mines and unexploded ordnance from the operating sites as requested by CTF 65.

(3) The GOE will provide personnel and equipment, within their capability, in support of NIMBUS MOON/NIMROD SPAR operations.

(4) The GOE will provide U.S. advisors with support services and facilities within their capability.

2. MISSION:

a. To train and advise GOE military forces in order to enable them to remove unexploded ordnance from the contiguous waters of the Suez Canal as well as from the land areas on both sides of the canal, to an average distance of 250 meters, and to conduct salvage operations to remove designated shipwrecks from the canal.

3. EXECUTION:

a. Concept of operations: Due to the inherent dangers of NIMBUS MOON operations, the presence of land mine fields and other UXO, special operational constraints will be required. The safety of personnel is paramount. Safe landing areas and cleared areas for operating purposes will be established by the Task Force Commander.

(1) General.

(a) U.S. forces engaged in NIMBUS MOON operations under this plan will be limited to an advisory role only in assisting the GOE to clear land mines and explosive ordnance.

(b) The U.S. forces committed to provide training and advisory assistance to GOE forces engaged in water and land USO clearance efforts will be under direct control of the MCM Task Force Commander.

(c) Supervisor of Salvage (SUPSALV) will direct operations to remove ten designated wrecks from the Suez Canal. SUPSALV team of up to 5 Naval officers and 3-6 civilian employees of the Navy will supervise the activity of the Murphy Pacific Marine Salvage Company who will do the actual removal. SUPSALV will coordinate closely with the U.S. Ambassador, Cairo, and will report to him for interface with GOE/SCA on policy matters. He will report for additional duty to CTF 65, who is designated as coordinating authority.

(d) Royal Navy forces will be conducting mine hunting operations in the canal area.

(2) Deployment.

(a) U.S. forces engaged have already deployed to the area.

(b) Royal Navy forces have already deployed to the canal area for mine hunting operations.

(3) Employment.

(a) U.S. forces involved will be employed in an advisory role only.

(b) Royal Navy forces will continue to be employed in minehunting under the operational control of CTF 65.

(c) In-country logistic and communications support will be established to make maximum use of Egyptian support facilities and equipment.

b. TASK

(1) CTF 65 will:

(a) provide training and advisory assistance to the GOE efforts to clear land mines and unexploded ordnance along the Suez Canal, using assigned U.S. Army EOD/Engineer personnel.

(b) provide training and advisory assistance in the GOE efforts to render safe and dispose of explosive ordnance presently located within the contiguous waters of the Suez Canal using assigned U.S. Navy EOD personnel.

(c) be prepared to conduct the rapid withdrawal of U.S. military personnel and DOD sponsored civilian personnel engaged in NIMBUS MOON and NIMROD SPAR operations in accordance with current directives.

(d) prepare, in coordination with SUPSALV and GOE, detailed supporting plan with planned milestones.

(e) maintain appropriate liaison with GOE.

(f) keep COMSIXTHFLT advised of equipment and personnel required in area for NIMBUS MOON and NIMROD SPAR operations.

NOTE-COMFAIRMED had been tasked to conduct logistic operations, including intratheater airlift, in support of CTF 65.

c. COORDINATING INSTRUCTIONS

(1) This plan is approved for execution, and supersedes COMSIXTHFLT OPLAN 4371 which is hereby cancelled.

(2) Commander Task Force 65 (CTF 65) will maintain close and continuing liaison with GOE, MOD, Suez Canal Authority (SCA) and American Embassy Cairo.

4. LOGISTICS AND ADMINISTRATION

a. Concept of logistic support for Task Force 65 operations will make maximum use of existing lines of communication and assets already deployed to the canal area for NIMBUS STAR operations, and not scheduled for retrograde.

b. Assumptions.

(1) That GOE will continue to provide berthing, messing, and ground transportation for U.S. forces.

(2) Intra-theater airlift will continue into Ismailia with existing airspace and control provision.

(3) Major surgical support will be provided by the U.N.E.F./Canadian Field Hospital, Cairo. Additionally, U.N.E.F. Field Medical sites are being set-up in the canal area and when operational will accept CTF 65 personnel for emergency treatment on a case basis.

(4) That Cairo airport is available for use.

(5) That Task Force Commander's staff provide single point of contact with GOE for logistic transportation and housekeeping support of forces.

(6) That a two ACFT, H46 Helo Detachment with appropriate support, will be provided for further use of CTF SIX FIVE.

(7) That present resupply lines of communication are adequate, and will be altered in response to changing needs.

(8) That USS BARNSTABLE COUNTY (LST 1197) will act as flagship for CTF 65.

c. Logistic Responsibilities. In order to accomplish the logistic tasks required by this plan the following responsibilities are assigned:

(1) CTF 65 will:

(a) coordinate through COMSIXTHFLT for logistic and administrative support for all NIMBUS MOON/NIMROD SPAR operations.

(2) COMFAIRMED will:

(a) provide or arrange for shore based and intra-theater air logistics support for the U.S. forces involved.

(b) provide official intra-theater airlift for RN Mine/UXO forces on a not to interfere basis.

(c) provide staff liaison personnel as required or directed.

(d) coordinate any required aviation maintenance requirements ashore.

(e) provide interface between operating forces and the normal supply shore establishment.

(f) provide intermediate level maintenance support for all TF 65 aircraft.

d. Supply and Distribution

(1) The primary cargo line of communication will be by MAC channel from CONUS to Naples thence by CINCUSNAVEUR organic airlift to the canal area.

(2) Mail for participating units will be received, sorted and redistributed from Fleet Mail Center, Naples.

(3) Personnel movement in support of TF 65 operations will be conducted in accordance with existing procedures.

(4) Salvage operations in support of this plan will be coordinated by CTF 65.

(5) Local procurement in support of TF 65 operations will be governed by existing directives and coordinated by COMSIXTHFLT.

(6) The GOE has agreed to satisfy USN fuel requirements at the canal area for forces engaged in this operation.

(7) Precise and separate documentation of costs for NIMBUS MOON and NIMROD SPAR must be maintained. NIMBUS MOON will continue under specifically approved funding. NIMROD SPAR support is provided through allocation of state/aid security supporting assistance appropriation funds. CHNAVMAT is assigned funding responsibility of NIMROD SPAR. No involvement in NIMROD SPAR funding is anticipated via CINCUSNAVEUR channels.

e. Maintenance

(1) CINCUSNAVEUR maintenance policy is contained in CINCUSNAVEURINST 4700.1 series.

(2) Intermediate level maintenance of TF 65 aircraft will be provided by COMFAIRMED.

f. MEDICAL/DENTAL SERVICES

(1) All medical support will be directed by the senior Medical Officer CTF 65. He will control and assign first aid teams as necessary to field sites. Those patients requiring treatment beyond the professional capability of corpsmen ashore will be transferred by logistic helicopter or other appropriate means to the flagship for further treatment.

(2) Routine consultation/patient transfer to armed forces hospitals will utilize established aeromedical evacuation from either Ismailia or Cairo, normally using ASCOMED support procedures as per COMFAIRMED/COMASWFORSIXTHFLTINST 4630.2C (Air Logistics Manual).

(3) Area evacuation of patients may be effected using the most available method, usually an ASCOMED airlift.

(4) Serious or mass casualty cases requiring immediate, lifesaving treatment may be evacuated to the UN Canadian Hospital at Cairo by GOE helicopter or ambulance. Evacuation may be made to UN hospitals in the canal area when these facilities are established. Emergency cases will be further transferred from the UN Hospital to an armed forces hospital by AEROEVACUATION when conditions permit.

(5) A preventive medicine inspection will be made in all site areas on a periodic basis, with recommendations made regarding sanitation, hygiene, messing facilities, water supply, waste disposal and pest control.

(6) No U.S. Government dental facility is available in the Suez Canal area. Dental emergencies will be evacuated for treatment at the U.S. Naval Hospital, Naples. When more practical, local dental service may be utilized, the serviceman later being reimbursed from government funds.

g. PUBLIC AFFAIRS

(1) In support of this plan, timely information will be provided for external and internal public affairs use concerning U.S. military activities, consistent with national objectives and security requirements. However, a low profile will be maintained in salvage operations. Higher authority will provide public affairs policy guidance as required.

(2) Public affairs activity and procedures will be coordinated with the host government.

(3) CTF 65 will be responsible for assisting newsmen in covering U.S. activities, and general news and feature material on press release.

(a) Press releases will be cleared, reproduced and distributed to the press on the scene, in coordination with USIS Cairo and the host government. Feature material will be released locally and through CHINFO. Still photography will be processed and released locally. Motion picture footage will be forwarded unprocessed to the Naval Photographic Center, Washington, D.C., for public release and historical purposes, keeping CHINFO advised of shipping data. Copies of press releases and sitreps for public release will be forwarded to appropriate higher authorities, including COMSIXTHFLT, CINCUSNAVEUR and USCINCEUR.

(b) Logistic support from USIS Cairo will continue to be necessary

(c) There will be no differentiation between U.S. and foreign newsmen regarding cooperation or facilities. Any press accreditation requirements will be coordinated through U.S. diplomatic authorities and host governments.

(4) USIS Cairo will act as a point of contact in Cairo for newsmen.

(5) One Public Affairs Officer (165X) and one photojournalist (8148) will be assigned to CTF 65. When required, the CTF 65 Public Affairs Officer may request additional still and motion picture photo assistance from COMSIXTHFLT with COMBATCAMGRU Det Naples an info addee.

Appendix C

MAJOR SHIPS OF TASK FORCE 65

This Appendix provides documentation on the twenty-two ships under the flags of four nations which took part in the overall Suez Canal clearance operation. This force ranging in size from 600-foot amphibious assualt ships to 136-foot coastal minesweepers was augmented by a number of tugs, pilot boats, floating cranes, barges and small craft to support the personnel and equipment of Task Force 65.

FRENCH NAVY. French Navy forces of TG 65.8 utilized four minesweepers to support clearance divers, two minehunters to search for ordnance and a general Task Group logistic support ship.

MINESWEEPERS. ACACIA Class

AJONC, GARDENIA, GIROFLEE, LILAS

length	136 feet
beam	26 feet
draft	8.3 feet
displacement	370 tons
complement	3 officers 35 men

MINEHUNTERS. CIRCE Class

CALLIOPE, CERES

length	152 feet
beam	29.2 feet
draft	8 feet
displacement	460 tons
complement	5 officers 45 men

MINESWEEPER SUPPORT

LOIRE

length	300 feet
beam	43 feet
draft	12 feet
displacement	2,075 tons
complement	5 officers 66 men

ROYAL NAVY. Royal Navy forces employed three minehunters to search for ordnance and one minelayer as a support vessel. One minehunter, HMS WILTON, was constructed with glass reinforced plastic (GRP).

MINEHUNTERS. TON Class

BOSSINGTON, MAXTON, WILTON*		
length	140 feet	153 feet*
beam	28.8 feet	28.8feet*
draft	8.2 feet	8.5 feet*
displacement	360 tons	450 tons*
complement	5 officers 31 ratings	

MINELAYER.

ABDIEL	
length	244.5 feet
beam	28.5 feet
draft	10 feet
displacement	1,350 tons
complement	14 officers 109 ratings

UNITED STATES NAVY. Four successive ships served as flagship with communications and logistic support roles. Two amphibious assault ships served as flagship during Operation NIMBUS STAR and supported the RH-53 Sea Stallion mine countermeasures helicopters. Two tank landing ships served as flagship during the following NIMBUS MOON/NIMROD SPAR operation. Additionally, the two heavy lift cranes THOR and ROLAND and heavy lift craft (YHLC) CRILLY and CRANDELL served as principal assets during the salvage operations. These four unique salvage vessels are shown in Chapter II.

AMPHIBIOUS ASSAULT SHIPS. (LPH) IWO JIMA Class

IWO JIMA, INCHON	
length	592 feet
beam	84 feet
draft	26 feet
displacement	18,300 tons full load
complement	48 officers 480 enlisted

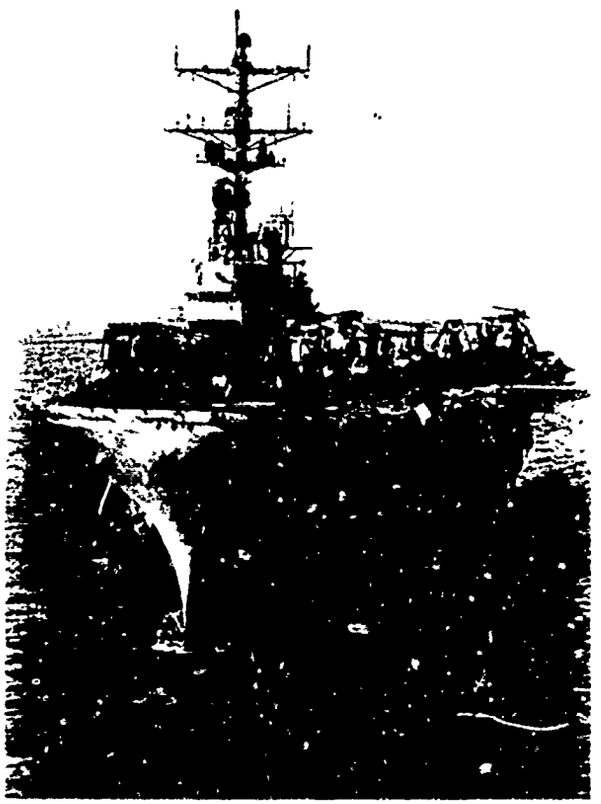
TANK LANDING SHIPS. (LST) NEWPORT Class

BOULDER, BARNSTABLE COUNTY	
length	522 feet
beam	69.5 feet
draft	15 feet
displacement	8,342 tons full load
complement	14 officers 217 enlisted

EGYPTIAN SUPPORT VESSELS. The majority of tugs, pilot boats, barges and floating cranes employed were provided by the Suez Canal Authority from existing assets. In addition, they provided two large tugs which supported movement of the principal salvage craft and the converted yacht NADA which was used as a support vessel for the Royal Navy Fleet Clearance Diving Team. The A.R.E. Navy provided two salvage ships MAX and DEKHELA. These ships supported both the independent A.R.E. Navy EOD divers and conducted some light salvage on non-ordnance contacts.

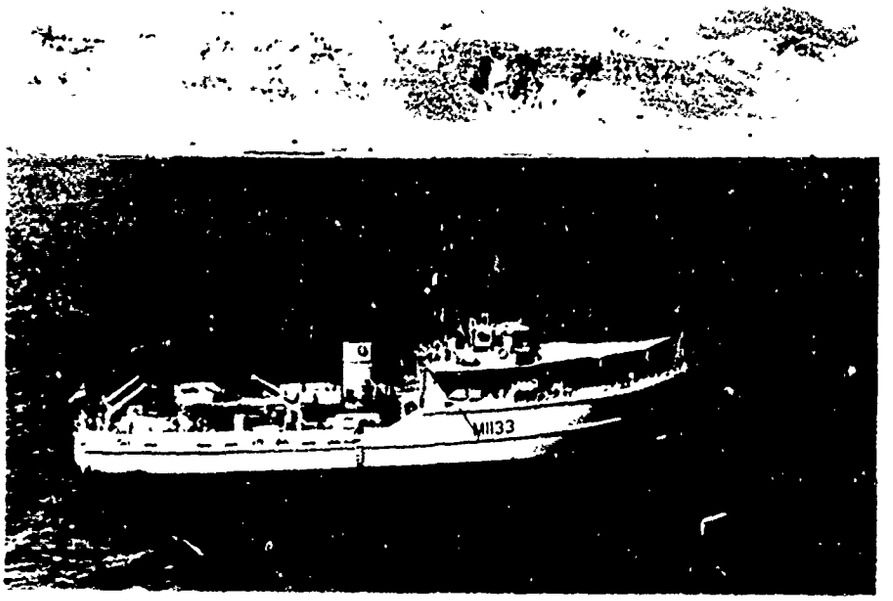
DEKHELA

length	43 meters
beam	10.3 meters
draft	4.71 meters
displacement	936 tons full load
complement	8 officers 56 men

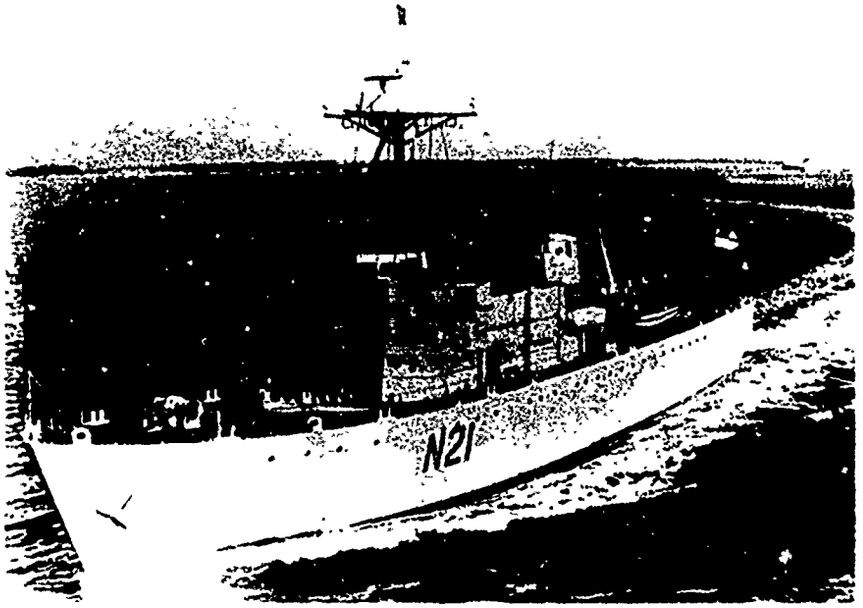


USS IWO JIMA (LPH-2) one of two amphibious assault ships to serve as TF 65 Flagship during NIMBUS STAR - NIMBUS MOON Operations.

USS BOULDER (LST-1190) one of two Tank Landing Ships to serve as TF 65 Flagship during NIMBUS MOON and NIMROD SPAR Operations.



HMS BOSSINGTON searching Suez Bay anchorage areas. One of three Royal Navy Minehunters employed in OPERATION NIMBUS MOON.

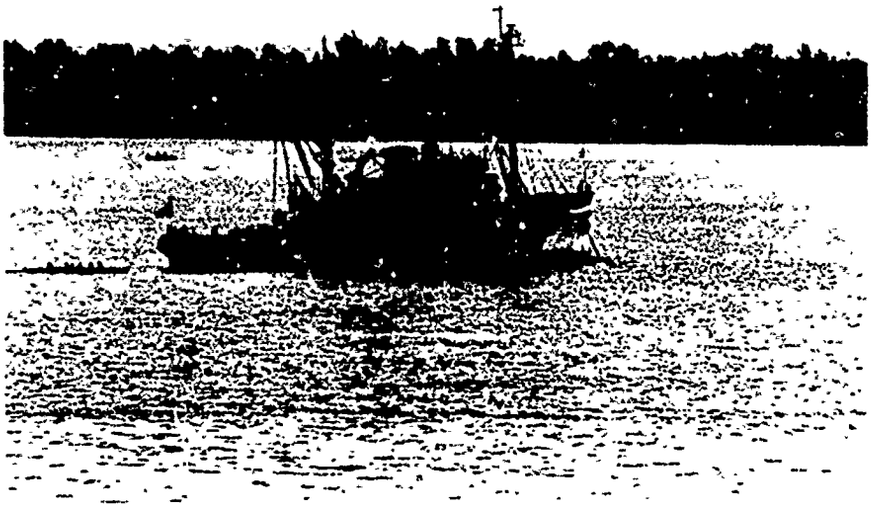


HMS ABDIEL Royal Navy Minelayer employed as a Command Support Ship during NIMBUS MOON Operations.

French Navy Minesweep GARDINIA one of four vessels of this Class which served in NIMBUS MOON Operations.

French Navy Minehunters and Support Vessel moored in Lake Timsah.

Converted Egyptian Yacht NADA used by Royal Navy Fleet Clearance Diving Team in NIMBUS MOON Operations.



USS ESCAPE (ARS-6) Support Ship for Residual Task Force.

MAX one of two A.R.E. Navy Diving Ships used in the Suez Canal Clearance Operation.

APPENDIX D

GLOSSARY OF TERMS

AMCM	Airborne Mine Countermeasures
ARE	Arab Republic of Egypt
ARS	Submarine Rescue/Salvage Ship
ASCOMED	Aircraft Scheduling Command-Mediterranean
BLU	Bomb Live Unit
BUMED	Bureau of Medicine
CHINFO	Chief of Information, Navy Department
CINCEUR	Commander in Chief, U.S. European Command
CINCUSNAVEUR	Commander in chief, U.S. Naval Forces Europe
CNM	Chief of Naval Material
COMBATCAMGRU	Atlantic Fleet Combat Camera Group
COMFAIRMED	Commander Fleet Air, Mediterranean
COMINEWARFOR	Commander Mine Warfare Force
COMNAVSEASYSCOM	Commander Naval Sea Systems Command
COMSIXTHFLT	Commander SIXTH Fleet
CONUS	Continental United States
EOD	Explosive Ordnance Disposal
F	Farenheit
FCDT	Fleet Clearance Diving Team (Royal Navy)
FM	Frequency Modulation
FN	French Navy
FPO	Fleet Post Office
FT	Foreign Currency
GBL	Great Bitter Lake
GOE	Government of Egypt
HF	High Frequency
HMM	Marine Medium Helicopter Squadron
HMS	Her Majesty's Ship
KHZ	Kilohertz
KM	Kilometer
LPH	Helicopter Landing Platform
LST	Tank Landing Ship
MEDEVAC	Medical Evacuation
NAMRU-3	Naval Medical Research Unit 3, Cairo, Egypt
NAVCHAPGRU	Naval Cargo Handling and Port Group
NAVOCEANO	Naval Oceanographic Office
NCSL	Naval Coastal Systems Laboratory, Panama City, Fla.
O&M, N	Operation and Maintenance, Navy
OPLAN	Operation Plan
OPN	Other Procurement Navy
OPORD	Operation Order
PAO	Public Affairs Officer
PMU-7	Preventive Medicine Unit 7, Naples
PPM	Parts Per Million
RM	Radioman
RN	Royal Navy
SCA	Suez Canal Authority
SCUBA	Self Contained Underwater Breathing Apparatus
SEP	Search Effectiveness Probability
SERVLANT	Service Force, U.S. Atlantic Fleet
SITREP	Situation Report

SS	Steamship
SUPSAL	Supervisor of Salvage
TACAN	Tactical Aircraft Navigation
TF	Task Force
TG	Task Group
UHF	Ultra High Frequency
UK	United Kingdom
UN	United Nations
UNEF	United Nations Emergency Force
USCINCEUR	Commander in Chief, U.S. Forces Europe
USIS	United States Information Service
UXO	Unexploded Ordnance
VFR	Visual Flight Rules
VHF	Very High Frequency
YHLC	Heavy Lift Craft

APPENDIX E

DISTRIBUTION

JCS	2	MAC	1
SECNAV	2	DNL	1
CNO	10	NAVCOASTSYSLAB	5
CSA	2	NPTLAB NUSC	1
CSAF	2	NAVUSEACEN	1
USCINCEUR	2	NOL	1
CINCUSNAVEUR	2	COMNAVEODFAC	3
COMSIXTHFLT	2	COMNAVEODSCOL	2
CINCPAC	1	SUPSALV	4
CINCPACFLT	1	NAVXDIVINGU	2
CINCLANT	2	NAVSCOLDIVESALV	2
CINCLANTFLT	2	COMEODGRU ONE	3
COMFAIRMED	1	COMEODGRU TWO	3
COMINFWARFOR	6	CIVENGGRLAB	1
COMNAVINSWARLANT	10	COMOMCOM	2
MINEWARFOR PROJ	2	NNMC BETHESDA	1
COMNAVSURFLANT	4	NAVHOSP PORTSMOUTH	1
CHNAVMAT	4	NAVHOSP PHILA.	1
COMNAVSEASYSCOM	4	NAVMEDRSCHU 3 CAIRO	1
COMNAVINTCOM	1	NAVPUNTMEDU No. 7	1
COMNAVELEXSYSCOM	1	CO, PHIBCB TWO	1
CHINFO	10	CO, HCU TWO	1
BUMED	3	ONR	2
OLA	1	OCEANAV	2
JAG	1	NAVOCEANO	2
USDAO CAIRO	1	NAVAIDSUPPUNIT	2
COMUSARFORCOM	2	NAVCHAPGRU	1
ARMY MATERIAL COMM	1	USS IWO JIMA	1
DIA	2	USS INCHON	1
CNA	1	USS BARNSTABLE COUNTY	1
DIRNAVHISTCEN	1	USS BOULDER	1
COMNAVSUPSYSCOM	1	CINCUSAREUR	2
COMNAVFACENGCOM	1	COMSEVENTHSIG BRIGADE	2
USDAO BONN	1	SECOND MOB LINDSEY AS GERMANY	2
USDAO LONDON	1	USDAO PARIS	1
MOD UK	1	DEFENSE DOCUMENTATION CENTER	40
DIR, FEDRECCEN SUITLAND	10		