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July 1963

Research Memorandum 3

FIELD TESTS ON MAN-PACK RADIOS IN A TROPICAL ENVIRONMENT

by

W. R. Vincent

Contract DA-36-039-AMC-00040(E)
Order No. 5384-PM-63-91(6109)
PR&C No. 63-ELNR-6109
Sponsored by ARPA
Order No. 371

SRI Project 4240

Prepared for

United States Army Electronics Research and Development Laboratory
Fort Monmouth, New Jersey

STANFORD RESEARCH INSTITUTE

MENLO PARK, CALIFORNIA

Ind 2.

28 OCT 1965

AMSEL-NL-R-4

SUBJECT: Request for Scientific and Technical Reports

TO: Administrator
Defense Documentation Center
ATTN: DDC-OSR-2
Cameron Station, Bldg 5
Alexandria, Virginia 22314

1. Reference is made to your letter, dated 6 October 1965, requesting twenty (20) copies of Stanford Research Institute Research Memorandum 3 under Contract Nr. DA-36-039 AMC-00040(E).

2. Inclosed is one (1) copy Research Memorandum 3, "Field Tests on Man-Pack Radios In A Tropical Environment" dated July 1963 by Stanford Research Institute, Menlo Park, California.

3. The availability/limitation notice should read, "Qualified requestors may obtain copies of this report from DDC. DDC release to CFSTI not authorized."

4. This report had a limited distribution and was not made available to DDC at that time.

5. Your Agency has been included in our distribution list for all future technical reports on Contract DA 36-039 AMC-00040(E).

FOR THE COMMANDER:

2 Incls.
1. Form ltr dtd 6 Oct 65
re: Req for Scientific &
Tech. Reports
2. Cy Res Memo 3, dtd July 1963,
Fld Tests on Man-Pack Radios In
A Tropical Environment by SRI

STANFORD RESEARCH INSTITUTE
MENLO PARK, CALIFORNIA

(9) Research Memo

(14) RM-3

July 1963

(6) FIELD TESTS ON MAN-PACK RADIOS IN A TROPICAL ENVIRONMENT.

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Prepared by:

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cc

Copy No. 21

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I INTRODUCTION

Under the direction of the Advanced Research Projects Agency and the United States Army Electronic Research and Development Laboratory, Stanford Research Institute conducted a field test program to compare the performance of selected man-pack radio sets under various tropical terrain, vegetation, and weather conditions. Research Memorandum 2 under this contract describes results obtained in a tropical forest area. This memorandum contains data on all tests completed to its date of issue, including those data presented in Research Memorandum 2, so that all test data can be available in one report and comparisons can be made.

Initial steps had been taken to establish a Communication Laboratory as a portion of the Combat Development and Test Center (CDTC) in Thailand. The formation of the basic laboratory was hastened and personnel assignments altered to provide adequate field test crews. Laboratory equipment did not become available to support the field effort until the later stages of the test program. However, the availability of a central headquarters, a temporary laboratory, and the meager repair facilities and support did facilitate the field tests somewhat.

This report described the results of voice and CW tests on selected man-pack sets. Tests were conducted in the tropical forest area in southern Thailand, the rice paddy area of the low delta region near Bangkok, and the mountains about 100 miles north of Bangkok. Figure 1 shows the location of the test areas. More detailed maps of the test areas are shown in Sec. II.

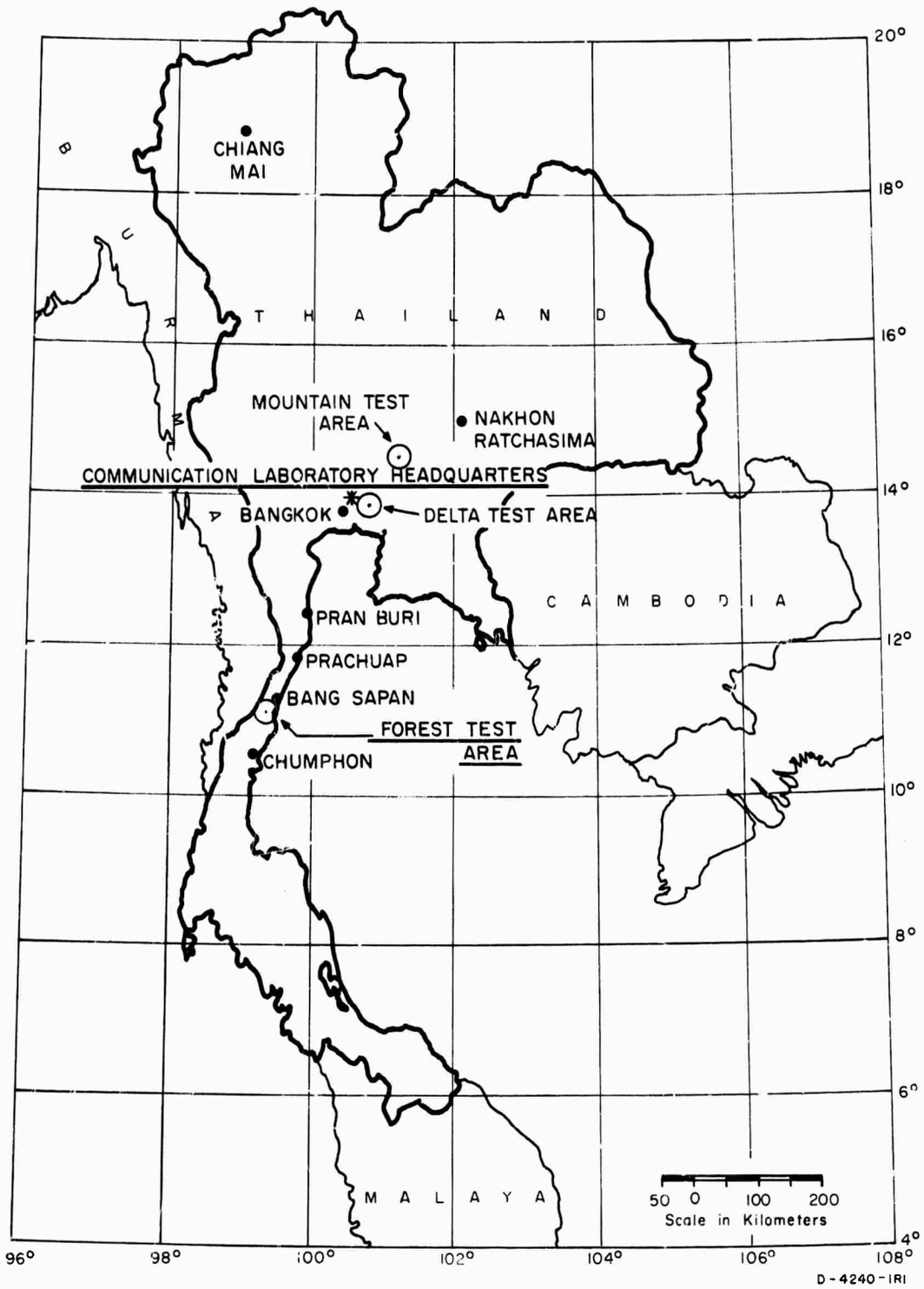

FIG. 1 MAP SHOWING TEST AREAS

II DESCRIPTION OF TEST AREAS

A. TROPICAL FOREST AREA

The test series was started in a tropical forest area because of interest expressed by Advanced Research Projects Agency and United States Army Electronic Research and Development Laboratory personnel and the desire of Stanford Research Institute to become familiar with what was commonly believed to be the most difficult tropical communication situation. Two tropical forest areas were considered, the Korat National Forest and the forest region south of Bang Sapan. Both areas contain relatively dense tropical forest useful for the field testing of man-pack radio sets. The Bang Sapan area was selected because of access by both road and railroad. A Bangkok business man generously donated his hunting camp as a headquarters and living area, which relieved housing problems. While improvements in living facilities were required, such as the construction of adequate cooking facilities, toilets, and showers, the hunting camp has proved entirely adequate.

Small test station huts were constructed at sites 0, 5, 10, and 22 miles from the base camp shown on the map in Fig. 2. These huts were constructed of local material by local labor. They were placed in areas of dense ground vegetation, which was cleared for an area a few feet around a hut. All huts were accessible by side road or jeep trail. Some side road repair was necessary to prevent jeeps and trucks from scraping bottom; this was accomplished by local hand labor.

Slant-wire antennas were erected between the hut and trees, with an elevation angle of about 30 degrees. The orientation of antennas was generally in the direction most free of surrounding vegetation. Doublet antennas were erected between trees, about 25 feet above ground, generally broadside to the other test sites.

Adequate sites could not be found at 15 and 25 miles, because of conditions of terrain and lack of vegetation and of access roads.

Although the space between the sites is largely forest area with dense undergrowth, there are occasional fields cleared for bananas and

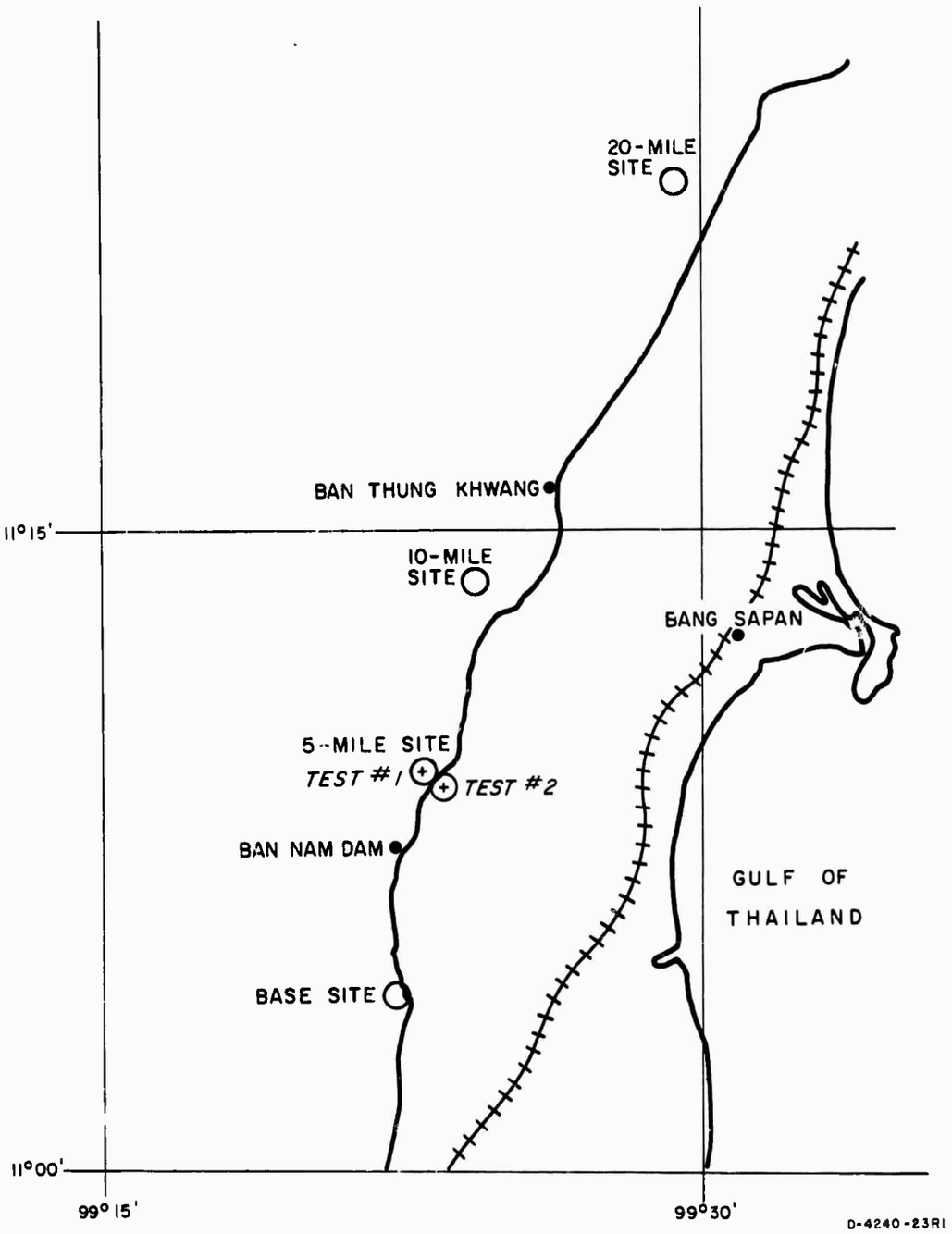

FIG. 2 MAP SHOWING LOCATION OF TROPICAL FOREST AREA SITES

other tropical crops. The location of sites was based on visual aerial survey, to minimize the occurrence of cleared land between them. Figure 3 illustrates the general nature of vegetation in the test region. The trees are very tall and generally at some distance from each other. The ground is densely covered with bamboo and other tropical plants. Since the ground vegetation extends upward for 25 to 40 feet, all antennas, except the VHF whips, were, for all practical purposes, immersed in the vegetation. No vegetation was allowed to touch an antenna wire.

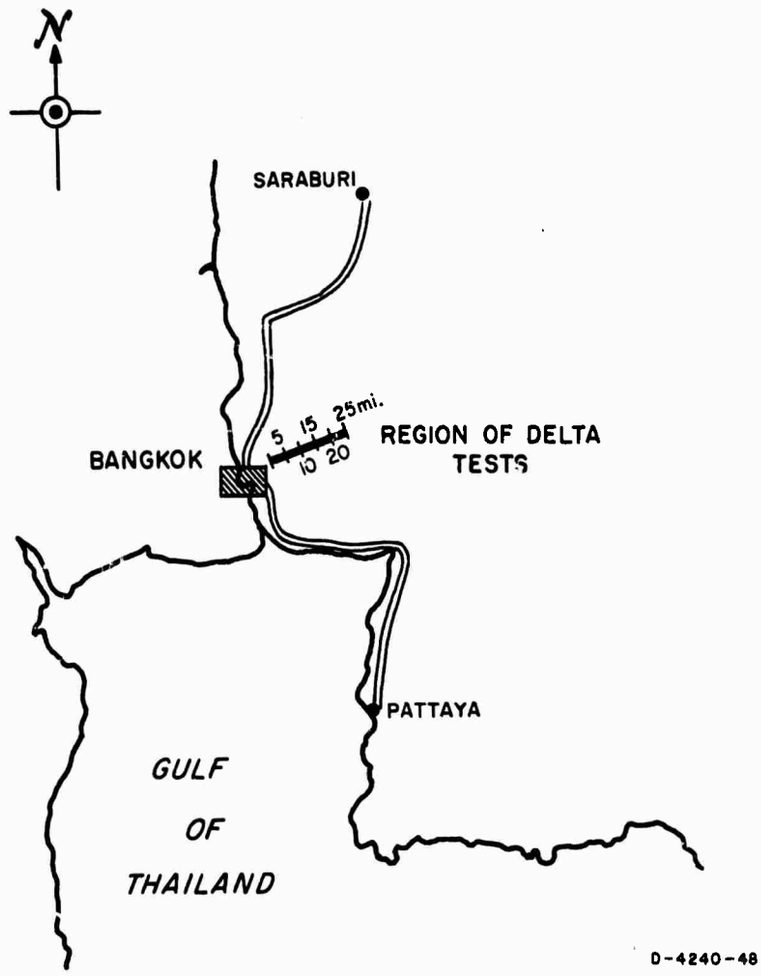

FIG. 3 MAP SHOWING LOCATION OF DELTA REGION SITES

B. FLAT DELTA AREA

The large, flat delta region surrounding Bangkok provided an excellent test area. The delta region consists of extensive rice paddy land with few obstructions and little change in elevation. The road network was adequate to enable sites to be chosen at ranges of 5, 10, 15, 20, and 25 miles. The location of sites used is shown on Fig. 3.

Portable wooden and canvas huts were constructed by a Bangkok firm. One hut, installed at Site 0, was used as the base site for all tests. A second hut was moved from site to site. Local labor could disassemble and reassemble the hut at a new site in one day, thus providing a convenient test shelter at each location. All sites were located on rice paddy land clear of obstructions. No obstructions or built-up areas existed between the sites.

C. MOUNTAIN AREA

The mountains north of Bangkok, which, although low, are quite rugged, can be reached via highway in a few hours time. Sites were selected along the access road, constructed to service various military installations and to open the area for development. The map of Fig. 4 shows the location of the sites chosen at ranges of 0, 5, 12, 25, 50, and 100 miles.

The base camp was located in a new resort area at Kao Yai, where personnel housing and support could be obtained without construction facilities. The portable wooden and canvas shelters constructed for the flat delta land tests were transported to the mountains and assembled at the required locations.

The 50- and 100-mile tests can more properly be described as varied-terrain tests, rather than mountain tests, because one terminal for these tests was located in the delta region. Since these tests were carried out as an extension to tests with both terminals in mountains, the results are given with those of the mountain tests.

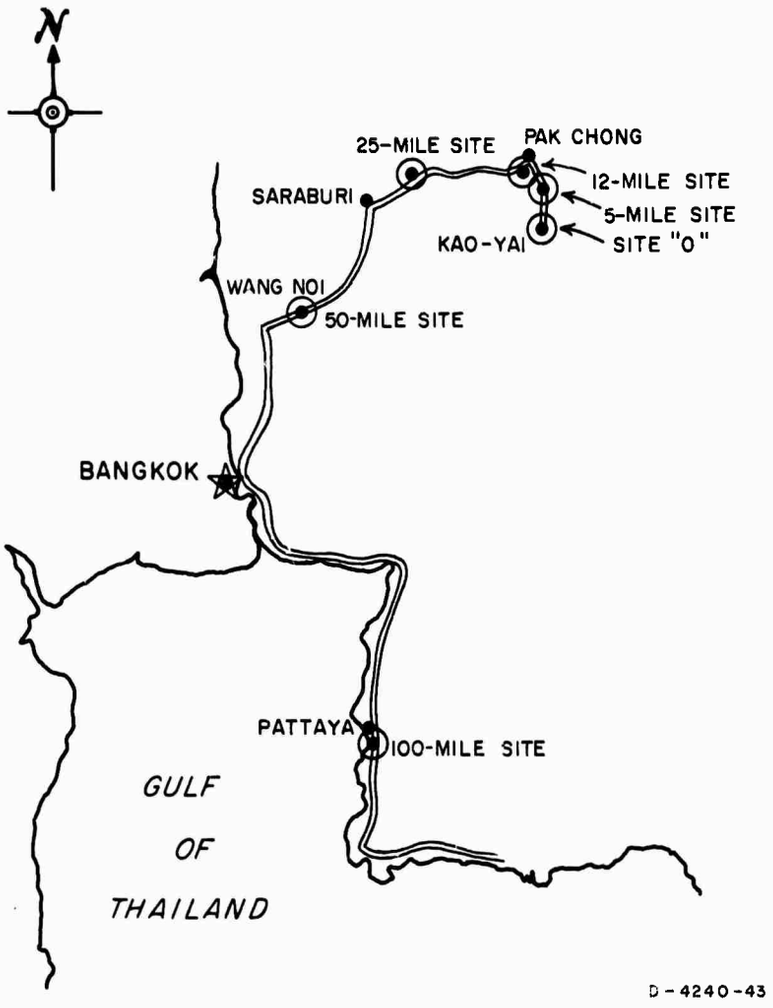

FIG. 4 MAP SHOWING LOCATION OF MOUNTAIN AREA SITES

III TEST CONDITIONS

The priority and emphasis placed on immediate testing of man-pack radio sets made it necessary to use short cuts and abbreviated test procedures. Consequently, the tests described in this memorandum have inadequacies and, to some extent, limited results It is hoped that the conditions and limitations of the tests are so presented that the results can be adequately evaluated.

One each of the radio sets described in Table 1 were installed in a base hut at Site 0, except for the experimental AN/PRC-35 set. The well-known AN/GRC-9 set is not shown in the table. Additional sets were moved from Site 1 to Sites 2 or 3, depending upon the range desired. A gasoline motor generator at each location provided power for battery charging, lights, auxiliary equipment, and other needs. Spare sets, spare batteries, and minor repair facilities were kept at the base camp, near Site 0.

The antennas required the first compromise. All sets were designed to operate with a slant-wire antenna. The 77-AM and AN/TRC-88 sets were not specifically designed to feed a doublet antenna. The 77-AM and AN/TRC-88 sets used the same slant-wire antenna kit; however, the HC-162 slant-wire was somewhat different in design. Because of the late arrival of HC-162 sets in Thailand, the slant-wire antenna for the 77-AM and AN/TRC-88 sets was installed in the field and was used for all sets. A doublet was cut to the test frequency and fed with a length of RG59/U coaxial cable. No attempt was made to properly match the single-end coaxial cable to the dipole, because adequate matching transformers or baluns were not available, and seem not to be used in field military installations. The doublet-feed coaxial cable was connected directly to the antenna terminals of the 77-AM and AN/TRC-88 sets and to the coaxial output of the HC-162 and TRP-4 sets.

Adequate test messages or word lists could not be assembled in time for the field tests. Consequently, groups of ten random digits were employed as test messages. Although this closely approximates certain types of military messages, it can by no means be considered a comprehensive test.

Table 1

GENERAL CHARACTERISTICS OF MAN-PACK RADIO SETS

RADIO SET	MANUFACTURER	WEIGHT (lb)	POWER OUTPUT	MODU-LATION	FREQUENCY RANGE (Mc)	NUMBER OF CHANNELS	BAND PASS (kc)	IF FREQUENCY	UNITS ON HAND	UNITS CAN BE RUN FROM VEHICLE	BATTERY I
77-AM	Sylvania	28	6-7 w	CW AM	3-8 Separate plug-in crystals for transmitting and receiving	6 Can be changed with plug-in crystals	5-6	455 kc	10	Yes on 12 v syatem	Rechargeable Voltage: 12 v Capacity: 4 ah Receiving curr Transmitting c Charge time: 4 charger; 2 hr charger (24 v Weight: 16 lb Has 12 v exter for auxiliary Interchangeabl
AN/TRC-88	Sylvania	27	10-14 w on CW 10 w on SSB	CW SSB FSK	3-8 Separate plug-in crystals for transmitting and receiving	6 Can be changed with plug-in cryatals	5-6	455 kc	4	Yes on 12 v system	Rechargeable Voltage: 12 v Capacity: 14 a Receiving curr Transmitting c Charge time: 4 charger; 2 hr charger (24 v Weight: 10 lb Has 12 v exter for auxiliary Interchangeabl
TRP-4	Oki Radio	30	2 w	SSB	2.5-7.5	6 Can be changed with plug-in crystala	3	455 kc	4	No	Rechargeable Voltage: 6 v Capacity: 10 a Receiving curr Transmitting c Charge time: 1 meter on fron Weight: 17.6 l Duty cycle: 5
HC-162	Hughes	20 or 25	15 w	CW SSB	2-11.99	Tunes to 1-kc incre-menta from 2 to 12 Mc	2.7 at 3 db 3 at 6 db	1750 kc 3250 kc (upper or lower frequency)	3	No	Rechargeable 2 typea: (1) Voltage: Capacity: Charge ti ¼ ah Weight: 7 (2) Voltage: Capacity: Charge ti 5 ah Weight: 1
AN/PRC-25	RCA	17	1.5 w	FM	30-75.95 13 crystals	Continuoua 50-kc incre-ments	35	11.5 Mc	2	Yea on 24 v syatem	Dry, disposable Voltage: 2 type (1) 0 + 3 + 15 DC converte (2) +3 + 15 + Capacity: 20 ah Weight: 3 lb 12 Duty cycle: 9-1
AN/PRC-35	RCA (Experi-mental model)	10	30 mw	FM	30-69.9 19 cryatala	4 800 poaaible in 50-kc incrementa with crya-tala	40	10 Mc	3	No	Dry, dispoaable Voltage: 26 v Capacity: 10 ah Weight: 1.25 lb Duty cycle: 9-1
AN/PRC-10	Admiral	--	1 w	FM	38-55	Continuous tuning	--	--	8	No	Dry, diapoaable Voltage: -6 + 1. 135 v

Table 1

GENERAL CHARACTERISTICS O. MAN-PACK RADIO SETS

J-ON	FREQUENCY RANGE (Mc)	NUMBER OF CHANNELS	BAND PASS (kc)	IF FREQUENCY	UNITS ON HAND	UNITS CAN BE RUN FROM VEHICLE	BATTERY INFORMATION	ANTENNA INFORMATION
	3-8 Separate plug-in crystals for transmitting and receiving	6 Can be changed with plug-in crystals	5-6	455 kc	10	Yes on 12 v system	Rechargeable Voltage: 12 v Capacity: 4 ah Receiving current: 16 ma Transmitting current: 3.5-4 a Charge time: 4 hr using AC charger; 2 hr using DC charger (24 v) Weight: 16 lb Has 12 v external terminals for auxiliary equipment Interchangeable with TRC-88	3 slant-wire antennas: 28, 40, and 57 ft 2-wire counterpoise 50 ft long Interchangeable with TRC-88
B K	3-8 Separate plug-in crystals for transmitting and receiving	6 Can be changed with plug-in crystals	5-6	455 kc	4	Yes on 12 v system	Rechargeable Voltage: 12 v Capacity: 14 ah Receiving current: 16 ma Transmitting current: 2-3.7 a Charge time: 4 hr uaing AC charger; 2 hr using DC charger (24 v) Weight: 10 lb Has 12 v external terminals for auxiliary equipment Interchangeable with 77-AM	3 slant-wire antennas: 25, 40, and 57 ft 2-wire counterpoise 50 ft long Interchangeable with 77-AM
B	2.5-7.5	6 Can be changed with plug-in crystala	3	455 kc	4	No	Rechargeable Voltage: 6 v Capacity: 10 ah Receiving current: 4 ma Transmitting current: 1 a Charge time: 10 hr(has charge meter on front panel) Weight: 17.6 lb Duty cycle: 5-1	3 types: (1) Whip (2) ¼-wave wire with counterpoise (3) ½-wave wire; uae on 4 Mc only
B	2-11.99	Tunes to 1-kc incrementa from 2 to 12 Mc	2.7 at 3 db 3 at 6 db	1750 kc 3250 kc (upper or lower frequency)	3	No	Rechargeable 2 types: (1) Voltage: 12 v Capacity: 4 ah Charge time: 24 hr at ¼ ah Weight: 7 lb (2) Voltage: 12 v Capacity: 14 ah Charge time: 4 hr at 5 ah Weight: 12 lb	4 slant-wire antennaa: 19, 31, 43, and 63 ft 80-ft counterpoiae wire Dipole output at 72 ohma provided
	30-75.95 13 crystala	Continuous 50-kc increments	35	11.5 Mc	2	Yes on 24 v ayatem	Dry, disposable Voltage: 2 typea (1) 0 + 3 + 15 v with DC-to-DC converter (2) +3 + 15 + 150 v Capacity: 20 ah Weight: 3 lb 12 oz (HV type) Duty cycle: 9-1	Whips, 3 and 10 ft 3-ft whip interchangeable with PRC-35 antenna whipa
	30-69.9 19 cryatala	4 800 poasible in 50-kc incrementa with cryatala	40	10 Mc	3	No	Dry, diapoaable Voltage: 26 v Capacity: 10 ah Weight: 1.25 lb Duty cycle: 9-1	Steel-tape whip, 3 ft 2 typea: (1) One has flexible baae (2) Other doea not Both interchangeable with 3-ft whip on PRC-25
	38-55	Continuoua tuning	--	--	8	No	Dry, dispoaable Voltage: -6 + 1.5 + 67.5 + 135 v	2 typea: (1) Steel-tape short whip (2) Long whip

2

Operators were relied upon to manually record received messages. In all cases the score was tabulated from the observations of single operators on 8-hour shifts. Also, operators were used to modulate the transmitters. It is recognized that inaccuracies can occur in the results of tests using such gross manual techniques. Time did not permit the accumulation of gear required to use prerecorded test messages designed to simulate the conditions of military message structures, and to tape record received signals for later evaluation by listening teams.

In an effort to keep test conditions constant, an attempt was made to carry out each test sequence with the operators in an environment that was as pleasant as possible. Field representatives from the manufacturers of the various radio sets were requested to be absent while testing was going on. Visitors were asked to review the results between test sequences. Changes in the test crews were not permitted during a sequence. The test sequences were so arranged that there was adequate time to properly conduct a test and to make antenna changes and tuning adjustments with reasonable care. These precautions at least minimized the problem of human interpretation of received signals in noise.

While the receiver operator did not know the contents of the test message, he was well aware of the use of ten-digit groups and knew he was to listen at a specific time.

Laboratory facilities to measure characteristics of set performance, such as receiver sensitivity, receiver bandwidth, power output, modulation index, antenna patterns, and antenna VSWR, were not available at the beginning of the test series. Consequently, the sets were unpacked, inspected, checked for general performance, and then placed directly into the test series.

The general capability of test personnel was high, and they were familiar with many kinds of communication gear. This was, however, their first experience with man-pack sets.

A field service representative from Hughes Aircraft for the HC-162 arrived several days before the test series began. In fact, he arrived several days before the HC-162 radio sets, and participated in the establishment of a temporary service and repair center in Bangkok. A representative from the Sylvania Corporation for the 77-AM and AN/TRC-88 sets arrived during the test sequence. Both representatives were capable

and experienced in the maintenance of their radio sets. Both visited the field site area between tests, provided helpful information on the operation of their sets, and promptly corrected maintenance problems.

The following operating frequencies were employed on the first test in the tropical forest area.

Set	Frequency (Mc)
77-AM	3.567
AN/TRC-88	3.567
TRP-4	3.570
HC-162	3.575
AN/PRC-10	40
AN/PRC-25	40

On all other tests, the following operating frequencies were employed.

Set	Frequency (Mc)
77-AM	3.567
AN/TRC-88	3.567
TRP-4	3.570
HC-162	3.567
AN/PRC-10	40
AN/PRC-25	40

The VHF sets employed in the tests were designed as line-of-sight communication equipment; consequently, they could not be expected to operate over the ranges used by the HF sets. Quarter-wave whip antennas were installed on the end of 30-foot bamboo masts to elevate antennas and extend the range of the VHF sets. To further improve their range, the bamboo masts were lashed to the tops of trees, resulting in a whip elevation of about 70 feet. RG58/U coaxial cable was used to connect the whip to the radio sets. One whip was used for all VHF sets at a site.

The ability of each set to handle a brief random message was checked every hour or every second hour of a 24-hour period. The sets were

checked in sequence, and the sequence was not changed during a test. As has been stated, the receiver operator knew when a message would start and that it would consist of groups of ten random digits. After the completion of a test series, the log sheets were examined to compare the received message with the transmitted message. The total number of digits received correctly for each trial is shown in the score sheets. Thus, if seven were received correctly out of the ten transmitted, then a score of 7 is shown. If all ten were correctly received, then a score of 10 is shown. A zero indicates that no message was received or that all digits were wrong.

The short time schedule did not permit the design of a good CW test that eliminated the problem of large variations between human operators. Since teams of operators whose CW operating characteristics were well-known could not be established, alternate tests were devised. An attempt was made during early tests to obtain signal strength recordings of the CW tone so that amplitude comparisons could be made. This failed because of the insensitivity of available recording devices.

A team of two copied CW and attempted to set up standards of signal strength and tone readability which would allow a message to be copied. These standards, established by field operation and necessarily coarse, were used in all tests.

The results of the CW test must be treated with caution, and small differences in data are probably not relevant. A summary chart given in Sec. V-G illustrates only the gross effects of the CW tests.

IV TEST RESULTS

A. GENERAL

Two separate tests were conducted in the tropical forest area south of Bang Sepan, the first and last tests of the series. The results of the first test (published in Research Memorandum 2) are included in this memorandum.

The procedure for scoring the tests has been discussed in Sec. III. The scoring procedure was identical for all tests described in this report.

Occasionally, a set was not used during a portion of the test due to battery replacement or another problem not related to the radio sets. These periods are shown in the score sheets as horizontal dashes.

So that a complete record of results can be reviewed by those interested, the score sheets are presented; each score sheet is followed by a summary showing the performance of each set for that test (Tables 2 through 49). The performance summary is followed by a histogram showing the relationship between communication performance and time of day (Figs. 5 through 20). A measure of communication performance can be obtained by adding the scores of the sets during each period. Test periods where incomplete data were obtained have been ignored.

Score sheets for the CW test are given as Tables 50 through 56, followed by a summary chart (Table 57).

B. RESULTS FROM TROPICAL FOREST TEST 1

Table 2

SCORE SHEET OF 5-MILE FOREST TEST 1
SITE 0 RECEIVING

LOCAL TIME		77-AM		AN/TRC-88		TRF-4		HC-162	
		D*	S†	D	S	D	S	D	S
0900	12 Mar	10	10	9	10	9	8	--	--
1100		10	10	10	10	10	10	--	--
1300		10	10	10	10	10	10	--	--
1500		9	10	0	0	0	0	--	--
1700		10	10	0	9	10	9	--	--
1900		0	0	0	0	0	0	--	--
2100		0	0	0	0	0	0	10	10
2300		10	10	0	0	0	0	9	9
0100	13 Mar	0	0	0	0	0	0	10	8
0300		0	0	0	0	0	0	10	10
0500		--	--	--	--	--	--	--	--
0700		10	9	0	0	0	0	10	10
0900		10	9	10	10	10	10	10	10
1100		10	10	10	10	10	10	10	10
1300		10	10	10	10	10	10	9	10
1500		10	9	10	9	10	10	10	10
1200	14 Mar	10	9	10	10	10	10	9	9
1300		10	10	10	9	10	10	9	10
1400		10	10	10	10	10	10	10	10
1500		9	9	9	9	10	9	--	--
1600		10	10	10	8	9	8	8	10
1700		10	9	9	10	10	8	10	10
1800		0	0	0	0	0	0	10	8
1900		0	0	0	0	0	0	0	0
2000		0	0	0	0	0	0	10	10
2100		0	0	0	0	0	0	10	10
2200		0	0	0	0	0	0	10	10
2300		0	0	0	0	0	0	10	10
2400		0	0	0	0	0	0	9	10
0100	15 Mar	0	0	0	0	0	0	10	9
0200		0	0	0	0	0	0	10	10
0300		0	0	0	0	0	0	10	10
0400		0	0	0	0	0	0	10	10
0500		0	0	0	0	0	0	10	9
0600		--	--	--	--	--	--	9	10
0700		9	10	9	9	10	10	9	10
0800		10	10	9	10	10	10	10	10
0900		10	10	10	10	10	10	10	10
1000		10	10	10	10	10	10	10	10
1100		10	10	10	10	10	10	10	10

* Doublet antenna.

† Slant-wire antenna.

Table 3

SCORE SHEET OF 5-MILE FOREST TEST 1
SITE 1 RECEIVING

LOCAL TIME	77-AM		AN/TRC-88		TRP-4		HC-162	
	D*	S†	D	S	D	S	D	S
0900 12 Mar	10	10	10	10	10	10	--	--
1100	10	10	10	10	10	10	--	--
1300	9	10	10	9	8	9	--	--
1500	10	10	0	0	0	0	--	--
1700	10	10	0	10	8	7	--	--
1900	0	0	0	0	0	0	--	--
2100	0	0	0	0	0	0	10	10
2300	10	0	0	0	0	0	10	10
0100 13 Mar	0	0	0	0	0	0	10	8
0300	0	0	0	0	0	0	10	9
0500	--	--	--	--	--	--	--	--
0700	10	10	0	0	0	0	8	7
0900	10	10	10	10	10	10	5	10
1100	10	10	10	10	10	10	10	9
1300	10	10	10	10	10	10	10	10
1500	10	10	10	10	10	10	10	10
1200 14 Mar	10	10	10	10	0	10	10	9
1300	7	10	7	10	10	10	10	10
1400	9	10	9	10	10	9	10	10
1500	7	9	7	9	9	10	--	--
1600	10	10	10	10	9	10	9	10
1700	0	0	10	10	10	8	10	10
1800	0	0	0	0	0	0	10	10
1900	0	0	0	0	0	0	10	0
2000	0	0	0	0	0	0	10	10
2100	0	0	0	0	0	0	10	9
2200	0	0	0	0	0	0	10	10
2300	0	0	0	0	0	0	10	10
2400	0	0	0	0	0	0	10	10
0100 15 Mar	0	0	0	0	0	0	10	10
0200	0	0	0	0	0	0	10	10
0300	0	0	0	0	0	0	10	9
0400	0	0	0	0	0	0	8	7
0500	0	0	0	0	0	0	10	9
0600	0	0	0	0	0	0	10	10
0700	10	10	10	10	10	10	10	10
0800	9	7	10	8	10	9	10	10
0900	10	8	10	8	9	10	10	8
1000	10	10	10	9	10	10	10	10
1100	10	10	10	7	10	10	10	10

* Doublet antenna.

† Slant-wire antenna.

Table 4

SUMMARY OF 5-MILE FOREST TEST 1

SITE RECEIVING	77-AM		AN/TRC-88		TRP-4		HC-162	
	D*	S†	D	S	D	S	D	S
Site 0								
Total Messages	380	380	380	380	380	380	320	320
Number Correct	217	214	175	183	188	182	301	302
Percent Correct	57%	56%	46%	48%	49%	48%	94%	94%
Site 1								
Total Messages	390	390	390	390	390	390	320	320
Number Correct	201	194	173	180	173	182	310	294
Percent Correct	52%	50%	44%	46%	44%	47%	97%	92%

* Doublet antenna.

† Slant-wire antenna.

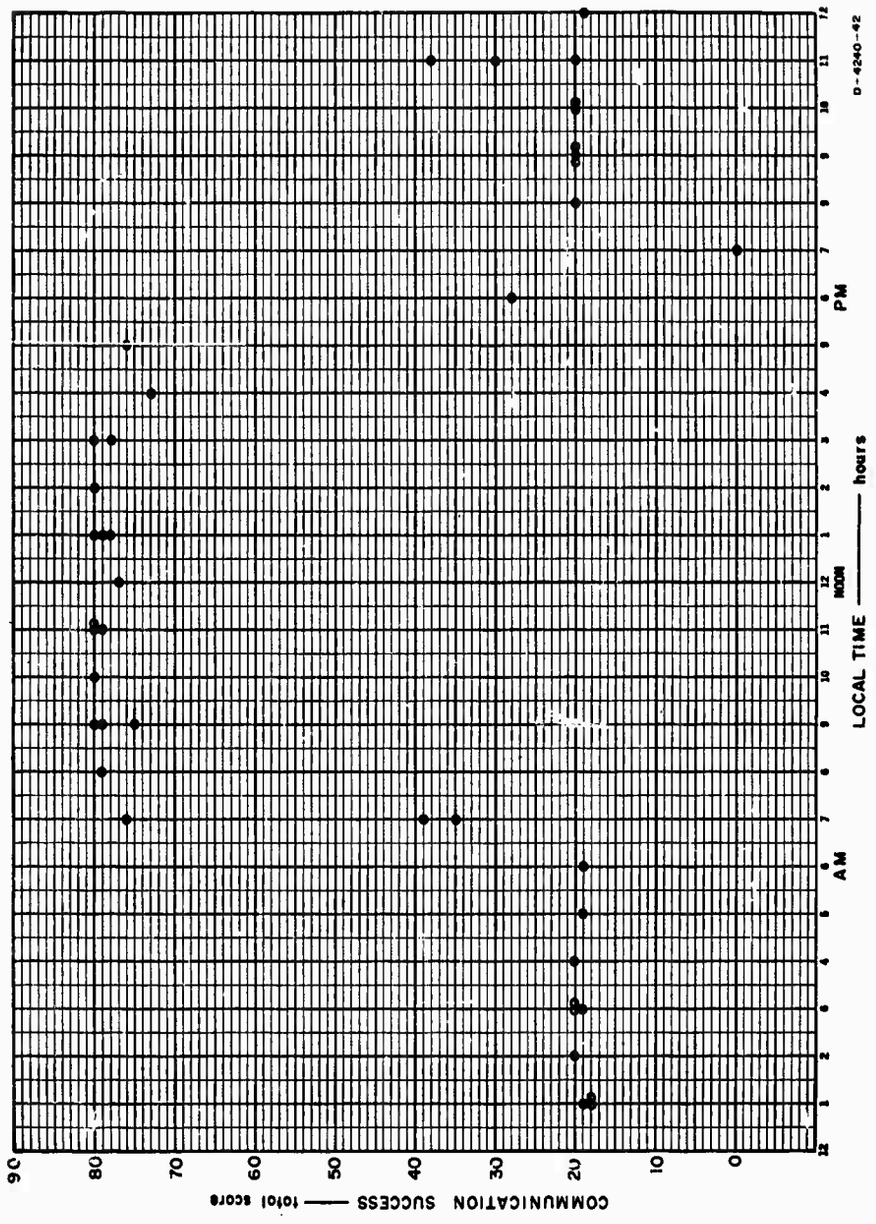

FIG. 5 HISTOGRAM SHOWING COMMUNICATION SUCCESS vs. TIME OF DAY – 5-MILE FOREST TEST 1

Table 5

SCORE SHEET OF 10-MILE FOREST TEST 1
SITE 0 RECEIVING

LOCAL TIME	77-AM		AN/TRC-88		TRP-4		HC-162	
	D*	S†	D	S	D	S	D	S
1100 26 Mar	10	10	10	10	10	10	10	10
1300	10	10	10	10	10	10	10	10
1500	8	9	9	6	10	8	6	0
1700	10	8	8	8	8	9	10	10
1900	6	0	2	0	9	0	10	10
2100	0	0	0	0	8	0	10	10
2300	0	0	0	0	0	0	0	0
0100 27 Mar	0	0	0	0	10	0	10	10
0300	0	0	8	0	10	0	8	10
0500	0	0	0	0	0	0	10	0
0700	0	0	10	8	9	6	10	10
0900	10	9	10	10	10	9	10	10
1100	10	10	10	10	10	10	10	10
1300	10	10	10	10	10	10	10	10
1500	0	0	0	0	10	7	10	9
1700	6	5	9	9	7	0	10	0
1900	0	0	0	0	9	0	10	10
2100	0	0	0	0	0	0	10	10
2300	0	0	0	0	0	0	10	10
0100 28 Mar	0	0	0	0	0	0	0	0
0300	0	0	9	0	10	0	10	10
0500	0	0	0	0	0	0	10	0
0700	10	10	10	10	10	8	10	10
0900	9	10	10	10	10	10	10	10

* Doublet antenna.
† Slant-wire antenna.

Table 6

SCORE SHEET OF 10-MILE FOREST TEST 1
SITE 2 RECEIVING

LOCAL TIME	77-AM		AN/TRC-88		TRP-4		HC-162	
	D*	S†	D	S	D	S	D	S
1100 26 Mar	10	10	10	8	10	10	10	10
1300	9	10	10	5	10	5	9	10
1500	9	8	8	6	10	2	10	0
1700	10	9	10	10	10	10	10	9
1900	0	0	0	0	10	0	8	10
2100	0	0	0	0	9	0	10	8
2300	0	0	0	0	0	0	0	0
0100 27 Mar	0	0	7	0	5	0	9	5
0300	0	0	9	0	9	0	10	7
0500	0	0	0	0	0	0	7	0
0700	0	0	9	[illegible]	10	9	10	9
0900	10	10	10	6	10	10	10	10
1100	10	10	10	7	10	9	10	10
1300	10	10	9	9	10	10	10	10
1500	0	0	0	0	10	8	10	10
1700	5	7	8	8	7	0	10	0
1900	0	0	0	0	9	0	10	10
2100	0	0	0	0	0	0	10	10
2300	0	0	0	0	0	0	10	10
0100 28 Mar	0	0	0	0	0	0	0	0
0300	0	0	10	0	9	0	10	10
0500	0	0	0	0	0	0	8	0
0700	10	7	10	10	10	10	10	10
0900	10	10	10	10	10	10	10	10

* Doublet antenna.
† Slant-wire antenna.

Table 7

SUMMARY OF 10-MILE FOREST TEST 1

SITE RECEIVING	77-AM		AN/TRC-88		TRP-4		HC-162	
	D*	S†	D	S	D	S	D	S
Site 0								
Total Messages	240	240	240	240	240	240	240	240
Number Correct	99	91	125	101	170	97	214	179
Percent Correct	41%	38%	52%	42%	71%	40%	89%	75%
Site 2								
Total Messages	240	240	240	240	240	240	240	240
Number Correct	93	91	130	88	168	93	211	168
Percent Correct	39%	38%	54%	37%	70%	39%	88%	70%

* Doublet antenna.

† Slant-wire antenna.

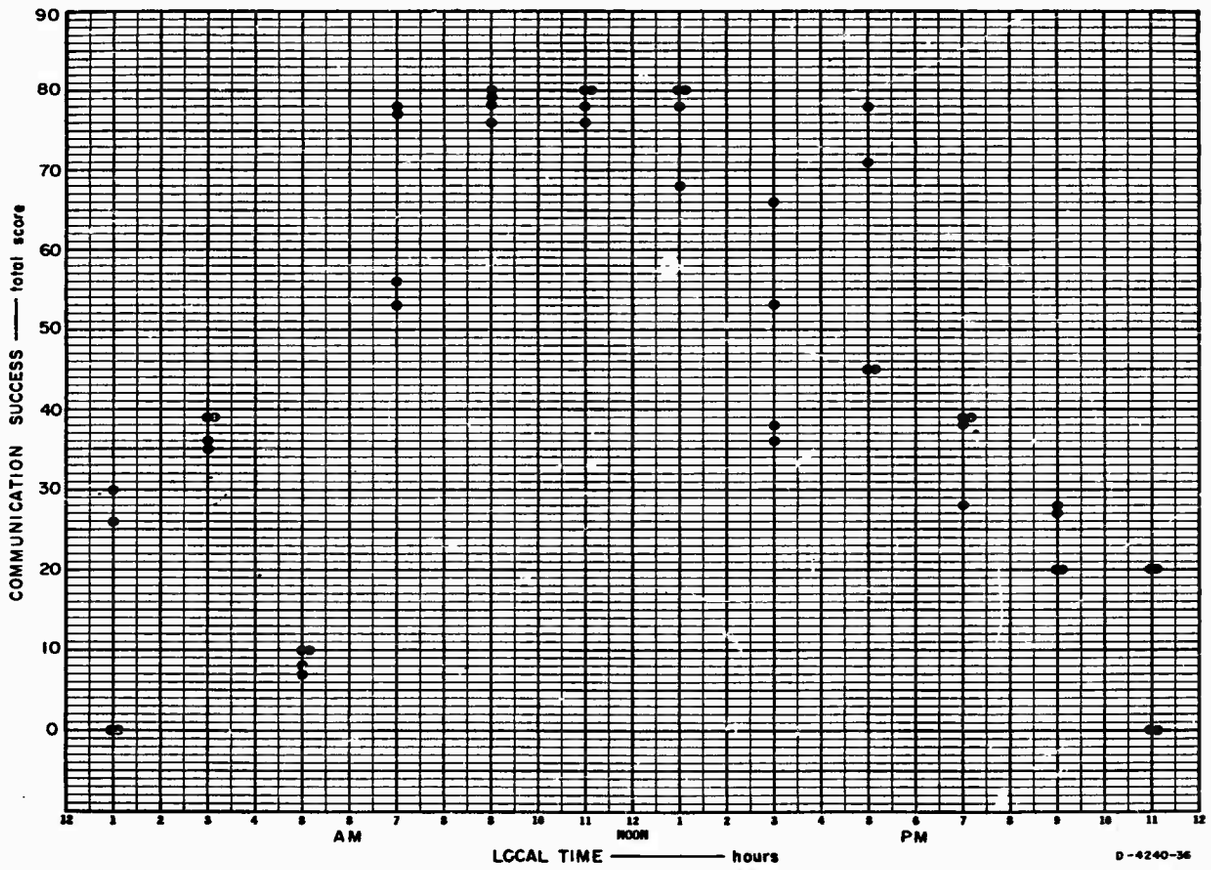

FIG. 6 HISTOGRAM SHOWING COMMUNICATION SUCCESS vs. TIME OF DAY – 10-MILE FOREST TEST 1

Table 8

SCORE SHEET OF 22-MILE FOREST TEST 1
SITE 0 RECEIVING

LOCAL TIME	77-AM		AN/TRC-88		TRP-4		HC-162	
	D*	S†	D	S	D	S	D	S
1100 19 Mar	10	2	0	0	10	0	9	0
1300	10	9	0	0	10	9	10	10
1500	10	8	0	0	10	0	9	7
1700	9	8	10	0	10	0	10	7
1900	0	0	0	0	0	0	7	0
2100	0	0	0	0	0	0	9	0
2300	0	0	0	0	0	0	10	10
0100 20 Mar	0	0	0	0	0	0	10	10
0300	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0
0700	0	0	0	0	10	0	10	4
0900	9	10	10	10	10	7	10	8
1100	10	3	10	0	10	0	10	0
1300	10	0	10	0	10	0	10	0
1500	10	10	9	0	10	5	10	8
1700	10	10	10	10	10	10	10	10
1900	9	0	10	0	10	0	10	10
2100	0	0	8	0	10	0	10	0
2300	10	0	0	0	9	0	10	10
0100 21 Mar	0	0	0	0	10	0	10	7
0300	6	0	7	0	10	0	10	10
0500	0	0	0	0	0	0	0	0
0700	10	10	10	7	10	9	10	0
0900	10	7	10	8	10	10	10	10

* Doublet antenna.

† Slant-wire antenna.

Table 9

SCORE SHEET OF 22-MILE FOREST TEST 1
SITE 3 RECEIVING

LOCAL TIME	77-AM		AN/TRC-88		TRP-4		HC-162	
	D*	S†	D	S	D	S	D	S
1100 19 Mar	10	10	0	0	10	0	10	10
1300	8	9	0	0	10	0	10	10
1500	8	10	0	0	0	0	10	10
1700	9	10	6	9	8	0	10	10
1900	0	0	0	0	0	0	9	0
2100	0	0	0	0	0	0	10	0
2300	0	0	0	0	0	0	9	9
0100 20 Mar	0	0	0	0	0	0	10	10
0300	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0
0700	0	0	0	0	0	0	10	10
0900	10	10	10	10	8	10	10	10
1100	10	9	10	0	10	0	10	0
1300	10	0	10	0	10	0	10	0
1500	7	10	10	0	9	7	10	9
1700	10	10	10	10	9	10	10	10
1900	10	0	5	0	9	0	6	8
2100	0	0	10	0	9	0	10	0
2300	10	0	0	0	10	0	10	10
0100 21 Mar	0	0	0	0	9	0	10	10
0300	9	0	7	0	9	0	10	10
0500	0	0	0	0	0	0	0	0
0700	10	9	10	9	10	10	10	10
0900	10	8	10	9	10	10	10	10

* Doublet antenna.
† Slant-wire antenna.

Table 10

SUMMARY OF 22-MILE FOREST TEST 1

SITE RECEIVING	77-AM		AN/TRC-88		THP-4		HC-162	
	D*	S†	D	S	D	S	D	S
Site 0								
Total Messages	240	240	240	240	240	240	240	240
Number Correct	133	77	104	35	169	50	204	121
Percent Correct	55%	32%	43%	15%	70%	21%	85%	50%
Site 3								
Total Messages	240	240	240	240	240	240	240	240
Number Correct	131	95	98	47	140	47	20[illegible]	156
Percent Correct	55%	40%	41%	20%	58%	20%	85%	65%

* Doublet antenna.

† Slant-wire antenna.

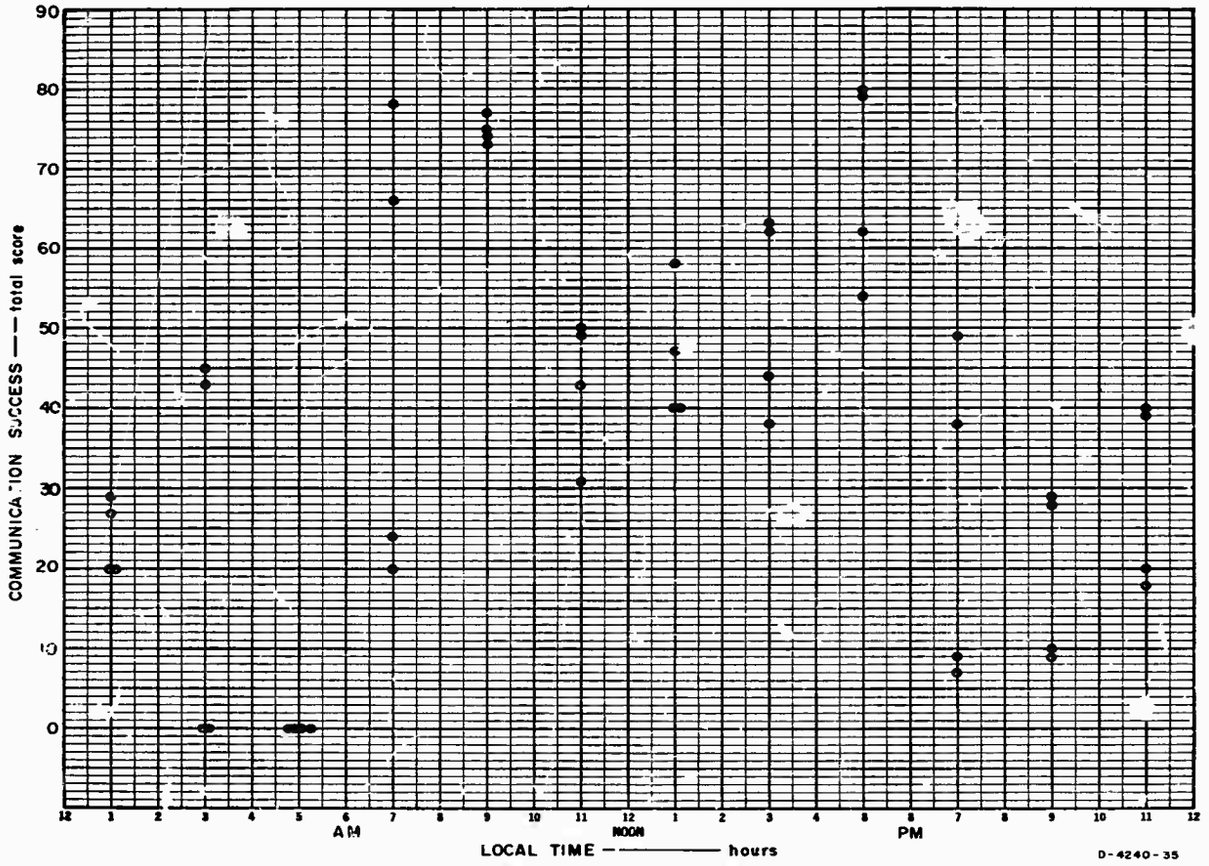

FIG. 7 HISTOGRAM SHOWING COMMUNICATION SUCCESS vs. TIME OF DAY – 22-MILE FOREST TEST 1

C. RESULTS FROM TROPICAL FOREST TEST 2

Table 11

SCORE SHEET OF 5-MILE FOREST TEST 2
SITE 0 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
1300 15 June	10	8	10	10	7	10	10	8	10	10	0	8	0	0	0
1500	10	10	10	10	10	10	10	9	10	10	7	5	10	8	[illegible]
1700	10	10	8	10	10	10	10	9	10	10	8	3	9	8	5
1900	10	0	0	10	8	2	10	10	8	10	2	0	10	0	0
2100	10	0	0	9	0	0	10	7	0	9	0	0	10	0	0
2300	10	0	0	10	0	0	10	9	0	10	0	0	9	0	0
0100 16 June	10	0	0	10	0	0	10	0	0	10	0	0	10	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	10	9	9	10	1	0	10	0	0	0	0	0	0	0	0
0900	10	9	10	9	0	0	10	10	10	10	0	0	8	0	0
1100	10	10	10	10	4	0	10	10	10	10	0	0	10	0	0
1300	9	0	10	10	5	5	10	7	9	8	6	5	10	0	0
1500	10	4	9	10	9	4	10	10	8	9	0	3	10	0	0
1700	10	10	10	10	10	9	10	9	9	10	10	6	10	10	0
1900	10	7	6	10	5	4	10	8	8	10	7	0	10	0	0
2100	10	0	0	10	0	0	10	0	0	10	0	0	9	0	0
2300	2	0	0	0	0	0	10	0	0	0	0	0	0	0	0
0100 17 June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	10	0	0	0	0	0	10	0	0	0	0	0	0	0	0
0500	10	0	0	0	0	0	9	0	0	0	0	0	0	0	0
0700	10	9	10	10	10	0	10	10	10	9	10	0	10	0	0
0900	10	9	8	8	7	9	10	10	10	10	5	7	10	0	0
1100	10	10	9	10	10	10	10	10	9	10	8	0	10	0	0

* Doublet antenna.
† Slant-wire antenna.
§ Whip antenna.

Table 12

SCORE SHEET OF 5-MILE FOREST TEST 2
SITE 1 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
1300 15 June	10	10	10	10	8	10	9	10	10	10	0	9	0	0	0
1500	10	10	10	10	10	10	10	10	10	10	10	9	9	4	0
1700	10	10	10	10	10	10	9	10	9	10	9	7	9	6	7
1900	10	0	0	10	9	7	10	10	10	10	2	0	10	0	0
2100	10	0	0	9	0	0	10	10	0	5	0	0	7	0	0
2300	9	0	0	9	0	0	10	9	0	9	0	0	8	0	0
0100 16 June	10	0	0	10	0	0	10	0	0	5	0	0	9	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	10	10	9	10	9	0	10	8	0	0	0	0	0	0	0
0900	9	9	10	10	0	0	10	10	10	8	0	0	8	0	0
1100	10	10	10	10	10	10	10	10	10	10	0	0	8	0	0
1300	10	10	10	10	9	10	10	10	10	9	7	10	10	0	0
1500	10	10	10	10	10	10	10	10	10	10	0	10	10	0	0
1700	10	10	10	10	10	10	10	10	10	9	10	8	10	9	0
1900	9	10	10	10	8	8	10	8	9	10	8	0	6	0	0
2100	10	5	0	9	0	0	10	0	0	9	0	0	4	0	0
2300	6	0	0	0	0	0	8	0	0	0	0	0	0	0	0
0100 17 June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	10	0	0	0	0	0	10	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
0700	10	10	10	10	7	0	10	10	10	8	3	0	10	0	0
0900	9	8	10	10	7	10	10	10	10	10	8	10	10	0	0
1100	10	9	8	10	9	9	10	10	9	10	8	0	10	9	0

* Doublet antenna.
† Slant-wire.
§ Whip antenna.

Table 13

SUMMARY OF 5-MILE FOREST TEST 2

SITE RECEIVING	HC-162			'77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
Site 0															
Total Messages	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	201	105	119	176	96	73	209	136	121	165	63	37	155	26	14
Percent Correct	84%	44%	50%	73%	40%	30%	87%	57%	50%	69%	26%	15%	65%	11%	6%
Site 1															
Total Messages	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	192	131	127	177	116	104	206	155	127	152	65	[illegible]	138	28	7
Percent Correct	80%	55%	53%	74%	48%	43%	86%	65%	53%	63%	27%	26%	58%	12%	3%

* Doublet antenna.

† Slant-wire antenna.

§ Whip antenna.

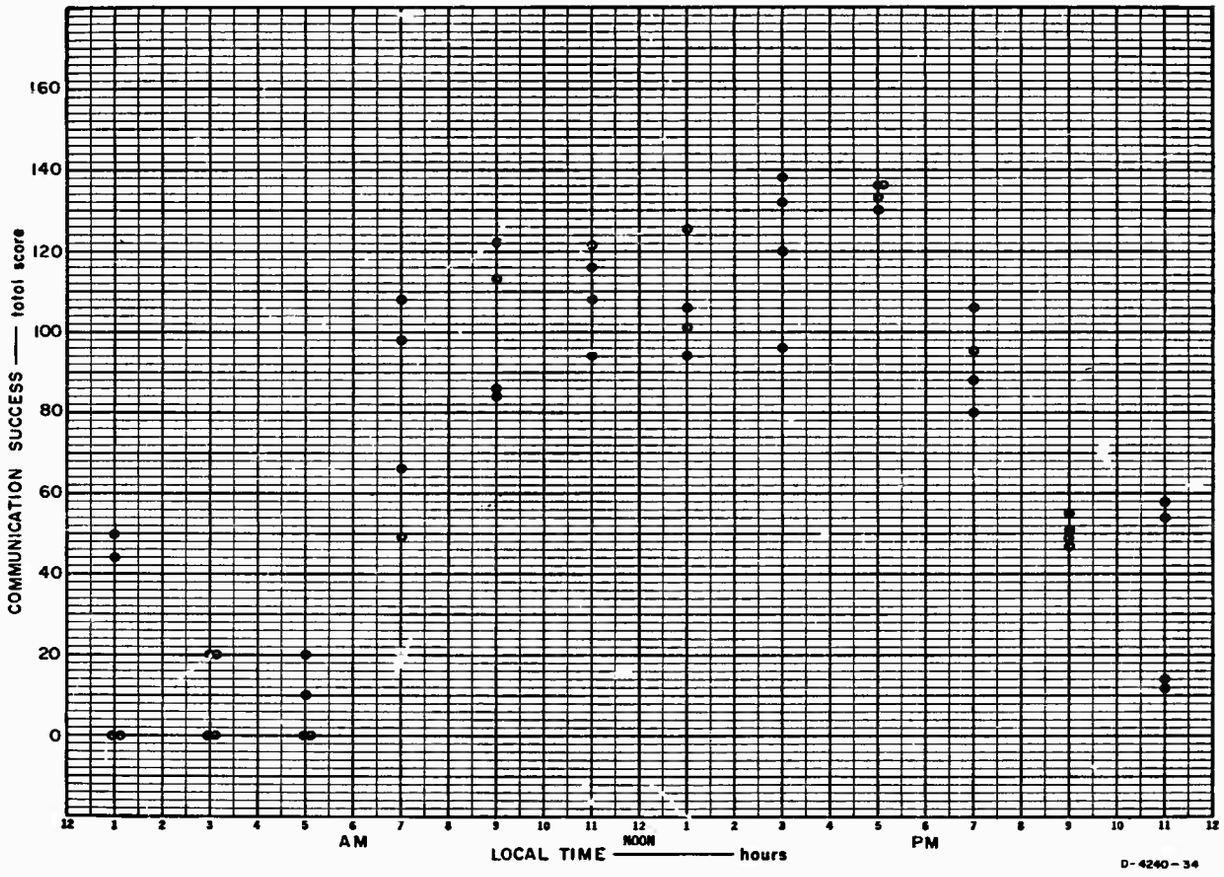

FIG. 8 HISTOGRAM SHOWING COMMUNICATION SUCCESS vs. TIME OF DAY – 5-MILE FOREST TEST 2

Table 14

SCORE SHEET OF 10-MILE FOREST TEST 2
SITE 0 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
1300 12 June	10	0	0	10	7	0	10	10	10	10	3	0	9	0	0
1500	8	9	9	9	2	0	9	10	10	2	0	0	0	0	0
1700	8	0	0	0	0	0	10	9	9	0	8	0	9	0	0
1900	8	8	0	0	0	0	10	7	7	0	0	0	0	0	0
2100	10	0	0	0	0	0	9	1	0	0	0	0	0	0	0
2300	9	0	0	0	0	0	4	0	0	0	0	0	0	0	0
0100 13 June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	10	8	10	9	0	0	10	7	10	10	0	0	9	0	0
0900	9	9	10	10	0	0	9	0	0	10	7	10	10	0	0
1100	10	10	10	10	7	9	10	0	0	7	0	0	9	0	0
1300	10	10	10	9	10	10	10	10	10	9	9	9	10	9	10
1500	10	10	10	10	5	10	10	8	9	9	0	0	7	0	0
1700	10	9	10	10	8	0	10	9	9	7	0	0	10	0	0
1900	10	10	0	0	0	0	10	10	0	8	0	0	0	0	0
2100	9	0	0	4	0	0	10	7	0	5	0	0	0	0	0
2300	10	0	0	0	0	0	10	0	0	0	0	0	0	0	0
0100 14 June	10	0	0	0	0	0	7	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	10	10	0	10	4	0	10	0	0	10	10	0	10	4	0
0900	10	10	10	10	8	10	10	10	7	10	9	0	10	8	0
1100	10	10	10	10	9	10	10	0	0	10	5	0	10	9	0

* Doublet antenna.
† Slant-wire antenna.
§ Whip antenna.

Table 15

SCORE SHEET OF 10-MILE FOREST TEST 2
SITE 2 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
1300 12 June	10	0	0	10	0	0	10	10	10	10	10	0	10	0	0
1500	10	10	10	10	7	0	10	10	10	10	0	0	0	0	0
1700	10	0	0	0	0	0	10	10	10	10	0	0	10	0	0
1900	10	7	0	0	0	0	10	10	9	0	0	0	0	0	0
2100	10	0	0	0	0	0	10	9	0	0	0	0	0	0	0
2300	6	0	0	0	0	0	10	0	0	0	0	0	0	0	0
0100 13 June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	10	10	10	10	0	0	10	10	10	10	0	0	10	0	0
0900	10	10	10	10	0	0	10	0	0	10	9	9	9	0	0
1100	10	9	10	10	6	5	10	0	0	10	0	0	10	0	0
1300	10	10	10	10	10	10	10	10	10	9	8	10	10	6	6
1500	10	10	10	10	9	10	10	10	10	10	0	0	10	0	0
1700	10	9	8	9	10	0	9	10	10	10	0	0	8	0	0
1900	10	0	0	0	0	0	10	10	0	10	0	0	0	0	0
2100	8	0	0	9	0	0	10	3	0	10	0	0	0	0	0
2300	9	0	0	5	0	0	10	0	0	0	0	0	0	0	0
0100 14 June	10	0	0	0	0	0	10	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	10	8	0	10	2	0	10	0	0	10	8	0	10	2	0
0900	10	10	10	10	9	10	10	10	9	10	9	0	10	7	0
1100	10	10	9	10	10	10	10	10	0	10	6	0	10	5	0

* Doublet antenna.
† Slant-wire antenna.
§ Whip antenna.

Table 16

SUMMARY OF 10-MILE FOREST TEST 2

SITE RECEIVING	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
Site 0															
Total Messages	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	181	113	89	111	60	49	178	98	81	107	56	19	103	30	10
Percent Correct	75%	47%	37%	46%	25%	20%	74%	41%	34%	44%	23%	8%	43%	12%	4%
Site 2															
Total Messages	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	183	103	87	123	63	45	189	122	88	139	50	19	107	20	6
Percent Correct	76%	43%	36%	51%	26%	19%	79%	51%	37%	58%	21%	8%	45%	8%	3%

* Doublet antenna.

† Slant-wire antenna.

§ Whip antenna.

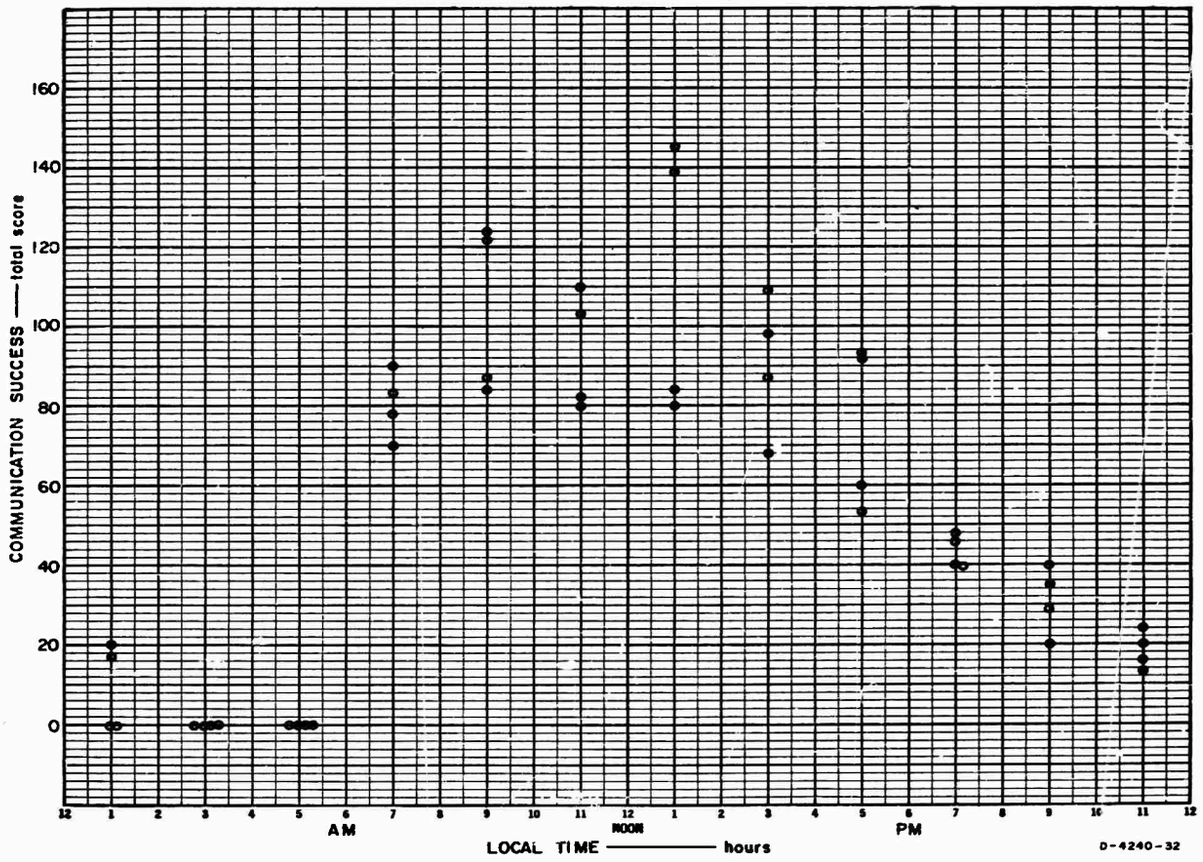

FIG. 9 HISTOGRAM SHOWING COMMUNICATION SUCCESS vs. TIME OF DAY – 10-MILE FOREST TEST 2

Table 17

SCORE SHEET OF 22-MILE FOREST TEST 2
SITE 0 RECEIVING

LOCAL TIME		HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
		D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
0900	9 June	10	0	0	10	7	0	10	10	6	4	0	0	10	0	0
1100		6	0	0	9	0	0	10	8	0	9	0	0	10	0	0
1300		7	0	0	10	0	0	10	10	0	10	0	0	10	0	0
1500		9	7	0	10	0	0	10	8	0	9	0	0	9	0	0
1700		10	10	0	10	10	0	8	7	0	6	0	0	10	0	0
1900		9	0	0	0	0	0	10	0	0	0	0	0	0	0	0
2100		8	0	0	5	0	0	10	0	0	8	0	0	0	0	0
2300		0	0	0	0	0	0	9	0	0	0	0	0	0	0	0
0100	10 June	10	10	0	7	0	0	9	9	7	10	3	0	0	0	0
0300		10	0	0	0	0	0	9	10	0	4	0	0	10	0	0
0500		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700		10	9	0	10	10	8	10	9	10	10	3	0	7	0	0
0900		10	10	0	10	6	0	10	9	9	10	0	0	0	0	0
1100		10	0	0	10	0	0	10	10	0	10	0	0	0	0	0
1300		10	8	0	10	0	0	10	10	4	10	0	0	10	0	0
1500		10	10	8	10	0	0	10	10	0	9	0	0	10	0	0
1700		10	10	9	9	9	0	10	10	7	8	0	0	9	0	0
1900		10	10	0	8	9	0	10	9	7	1	0	0	6	0	0
2100		6	0	0	0	0	0	10	10	0	0	0	0	0	0	0
2300		8	1	0	0	0	0	10	6	0	0	0	0	0	0	0
0100	11 June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300		0	0	0	0	0	0	7	0	0	0	0	0	0	0	0
0500		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700		9	8	0	8	0	0	10	0	0	6	0	0	9	0	0

* Doublet antenna.
† Slant-wire antenna.
§ Whip antenna.

Table 18

SCORE SHEET OF 22-MILE FOREST TEST 2
SITE 3 RECEIVING

LOCAL TIME		HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
		D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
0900	9 June	10	0	0	10	10	0	10	10	10	10	0	0	10	0	0
1100		10	0	0	10	0	0	10	9	0	10	0	0	10	0	0
1300		10	0	0	10	0	0	10	9	0	10	0	0	9	0	0
1500		10	10	0	10	0	0	10	9	0	10	0	0	0	0	0
1700		10	10	0	10	7	0	10	9	0	10	0	0	10	0	0
1900		9	0	0	6	0	0	10	0	0	8	0	0	0	0	0
2100		10	0	0	7	0	0	10	0	0	10	0	0	0	0	0
2300		10	0	0	0	0	0	10	0	0	0	0	0	0	0	0
0100	10 June	9	0	0	9	0	0	10	10	9	10	0	0	0	0	0
0300		9	0	0	0	0	0	10	10	0	10	0	0	10	0	0
0500		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700		10	10	0	10	10	8	10	10	9	10	10	0	4	0	0
0900		10	10	0	9	9	0	10	10	10	9	0	0	0	0	0
1100		0	0	0	10	0	0	10	10	0	0	0	0	0	0	0
1300		10	10	0	10	0	0	10	9	0	10	0	0	10	0	0
1500		10	10	9	10	0	0	10	6	0	10	0	0	10	0	0
1700		10	10	10	10	10	0	10	10	9	8	0	0	10	0	0
1900		10	10	0	6	0	0	10	10	9	10	0	0	9	0	0
2100		10	0	0	0	0	0	10	10	0	0	0	0	9	0	0
2300		10	3	0	0	0	0	10	4	0	10	0	0	0	0	0
0100	11 June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300		0	0	0	0	0	0	9	0	0	0	0	0	0	0	0
0500		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700		10	10	0	10	0	0	10	0	0	10	0	0	10	0	0

* Doublet antenna.
† Slant-wire antenna.
§ Whip antenna.

Table 19

SUMMARY OF 22-MILE FOREST TEST 2

SITE RECEIVING	HC-162			77-AM			AN/TRC-83			TRP-4			AN/GRC-9		
	D*	S†	W$	D	S	W	D	S	W	D	S	W	D	S	W
Site 0															
Total Messages	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	172	93	17	136	51	8	202	145	50	124	6	0	110	0	0
Percent Correct	72%	39%	7%	57%	21%	3%	84%	60%	21%	52%	3%	0%	46%	0%	0%
Site 3															
Total Messages	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	187	93	19	147	46	8	209	145	56	165	10	0	111	0	0
Percent Correct	78%	39%	8%	61%	19%	3%	87%	60%	23%	69%	4%	0%	46%	0%	0%

* Doublet antenna.

† Slant-wire antenna.

$ Whip antenna.

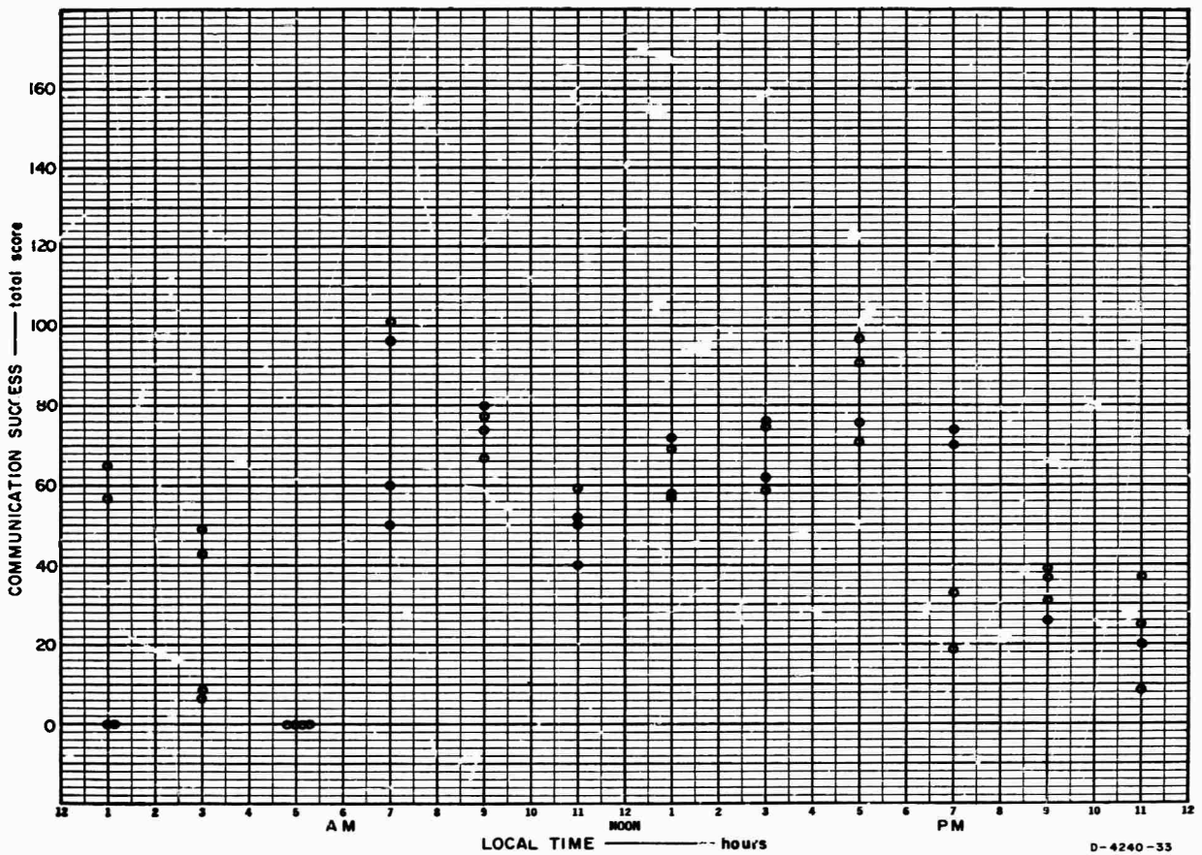

FIG. 10 HISTOGRAM SHOWING COMMUNICATION SUCCESS vs. TIME OF DAY – 22-MILE FOREST TEST 2

D. RESULTS FROM DELTA AREA TEST

Table 20

SCORE SHEET OF 5-MILE DELTA TEST
SITE 0 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
1100 22 Apr	--	--	--	10	10	10	10	10	10	10	10	10	0	0	0
1300	--	--	--	10	10	10	0	10	10	10	10	10	0	0	0
1500	10	10	10	10	10	10	10	10	10	9	10	10	0	0	0
1700	10	10	10	0	10	10	0	10	10	9	10	10	0	0	0
1900	10	10	10	0	10	10	10	10	10	10	10	10	0	10	10
2100	10	10	10	10	10	10	10	10	10	10	10	10	0	10	0
2300	10	10	10	6	10	10	9	8	10	8	0	9	7	10	10
0100 23 Apr	10	10	10	0	9	10	10	10	10	10	10	10	8	10	10
0300	2	9	0	0	7	0	0	0	0	0	0	0	0	0	0
0500	0	10	10	0	0	0	0	10	10	0	8	10	0	10	10
0700	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
0900	10	10	10	10	10	10	10	10	10	10	10	10	10	10	0
1100	10	10	10	10	10	10	0	10	10	10	10	10	10	10	10
1300	10	10	10	8	10	10	0	10	10	10	10	10	10	9	10
1500	10	10	10	10	10	10	9	10	10	10	10	9	7	5	9
1700	10	10	9	0	10	10	10	10	10	10	10	10	10	10	9
1900	10	10	10	0	10	10	0	10	10	7	10	10	10	10	10
2100	0	10	10	10	10	10	9	10	10	9	10	10	10	10	10
2300	0	10	10	0	10	10	0	10	10	0	10	0	0	0	0
0100 24 Apr	0	10	10	0	0	9	0	10	9	0	10	10	0	10	9
0300	9	10	10	0	10	10	0	10	8	0	10	10	0	10	10
0500	0	10	10	0	10	10	0	10	10	0	10	10	0	10	10
0700	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10
0900	10	9	10	10	10	10	0	10	10	10	10	10	0	7	7

* Doublet antenna.
† Slant-wire antenna.
§ Whip antenna.

Table 21

SCORE SHEET OF 5-MILE DELTA TEST
SITE 1 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
1100 22 Apr	--	--	--	10	10	10	10	10	10	10	10	10	0	0	0
1300	--	--	--	10	10	10	0	10	10	10	10	10	0	0	0
1500	0	10	10	10	10	10	9	10	10	10	10	10	0	0	0
1700	9	10	9	0	10	10	0	10	10	9	10	10	0	0	0
1900	10	10	10	0	10	10	6	9	4	10	7	9	0	10	0
2100	10	10	10	9	10	10	5	5	6	9	9	8	0	0	0
2300	10	10	10	0	10	6	6	9	8	4	0	0	10	10	0
0100 23 Apr	10	10	10	7	10	10	10	10	10	10	10	8	8	10	10
0300	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	10	10	0	0	0	0	8	10	0	10	10	0	10	10
0700	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10
0900	10	10	10	5	10	10	4	10	10	10	10	10	10	10	0
1100	10	10	10	10	10	10	0	10	10	10	9	10	10	10	10
1300	10	10	10	9	10	10	0	10	10	10	10	10	10	10	10
1500	10	10	7	8	10	10	0	10	10	10	10	10	10	10	8
1700	8	10	10	0	10	9	9	10	10	10	10	10	10	10	10
1900	8	10	10	0	10	10	0	9	8	5	8	3	10	10	5
2100	0	10	10	10	10	10	3	8	9	3	6	3	10	0	10
2300	0	10	2	0	10	10	0	10	10	0	7	0	0	0	0
0100 24 Apr	0	10	10	0	10	10	0	10	10	0	10	7	0	10	10
0300	10	10	9	0	10	10	0	10	10	0	10	8	0	9	10
0500	0	10	10	0	10	10	0	10	10	0	4	10	0	10	10
0700	10	10	10	6	10	10	10	10	10	10	10	10	10	10	10
0900	10	10	9	10	9	10	0	10	10	10	10	9	0	10	10

* Doublet antenna.
† Slant-wire antenna.
§ Whip antenna.

Table 22

SUMMARY OF 5-MILE DELTA TEST

SITE RECEIVING	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W$	D	S	W	D	S	W	D	S	W	D	S	W
Site 0															
Total Messages	220	220	220	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	161	217	209	124	216	219	117	228	227	172	218	218	102	171	154
Percent Correct	73%	99%	95%	52%	90%	91%	49%	95%	95%	72%	91%	91%	43%	71%	64%
Site 1															
Total Messages	220	220	220	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	145	220	196	113	219	215	82	218	215	160	200	185	108	159	133
Percent Correct	66%	100%	89%	47%	91%	90%	34%	91%	90%	67%	83%	77%	45%	66%	55%

* Doublet antenna.

† Slant-wire antenna.

$ Whip antenna.

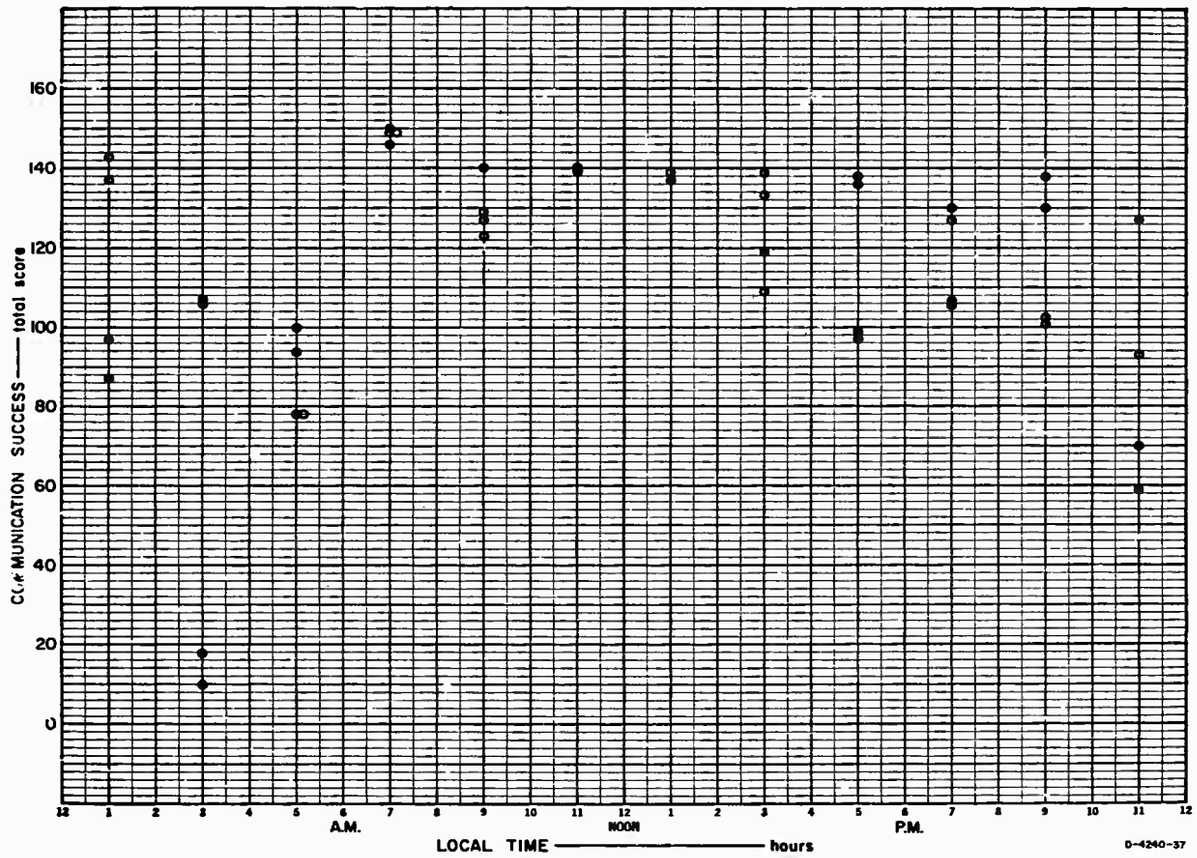

FIG. 11 HISTOGRAM SHOWING COMMUNICATION SUCCESS vs. TIME OF DAY – 5-MILE DELTA TEST

Table 23

SCORE SHEET OF 10-MILE DELTA TEST

SITE 0 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
1000 2 May	10	10	10	10	10	10	10	10	10	10	10	10	8	10	10
1200	10	10	10	10	9	9	10	10	9	10	9	0	0	0	0
1400	10	10	10	10	10	10	10	10	10	9	10	10	0	8	0
1600	10	10	10	7	10	10	9	10	9	9	10	8	6	9	7
1800	10	10	10	10	10	10	10	10	9	10	10	0	10	9	0
2000	10	10	10	7	10	10	10	10	10	7	0	0	9	10	0
2200	0	0	0	9	10	10	10	10	10	0	0	0	10	9	0
2400	10	10	0	7	10	10	10	0	0	0	0	0	0	0	0
0200 3 May	10	10	7	10	10	10	0	0	0	0	0	0	0	0	0
0400	--	--	--	0	10	10	0	0	0	10	10	10	0	0	0
0600	--	--	--	9	10	10	0	0	0	0	10	10	9	0	0
0800	--	--	--	10	10	10	10	10	10	0	0	0	9	10	0
1000	--	--	--	9	9	10	10	9	10	9	10	10	10	10	0
1200	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
1400	10	10	10	10	10	10	10	10	10	10	10	10	9	10	10
1600	9	10	10	10	10	10	10	10	10	9	10	8	4	10	10
1800	10	10	10	10	10	10	10	10	10	10	10	5	3	10	0
2000	10	10	10	9	10	10	10	10	10	6	8	0	0	0	0
2200	0	0	0	0	10	10	0	10	10	0	0	0	0	0	0
2400	0	0	0	10	10	10	10	10	10	10	10	6	0	0	0
0200 4 May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Doublet antenna.

† Slant-wire antenna.

§ Whip antenna.

Table 24

SCORE SHEET OF 10-MILE DELTA TEST
SITE 2 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
1000 2 May	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
1200	10	10	10	10	10	9	10	10	10	9	10	10	0	0	0
1400	10	10	10	10	10	10	10	10	10	10	10	8	10	10	0
1600	10	10	10	9	10	10	9	10	10	8	10	10	10	10	10
1800	10	10	10	8	10	10	10	10	8	10	8	0	10	4	0
2000	10	10	10	10	10	10	10	9	10	5	0	0	10	10	0
2200	0	0	0	6	10	10	10	10	10	0	0	0	9	10	0
2400	0	0	0	9	10	10	8	0	0	7	0	0	0	0	0
0200 3 May	0	0	0	7	10	10	9	8	10	0	0	0	0	10	0
0400	--	--	--	0	10	10	10	10	10	0	0	0	5	10	9
0600	--	--	--	10	9	10	10	8	8	0	0	0	10	10	10
0800	--	--	--	10	10	10	10	10	0	0	0	0	10	10	0
1000	--	--	--	8	10	10	10	10	10	9	10	10	10	10	0
1200	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
1400	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
1600	9	10	10	7	10	10	10	10	10	10	10	10	10	10	10
1800	8	10	10	8	10	6	10	10	10	9	9	0	8	10	9
2000	10	10	10	9	10	10	10	10	10	6	10	0	0	0	0
2200	0	0	0	0	10	10	10	10	10	0	0	0	0	0	0
2400	0	0	0	10	10	9	10	10	10	0	6	0	0	0	0
0200 4 May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Doublet antenna.

† Slant-wire antenna.

§ Whip antenna.

Table 25

SCORE SHEET OF 10-MILE DELTA TEST

SITE RECEIVING	HC-I62			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
Site 0															
Total Messages	200	200	200	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	129	130	117	167	198	199	159	159	157	129	137	97	97	115	47
Percent Correct	64%	65%	58%	70%	83%	83%	66%	66%	65%	54%	57%	40%	40%	48%	20%
Site 2															
Total Messages	200	200	200	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	107	110	110	161	199	194	196	185	176	113	113	78	132	144	78
Percent Correct	54%	55%	55%	67%	83%	81%	82%	77%	73%	47%	47%	32%	55%	60%	32%

* Doullet antenna.

† Slant-wire antenna.

§ Whip antenna.

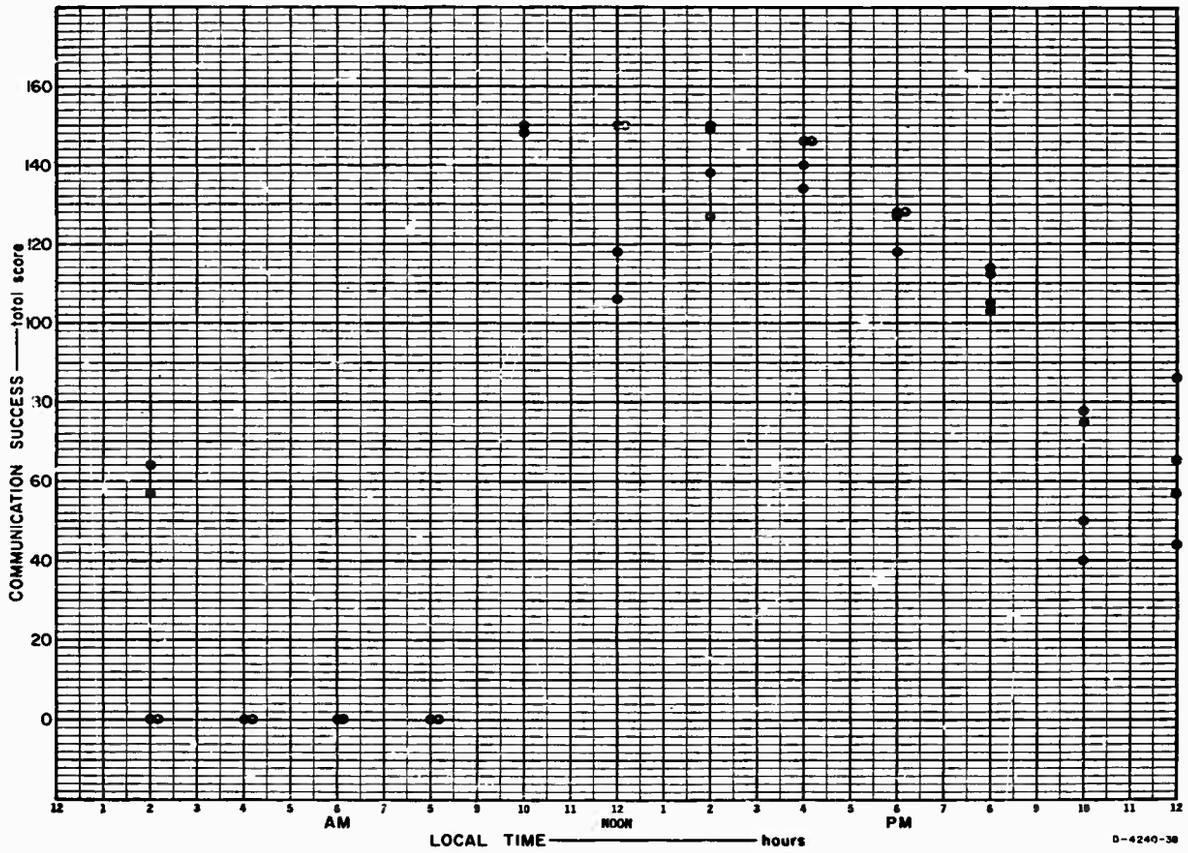

FIG. 12 HISTOGRAM SHOWING COMMUNICATION SUCCESS vs. TIME OF DAY – 10-MILE DELTA TEST

Table 26

SCORE SHEET OF 15-MILE DELTA TEST
SITE 0 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W$	D	S	W	D	S	W	D	S	W	D	S	W
0900 30 Apr	10	10	10	10	10	10	10	10	9	10	10	10	0	0	0
1100	10	10	10	9	10	10	0	10	9	10	10	10	0	0	0
1300	10	10	10	10	10	9	7	10	10	9	10	10	0	0	0
1500	10	10	10	2	10	10	0	10	9	7	9	8	0	0	0
1700	10	10	10	9	10	10	10	10	10	10	10	10	10	0	0
1900	10	10	10	10	10	0	8	9	7	10	0	0	10	0	0
2100	10	10	6	0	0	0	10	10	4	10	0	0	9	0	0
2300	10	10	10	10	9	8	10	10	8	10	5	0	10	0	0
0100 1 May	10	10	7	10	0	10	10	10	10	10	7	0	10	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	10	10	10	10	10	10	10	10	10	9	10	10	10	9	9
0900	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
1100	9	10	10	9	10	10	10	10	10	10	10	10	0	0	0
1300	0	10	10	10	10	10	10	10	10	10	10	10	0	0	0
1500	0	10	10	8	10	10	0	10	10	8	10	10	0	0	0
1700	10	10	10	9	10	10	10	9	10	10	10	9	9	10	10
1900	10	10	9	10	10	10	9	9	7	8	0	0	10	0	0
2100	10	10	7	9	10	6	10	10	10	10	0	0	10	0	0
2300	10	9	9	10	10	10	10	10	10	1	0	0	0	0	0
0100 2 May	0	10	9	0	0	0	0	0	0	0	10	0	10	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Doublet antenna.
† Slant-wire antenna.
$ Whip antenna.

Table 27

SCORE SHEET OF 15-MILE DELTA TEST
SITE 3 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W$	D	S	W	D	S	W	D	S	W	D	S	W
0900 30 Apr	10	10	10	8	10	10	10	10	10	9	10	10	0	0	0
1100	5	10	10	10	10	10	0	10	10	10	10	9	0	0	0
1300	10	10	9	10	10	9	0	10	10	7	9	9	0	0	0
1500	10	9	10	8	9	10	0	8	10	8	9	8	0	0	0
1700	10	10	10	8	10	10	10	10	10	9	4	7	9	0	0
1900	10	9	10	10	0	0	10	6	1	9	0	0	10	0	0
2100	10	10	10	0	0	0	10	6	10	10	0	0	9	0	0
2300	10	10	8	10	8	10	10	10	10	9	7	0	8	0	0
0100 1 May	10	10	10	10	10	10	10	10	10	6	0	0	10	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	10	10	10	9	10	10	10	10	10	10	10	8	10	8	9
0900	10	10	10	10	10	10	9	10	10	10	10	10	7	7	0
1100	10	10	10	10	10	10	0	10	10	10	10	10	0	0	0
1300	0	10	10	9	10	10	10	10	10	10	10	9	0	0	0
1500	0	10	10	10	9	9	0	9	10	7	7	7	0	0	0
1700	10	10	9	8	10	10	10	10	10	10	4	5	8	7	0
1900	10	8	10	10	10	6	10	9	10	10	0	0	10	0	0
2100	10	9	10	10	9	8	9	8	9	10	0	0	10	0	0
2300	10	10	10	10	9	6	9	10	10	10	0	0	0	0	0
0100 2 May	10	9	10	0	0	0	0	0	0	0	0	5	10	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Doublet antenna.
† Slant-wire antenna.
$ Whip antenna.

Table 28

SUMMARY OF 15-MILE DELTA TEST

SITE RECEIVING	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
Site 0															
Total Messages	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	159	189	177	155	159	153	144	177	163	162	131	107	108	29	29
Percent Correct	66%	79%	74%	65%	66%	64%	60%	74%	68%	68%	55%	45%	45%	12%	12%
Site 3															
Total Messages	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	165	184	186	160	154	148	127	166	170	164	100	97	101	22	9
Percent Correct	69%	77%	78%	67%	64%	62%	53%	69%	71%	68%	42%	40%	42%	9%	4%

* Doublet antenna.

† Slant-wire antenna.

§ Whip antenna.

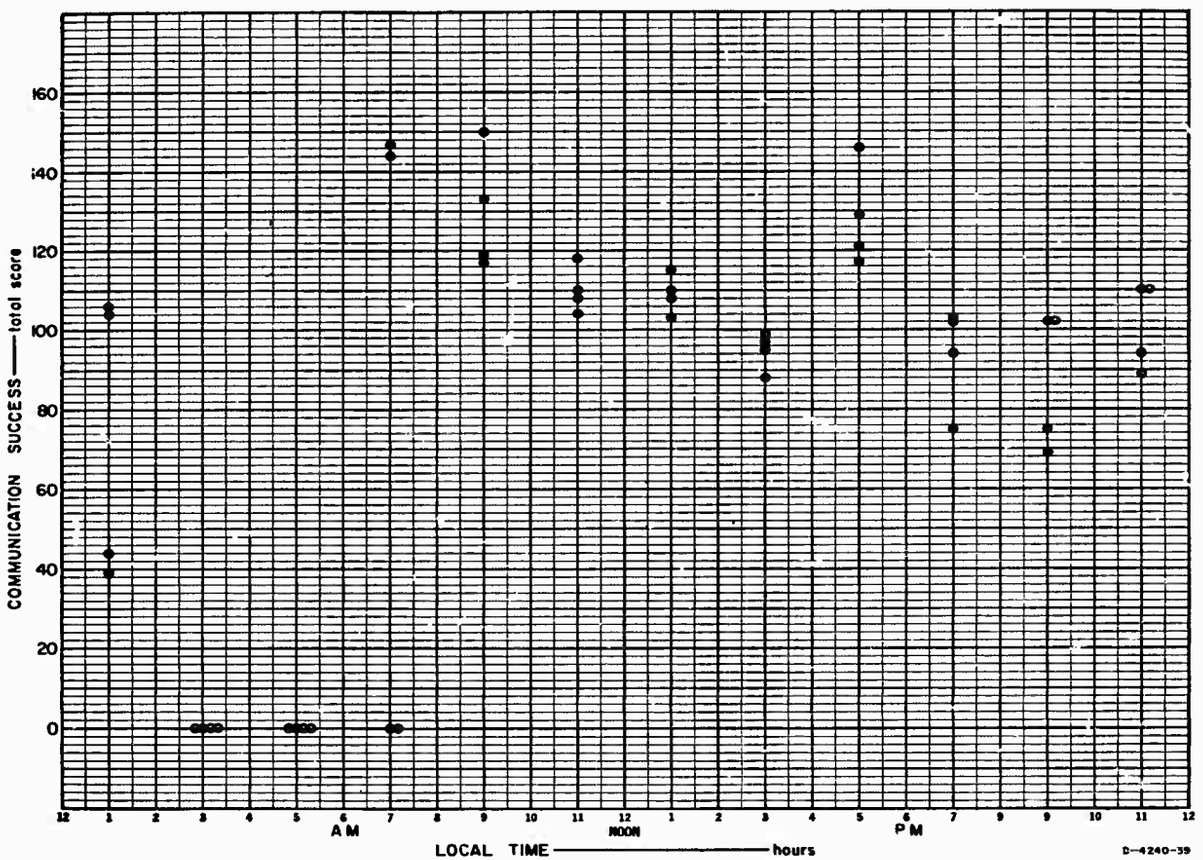

FIG. 13 HISTOGRAM SHOWING COMMUNICATION SUCCESS vs. TIME OF DAY – 15-MILE DELTA TEST

Table 29

SCORE SHEET OF 20-MILE DELTA TEST
SITE 0 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
1500 11 Apr	10	10	10	10	10	10	0	10	10	0	9	10	0	0	0
1700	10	10	0	10	10	10	10	10	10	10	10	10	0	0	0
1900	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
2100	10	0	0	0	0	0	10	0	0	9	0	0	0	0	0
2300	9	0	0	0	0	0	9	0	0	0	0	0	0	0	0
0100 12 Apr	10	0	0	7	0	0	0	0	0	10	0	0	0	0	0
0300	9	10	9	5	0	0	10	0	0	10	0	0	3	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	10	10	10	10	10	10	10	0	0	10	10	10	10	0	0
0900	0	10	10	10	10	10	0	0	0	10	10	10	10	10	0
1100	0	10	10	10	10	10	0	8	8	10	10	0	0	0	0
1300	--	--	--	10	10	10	0	8	10	10	10	10	0	0	0
1500	--	--	--	10	8	10	7	10	10	8	10	10	0	0	0
1700	9	9	10	10	10	10	10	10	10	10	10	10	10	10	0
1900	10	0	0	10	0	10	10	10	0	9	0	0	10	0	0
2100	10	10	8	0	0	0	0	0	0	0	0	0	0	0	0
2300 13 Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100	10	0	0	7	0	0	10	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	10	0	0	7	0	0	0	0	0	0	0	0	0	0	0
0700	10	10	10	10	10	10	10	10	10	10	10	10	10	0	0
0900	9	10	10	10	10	10	10	10	10	10	10	10	10	8	0
1100	9	10	10	10	10	9	10	9	10	10	10	0	0	0	0
1300	10	10	10	10	10	10	9	10	10	10	10	10	0	0	0

* Doublet antenna.
† Slant-wire antenna.
§ Whip antenna.

Table 30

SCORE SHEET OF 20-MILE DELTA TEST
SITE 4 RECEIVING

LOCAL TIME		HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
		D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
1500	11 Apr	6	10	7	6	10	10	0	10	8	0	10	10	0	0	0
1700		10	9	0	10	10	10	10	10	10	10	10	10	0	0	0
1900		0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
2100		9	0	0	0	0	0	8	0	0	8	0	0	0	0	0
2300		6	0	0	0	0	0	8	0	0	0	0	0	0	0	0
0100	12 Apr	10	0	0	9	0	0	0	0	0	10	0	0	0	0	0
0300		10	9	10	9	0	0	4	0	0	10	0	0	10	0	0
0500		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700			10	10	10	10	10	10	0	0	10	10	10	10	0	0
0900		0	10	10	10	10	10	0	0	0	10	10	10	9	7	0
1100		0	10	10	10	10	10	0	9	10	9	9	6	0	0	0
1300		--	--	--	10	10	9	0	10	9	10	10	10	0	0	0
1500		--	--	--	10	10	10	10	10	10	10	10	10	0	0	0
1700		10	10	10	10	10	10	9	10	10	10	8	10	10	10	0
1900		7	0	0	10	0	10	8	9	0	9	0	0	4	0	0
2100		9	10	8	0	0	0	0	0	0	0	0	0	0	0	0
2300		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100	13 Apr	10	0	0	8	0	0	10	0	0	0	0	0	0	0	0
0300		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500		7	0	0	10	0	0	0	0	0	0	0	0	0	0	0
0700		10	10	10	10	10	10	10	10	10	10	10	10	10	0	0
0900		10	0	10	10	10	9	8	10	9	10	10	10	10	0	0
1100		9	9	10	10	10	10	10	10	10	8	10	0	0	0	0
1300		10	10	9	6	10	10	6	9	10	10	10	10	0	0	0

* Doublet antenna.
† Slant-wire antenna.
§ Whip antenna.

Table 31

SUMMARY OF 20-MILE DELTA TEST

SITE RECEIVING	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W$	D	S	W	D	S	W	D	S	W	D	S	W
Site 0															
Total Messages	220	220	220	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	155	119	107	156	118	129	135	105	98	146	119	100	68	28	0
Percent Correct	70%	54%	49%	65%	49%	54%	56%	44%	41%	61%	50%	42%	28%	12%	0%
Site 4															
Total Messages	220	220	220	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	143	107	104	158	120	128	121	107	96	144	117	106	63	17	0
Percent Correct	65%	49%	47%	66%	50%	53%	50%	45%	40%	60%	49%	44%	26%	7%	0%

* Doublet antenna.

† Slant-wire antenna.

$ Whip antenna.

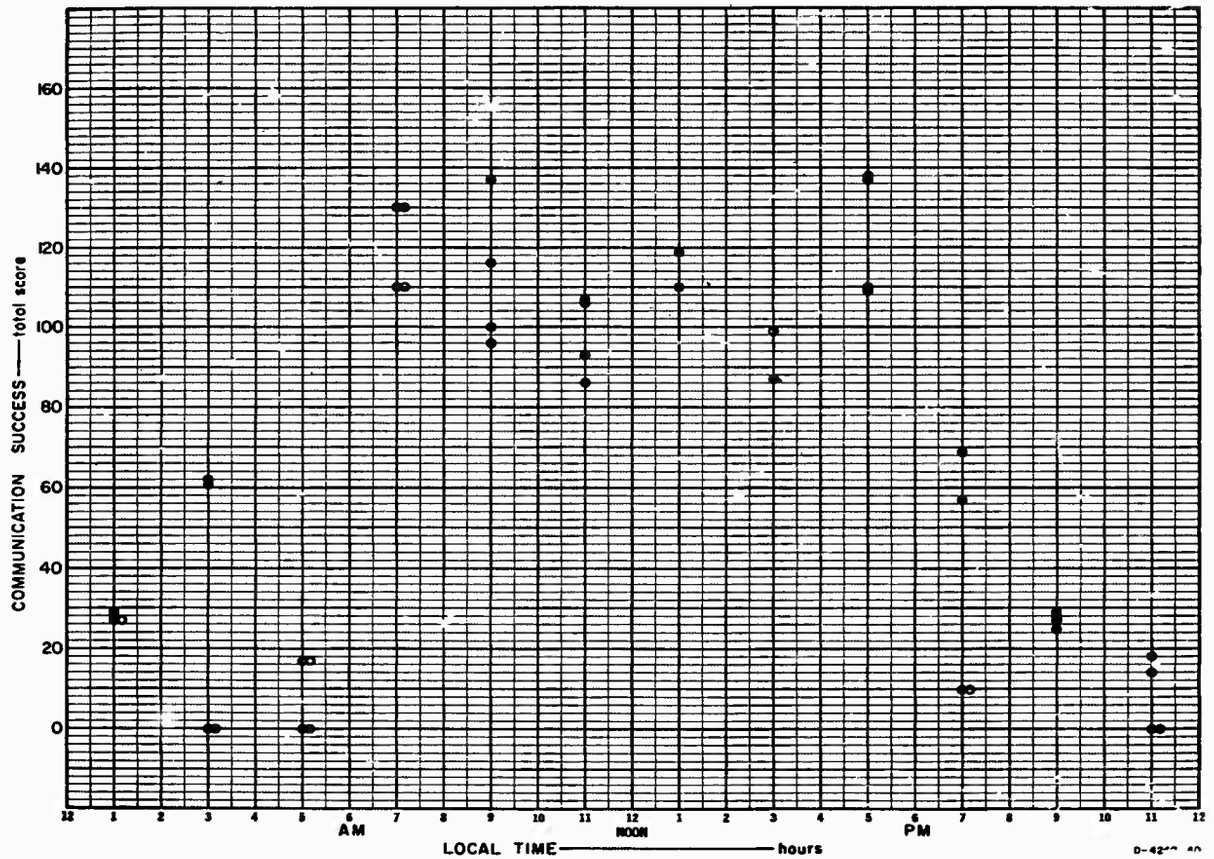

FIG. 14 HISTOGRAM SHOWING COMMUNICATION SUCCESS vs. TIME OF DAY – 20-MILE DELTA TEST

Table 32

SCORE SHEET OF 25-MILE DELTA TEST
SITE 0 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-38			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
1100 25 Apr	10	10	10	10	10	9	10	10	10	9	10	10	--	--	--
1300	10	10	10	8	10	9	0	10	9	9	7	10	7	10	0
1500	10	10	10	7	10	10	10	7	4	10	10	10	0	0	0
1700	10	10	10	10	10	10	9	9	0	10	6	0	0	0	0
1900	10	10	10	9	0	0	10	6	0	9	0	0	10	0	0
2100	10	9	4	10	3	0	10	0	0	10	0	0	10	0	0
2300	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100 26 Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0
0500	10	10	10	9	10	10	0	10	10	2	10	0	0	0	0
0700	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10
0900	10	10	10	10	10	10	10	9	10	8	10	10	10	10	9
1100	10	10	10	0	10	10	9	9	10	7	9	10	10	10	9
1300	6	10	10	0	9	10	3	10	10	9	10	9	10	10	10
1500	9	10	9	9	10	8	6	7	2	8	9	4	9	10	0
1700	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1900	10	9	8	10	6	0	8	0	0	9	0	0	9	0	0
2100	8	9	7	10	10	8	8	6	0	10	0	0	9	0	0
2300	5	7	9	10	5	5	10	7	0	0	0	0	9	0	0
0100 27 Apr	10	10	5	10	9	9	9	8	7	10	0	0	9	0	0
0300	0	10	10	0	10	10	0	8	8	0	0	0	0	0	0
0500	10	10	9	10	10	10	4	9	10	10	8	8	9	0	0
0700	10	10	10	10	9	10	10	10	10	10	10	9	10	10	10
0900	10	10	8	10	10	10	9	10	10	8	10	9	0	0	0

* Doublet antenna.
† Slant-wire antenna.
§ Whip antenna.

Table 33

SCORE SHEET OF 25-MILE DELTA TEST
SITE 5 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W$	D	S	W	D	S	W	D	S	W	D	S	W
1100 25 Apr	10	10	10	10	10	10	10	10	10	8	10	10	--	--	--
1300	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
1500	10	10	10	10	0	10	10	10	10	10	10	10	0	0	0
1700	10	10	10	9	10	10	10	10	10	10	7	0	0	0	0
1900	10	9	10	9	0	0	10	10	0	10	0	0	10	0	0
2100	10	8	9	8	6	10	0	0	0	10	0	0	10	0	0
2300	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100 26 Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	9	10	10	0	0	0	0	0	0	0	0	0	0	0	0
0500	10	10	10	5	10	10	0	10	10	0	9	0	0	0	0
0700	10	10	10	10	10	10	10	9	10	10	10	10	10	10	10
0900	10	10	10	10	10	10	10	10	9	10	9	10	9	10	10
1100	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
1300	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
1500	10	10	10	9	10	10	6	10	8	9	7	9	8	4	0
1700	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1900	10	5	9	10	6	0	10	0	0	9	0	0	4	0	0
2100	10	9	8	10	10	7	10	8	0	10	0	0	8	0	0
2300	10	10	10	7	10	10	10	10	0	0	0	0	6	0	0
0100 27 Apr	10	10	10	10	10	9	10	8	9	9	0	0	10	0	0
0300	0	10	9	0	8	9	0	9	9	0	0	0	0	0	0
0500	10	10	10	9	10	10	6	8	9	7	8	9	9	0	0
0700	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
0900	10	10	10	8	10	10	9	9	8	10	10	10	0	0	0

* Doublet antenna.
† Slant-wire antenna.
$ Whip antenna.

Table 34

SUMMARY OF 25-MILE DELTA TEST

SITE RECEIVING	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
Site 0															
Total Messages	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230
Number Correct	196	204	189	162	170	158	145	155	120	158	119	99	131	70	48
Percent Correct	85%	89%	82%	70%	74%	69%	63%	67%	52%	69%	52%	43%	57%	30%	21%
Site 5															
Total Messages	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230
Number Correct	209	201	205	174	170	175	161	171	142	162	120	108	124	64	60
Percent Correct	91%	87%	89%	76%	74%	76%	70%	74%	62%	70%	52%	47%	54%	28%	26%

* Doublet antenna.

† Slant-wire antenna.

§ Whip antenna.

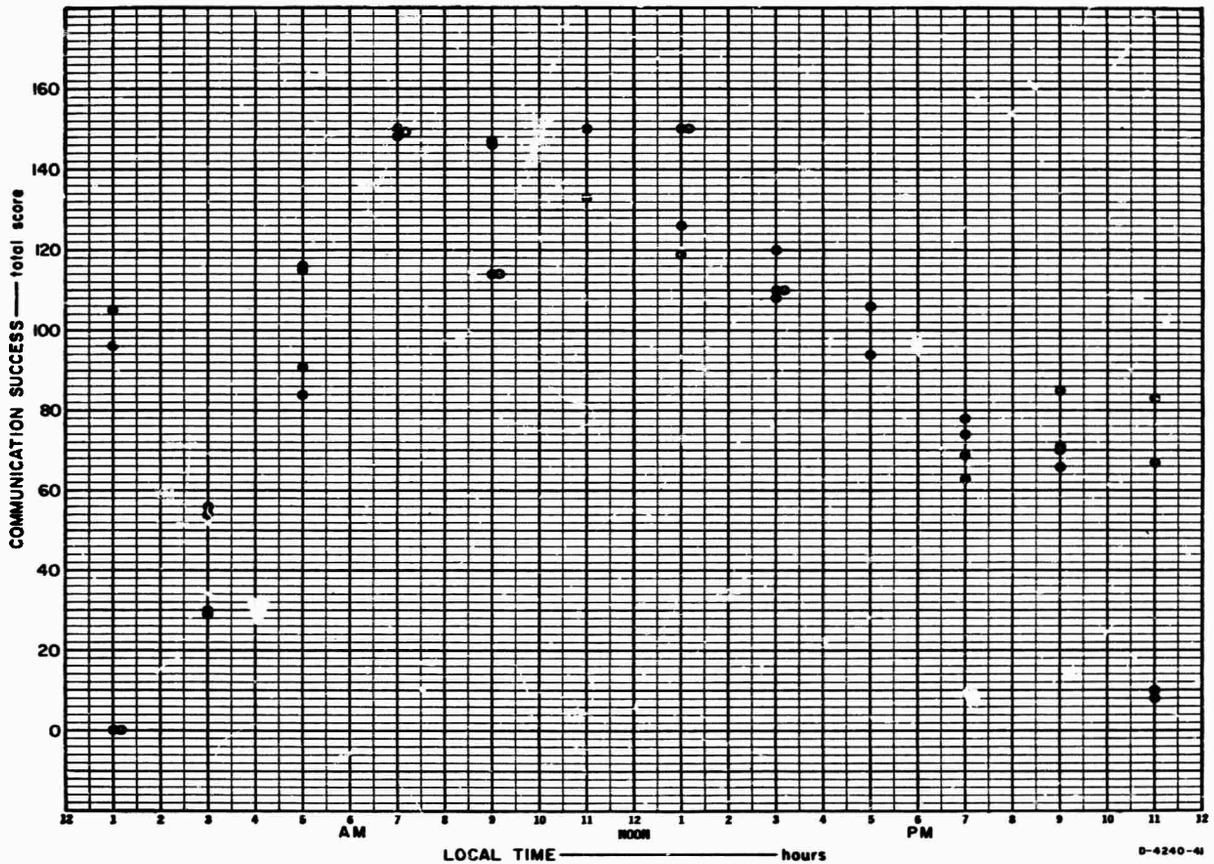

FIG. 15 HISTOGRAM SHOWING COMMUNICATION SUCCESS vs. TIME OF DAY – 25-MILE DELTA TEST

E. RESULTS FROM MOUNTAIN AREA TEST

Table 35

SCORE SHEET OF 5-MILE MOUNTAIN TEST
SITE 0 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
1300 10 May	10	10	10	10	10	9	10	10	10	10	9	9	10	10	6
1500	10	0	0	10	9	10	10	10	10	10	5	10	10	9	7
1700	9	9	9	10	8	0	10	9	8	10	6	4	10	2	0
1900	8	0	0	7	0	0	10	0	0	0	0	0	0	0	0
2100	10	0	0	10	0	0	0	0	0	10	0	0	10	0	0
2300	4	0	0	7	0	0	8	0	0	10	0	0	6	0	0
0100 11 May	10	0	0	9	0	0	8	0	0	9	0	0	10	0	0
0300	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	10	0	0	0	0	0	10	0	0	9	0	0	0	0	0
0700	10	0	0	10	9	0	10	0	0	10	0	0	--	--	--
0900	10	9	0	10	10	10	10	0	0	10	0	0	10	0	0
1100	10	0	0	10	10	9	10	10	10	10	0	0	10	0	0
0900 13 May	10	10	0	10	10	9	10	10	10	10	10	10	10	9	0
1100	10	10	9	10	10	10	10	10	10	10	10	9	10	7	8
1300	9	10	10	10	10	10	10	10	10	10	10	9	10	9	4
1500	10	10	10	10	10	9	10	10	10	10	4	7	10	0	0
1700	8	10	8	10	5	0	10	6	0	10	0	0	10	0	0
1900	10	9	0	10	0	0	7	0	0	10	0	0	0	0	0
2100	10	9	0	10	5	0	10	0	0	10	0	0	0	0	0
2300	10	10	0	10	0	0	10	0	0	9	0	0	0	0	0
0100 14 May	10	9	0	10	0	0	10	0	0	10	0	0	0	0	0
0300	10	8	0	10	0	0	10	0	0	10	0	0	0	0	0
0500	10	0	0	10	0	0	10	0	0	10	0	0	0	0	0
0700	10	10	10	10	9	6	10	10	8	10	0	0	0	0	0

* Doublet antenna.
† Slant-wire antenna.
§ Whip antenna.

Table 36

SCORE SHEET OF 5-MILE MOUNTAIN TEST
SITE 1 RECEIVING

LOCAL TIME		HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
		D*	S†	W$	D	S	W	D	S	W	D	S	W	D	S	W
1300	10 May	10	10	10	10	10	10	10	10	10	10	10	9	10	9	10
1500		10	0	0	10	10	10	10	10	10	10	10	8	10	9	9
1700		10	10	10	10	10	7	10	10	9	9	10	8	10	6	0
1900		10	0	0	8	0	0	9	0	0	0	0	0	9	0	0
2100		10	0	0	9	0	0	9	0	0	7	0	0	8	0	0
2300		7	0	0	2	0	0	10	0	0	9	0	0	3	0	0
0100	11 May	10	0	0	9	0	0	10	0	0	10	0	0	10	0	0
0300		10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500		10	0	0	0	0	0	10	0	0	2	0	0	0	0	0
0700		10	9	7	0	5	0	10	6	0	10	0	0	--	--	--
0900		10	10	10	10	10	9	10	0	0	10	0	0	10	0	0
1100		10	10	0	10	10	10	10	10	7	10	0	0	9	0	0
0900	13 May	10	10	0	10	8	10	9	10	10	10	10	10	10	10	0
1100		9	10	10	10	10	10	10	10	10	10	10	9	10	10	9
1300		10	10	10	10	10	10	10	10	10	10	10	10	10	10	9
1500		9	10	10	9	10	10	10	10	10	10	10	6	9	0	0
1700		9	9	8	10	9	0	9	9	8	10	0	0	9	0	0
1900		10	8	0	10	0	0	9	0	0	9	0	0	0	0	0
2100		10	10	0	9	6	0	10	0	0	7	0	0	0	0	0
2300		10	6	0	8	0	0	6	0	0	3	0	0	0	0	0
0100	14 May	10	7	0	10	0	0	10	7	0	10	0	0	0	0	0
0300		10	7	0	10	3	0	10	0	0	8	0	0	0	0	0
0500		9	0	0	9	0	0	9	0	0	10	0	0	0	0	0
0700		10	9	7	10	10	10	10	10	10	10	10	0	0	0	0

* Doublet antenna.
† Slant-wire antenna.
$ Whip antenna.

Table 37

SUMMARY OF 5-MILE MOUNTAIN TEST

SITE RECEIVING	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W$	D	S	W	D	S	W	D	S	W	D	S	W
Site 0															
Total Messages	240	240	240	240	240	240	240	240	240	240	240	240	230	230	230
Number Correct	225	133	66	213	115	82	213	95	86	217	54	58	126	46	25
Percent Correct	94%	55%	28%	89%	48%	34%	89%	40%	36%	90%	22%	24%	55%	20%	11%
Site 1															
Total Messages	240	240	240	240	240	240	240	240	240	240	240	240	230	230	230
Number Correct	234	145	82	193	121	96	220	112	94	194	80	60	127	54	37
Percent Correct	98%	60%	34%	80%	50%	40%	92%	47%	40%	81%	33%	25%	55%	24%	16%

* Doublet antenna.

† Slant-wire antenna.

$ Whip antenna.

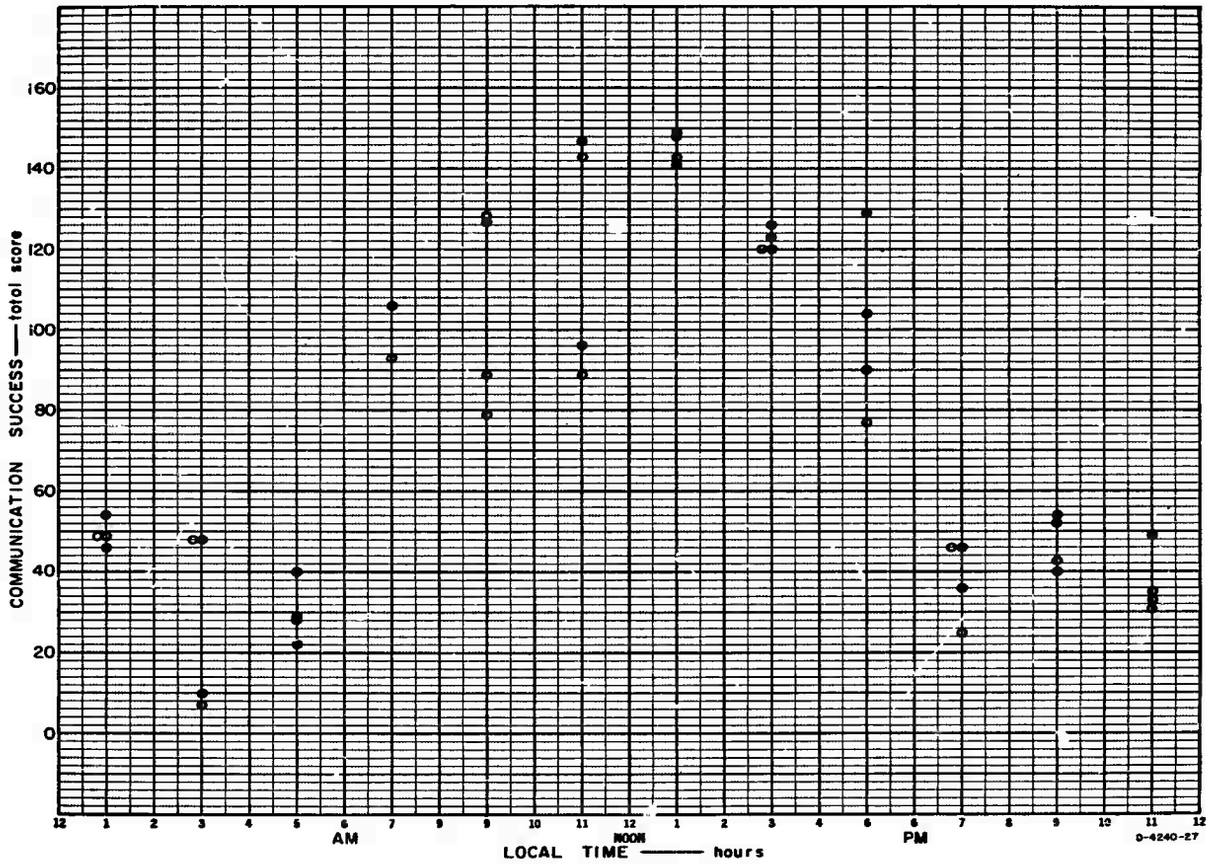

FIG. 16 HISTOGRAM SHOWING COMMUNICATION SUCCESS vs. TIME OF DAY - 5-MILE MOUNTAIN TEST

Table 38

SCORE SHEET OF 12-MILE MOUNTAIN TEST
SITE 0 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
0900 20 May	10	10	10	10	10	10	10	10	10	10	10	0	9	0	0
1100	10	10	10	10	10	10	10	10	10	10	10	0	10	0	0
1300	10	10	10	10	10	10	10	9	10	10	10	0	10	0	0
1500	10	10	9	10	10	9	10	9	8	10	9	0	9	0	0
1700	10	8	0	10	3	0	10	0	0	10	0	0	6	0	0
1900	10	5	0	10	1	0	10	0	0	10	0	0	10	0	0
2100	10	10	0	8	0	0	8	0	0	0	0	0	0	0	0
2300	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100 21 May	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	10	10	9	10	9	0	10	0	0	10	0	0	9	0	0
0900	9	10	10	9	10	8	10	9	9	10	10	8	10	0	0
1100	10	10	10	9	10	10	10	10	10	10	7	10	10	10	0
1300	10	10	10	8	9	10	10	10	10	10	9	2	8	8	0
1500	10	10	6	9	1	0	10	9	0	10	0	0	10	0	0
1700	10	8	5	9	7	1	10	10	8	10	0	0	10	5	0
1900	10	8	0	10	8	0	10	10	0	10	1	0	9	0	0
2100	10	5	0	0	0	0	9	0	0	4	0	0	4	0	0
2300	10	9	0	0	0	0	9	0	0	5	0	0	0	0	0
0100 22 May	10	9	0	6	0	0	10	9	0	8	0	0	6	0	0
0300	10	0	0	7	0	0	0	0	0	0	0	0	0	0	0
0500	10	10	0	7	3	0	10	7	0	10	0	0	10	0	0
0700	10	10	9	9	0	0	10	0	0	9	1	0	9	8	0

* Doublat antenna.
† Slant-wire antenna.
§ Whip antenna.

Table 39

SCORE SHEET OF 12-MILE MOUNTAIN TEST
SITE 2 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
0900 20 May	10	9	10	9	10	8	10	10	10	10	10	0	0	0	0
1100	10	10	9	10	10	10	10	10	9	10	10	0	9	0	0
1300	10	10	10	10	10	9	9	10	10	10	10	0	10	0	0
1500	10	10	9	10	10	9	10	8	6	10	7	0	9	0	0
1700	10	10	0	10	10	0	10	10	0	10	0	0	8	0	0
1900	10	10	0	10	9	0	7	0	0	5	0	0	7	0	0
2100	10	9	0	10	0	0	10	0	0	0	0	0	0	0	0
2300	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100 21 May	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	10	10	10	9	10	0	10	0	0	10	0	0	9	0	0
0900	10	10	10	10	9	10	10	10	10	9	9	8	1	0	0
1100	10	10	10	10	10	10	10	10	10	10	10	8	10	9	0
1300	7	9	10	10	5	9	9	10	10	7	6	3	6	9	0
1500	10	10	8	3	1	0	10	4	0	8	0	0	10	0	0
1700	10	10	8	10	10	0	10	10	7	10	7	0	10	10	0
1900	10	10	0	9	9	0	10	9	0	10	4	0	10	0	0
2100	10	7	0	9	0	0	10	0	0	0	0	0	8	0	0
2300	10	6	0	10	0	0	10	0	0	4	0	0	0	0	0
0100 22 May	9	4	0	9	0	0	10	4	0	9	0	0	8	0	0
0300	9	0	0	0	0	0	2	0	0	0	0	0	0	0	0
0500	10	10	0	10	7	0	2	5	0	10	0	0	10	0	0
0700	10	9	10	10	0	0	10	0	0	10	10	0	10	9	0

* Doublet antenna.
† Slant-wire antenna.
§ Whip antenna.

Table 40

SUMMARY OF 12-MILE MOUNTAIN TEST

SITE RECEIVING	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
Site 0															
Total Messsges	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	214	172	98	161	101	68	186	112	75	166	67	20	149	31	0
Percent Correct	89%	72%	41%	67%	42%	28%	78%	47%	31%	69%	28%	8%	62%	13%	0%
Site 2															
Total Messsges	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	213	173	104	178	120	65	179	110	72	152	83	19	135	37	0
Percent Correct	89%	72%	43%	74%	50%	27%	75%	46%	30%	63%	35%	8%	56%	15%	0%

* Doublet antenna.

† Slant-wire antenna.

§ Whip antenna.

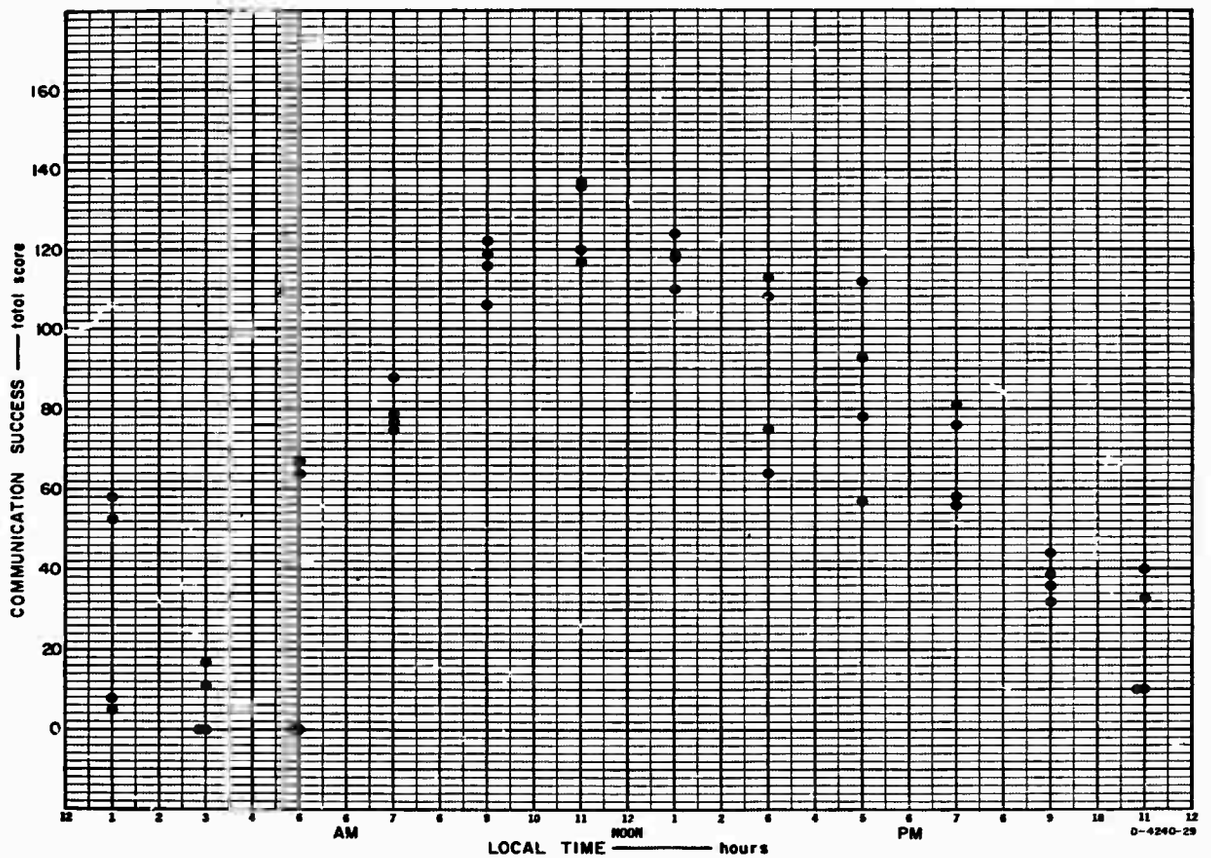

FIG. 17 HISTOGRAM SHOWING COMMUNICATION SUCCESS vs. TIME OF DAY – 12-MILE MOUNTAIN TEST

Table 41

SCORE SHEET OF 25-MILE MOUNTAIN TEST
SITE 0 RECEIVING

LOCAL TIME		HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
		D*	S†	W$	D	S	W	D	S	W	D	S	W	D	S	W
0900	15 May	10	10	9	10	10	1	10	5	0	10	0	0	0	0	0
1100		10	10	8	10	8	0	10	9	0	10	0	0	0	0	0
1300		10	10	9	10	10	0	10	9	5	7	0	0	0	0	0
1500		10	4	0	9	7	4	10	8	0	10	0	0	10	0	0
1700		10	0	0	9	1	0	9	7	0	10	0	0	10	0	0
1900		9	0	0	10	0	0	10	10	0	0	0	0	0	0	0
2100		9	0	0	6	0	0	9	0	0	4	0	0	0	0	0
2300		10	0	0	10	0	0	8	7	0	8	0	0	0	0	0
0100	16 May	9	0	0	3	0	0	9	0	0	0	0	0	0	0	0
0300		10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500		10	3	0	9	0	0	10	0	0	7	0	0	0	0	0
0700		10	9	0	10	4	0	10	10	0	10	0	0	10	4	0
0900		10	10	5	9	7	0	10	9	0	10	0	0	10	6	0
1100		10	10	0	10	0	0	10	9	0	10	0	0	0	0	0
1300		10	10	0	10	0	0	10	4	0	6	0	0	0	0	0
1500		7	0	0	0	0	0	7	0	0	7	0	0	0	0	0
1700		10	0	0	4	0	0	0	0	0	9	0	0	0	0	0
1900		10	8	0	7	0	0	9	6	0	10	0	0	0	0	00
2100		10	0	0	0	0	0	4	0	0	6	0	0	0	0	0
2300		10	7	0	0	0	0	9	0	0	9	0	0	7	0	0
0100	17 May	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300		10	0	0	0	0	0	10	0	0	10	0	0	0	0	0
0500		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700		10	10	0	10	9	0	9	10	0	10	0	0	9	0	0

* Doublet antenna.
† Slant-wire antenna.
$ Whip antenna.

Table 42

SCORE SHEET OF 25-MILE MOUNTAIN TEST
SITE 3 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W$	D	S	W	D	S	W	D	S	W	D	S	W
0900 15 May	10	10	9	9	9	10	10	10	0	10	10	0	0	0	0
1100	10	10	10	10	10	0	9	9	0	10	0	0	0	0	0
1300	10	10	10	9	10	0	10	10	0	10	10	0	0	0	0
1500	10	10	0	10	10	10	10	9	4	9	0	0	10	0	0
1700	9	0	0	10	8	0	9	8	0	10	0	0	10	0	0
1900	10	0	0	10	0	0	6	0	0	10	0	0	10	0	0
2100	10	0	0	10	0	0	10	0	0	8	0	0	0	0	0
2300	5	0	0	0	0	0	10	8	0	9	0	0	0	0	0
0100 16 May	10	0	0	7	0	0	10	0	0	7	0	0	0	0	0
0300	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	9	9	0	10	3	0	9	0	0	10	0	0	6	0	0
0700	9	8	0	10	0	0	10	9	0	10	0	0	10	5	0
0900	10	10	8	10	10	0	10	9	0	10	0	0	4	0	0
1100	10	10	0	10	8	0	5	8	0	10	0	0	0	0	0
1300	9	9	0	7	0	0	9	7	0	9	0	0	0	0	0
1500	8	0	0	0	0	0	10	0	0	10	0	0	9	0	0
1700	10	0	0	10	0	0	7	0	0	10	0	0	0	0	0
1900	10	10	0	10	0	0	8	10	0	10	0	0	0	0	0
2100	10	0	0	0	0	0	9	0	0	10	0	0	0	0	0
2300	10	0	0	0	0	0	10	0	0	10	0	0	10	0	0
0100 17 May	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	10	0	0	0	0	0	10	0	0	10	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	10	9	0	10	9	0	10	10	0	10	0	0	2	0	0

* Doublet antenna.
† Slant-wire antenna.
$ Whip antenna.

Table 43

SUMMARY OF 25-MILE MOUNTAIN TEST

SITE RECEIVING	HC-162			77-AM			AN/TRC-88			TRP -4			AN/GRC-9		
	D*	S†	W$	D	S	W	D	S	W	D	S	W	D	S	W
Site 0															
Total Messages	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	224	101	31	146	56	5	183	103	5	163	0	0	56	10	0
Percent Correct	93%	42%	13%	61%	23%	2%	76%	43%	2%	68%	0%	0%	23%	4%	0%
Site 3															
Total Messages	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	217	105	37	152	77	20	191	107	4	202	20	0	71	5	0
Percent Correct	90%	44%	15%	63%	32%	8%	80%	45%	2%	84%	8%	0%	30%	2%	0%

*Doublet antenna.

†Slant-wire antenna.

$Whip antenna.

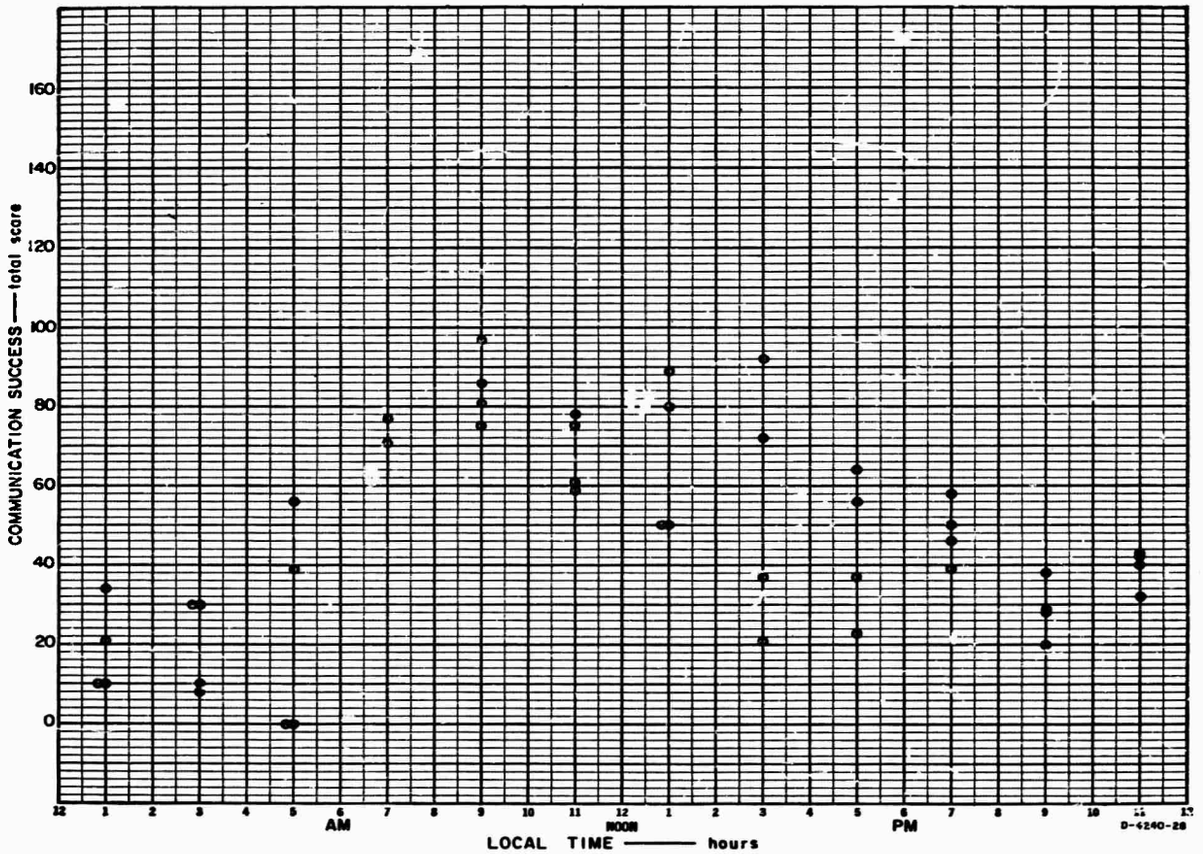

FIG. 18 HISTOGRAM SHOWING COMMUNICATION SUCCESS vs. TIME OF DAY – 25-MILE MOUNTAIN TEST

Table 44

SCORE SHEET OF 50-MILE VARIED-TERRAIN TEST
SITE 0 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
0900 24 May	10	9	0	9	3	0	10	10	0	10	0	0	10	0	0
1100	10	10	8	10	6	0	9	8	0	10	9	0	10	0	0
1300	10	10	0	10	0	0	10	0	0	10	0	0	7	0	0
1500	10	10	0	9	0	0	10	0	0	9	0	0	9	0	0
1700	10	7	0	7	0	0	10	0	0	7	0	0	3	0	0
1900	10	9	0	7	0	0	9	0	0	0	0	0	5	0	0
2100	9	9	0	8	0	0	9	0	0	0	0	0	0	0	0
2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100 25 May	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	10	0	0	10	0	0	10	0	0	10	0	0	8	0	0
0500	10	0	0	5	0	0	7	0	0	9	0	0	10	0	0
0700	10	10	7	10	8	9	10	10	10	10	7	0	10	10	0
0900	10	8	8	10	10	10	10	10	9	10	7	0	8	0	0
1100	10	10	10	10	10	9	10	10	10	10	0	0	10	10	0
1300	10	9	9	8	7	3	10	8	8	0	0	0	6	0	0
1500	10	7	10	6	0	0	7	0	0	0	0	0	6	0	0
1700	10	0	0	10	0	0	0	0	0	0	0	0	0	0	0
1900	10	0	0	8	0	0	10	0	0	8	0	0	8	0	0
2100	10	0	0	9	0	0	9	0	0	10	0	0	10	0	0
2300	10	0	0	6	0	0	7	0	0	10	0	0	0	0	0
0100 26 May	10	0	0	0	0	0	8	0	0	0	0	0	0	0	0
0300	10	0	0	0	0	0	9	0	0	7	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	10	10	0	10	9	0	9	0	0	6	0	0	10	0	0

*Doublet antenna.
†Slant-wire antenna.
§Whip antenna.

Table 45

SCORE SHEET OF 50-MILE VARIED-TERRAIN TEST
SITE 4 RECEIVING

TIME LOCAL		HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
		D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
0900	24 May	10	9	0	10	7	0	10	7	0	10	0	0	9	0	0
1100		10	6	9	9	10	0	9	9	0	9	7	0	10	0	0
1300		10	9	0	10	0	0	8	0	0	10	0	0	9	0	0
1500		10	8	0	10	0	0	9	0	0	10	0	0	10	0	0
1700		10	8	0	8	0	0	8	0	0	10	0	0	9	0	0
1900		10	5	0	9	0	0	10	0	0	10	0	0	10	0	0
2100		10	6	0	0	0	0	5	0	0	0	0	0	0	0	0
2300		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100	25 May	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300		10	0	0	10	0	0	9	0	0	10	0	0	10	0	0
0500		10	0	0	10	0	0	10	0	0	10	0	0	10	0	0
0700		10	8	9	10	10	10	10	9	9	10	9	0	10	10	0
0900		10	9	10	9	10	9	0	10	8	9	6	0	8	0	0
1100		10	10	10	10	10	9	10	10	10	9	0	0	5	10	0
1300		10	10	6	10	7	7	9	6	0	0	0	0	9	0	0
1500		8	5	0	9	9	0	3	0	0	0	0	0	4	0	0
1700		10	0	0	10	0	0	0	0	0	0	0	0	0	0	0
1900		10	0	0	8	0	0	9	0	0	10	0	0	10	0	0
2100		10	0	0	8	0	0	9	0	0	10	0	0	9	0	0
2300		10	0	0	9	0	0	9	0	0	10	0	0	9	0	0
0100	26 May	9	0	0	0	0	0	10	0	0	0	0	0	0	0	0
0300		10	0	0	0	0	0	9	0	0	7	0	0	0	0	0
0500		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700		10	10	0	10	10	0	10	0	0	10	0	0	10	0	0

* Doublet antenna.
† Slant-wire antenna.
§ Whip antenna.

Table 46

SUMMARY OF 50-MILE VARIED-TERRAIN TEST

SITE RECEIVING	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
Site 0															
Total Messages	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	215	118	52	162	53	31	183	56	37	136	23	0	130	20	0
Percent Correct	90%	49%	22%	68%	22%	13%	76%	23%	15%	57%	10%	0%	54%	8%	0%
Site 4															
Total Messages	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	215	103	44	169	73	35	166	51	27	154	22	0	151	20	0
Percent Correct	90%	43%	18%	70%	30%	15%	69%	21%	11%	64%	9%	0%	63%	8%	0%

* Doublet antenna.

† Slant-wire antenna.

§ Whip antenna.

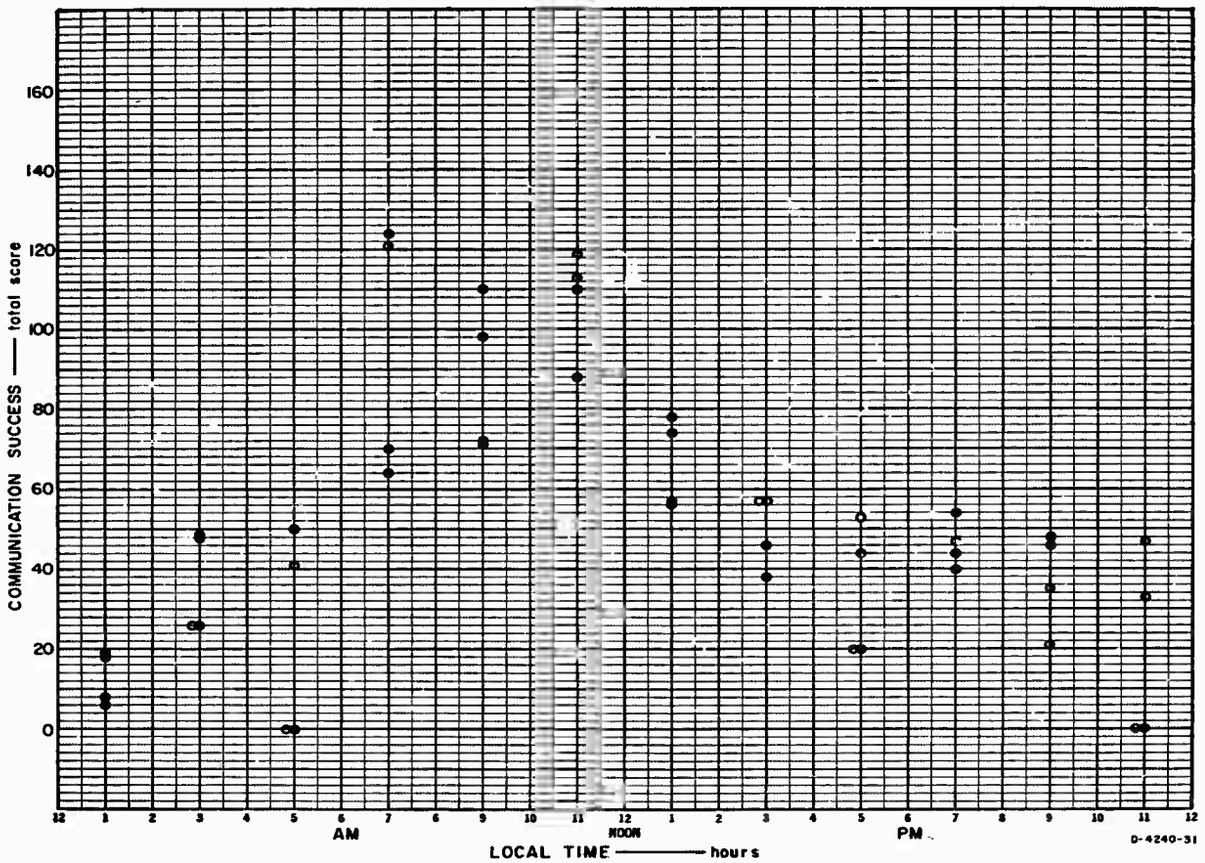

FIG. 19 HISTOGRAM SHOWING COMMUNICATION SUCCESS vs. TIME OF DAY – 50-MILE VARIED-TERRAIN TEST

Table 47

SCORE SHEET OF 100-MILE VARIED-TERRAIN TEST
SITE 0 RECEIVING

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W$	D	S	W	D	S	W	D	S	W	D	S	W
0700 31 May	10	10	7	10	0	0	9	8	0	10	0	0	9	0	0
0900	10	9	9	9	7	3	10	8	4	10	0	0	10	0	0
1100	10	9	9	7	0	0	9	8	0	8	0	0	10	2	0
1300	10	9	8	10	9	8	9	8	0	10	0	0	10	0	0
1500	10	1	0	10	7	9	6	6	10	9	0	0	0	0	0
1700	10	8	9	10	0	0	9	0	0	0	0	0	7	0	0
1900	9	0	0	7	0	0	0	0	0	0	0	0	4	0	0
2100	10	0	0	9	0	0	0	0	0	9	0	0	10	0	0
2300	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100 1 June	10	10	0	9	0	0	0	0	0	9	0	0	10	0	0
0300	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0		0	0
0700	10	10	10	6	0	0	0	0	0	10	0	0	10	0	0
0900	10	9	10	9	10	8	10	10	10	10	4	0	9	0	0
1100	10	9	10	10	10	9	10	9	0	10	5	0	10	0	0
1300	10	10	10	10	10	0	8	9	5	7	0	0	9	0	0
1500	10	10	10	10	10	10	10	6	0	10	0	0	4	0	0
1700	10	10	10	10	3	0	8	5	0	9	0	0	10	0	0
1900	10	10	0	10	5	0	7	0	0	0	0	0	0	0	0
2100	10	0	0	6	0	0	10	0	0	9	0	0	6	0	0
2300	10	0	0	0	0	0	8	0	0	10	0	0	9	0	0
0100 2 June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Doublet antenna.
†Slant-wire antenna.
$Whip antenna.

Table 48

SCORE SHEET OF 100-MILE VARIED-TERRAIN TEST
SITE 5 RECEIVING

LOCAL TIME		HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
		D*	S†	W$	D	S	W	D	S	W	D	S	W	D	S	W
0700	31 May	10	10	10	10	10	0	10	10	0	10	0	0	10	0	0
0900		10	10	8	10	10	0	9	6	4	10	0	0	10	0	0
1100		10	10	9	10	0	0	10	6	0	10	0	0	10	0	0
1300		10	10	0	10	10	5	10	9	5	10	1	0	9	0	0
1500		10	10	0	10	10	4	10	7	0	10	0	0	0	0	0
1700		10	10	9	10	0	0	10	0	0	0	0	0	9	0	0
1900		10	0	0	10	0	0	0	0	0	0	0	0	0	0	0
2100		9	0	0	9	0	0	0	0	0	9	0	0	9	0	0
2300		9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100	1 June	10	9	0	9	0	0	0	0	0	8	0	0	9	0	0
0300		10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700		10	8	7	8	0	0	0	0	0	9	0	0	9	0	0
0900		10	10	10	9	10	9	10	9	9	10	6	0	10	0	0
1100		10	10	9	10	10	4	10	8	0	10	2	0	10	0	0
1300		10	10	9	10	10	0	10	3	0	10	10	0	9	0	0
1500		10	9	6	10	8	9	9	9	0	10	0	0	8	0	0
1700		10	10	9	10	9	0	10	4	0	10	0	0	10	0	0
1900		10	10	0	10	7	0	9	0	0	0	0	0	0	0	0
2100		10	0	0	10	0	0	10	0	0	10	0	0	7	0	0
2300		10	0	0	0	0	0	9	0	0	10	0	0	10	0	0
0100	2 June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Doublet antenna.
† Slant-wire antenna.
$ Whip antenna.

Table 49

SUMMARY OF 100-MILE VARIED-TERRAIN TEST

SITE RECEIVING	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
Site 0															
Total Messages	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	199	124	102	152	71	47	123	77	29	140	9	0	137	2	0
Percent Correct	83%	52%	43%	63%	30%	20%	51%	32%	12%	58%	4%	0%	57%	0.8%	0%
Site 5															
Total Messages	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Number Correct	198	136	86	165	94	31	136	71	18	146	19	0	139	0	0
Percent Correct	83%	57%	36%	69%	39%	13%	57%	30%	8%	61%	8%	0%	58%	0%	0%

* Doublet antenna.

† Slant-wire antenna.

§ Whip antenna.

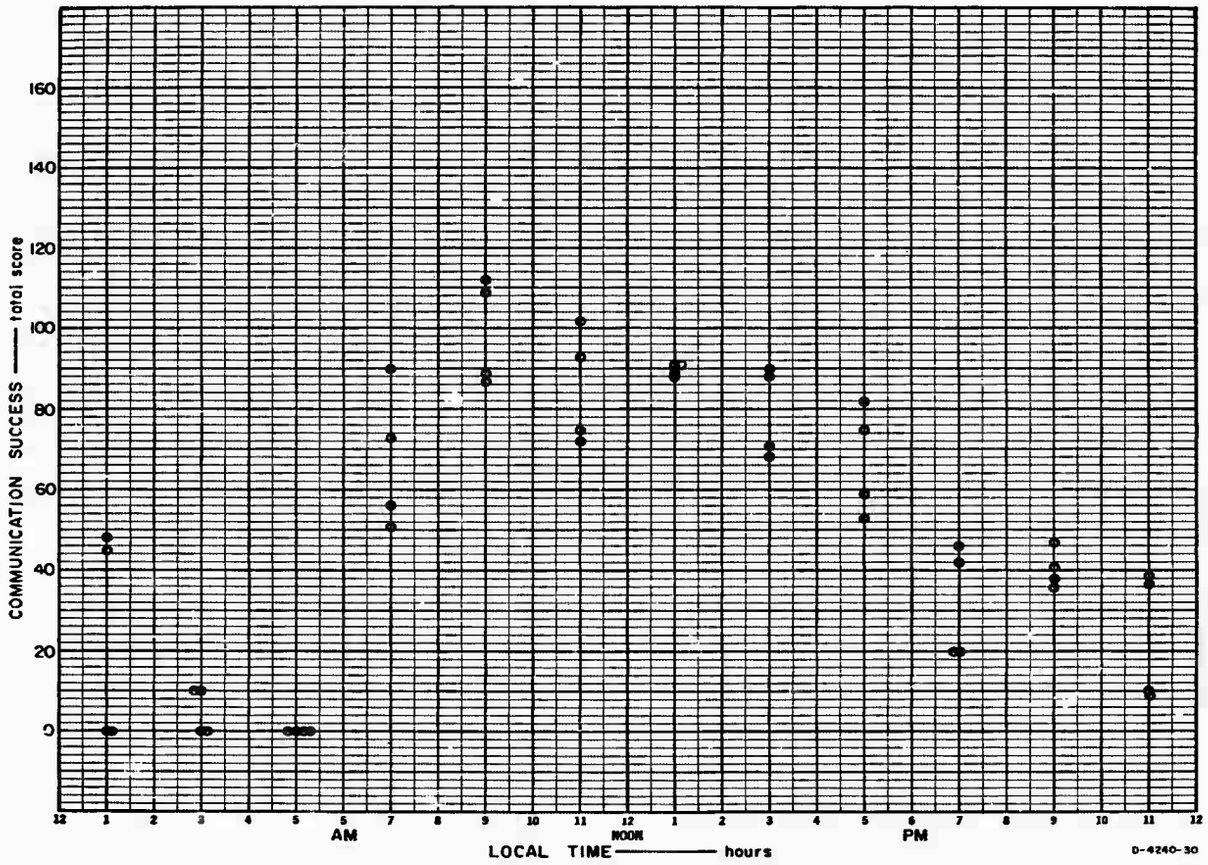

FIG. 20 HISTOGRAM SHOWING COMMUNICATION SUCCESS vs. TIME OF DAY - 100-MILE VARIED-TERRAIN TEST

F. RESULTS FROM CW TEST

Table 50

CW TEST

SCORE SHEET OF 10-MILE DELTA TEST

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
1000 2 May	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
1200	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
1400	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
1600	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
1800	1	1	1	0	1	0	0	1	1	1	1	0	1	0	0
2000	1	1	1	1	1	1	1	1	?	1	0	0	1	1	0
2200	0	0	0	1	1	1	1	1	1	0	0	0	1	1	0
2400	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0200 3 May	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0
0400	--	--	--	0	1	1	0	0	0	1	1	1	0	0	0
0600	--	--	--	1	1	1	0	0	0	0	1	1	0	1	1
0800	--	--	--	1	1	1	1	1	1	0	0	0	1	1	0
1000	--	--	--	1	1	1	1	1	1	1	1	1	1	1	0
1200	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1400	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
1600	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1800	1	1	1	1	1	0	1	1	1	1	1	0	1	0	0
2000	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
2200	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0
2400	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0
0200 4 May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Doublet antenna.

† Slant-wire antenna.

§ Whip antenna.

Table 51

CW TEST

SCORE SHEET OF 15-MILE DELTA TEST

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W$	D	S	W	D	S	W	D	S	W	D	S	W
0900 30 Apr	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
1100	0	1	1	1	1	1	0	1	1	1	1	1	0	0	0
1300	1	1	1	0	1	0	0	1	1	0	1	0	0	0	0
1500	1	1	1	0	0	0	0	0	0	1	1	1	0	0	0
1700	1	1	1	0	0	1	0	1	1	1	1	1	1	0	0
1900	1	1	1	1	0	0	1	0	0	1	0	0	1	0	0
2100	1	1	1	0	0	0	1	0	1	1	0	0	1	0	0
2300	1	1	1	1	0	1	1	1	0	1	0	0	0	0	0
0100 1 May	1	1	1	1	1	0	1	1	0	1	1	0	1	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0900	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
1100	1	1	1	1	1	1	0	0	0	1	1	1	0	0	0
1300	0	1	1	1	1	1	0	1	1	1	1	1	0	0	0
1500	0	1	1	1	1	1	0	1	1	1	1	1	0	0	0
1700	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0
1900	1	1	1	1	1	1	1	1	0	1	0	0	1	0	0
2100	1	1	1	1	1	1	0	0	0	1	0	0	1	0	0
2300	1	1	1	1	1	0	0	0	0	1	0	0	0	0	0
0100 2 May	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Doublet antenna.

† Slant-wire antenna.

$ Whip antenna.

Table 52

CW TEST

SCORE SHEET OF 5-MILE MOUNTAIN TEST

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
1300 10 May	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
1500	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1
1700	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0
1900	1	0	0	1	0	0	1	0	0	0	0	0	1	0	0
2100	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100 11 May	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0
0300	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	1	1	1	1	1	0	1	0	0	1	0	0	--	--	--
0900	1	1	1	1	1	1	0	0	0	1	0	0	1	0	0
1100	1	1	0	1	1	1	1	0	1	1	0	0	1	0	0
0900 13 May	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0
1100	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1300	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1500	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
1700	1	1	0	1	1	0	1	0	0	1	0	0	1	0	0
1900	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0
2100	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0
2300	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0
0100 14 May	1	1	0	1	0	0	1	0	0	1	0	0	1	0	0
0300	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0
0500	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0
0700	1	1	0	1	1	1	1	1	1	1	1	0	0	0	0

* Doublet antenna.

† Slant-wire antenna.

§ Whip antenna.

Table 53

CW TEST

SCORE SHEET OF 12-MILE MOUNTAIN TEST

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
0900 20 May	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0
1100	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0
1300	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0
1500	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0
1700	1	1	0	1	1	0	1	1	0	1	0	0	1	0	0
1900	1	1	0	1	1	0	0	0	0	0	0	0	1	0	0
2100	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0
2300	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100 21 May	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	1	1	1	1	1	0	1	0	0	1	0	0	1	0	0
0900	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
1100	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
1300	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
1500	1	1	1	1	0	0	1	1	0	1	0	0	1	0	0
1700	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0
1900	1	1	1	1	0	0	1	1	0	1	1	0	1	0	0
2100	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0
2300	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
0100 22 May	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0
0300	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0
0700	1	1	1	1	0	0	1	0	0	1	0	0	1	1	0

* Doublet antenna.

† Slant-wire antenna.

§ Whip antenna.

Table 54

CW TEST

SCORE SHEET OF 25-MILE MOUNTAIN TEST

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W$	D	S	W	D	S	W	D	S	W	D	S	W
0900 15 May	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0
1100	1	1	1	1	1	0	1	1	0	1	0	0	0	0	0
1300	1	1	1	1	1	0	1	1	1	1	0	0	0	0	0
1500	1	1	0	1	1	1	1	1	0	1	0	0	1	0	0
1700	1	0	0	1	0	0	1	1	0	1	0	0	0	0	0
1900	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0
2100	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0
2300	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0
0100 16 May	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
0300	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0
0700	1	1	0	1	0	0	1	1	0	1	0	0	1	0	0
0900	1	1	1	1	1	0	1	1	0	1	1	0	1	1	0
1100	1	1	1	1	0	0	1	1	0	1	0	0	0	0	0
1300	1	1	0	1	0	0	1	0	0	1	0	0	0	0	0
1500	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
1700	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
1900	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2100	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2300	1	1	0	0	0	0	1	0	0	1	0	0	1	0	0
0100 17 May	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	1	1	0	1	1	0	1	0	0	1	0	0	1	0	0

* Doublet antenna.

† Slant-wire antenna.

$ Whip antenna.

Table 55

CW TEST

SCORE SHEET OF 50-MILE VARIED-TERRAIN TEST

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
0900 24 May	1	1	0	1	1	0	1	1	0	1	0	0	1	0	0
1100	1	1	0	1	1	0	1	1	0	1	1	0	1	0	0
1300	1	1	0	1	0	0	1	0	0	1	0	0	1	0	0
1500	1	1	0	1	0	0	1	0	0	1	0	0	1	0	0
1700	1	1	0	1	0	0	1	0	0	1	0	0	0	0	0
1900	1	1	0	1	0	0	1	0	0	1	0	0	1	0	0
2100	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0
2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100 25 May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0
0500	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0
0700	1	1	0	1	1	1	1	1	1	1	1	0	1	1	0
0900	1	1	0	1	1	1	1	1	1	1	0	0	1	0	0
1100	1	1	1	1	1	0	1	1	1	1	0	0	1	1	0
1300	1	1	1	1	1	0	0	1	0	0	0	0	1	0	0
1500	1	1	1	1	0	0	1	0	0	0	0	0	1	0	0
1700	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
1900	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0
2100	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0
2300	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0
0100 26 May	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	1	1	0	1	1	0	1	0	0	1	0	0	1	0	0

* Doublet antenna.

† Slant-wire antenna.

§ Whip antenna.

Table 56

CW TEST

SCORE SHEET OF 100-MILE VARIED-TERPAIN TEST

LOCAL TIME	HC-162			77-AM			AN/TRC-88			TRP-4			AN/GRC-9		
	D*	S†	W§	D	S	W	D	S	W	D	S	W	D	S	W
0700 31 May	1	1	1	1	0	0	1	1	0	1	0	0	1	0	0
0900	1	1	1	1	1	0	1	1	0	1	0	0	1	0	0
1100	1	1	1	1	0	0	1	1	0	1	0	0	1	0	0
1300	1	1	1	1	1	1	1	0	0	1	0	0	1	0	0
1500	1	0	0	1	1	1	1	1	1	1	0	0	0	0	0
1700	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0
1900	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0
2300	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100 1 June	1	0	0	1	0	0	0	0	0	1	0	0	1	0	0
0300	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	1	1	1	1	0	0	0	0	0	1	0	0	1	0	0
0900	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0
1100	1	1	1	1	1	1	1	1	0	1	1	0	1	1	0
1300	1	1	1	1	1	0	1	1	0	1	0	0	1	0	0
1500	1	1	1	1	1	1	1	1	0	1	0	0	1	0	0
1700	1	1	1	1	0	0	1	0	0	1	0	0	1	0	0
1900	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2300	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
0100 2 June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* Doublet antenna.

† Slant-wire antenna.

§ Whip antenna.

Table 57

SUMMARY OF CW TEST

	HC-162	77-AM	AN/TRC-88	TRP-4	AN/GRC-9
Delta area over-all success percentage	68%	63%	53%	53%	25%
Mountain area over-all success percentage	61%	46%	42%	37%	23%

G. VHF TEST RESULTS

Because of the line-of-sight propagation characteristics of the VHF sets, it was not possible to directly compare the HF and VHF sets. The VHF sets were used with somewhat different test procedures than the HF sets and were tested extensively only during Forest Test 1.

During short-range special tests, it was found very advantageous to elevate the base-station antenna. Significant range increases were noted when 30- and 70-foot base-station antenna heights were used. The higher antenna always outperformed the lower antenna.

The use of a base-station antenna height of 30 feet resulted in about 3 miles of reliable range in communication with a man-pack unit in moderate to dense undergrowth. In one case, however, an area was found where VHF communication failed at less than one-half mile. The terrain was generally flat, but the undergrowth between the base station and the man-pack units can be described as truly formidable. Penetration of this area by man was not possible because of the extremely dense growth.

The VHF sets were used in direct competition with the HF sets during the first forest test on a 5-mile range and with antennas elevated 70 feet above ground. The results were excellent and no diurnal effect was observed. The signal was at about the FM threshold level, and a small increase in range would probably have resulted in a total failure. Trials at 10 miles separation resulted in total failure of signal reception.

No difference could be detected in the capability of the AN/PRC-10 and -25 sets to establish a communication channel. The AN/PRC-10 set did drift slightly in frequency, resulting in distorted speech. The distortion could always be eliminated by a small adjustment in tuning.

No attempt was made to evaluate the magnitude of the drift, because of the lack of adequate measuring equipment

H. INTERFERENCE TEST RESULTS

Severe interference was common during all tests, causing some inaccuracy and variation in the test results given in this memorandum. Neither equipment or techniques were available to adequately record or describe the effects of interference on the test results. The ever-changing character of interfering signals made it an almost impossible task to evaluate on the spot the effect on a particular test, and adequate time was not available during a test series to identify and make notes on specific causes of interference.

Several special tests were conducted on interference during periods between test series. The HC-162 1-kc tuning steps proved to be a useful tool in dodging interference.

The effect of interference on the limited number of channels of the 77-AM, AN/TRC-88, and TRP-4 sets is the reduction of channels available for successful communication. Brief samples were made on the signals noted in the channels of a 77-AM. The observations of one evening are summarized as follows:

LOCAL TIME	CHANNEL	COMMENTS
2100	1	Strong carrier with no modulation
	2	Modulation splatter from adjacent channel
	3	Broadcast station
	4	Several stations—all strong
	5	Weak CW signals
	6	Broadcast station—speech
2145	1	Static—no interference
	2	Static and popping noise—no interference
	3	Music
	4	CW station
	5	Static—no interference
	6	Strong carrier signal with no modulation

V DISCUSSION OF TEST RESULTS

A. SPECIAL COMMENTS ON THE AN/TRC-88

The AN/TRC-88 radio sets were given a routine check between the mountain test and the last forest area test. During this routine check, the Sylvania technical representative found the transmitter carrier to be on the edge of the receiver IF bandpass, resulting in a loss of approximately 15 db to the desired signal. To reduce the IF bandwidth from 6 to 3 kc, new receiver IF filters had already been ordered by Sylvania, so that a more reasonable bandwidth could be used for SSB modulation employed in the AN/TRC-88.

Due to the discovery and correction of the faulty match between the transmitter frequency and the receiver IF frequency and the installation of new receiver filters, a significant improvement in performance was obtained from the AN/TRC-88 sets. This can clearly be seen by examining their performance for the second tropical forest test, and comparing the results of this test with those of the other tests. All three AN/TRC-88 sets were modified and all showed similar improvement in performance.

The AN/TRC-88 sets were carefully checked by the Sylvania representative several times between previous tests, with the limited test gear on hand. Only after laboratory equipment had arrived in Thailand could adequate checks be performed to discover the specific situation that had occurred. Stable frequency-counting equipment was required to enable bandpass characteristics to be matched to transmitter frequency.

B. COMPARISON OF SETS

The data summary tables for each test environment and range given in Sec. IV can be used to establish the relative performance of the sets under test. The modification of the AN/TRC-88 sets between the mountain test and the second forest test changes its relative position in a significant way, and this must be considered in a final judgment of the relative merits of the various sets.

A gross method of comparison is shown in Fig. 21, where the total performance of each set is shown. This illustration, of course, tends to neglect the increased performance of the AN/TRC-88 set after its modification.

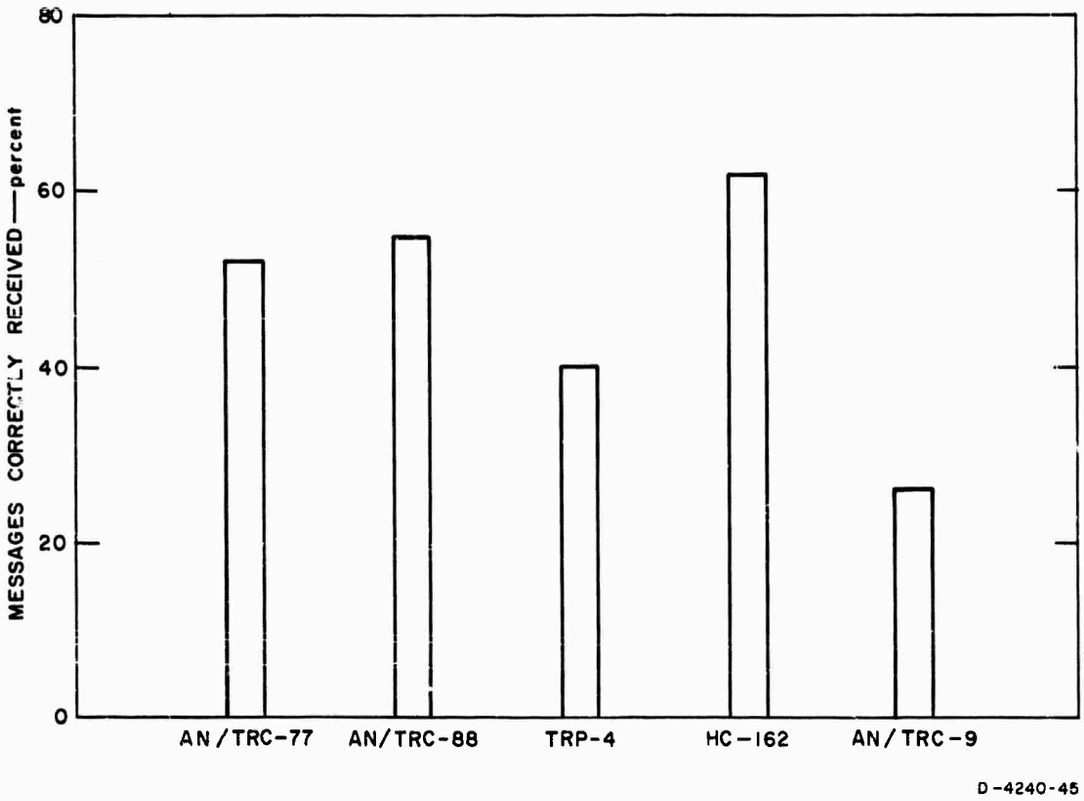

FIG. 21 COMPARISON IN PERFORMANCE OF MAN-PACK RADIO SETS

One way of reviewing the increased performance of the AN/TRC-88 in relation to the other tests is to compare the performance of the sets during the first forest test to that during the second forest test. These tests were carried out under similar conditions and in the same general area. Figure 22 shows such a comparison of the sets. In Fig. 23 the performance of the sets with dipole and with slant-wire antennas is distinguished. Results for the whip are not shown since it was not used during Forest Test 1. Both Fig. 22 and Fig. 23 illustrate the increased performance of the AN/TRC-88 during Forest Test 2. The 77-AM and TRP-4 sets remained at about their same performance level; however,

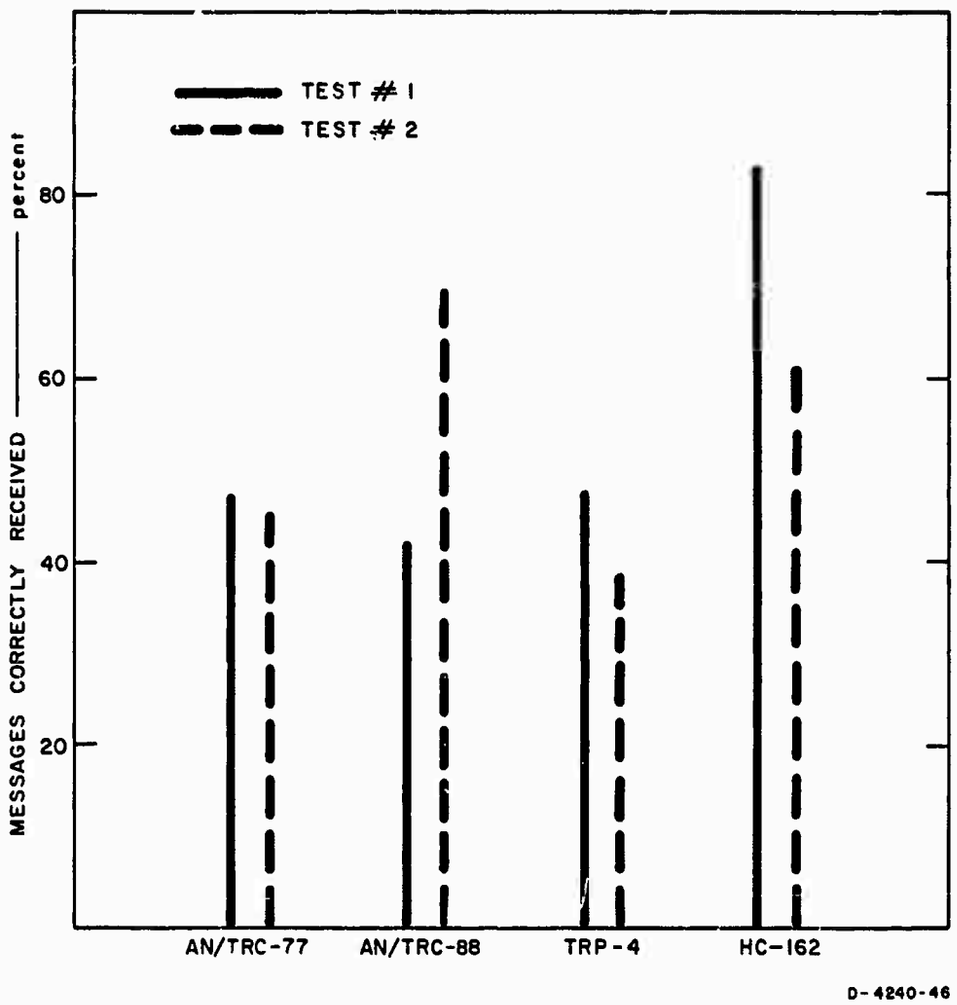

FIG. 22 COMPARISON IN PERFORMANCE OF SETS IN FOREST TEST 1 AND FOREST TEST 2

the HC-162 appears to have suffered a performance degradation during Forest Test 2.

C. COMPARISON OF ANTENNAS

To illustrate the effect of antennas on communication capability, the percentage of messages received correctly for each set for the dipole, slant-wire, and whip antennas is shown in Fig. 24. This illustration has been made from data from situations when antennas

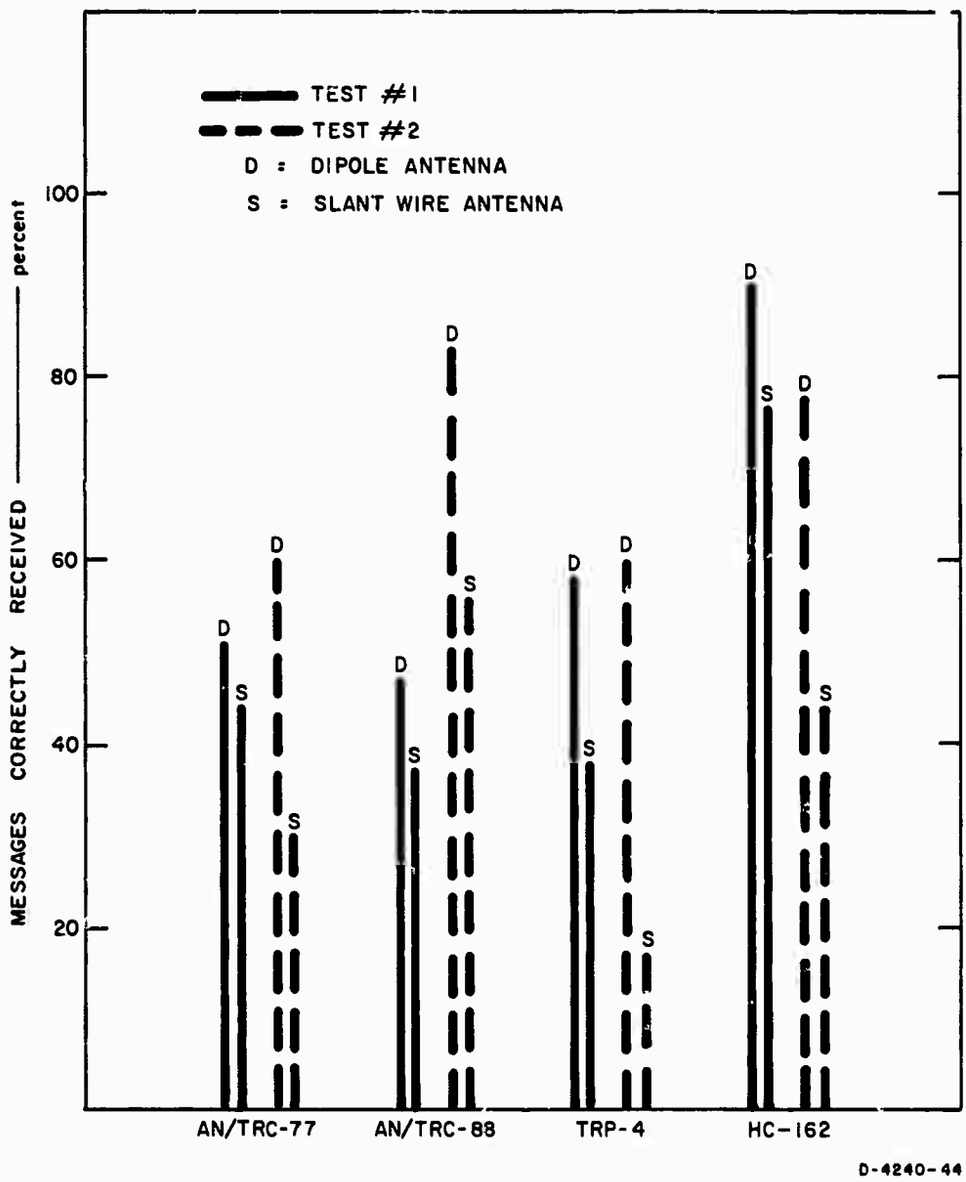

FIG. 23 COMPARISON OF PERFORMANCE OF SETS USING DIPOLE AND SLANT-WIRE ANTENNAS – FOREST TESTS 1 AND 2

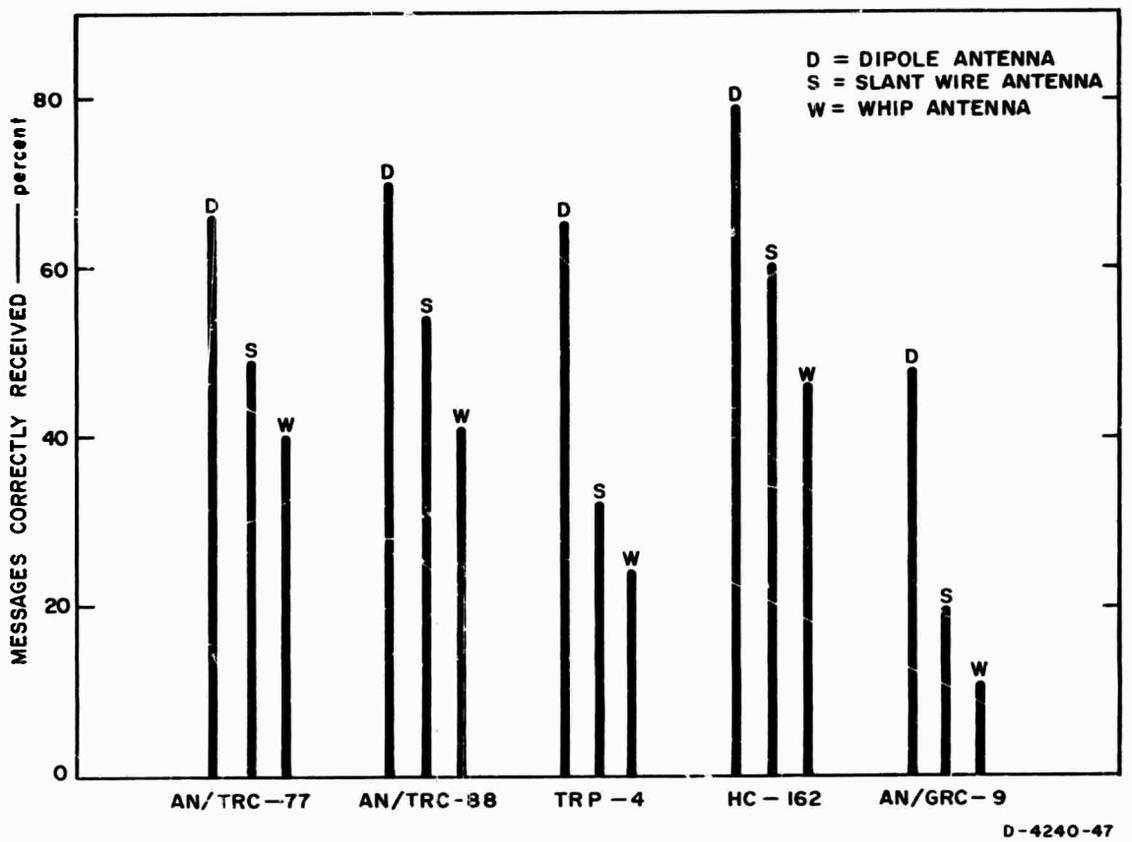

FIG. 24 COMPARISON OF PERFORMANCE OF SETS USING DIPOLE, SLANT-WIRE, AND WHIP ANTENNAS -- ALL TESTS

of all three types were used. The dipole always gives the maximum success level. The slant wire provides the next-best success level and the whip antenna the lowest level of success.

An examination of the score sheets and of the histograms showing performance *vs.* time of day (see Sec. IV) shows that all antennas gave generally poor performance ratings for early morning hours.

D. VARIATIONS IN RESULTS WITH TIME OF DAY AS SHOWN BY HISTOGRAMS

To better examine the variation in communication success level with time of day, histograms have been prepared for each individual test situation (Figs. 5 through 20). These histograms show a definite diurnal variation in success levels, with little success in early morning hours and considerable success during daylight hours. The diurnal effect is noted on all histograms including those illustrating results at 5-mile ranges.

Special tests conducted during non-test periods have convinced the author that failures in performance during the nighttime are related to normal ionospheric changes which alter propagation conditions. These changes usually cause significant increases in interference levels during the early evening and night hours, due to the removal of *D*-region absorption from the interference path geometry. Also, the normal nighttime decrease in ionospheric ionozation density results in the failure of normal layers to support assigned frequencies during early morning hours.

E. COMPARISON OF RESULTS FOR VARIOUS TERRAINS

A direct comparison in results obtained for the various terrain features is very difficult, due to the normal ionospheric variations from day to day. Adequate numbers of man-pack sets and test crews were not available to conduct simultaneous measurements for various terrain conditions. Ionospheric sounding equipment was not available to compare propagation conditions for the various tests.

A crude estimate can be established by reviewing the summary tables of Sec. IV. No significant differences can be found by the author that can be attributed to terrain.

The conclusion reached in Sec. V-D, that the significant propagation mode was via the ionosphere, even at a range of 5 miles, probably rules out any important effect of terrain between communication sites. The terrain and vegetation conditions near each antenna are probably very important, due to their potential effect on antenna radiation pattern. This appears to be the only major terrain effect that can affect performance results of the HF man-pack radios.

F. COMPARISON OF RESULTS FOR VARIOUS RANGES

A direct comparison in results obtained for the various ranges is very difficult, since the tests at different ranges occurred on different days. Normal daily ionospheric variations can alter results of tests of the type undertaken. Thus it is impossible to arrive at precise values of comparative performance at varying ranges. Adequate numbers of man-pack sets and test crews were not available to conduct simultaneous measurements at the various ranges.

A crude estimate of the effect of range can be established by reviewing Figs. 5 through 20. These histograms seem to indicate a more predictable or more stable situation at shorter ranges; however, the general success levels do not vary in any significant manner for tests at ranges out to 25 miles. The two examples of longer-range tests accomplished under the mountain test do not provide adequate data to be confident about success levels for longer ranges, since it was impossible to measure ionospheric stability during the test period. Ionospheric sounding equipment was not available to determine variations in propagation equipment during the test.

G. CW TESTS

Comments concerning the limitations of the CW tests given in Sec. III should be carefully noted prior to a detailed review of CW results.

In general, performance followed roughly that of the voice tests. Identical time-of-day phenomena were noted during early morning hours, when it was impossible to communicate. The success percentage of CW results was not higher than that of voice tests. More experienced operators would no doubt increase the CW success levels to some extent; however, the failure to communicate in early morning hours would limit the success level percentages.

An examination of the data sheets shows smaller variations between antennas for the delta area tests than for the mountain tests. The significance of this observation has not been determined by the author.

It has been observed that none of the sets tested reduces the IF bandwidth for CW operation. This reduction is a common practice in fixed station, commercial, and amateur operations and results in a significant increase in CW signal over noise.

Since CW tests results are not available for the AN/TRC-88 after its modification, no comment can be made on the improvement that should be anticipated.

H. LIMITATIONS OF TESTS

The test series described in this memorandum does not, of course, constitute a complete study of all the factors that require consideration in evaluation of a radio set. It would have been desirable to consider the following if time and equipment availability had permitted:

(1) A review of circuit parameters to determine safety factors used in component design to determine if weak spots and potential servicing problems might occur.

(2) A review of construction practices to see if mechanical design is consistent with requirements for long life and for ease of field maintenance.

(3) A field survivability test to insure that sets will survive the hazards of field operation.

(4) A complete measurement of all electrical parameters to determine if the sets perform in accordance with their capability. (See AN/TRC-88 comments in Sec. V-A.)

(5) A general laboratory evaluation of the circuits and use of components. For example, the HC-162 set contains a very compact frequency synthesizer. The level of unwanted spurious frequencies should be carefully measured. This can cause undesired signals in its transmitter output and cause a reduction of sensitivity on some of its receiver frequencies. Adequate instrumentation was not available in Thailand for this type of check during this test series.

VI CONCLUSIONS

The test series provided an opportunity to conduct extensive field tests on several types of new man-pack radio sets. During the series, data were accumulated permitting certain fairly definite conclusions, and the experience gained from special tests supplemented the actual data gathered.

The following conclusions were reached:

A. HF RADIO SETS

(1) The HC-162 and AN/TRC-88 sets have demonstrated a superior performance level over the other sets tested.

(2) The AN/TRC-88 set is simple and easy to tune and from this standpoint superior to the HC-162.

(3) The HC-162 has frequency flexibility not found in the other sets, which can be used to dodge interference. In the crowded spectrum of Southeast Asia, the frequency flexibility is a definite advantage.

(4) The HC-162 frequency flexibility makes it possible to reach any assigned frequency without cyrstal changing and subsequent alignment.

(5) The antenna tuning mechanism of the HC-162 is unduly complicated and difficult to adjust. It has three controls which interact, compared to two controls which do not interact for the other sets. Also, the adjustment of the HC-162 set requires an increased time factor of three to five for tuning when compared to the other sets. This results in waste of battery power.

(6) Doublet antennas gave the best performance. Slant-wire antennas were considerably lower in performance and whip antennas very poor in performance.

(7) The nature of terrain between sites is not a significant factor.

(8) Terrain features and vegetation near an antenna are probably important. (More detailed investigation of this factor is required.)

(9) Propagation via the ionosphere was the major mode observed on all tests. No ground-wave signal could be identified with certainty, even at 5-mile ranges.

(10) The HF spectrum is crowded in Southeast Asia. From the tests conducted, it appears impossible to guarantee interference-free channels. While it might be possible to clear a channel in Thailand, most of the interference observed originated in neighboring countries.

(11) Radio propagation predictions such as those developed and distributed by the United States Army Propagation Agency can be altered to apply to man-pack radio sets and can be used to predict their average performance.

(12) All man-pack sets can be monitored from long distances. The manuals contain no precaution concerning potential monitoring action. The inclusion of such a warning in the manuals and in a sign on the side of the set seems advisable.

(13) The tests clearly indicate that more consideration should be given to the specifications for antennas and propagation characteristics under which sets are constructed.

B. VHF SETS

The VHF tests were made using the AN/PRC-10 and -25 sets.

1. Use of Antennas

Using their long whip antennas, both the AN/PRC-10 and -25 sets generally worked well at ranges up to 3 miles in moderate forest areas.

Elevation of one or both whip antennas above ground gave decided range improvements. With both whip antennas 70 feet above the ground and lashed to the tops of trees, 5-mile range was established 24 hours a day. With both antennas elevated 30 feet above ground, 5-mile communication through moderate forest could not be established.

On one test conducted through extremely dense undergrowth, with a long whip on the base station set and a short or long whip on a hand-carried set, total loss of signal occurred at less than one-half mile range. Only one such location was found in the test area.

2. Comparison of AN/PRC-10 and -25

Little difference could be found between the capability of an AN/PRC-25 and an AN/PRC-10 to establish a useful voice channel. No range difference was noted.

The AN/PRC-10 did drift in tuning with time. This resulted in speech distortion which was corrected by occasional retuning. Drift rate tests on several units would be required to establish the magnitude of this problem.