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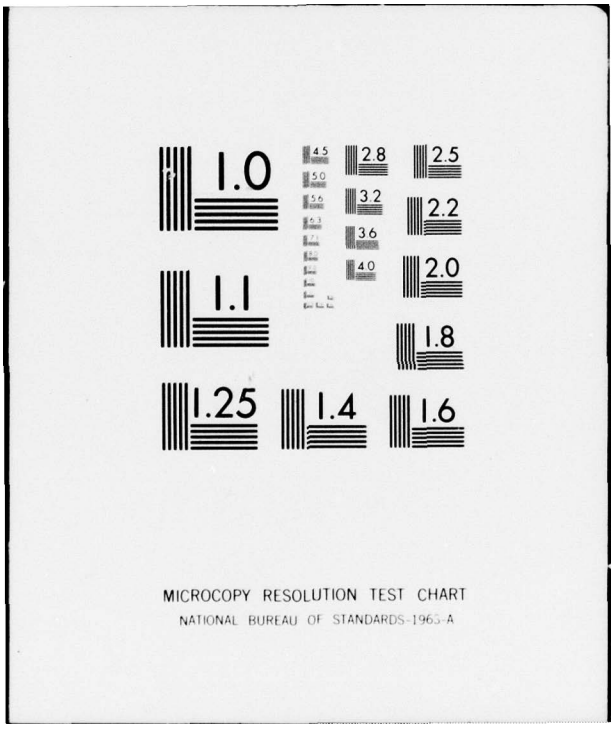
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NATIONAL BUREAU OF STANDARDS-1963-A

NRL Memorandum Report 1219

NRL FIELD SITE, BOCA RATON, FLORIDA

M. L. Shumaker

RADAR DIVISION

September 1961

U. S. NAVAL RESEARCH LABORATORY
Washington, D.C.

UNCLASSIFIED

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CONTENTS

ABSTRACT

The NRL Field Site at Boca Raton, Florida is a radar test facility adjacent to deep-ocean water on the Atlantic Coast. It has two buildings with 1080 square feet of floor space and a sixty-five foot radar tower. A detailed description is given of the site and the utilities available.

PROBLEM STATUS

This is an interim report; work on this problem is continuing.

AUTHORIZATION

NRL Problem R02-34
Projects RF 001-02-41-4008
and SF 001-06-01-1500

F00102, RF001041
F00106 SF

NRL FIELD SITE, BOCA RATON, FLORIDA

INTRODUCTION

In order to conduct tests with units of the Navy it is necessary to have a test site adjacent to deep-ocean water so that vessels may maneuver at their normal speeds in an environment similar to that encountered in normal ocean cruising. A shore facility of this type has many obvious advantages over an afloat facility. The following is a description of such a site established on the East Coast of Florida for conducting tests under Project CUTWATER.

LOCATION OF SITE

The NRL Field Site is a test facility of the U.S. Naval Research Laboratory, located on the Atlantic Coast at Boca Raton, Florida. At present, the property is leased on a yearly basis.

The property is located within the city limits of Boca Raton. It was assigned the street address of 2000 North Ocean Boulevard by the City Engineer. The geographic location is latitude 26° 22' 12" north, longitude 80° 04' 07" west. In relation to larger cities on the Florida Coast, it is located on U.S. Highway A1A, twenty-two miles south of Palm Beach, seventeen miles north of Fort Lauderdale, and thirty-eight miles north of Miami. The nearest airports are located in Fort Lauderdale and West Palm Beach. The Florida East Coast Railroad has stations and express offices located in Boca Raton and Delray Beach. Delray Beach is located six miles north of the site (Fig. 1).

TOPOGRAPHY OF SITE

The plot of land has 150 feet fronting on the Atlantic Ocean, and approximately 450 feet from highway A1A to the ocean. The coastline in this area lies within a few degrees of being a true north-south line. The width of the beach varies from twenty feet to forty feet; depending on the state of the tide which has an average rise and fall of 2.8 feet. There is a low sand dome west of the beach about forty feet wide (Figs. 2 and 3). The land then rises at approximately a thirty degree grade to an elevation twelve feet above mean high tide (Fig. 4). The top of this embankment was leveled giving an area 50 feet by 150 feet on which the tower and buildings were erected. West of the buildings, the land gradually slopes down to highway A1A (Fig. 5).

OCEAN CONDITIONS AT SITE

The chief advantage of this site is the good depth of water relatively close to shore. There is easy access to commercial facilities and weather conditions are favorable for conducting tests.

As shown on U.S. Coast and Geodetic Survey Chart No. 1248 (Fig. 6), the depth of water increases slowly to twenty-five feet at 600 yards from the beach. It continues to increase slowly to fifty feet at 1100 yards. Between 1100 yards and 1400 yards there is a trough of water with depths greater than fifty feet, then a sandbar occurs between 1400 yards and 1570 yards, with depths slightly less than fifty feet. East of this sandbar the ocean bottom drops rapidly so a vessel traveling parallel to the coast in this area will encounter no water with a depth less than:

100 feet at 2000 yards
200 feet at 3000 yards
350 feet at 4000 yards
425 feet at 5000 yards
525 feet at 6000 yards
575 feet at 7000 yards
600 feet at 8000 yards

(All soundings at mean low water.)

The center of the Gulf Stream lies eighteen miles off shore and has a velocity of 2.5 to 4.5 knots in this area. The western entrance to Northwest Providence Channel is fifty-four miles due east of the site. Bimini Island is fifty-four miles, bearing 125°T, from the site and Bahama Island is seventy-eight miles, bearing 075°T. Since the prevailing wind direction is from the southeast, the fetch is about fifty-four miles.

Vessels transiting the area in clear weather have the following navigational points constantly in view:

POINT	LATITUDE (N)	LONGITUDE (W)
Hillsboro Inlet Lighthouse	26° 15.6'	80° 04.9'
Deerfield Water Tank	26° 19.0'	80° 05.5'
Boca Raton Club Stack	26° 20.5'	80° 04.7'
Boca Raton Water Tank	26° 21.1'	80° 05.5'
Delray Beach Hotel Cupola	26° 27.7'	80° 03.5'

WEATHER SUMMARY

The climate of this area is essentially sub-tropical marine, featured by a long, warm summer, with abundant rainfall, followed by a mild, dry winter. The site is subject to winds from the east or southeast about half the time. The average daily range of temperature (difference between the maximum and the minimum) is only ten degrees. Tropical hurricanes occasionally affect the area, the months of greatest frequency being September and October.

The following table lists the average monthly temperature, precipitation, relative humidity, and wind. The values are based on the period 1921 to 1950 and are mean values computed by the Weather Bureau[1] for this general area.

MONTH	TEMPERATURE	PRECIPITATION	RELATIVE HUMIDITY	WIND MEAN SPEED	WIND PREVAILING DIRECTION
Jan	68.3	2.06	86	9.4	SE
Feb	68.7	1.85	86	9.8	SE
Mar	71.3	2.25	83	9.8	SE
Apr	74.9	3.99	81	10.1	ESE
May	78.0	5.55	81	9.1	ESE
Jun	81.3	6.82	83	8.0	SE
Jul	82.6	6.73	84	7.6	SE
Aug	82.9	6.61	86	7.2	SE
Sept	81.7	8.33	88	8.1	ESE
Oct	77.9	8.23	88	8.4	ENE
Nov	72.1	2.41	87	8.9	N
Dec	69.2	1.65	86	8.4	N

The following tables[2] show the sea state conditions that may be expected for each month of the year.

LOCATION: COASTAL AREA FROM PALM BEACH TO MIAMI

SEA	CODE	0	1	2	3	4	5	6	7	8	9	TOT
MONTH	HGT.(FT)	CALM	<1	1-3	3-5	5-8	8-12	12-20	20-40	≥ 40		DAYS
Jan		0.8	14.8	7.8	6.0	1.1	0.5					31
Feb		0.6	10.1	10.3	4.9	2.1						28
Mar		1.3	15.7	7.9	4.5	1.6						31
Apr		1.0	13.3	9.0	5.4	1.2		0.1				30
May		1.7	13.3	9.0	6.6	0.4						31
Jun		2.8	16.0	7.5	2.8	0.8			0.1			30
Jul		2.3	17.5	8.7	2.1	0.4						31
Aug		3.8	13.0	10.5	3.6	0.1						31
Sept		3.4	12.0	10.2	3.4	0.8	0.2					30
Oct		1.2	10.5	9.9	7.3	1.6	0.3	0.2				31
Nov		1.0	11.5	9.2	5.8	1.7	0.8					30
Dec		0.4	15.1	9.7	3.7	1.7	0.4					31

SEA STATE SUMMARY (Number of days per month)

1. Miami Area Weather Bureau 1960 Local Climatological Data
2. Sea and Swell Unit, Division of Oceanography, U.S. Navy Hydrographic Office

LOCATION: COASTAL AREA FROM PALM BEACH TO MIAMI

SEA	CODE	0	1	2	3	4	5	6	7	8	9	OBS.
MONTH	HGT.(FT)	CALM	<1	1-3	3-5	5-8	8-12	12-20	20-40	≧ 40		
Jan		2.6	47.6	25.1	19.4	3.7	1.6					191
Feb		2.3	36.2	36.7	17.5	7.3						177
Mar		4.4	50.6	25.6	14.4	5.0						160
Apr		3.4	44.3	29,9	17.8	4.0		.6				174
May		5.3	43.0	29.1	21.2	1.3						151
Jun		9.5	53.4	24.9	9.5	2.6			.5			221
Jul		7.2	56.5	28.2	6.7	1.4						209
Aug		12.2	41.7	33.9	11.7	.4						230
Sept		11.2	40.2	34.1	11.2	2.8	.6					179
Oct		4.0	33.7	32.0	23.4	5.1	1.1	.6				175
Nov		3.4	38.4	30.8	19.2	5.5	2.7					146
Dec		1.4	48.6	31.2	11.8	5.6	1.4					144

SEA TABULATIONS IN % OBSERVATIONS

BUILDINGS

There are two buildings on the site, each with overall inside dimensions of 27 feet by 20 feet by 8-1/2 feet, giving a floor space of 1080 square feet (Fig. 7). The floors are poured concrete slabs about eight inches above normal ground level. The walls are concrete block with the two top blocks filled with concrete and the top row of blocks reinforced with 5/8 inch steel rods. At the corners of each building the top rows of block are tied to the foundation with 3/4 inch steel re-inforcing rods. The roof is gravel-covered tar over three inches of composite felt and fiberboard insulation, with two by ten inch ceiling joist. The buildings have twelve single and four double windows of four-inch glass jalousie construction with inside screens. There is one 6-1/2 foot by 3-1/2 foot entrance door to each building from the breezeway between the buildings (Fig. 7). There is also an 8-1/2 foot by 6 foot double-door opening in the south end of the south building. This entrance has a four by seven foot concrete slab loading platform at floor level which is used for rolling heavy equipment outside the building where it can be reached by a crane (Fig. 8). Since the property was only leased for two years, the interior of the buildings was not finished (Fig. 9).

UTILITIES

Electrical power is supplied to the site by the Florida Power and Light Company, whose local office is located in Delray Beach, Florida. One hundred kilowatt, 120/208 volt, three-phase, four-wire

service is available. The main disconnect panel is located about seventy-five feet southwest of the south building and is well clear of the driveway to the buildings (Fig. 10). Two separate four-wire cables run underground to the north building. One runs through a metal conduit and terminates in a switch box that controls the rotation of the rapid-scan radar antenna. The other is a rubber-jacketed cable which terminates in a junction box. This junction box feeds two distribution boxes which are located on the west wall of the north building and provides a cable plug for the van containing electronic equipment. There is also a rubber-jacketed cable running from the junction box to the north wall of the south building where the radar transmitter disconnect switch is located. Since the interior of the buildings is not finished, the wiring from the distribution boxes to numerous lights and outlets is installed on the surface of the walls and ceilings.

The Boca Raton City Water Department supplies water service to the site. Their meter is located to the east of highway AIA and about fifteen feet south of the driveway to the buildings. A 3/4-inch copper pipe carries the water to the northwest corner of the north building. Here a standpipe extends two feet above ground with an outside faucet to which a 100-foot rubber hose is connected. The hose can reach any area around or in the buildings and also serves as a fire hose. There is a 3/4-inch cutoff valve between the standpipe and the buildings. A 1/2-inch copper pipe runs under the floor of the north building to supply water to a water closet, a lavatory, and a sink located in the northwest corner of the north building. There are also two branch lines off the main line near the standpipe which are used to supply water to a house trailer and cooling water to the radar transmitter. Each of these lines has cutoff valves located outside the building. The lines are 3/8-inch copper and are on the surface of the ground.

A concrete septic tank is located about ten feet north of the north building. The drain line runs due north from the water closet to the septic tank. The drain field for the septic tank is located to the north of the septic tank.

The Southern Bell Telephone and Telegraph Company provides the site with a private-line phone with an outside bell alarm. Their business office is located in Delray Beach, Florida.

The roadway from highway AIA to the buildings is paved with steel airstrip matting (Fig. 5). The areas to the east and west of the buildings are also paved with matting. These areas are used for parking a house trailer and a forty-foot van containing electronic equipment.

TOWER

The radar tower was erected on concrete footings which had been installed in 1953 when the Georgia Institute of Technology established a radar test site on this property. Figure 11 shows

the approximate size and construction of each footing. The footings are located at the four corners of the north building (Fig. 7). The centers of the north-south footings are thirty-two feet two inches apart and the east-west footings are twenty-four feet eight inches apart. The top of the footings are one foot above ground level.

The tower was designed and erected by the G.B. Electronics Corporation. Their Drawing No. 900899 shows the tower assembly and structure. The tower consists of three sections. The lower section is fifteen feet high and was designed to mount a fourteen foot diameter rapid-scan antenna system to seaward of the center section of the tower (Figs. 12 and 13). Two large I-beams extend six feet beyond the truss on the east side of the tower to accommodate the rapid-scan antenna. The truss construction of the north and east sides of the lower section can be seen in Figs. 12 and 13. The lower section of the tower completely surrounds the north building.

The center section of the tower, as well as the lower section, was assembled on the site by bolting together the prefabricated members. It is a thirty-foot section whose bottom cross-section is twelve feet square and tapers to a six foot square at its top (Figs. 14 and 15).

The top section, a vertical weldment section, was bolted to the top of the center section. This section is twenty feet high giving a total tower height of sixty-five feet from the top of the footings. The pedestal containing two five-horsepower drive motors and the gear train to elevate and train the forty-foot parabolic antenna is bolted to the top of the tower.

Vertical steel ladders run from the ground level to the pedestal. They are broken into ten-foot sections between the fifteen-foot level and the top of the tower and are offset from each other with steel gratings between the sections of the ladder at each level.

USE OF SITE

The site is presently being used by the High Resolution Branch, Radar Division, U.S. Naval Research Laboratory to conduct tests under Project CUTWATER. At present, an ultra-high-resolution radar system is installed at the site. The results of the tests conducted to date are contained in Naval Research Laboratory Reports 5651, 5653, and 5654.

FIGURES

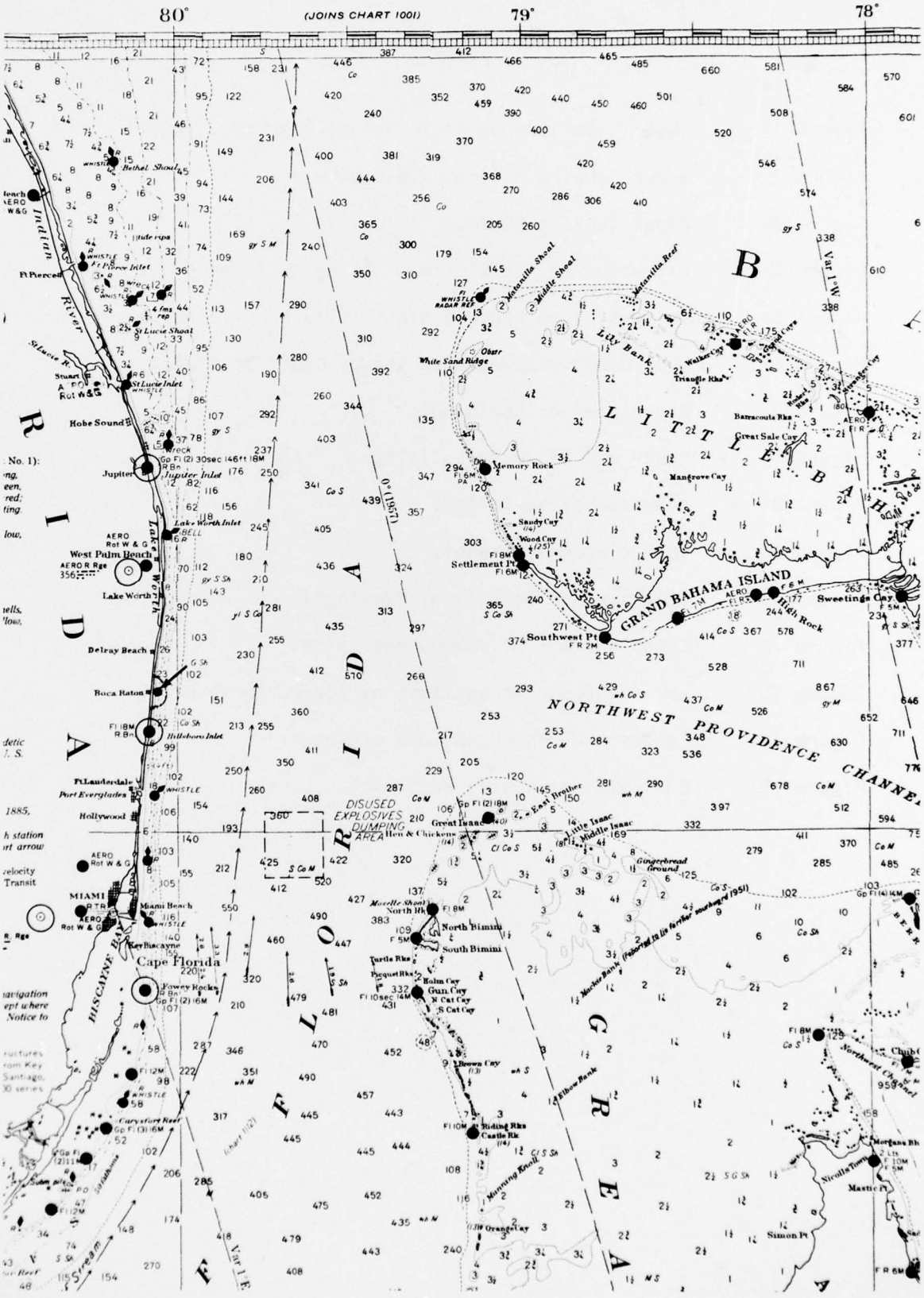
80°
(JOINS CHART 1001)
79°
78°
FLORIDA
FLORIDA STRAITS
LITTLE BAHAMA BANK
GRAND BAHAMA ISLAND
NORTHWEST PROVIDENCE CHANNEL
Indian River
Lake Worth
Biscayne Bay
Hobe Sound
Jupiter
West Palm Beach
Lake Worth
Delray Beach
Boca Raton
Ft Lauderdale
Hollywood
MIAMI
Miami Beach
Key Biscayne
Cape Florida
Fowey Rocks
Carysfort Reef
Stuart
Ft Pierce
Bethel Shoal
St Lucie Shoal
St Lucie Inlet
Jupiter Inlet
Lake Worth Inlet
Hillsboro Inlet
Port Everglades
Matanilla Shoal
Middle Shoal
Matanilla Reef
White Sand Ridge
Lily Bank
Memory Rock
Mangrove Cay
Sandy Cay
Wood Cay
Settlement Pt
Southwest Pt
Sweetings Cay
High Rock
Great Sale Cay
Barracouta Rks
Triangle Rks
Walker Cay
Great Isaac
Little Isaac
Middle Isaac
East Brother
Gingerbread Ground
Hen & Chickens
DISUSED EXPLOSIVES DUMPING AREA
North Bimini
South Bimini
Turtle Rks
Picquet Rks
Holm Cay
Gun Cay
W Cat Cay
S Cat Cay
Bimini Rks
Castle Rk
Elbow Bank
Morning Knoll
Orange Cay
Mastic Pt
Simon Pt
Sirolla Town
Var 1°W
Var 1°E
Stream
Gp Fl (2) 30sec 146ft 18M
Fl 18M
Fl 12M
Fl 10M
Fl 6M
Gp Fl (2) 16M
Gp Fl (2) 18M
Gp Fl (4) 15M
Fl 10sec 14M
Fl (3) 6M
Gp Fl (3) 6M
Fl 5M
Fl 2M
AERO Rot W & G
AERO R Rge 356°
WHISTLE
BELL
RADAR REF
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Chart 1002
Chart 1001
1571
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1885,
No. 1):
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Fig. 1 - U.S. Coast and Geodetic Survey Chart No. 1002

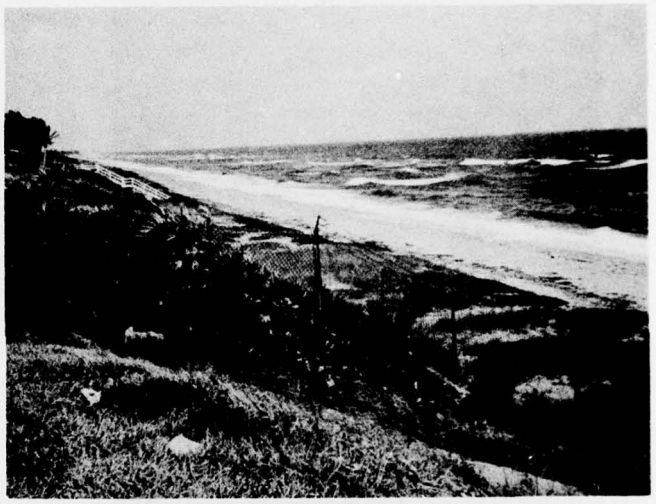

Fig. 2 - Beach looking NE from field site

Fig. 3 - Beach looking SE from field site

Fig. 4 - Elevation of field site;
looking NW from beach

Fig. 5 - Driveway from highway
AIA to site's buildings

Fig. 6 - U.S. Coast and Geodetic Survey Chart No. 1248

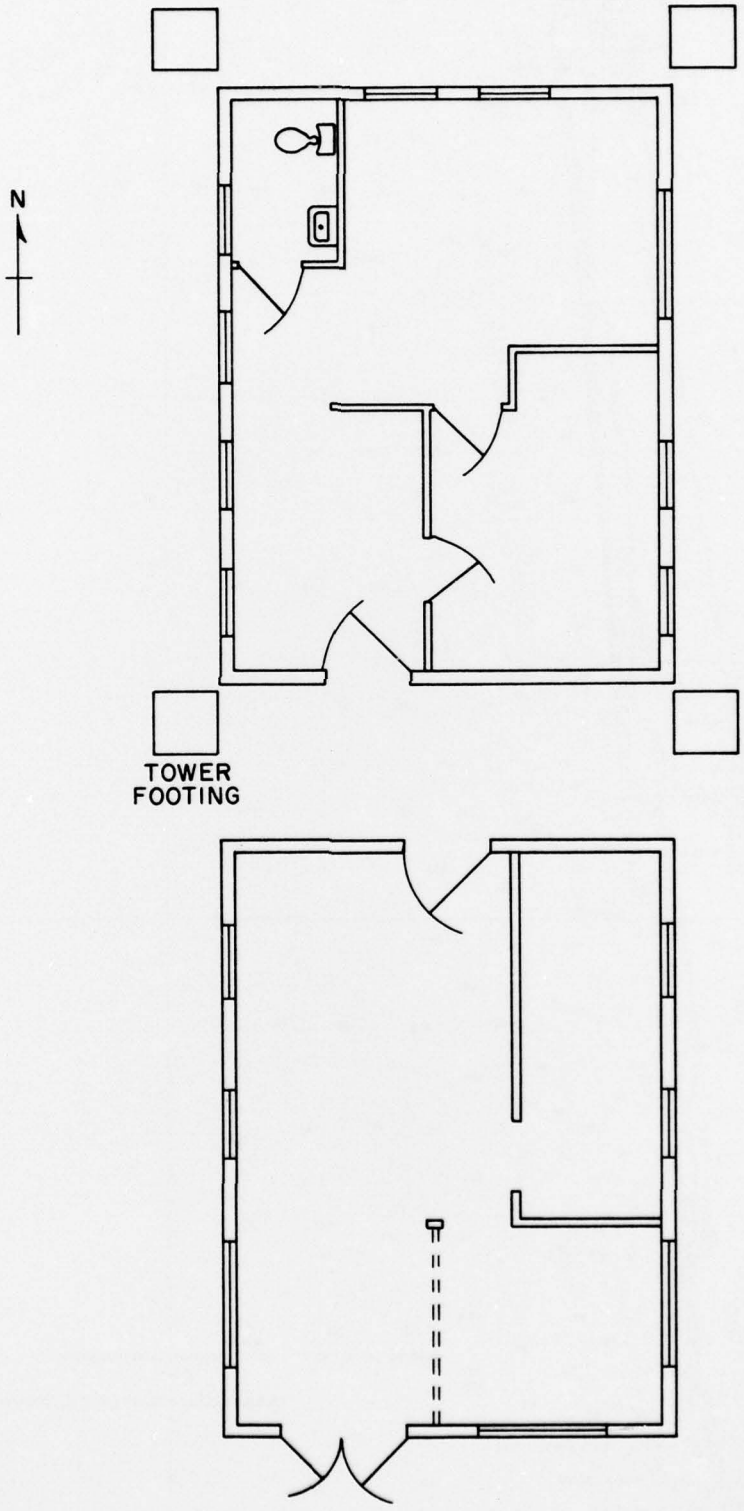

Fig. 7 - Floor plan of buildings

Fig. 8 - South end of south building

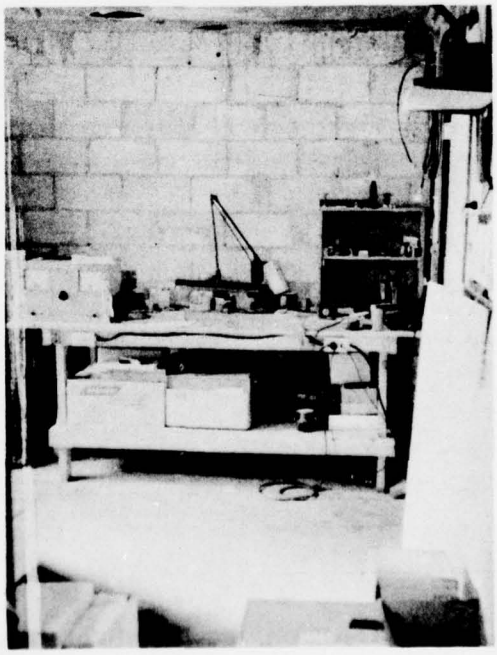

Fig. 9 - Interior of buildings

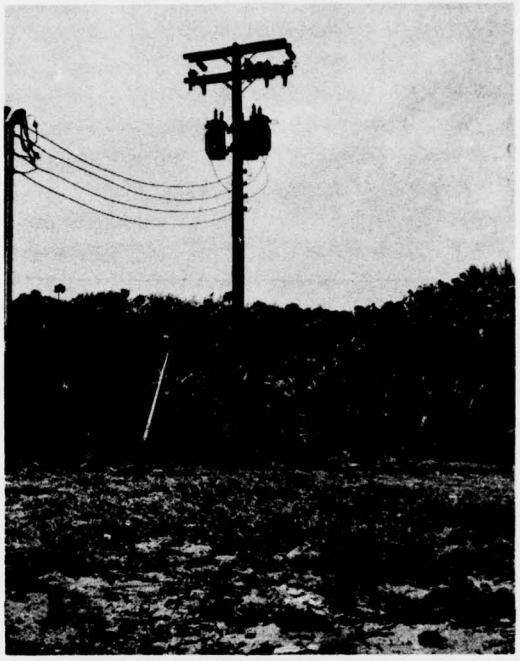

Fig. 10 - Main disconnect panel

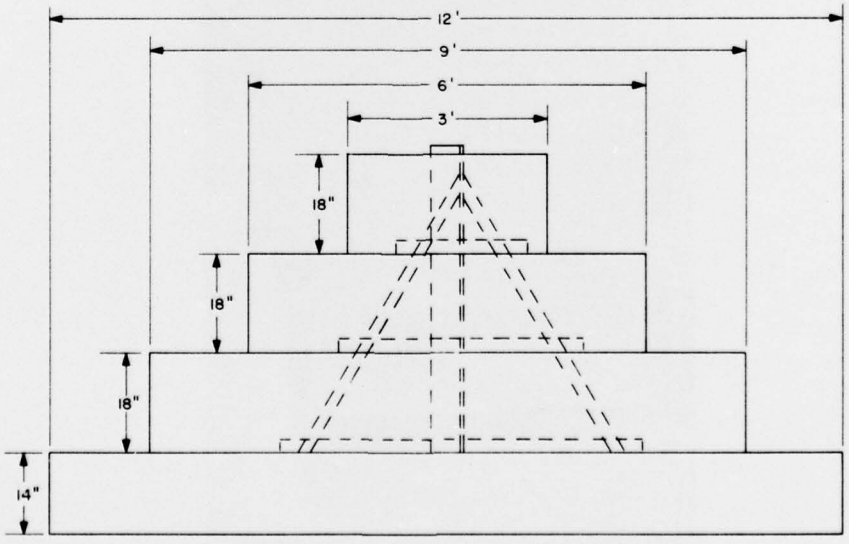

Fig. 11 - Construction details of footings

Fig. 12 - Lower section of tower, east side

Fig. 13 - Lower and center sections of tower, north side

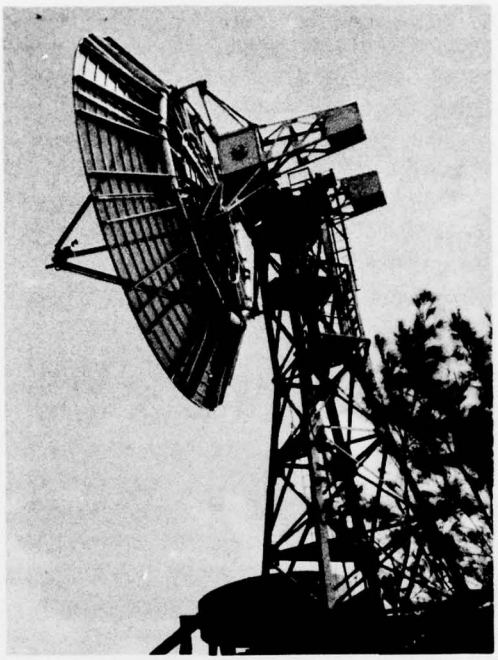

Fig. 14 - Center and upper sections of tower

Fig. 15 - Full view of tower, west side