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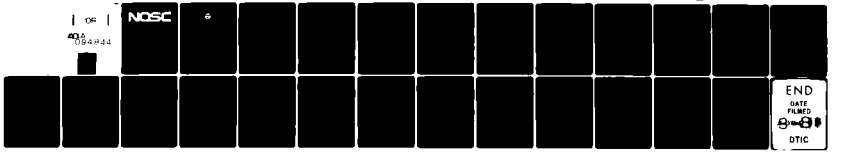

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Technical Report 511

DIRECT-DIAL AMPHIBIOUS COMMUNICATIONS

Investigations during MAFLEX 1-78 employing Automatic Telephone Central Office AN/TTC-38, Manual Telephone Switchboard SB-3614/TT, and multichannel radio equipments

EJ Reynolds

1 December 1980

Final Report: September through November 1978

Prepared for
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PME 108-142

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This report summarizes communications and results of limited communications experiments by the Third Marine Amphibious Force during MAFLEX 1-78, from 16 September through 20 October 1978. Manual Telephone Switchboard SB-3614/TT was installed and used on USS BLUE RIDGE (LCC 19) for direct dialing to shore-based systems. The investigations focused on direct- and indirect-dial internodal communications using automatic switching (shore) assets, five-level precedence, and internodal conferencing. Efforts were directed toward enhancing ship-shore communications to support Marine Corps landing operations.

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OBJECTIVE

Determine the capability of Manual Telephone Switchboard SB-3614/TT to provide internodal communications between afloat elements and Marine Forces ashore in support of amphibious operations. Use the results to determine the interoperability of the current and future Naval Telecommunications System with TRITAC shore systems. In specific capabilities investigated, include ship-to-shore direct dialing, conferencing, and automated switching.

RESULTS

1. The SB-3614/TT proved to be interoperable with both an inventory Marine Corps switchboard and an inventory Marine Corps multichannel radio.

2. Both progressive and preprogrammed conference calls were successfully initiated.

3. Direct-dial calls were completed without operator assistance.

4. Noisy rf circuits and a lack of technical expertise in equipment operation were the only detrimental factors encountered during the tests.

5. Overall, the SB-3614/TT demonstrated effective automated telecommunications, even in adverse situations.

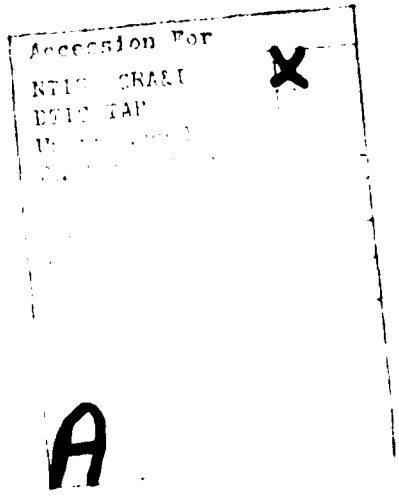
RECOMMENDATIONS

1. Provide for upgrading skill levels of technical personnel.

2. Provide 1st MAW with additional SB-3614/TT switchboards to continue field testing.

3. Provide an SB-3614/TT for onboard use on a WESTPAC vessel in order to determine usability in an operational environment.

4. Expand testing to include the hf spectrum.



CONTENTS

INTRODUCTION

This report summarizes results of limited communications experiments and documents the communications made by the Third Marine Amphibious Force (III MAF) during Marine Amphibious Force Landing Exercise (MAFLEX) 1-78, from 16 September through 20 October 1978. During this period, Manual Telephone Switchboard SB-3614/TT (hereinafter referred to merely as the SB-3614) was installed and used on the amphibious command ship, USS BLUE RIDGE (LCC 19) for direct dialing to shore-based systems.

Communications equipments employed were three 300-line Automatic Telephone Central Offices AN/TTC-38(V)1 (hereinafter referred to merely as AN/TTC-38s), one 30-line SB-3614 (on the BLUE RIDGE), 30-75.95 MHz multichannel Radio Terminal Sets AN/MRC-135 (hereinafter referred to merely as AN/MRC-135s) (shore), 30-75.95 MHz multichannel Telegraph-Telephone Terminal Sets AN/VCC-2 (hereinafter referred to merely as AN/VCC-2s) (on the BLUE RIDGE), tropo-scatter Radio Sets AN/TRC-97 (hereinafter referred to merely as AN/TRC-97s) (shore), hf Radio Teletypewriter Sets AN/TSC-15 (hereinafter referred to merely as AN/TSC-15s) (shore), Communication Technical Control Center AN/TSQ-84 (hereinafter referred to merely as AN/TSQ-84) (shore), and numerous other Marine Corps communications assets (shore).

Investigations emphasized direct-dial and indirect-dial internodal communications using automatic switching (shore assets), five-level precedence, and internodal conferencing. Efforts were directed toward enhancing ship-shore communications to support Marine Corps landing operations.

Initial experiments were conducted under the auspices of the First Marine Amphibious Force (I MAF), Camp Pendleton CA. All other efforts were under the auspices of the Third Marine Amphibious Force (III MAF), Camp Courtney, Okinawa. Participating units in support of III MAF undertakings included the Marine Seventh Communications Battalion (7th COMM BN), Camp Hansen; Third Marine Division (3rd MARDIV), Camp Courtney; and First Marine Aircraft Wing (1st MAW), Zukeran.

USS BLUE RIDGE (LCC 19) was located in the vicinity of the three shore systems and was equipped with one SB-3614 and several dial telephone instruments. Direct-dial off-ship communications over AN/VCC-2 circuits was available to shore-based AN/TTC-38 subscribers.

Background correspondence that provided for these investigations is as follows:

CG I MAF message 022120Z Aug 78 to Commander, Amphibious Group, East Pacific (COMPHIBGRUEASTPAC), San Diego.

COMPHIBGRUEASTPAC Message 032004Z Aug 78 to COMNAVSURFPAC, North Island, San Diego.

NOSC ltr Ser 8341153, to CEO III MAF.

This correspondence cites inadequacies of Marine Corps amphibious shipboard communications and recommends installation of one SB-3614 on USS BLUE RIDGE to investigate direct-dial ship-shore communications.

These investigative efforts were made possible by the combined and coordinated efforts of the Marine Corps communications community. Obtaining the SB-3614 and associated equipments along with the participation of NOSC personnel was made possible by cooperative efforts between NOSC and NAVELEX PME 108-142. The results bear on current amphibious communications studies to determine interoperability of the current and future Naval Telecommunications System (NTS) with TRITAC shore systems.

FIRST MARINE DIVISION EXPERIMENTS

First Marine Division (1st MARDIV) experiments were performed as the initial investigative effort to test compatibility of the SB-3614 and the AN/TTC-38 for internodal dial signaling. Initially, the two switching equipments were tested for hard-wire back-to-back operation on a subscriber-to-subscriber basis. This was followed by progressive and automated conferencing between the two switches: progressive conference call-up of conferees associated with the SB-3614 operator, who then reports to the AN/TTC-38 operator, who keys in his associated conferees, thus completing the conference call procedure for all associated subscribers. Automated preprogrammed conferencing is inherent to the AN/TTC-38 and is extendable to the SB-3614 operator. These conferencing capabilities were tested in back-to-back hard-wire configurations of the 1st MARDIV AN/TTC-38 and the SB-3614.

The second 1st MARDIV experiment used AN/MRC-135s (vhf multichannel, or MUX, radios) to trunk between the switchboards at a maximum range of about 6.5 miles non-LOS. Dial calls from single SB-3614 subscribers to single AN/TTC-38 subscribers, progressive and preprogrammed automatic call-up of conference members, and operator (AN/TTC-38) assisted dialing into the autovon system to NOSC Code 831 were accomplished satisfactorily.

Appendix A consists of remarks by S Sgt D Smeltzer, MCDEC-C[3], on the Camp Pendleton tests, including the AN/MRC-135 operational concept employed in engineering order-wire (EOW) operations.

MARINE AMPHIBIOUS FORCE LANDING EXERCISE 1-78

Marine Amphibious Force Landing Exercise 1-78 (MAFLEX 1-78) was under the auspices of the Third Marine Amphibious Force (III MAF), Camp Courtney, Okinawa. Four Marine Corps shore nodes and USS BLUE RIDGE (LCC 19) participated (fig 1). The four shore nodes included the Seventh Communications Battalion (7th COMM BN), located at Kin Blue; the Third Marine Division (3rd MARDIV), at Camp Courtney; the Force Service Support Group (FSSG), at Camp Foster; and the First Marine Aircraft Wing (1st MAW), located at Marine Corps Air Station, Futema.

One SB-3614 was installed on USS BLUE RIDGE (LCC 19) on 4 October 1978, and it was employed with AN/VCC-2s in attempted direct-dial experiments to shore-based AN/TTC-38 subscribers. The SB-3614 installation included WECO-2500 touch-tone instruments for direct-dial ship-shore communications by BLUE RIDGE SYSCON and SAC users. The SB-3614 installation was made to investigate feasibility and reliability of interfacing the switchboard with AN/VCC-2 equipments and of employing it in direct-dial communications with III MAF, 3rd

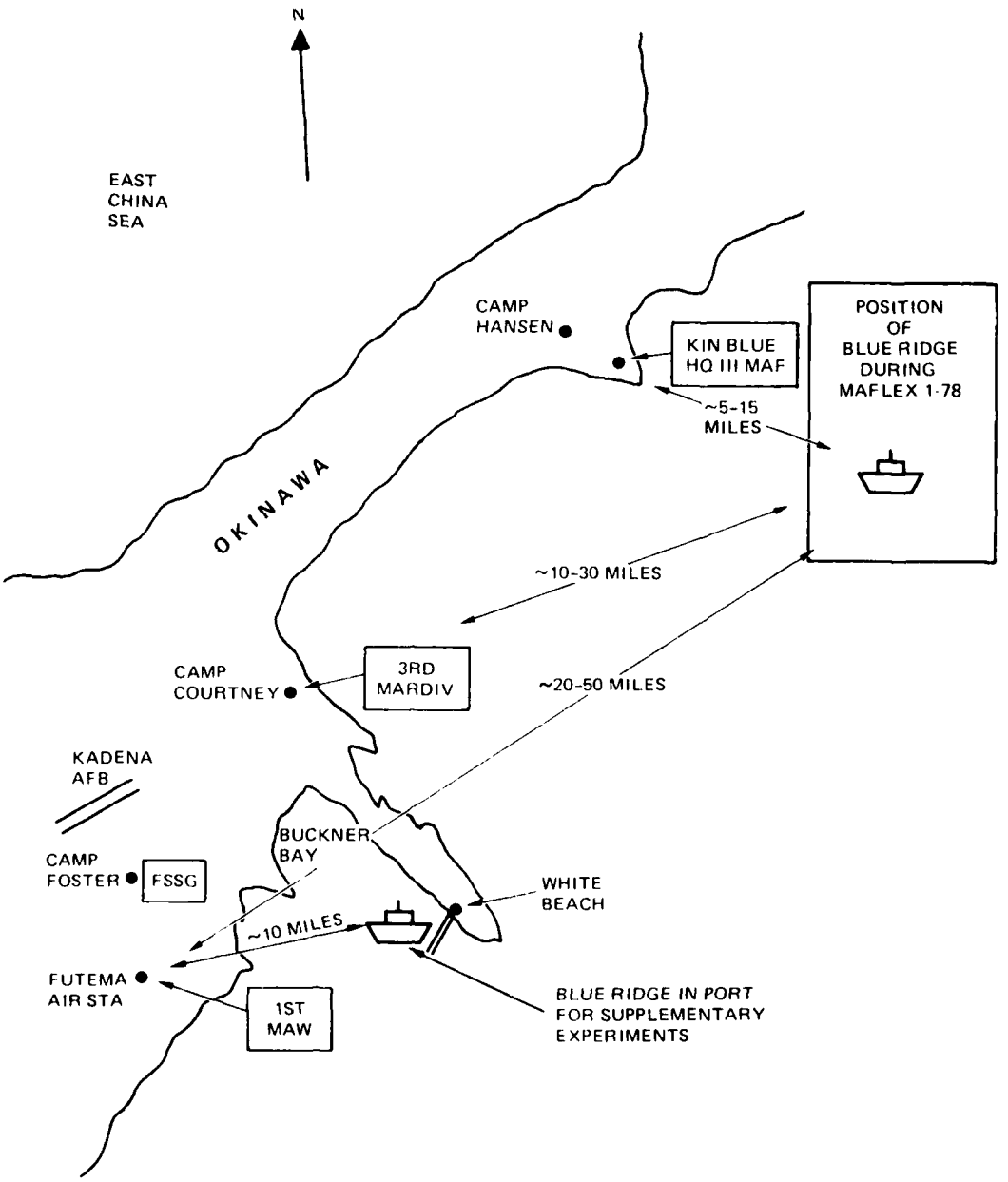


Figure 1. Location of communication systems.

MARDIV, and 1st MAW AN/TTC-38 subscribers. The dial signaling employed in the SB-3614 is the same as that employed in shore AN/TTC-38s that were operationally employed in MAFLEX 1-78.

Expeditious installation of the SB-3614 aboard BLUE RIDGE and graceful transitioning into normal AN/VCC-2 operations resulted directly from the expertise of S Sgt Goulet, USMC, who is assigned to Marine Wing Communicatio Squadron 18 (MWCS 18), Zukeran, Okinawa.

AN/TTC-38s and AN/TSQ-84s were employed in the Kin Blue (III MAF HQ), Camp Courtney (3rd MARDIV), and Futema (1st MAW) communication systems. In addition, these three shore nodes employed AN/MRC-135s for internodal trunking (including BLUE RIDGE – shore). Figure 2 shows the AN/MRC-135 and AN/TRC-97 wide-band internodal trunking relationships for the exercise. These two wide-band multichannel systems are used in conjunction with the dial-switched systems (AN/TTC-38) for internodal communications, specifically common-channel and hot-line circuits.

A list of dedicated, single-channel circuits to support the four shore nodes is provided in figure 2 and is organized as follows:

Single-channel hf circuits – 1, 2, 7, 8, 10, 11, 19, 23, 24, 26

Single-channel vhf ground-ground circuits – 3, 4, 5, 6, 9, 12, 16, 20, 22, 25

Single-channel uhf air-ground circuits – 1, 3, 14, 15, 17, 18, 21

Based on personal discussions, the following unofficial call estimates have been arrived at for the AN/TTC-38s at the three shore nodes equipped with these telecentrals during MAFLEX 1-78:

An estimated 6000 calls were processed by the 3rd MARDIV, Camp Courtney system. The AN/TTC-38 was out of operation during a 24-hour period because of power-supply failures.

An estimated 7000 calls were processed by the 7th COMM BN AN/TTC-38 at Kin Blue.

An estimated 10 000 calls were processed by the 1st MAW AN/TTC-38 during about 100 hours of essentially uninterrupted operation.

The aggregate 23 000 calls by the three shore nodes included intranodal and internodal direct-dial communications, four-level precedence provisions, single party and conferencing, and trunking on AN/MRC-135, AN/TRC-97, and hf radio systems.

The AN/TTC-38s and AN/TSQ-84s were deployed in MAFLEX 1-78 about 4-6 weeks after receipt in the field.

Application of the AN/TTC-38 and AN/TSQ-84 during the supplementary experiments by 1st MAW achieved a high degree of technical utilization, largely because of the outstanding performance of Gy Sgt Cappadona and S Sgt Goulet, who were assigned to MWCS 18, Zukeran.

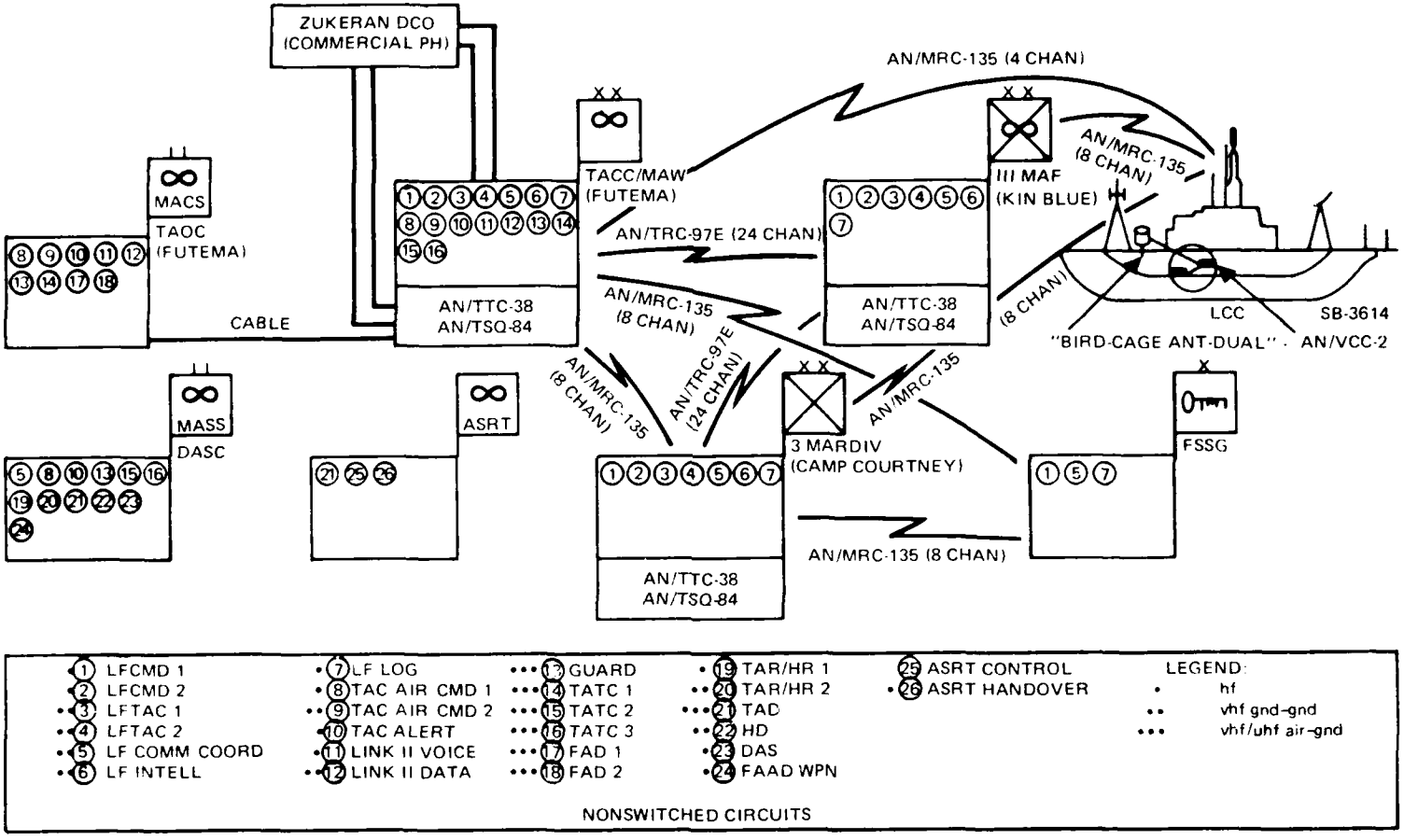


Figure 2. MAFLEX 1-78 communications interconnection diagram (Courtesy Maj MJ Hillsinger, 1st MAW).

Dial communications between BLUE RIDGE SB-3614 dial subscribers and the shore AN/TTC-38 subscribers at the MAF, DIV, and MAW nodes was not satisfactory during MAFLEX 1-78. (See figure 1.)

Good multichannel rf operations were established between BLUE RIDGE and 7th COMM BN (Kin Blue) during MAFLEX 1-78, but ship-shore dial operations could not be performed.

Fair multichannel rf operations were established between BLUE RIDGE and 3rd MARDIV (Camp Courtney), but ship-shore dial operations could not be performed.

The location and fringe operating range separating the 1st MAW (Futema) AN/TTC-38 and BLUE RIDGE during MAFLEX 1-78 precluded satisfactory dial-up ship-shore operations. Dial operation was achieved for a short period, however, which verified the feasibility when noisefree rf channels were available for the dial-up phase of communications.

Appendix B contains comments by S Sgt Goulet, USMC, 1st MAW, MWCS 18, regarding installation and testing of the SB-3614 aboard BLUE RIDGE.

Appendix C comprises comments of Gy Sgt Cappadona, USMC, 1st MAW, MWCS 18, regarding a radio-wire integration (RWI) experiment employing the AN/TTC-38, the AN/PRC-77, and the NOSC-supplied Telephone Terminal AN/FTA-28. The RWI experiment demonstrated the feasibility of connecting radio signals directly to 4-wire trunk lines. Normally, the radio transmitter must be keyed manually by the RWI operator. The experiment successfully demonstrated that the transmitter could be keyed automatically by the detection of a signal level.

Appendix D contains comments by Gy Sgt Cappadona regarding the technical controller and his tech control facility (AN/TSQ-84) in effectively integrating automatic switching (SB-3614 and AN/TTC-38) and rf assets to obtain direct-dial (automated) communications.

SUPPLEMENTARY FIRST MARINE AIRCRAFT WING DIRECT-DIAL VHF MULTICHANNEL SHIP-SHORE EXPERIMENTS

On 17 October 1978 supplementary multiplex experiments were conducted between BLUE RIDGE and the 1st MAW, MWCS 18 shore node. The AN/TSQ-84 tech controller (Gy Sgt Cappadona) and AN/TTC-38 controller (S Sgt Goulet) established the necessary levels in both legs of the AN/MRC-135 — AN/TTC-38 duplex path to compensate for the level differentials between these shore systems. Since the AN/VCC-2 — SB-3614 had a similar mismatch but lacked the equalization circuitry of the AN/TSQ-84, the shore AN/TSQ-84 was employed to overcome the inferior dial signals transmitted by the BLUE RIDGE AN/VCC-2. By overcoming the AN/VCC-2 (BLUE RIDGE) transmission mismatch in addition to his own transmission mismatch, the shore AN/TSQ-84 tech controller was able to provide a noiseless full-duplex circuit as required during the dial-up mode of communications. When a solid "handshake" multiplex circuit was obtained, the following multiplex dialings were accomplished.

Single-party ship-shore and shore-ship dialing was accomplished between the BLUE RIDGE and 1st MAW, Futema while the BLUE RIDGE was docked at White Beach (LOS of about 10 miles).

Three parties aboard BLUE RIDGE and three parties on shore were called automatically by the shore AN/TTC-38 operator on a preprogrammed conference.

The same parties were called progressively by the SB-3614 operator (aboard the BLUE RIDGE).

With the assistance of the AN/TTC-38 operator, one of the BLUE RIDGE subscribers performed a ship-to-shore commercial call.

CONCLUSIONS

1. Manual Telephone Switchboard 3614/TT is fully compatible with the tactical automatic switch (TAS), Automatic Telephone Central Office AN/TTC-38.

2. The AN/VCC-2 and AN/MRC-135 (vhf multichannel radio sets) can be utilized to establish linkage between the SB-3614/TT and the AN/TTC-38.

3. The vhf multichannel interface between the SB-3614/TT and the AN/TTC-38 requires AN/TSQ-84 equalization circuitry to condition the interconnect channels by amplification or attenuation as necessary.

4. Without further training and experimentation, the level of technical expertise required to install and maintain the automatic switch interface is higher than that normally possessed by a tactical unit. The 1st MAW is a notable exception.

5. Step-by-step procedures must be developed to establish the switch interface. The line-conditioning role of the AN/TSQ-84 is of greatest importance.

6. Field testing must be continued between the AN/TTC-38 and the SB-3614/TT, with the goal of establishing simplified procedural steps (ie a checkoff list).

7. Because of the talent available in the 1st MAW, an SB-3614/TT must be provided to expedite operational training and reporting thereof.

8. Successful internodal dialing via AN/TTC-38s and the SB-3614/TT over marginal AN/MRC-135 multiplex circuits is directly related to the level of expertise of AN/MRC-135, AN/TTC-38, and AN/TSQ-84 technicians.

9. Duplex internodal signaling between BLUE RIDGE and shore AN/TTC-38s and AN/TSQ-84s over AN/MRC-135 multiplex radios is limited in noisy channel conditions. Equalization was applied on the transmit leg to obtain successful dialing under noisy channel conditions.

10. During the talk mode between BLUE RIDGE and shore, normal (noiseless) multiplex channels provided exceptionally high quality audio; they provided discernible audio under extremely noisy (fringe rf circuit) conditions.

11. Installation and use of one SB-3614/TT aboard the BLUE RIDGE was accomplished without complicaton, principally because of the availability of S Sgt Goulet of the 1st MAW, MWCS 18, at Zukeran, Okinawa.

12. Successful automatic shore and BLUE RIDGE progressive call-up dial conferencing was performed among three shipboard and three shore subscribers. BLUE RIDGE dial conference members were located in SYSCON, SAC, and at the SB-3614/TT to simulate an exercise situation.

13. Radio-wire integration (RWI) capability was demonstrated by communicators of 1st MAW, MWCS 18, using the AN/FTA-28 in conjunction with the AN/TSQ-84, AN/TTC-38, and two vhf Radio Sets AN/PRC-75. The first PRC-75 simulated a jeep or airborne subscriber who called the second AN/PRC-75, which in turn alerted the RWI operator (ie the AN/TTC-38 operator), who then dialed the desired switch network subscriber. Automatic transceive was then possible by both the mobile rf subscriber and the fixed (switched) network subscriber.

RECOMMENDATIONS

1. Provide one or two SB-3614/TTs to 1st MAW CEO for continued field testing.

2. Issue power converters (110 V ac 60 Hz to 28 V dc) for the SB-3614/TTs that are allocated to field units, to facilitate shore-based operations over an extended period of time (24 hours or more) without continuously running a vehicle for vehicular power.

3. Utilize the AN/TRC-97 vhf and hf radios as well as wire lines to accomplish internodal trunking between automatic switches.

4. SB-3614/TT — BLUE RIDGE

   a. Modify the AN/VCC-2 for 8-channel operation.

   b. Expand 12 phones to about 24.

   c. Provide solid-state fixed 28 V dc power supply.

   d. Extend multiplex AN/MRC-135 investigation with 1st MARDIV.

   e. Expand ship-shore investigations to include hf.

   f. Modify the AN/VCC-2 to include a receiver signal strength meter and use VSWR on the transmit leg of the AN/VCC-2.

   g. Develop necessary procedures to assure optimized alignment of AN/VCC-2 equipments.

5. AN/MRC-135

   a. Modify the AN/MRC-135 for 8-channel operation.

   b. Same as f and g of recommendation 4.

   c. Develop "How to do it" manual for using the AN/MRC-135, AN/TSQ-84, AN/TTC-38, and SB-3614.

6. Equip one additional amphibious ship with the SB-3614 for use in WESTPAC where AN/TTC-38s and SB-3614s are to be used on shore.

APPENDIX A: RESULTS OF CAMP PENDLETON SB-3614/TT, AN/TTC-38, AND AN/MRC-135 EXPERIMENTS OF 25-26 SEPTEMBER 1978

by
S Sgt D Smeltzer, USMC, MCDEC-C[3]

TEST 1

Purpose

Determine the interoperability of the SB-3614 and the AN/TTC-38.

Associated Equipments

Automatic Telephone Central Office AN/TTC-38(V)1 — Qty 1
Telephone Switchboard SB-3614/TT — Qty 1
Telephone Set TA-838/TT — Qty 2
Wire WD-1/TT( )

Test Description

On Monday, 25 September 1978, a test was conducted at 1st MARDIV concerning interfacing the TTC-38 with the SB-3614. Initial results indicated this system to be very successful with numerous added capabilities.

The first test conducted was a back-to-back wire line connection between a 3614 switchboard and a TTC-38 central office. On the SB-3614 end, two local subscribers were given service for test purposes. A 4-wire tone signalling PABX trunk was utilized from the SB-3614 to the TTC-38. At first the SB-3614 was checked in all operational capabilities and proved to be all OK.

In the first attempt made to access the TTC-38 system utilizing the PABX 4-wire tone signalling trunk, the attempt was successful. The TTC-38 recognized seize tone and returned dial tone according to specifications. Upon receiving dial tone the subscriber then keyed the desired phone number and was connected to the called party without operator assistance. Further attempts were made with the same results. Also the operator was asked to extend a call, and there were no problems at all. All capabilities of both switches can be utilized with no shortcomings.

Summary

The TTC-38 and the SB-3614 proved to be interoperable with many enhancing features. This test proved that the TTC-38 and the SB-3614 can effectively provide automatic telecommunications in an adverse situation.

TEST 2

Purpose

Determine if the SB-3614 can effectively signal and provide a voice path utilizing multichannel radio as the transmission medium.

Test Results (Summary)

On 26 September 1978 a series of tests were conducted at 1st MARDIV, Camp Pendleton, concerning multichannel radios as the transmission media for the automatic switching systems utilized by the USMC. An MRC-135 was used for these tests. The first test consisted of an SB-3614 connected to an MRC-135 on channel 1. The radio was in 4-wire mode for all these tests. The radio after being checked out in all modes of operation proved to have good communications. The distance was approximately 1/2 mile LOS. A few problem areas still existed in antenna location and radio wave propagation. Upon establishing satisfactory communications, an attempt was made to signal the TTC-38 by utilizing a 4-wire tone signalling trunk from the SB-3614. The attempt was successful. Dial tone was returned from the TTC-38 and service was provided. This test proved that it does work, and the test personnel were ready to test this system from a greater distance, where LOS would not be possible. After the radios were again checked in all modes of operation, we were ready to signal the TTC-38 from the SB-3614. The site was located approximately 6-1/2 miles distant from the MRC-135. Between the two MRC-135 radios were several mountain peaks, which meant no LOS. An attempt was made to signal the distant TTC-38. It was successful. A few problesm were encountered when MRC-135s were substituted for the already operating MRC-135 radios, but they were quickly rectified. Also antenna siting should be closely scrutinized for best and proper results.

Conference capabilities were utilized in these tests in conjunction with both switches. A conference was initiated at the SB-3614, with all existing subscribers in that local switch involved in the conference. A trunk was seized to the TTC-38 and the operator signalled. The operator of the TTC-38 then added eight more conferees from his switch to the already existing conference. This was done by using the trunk from the SB-3614 to the TTC-38. A preprogrammed conference was tested from the TTC-38 to the SB-3614, with some of the conferees located in the local area of the SB-3614. Without operator assistance, the TTC-38 signalled the subscribers in the SB-3614 via the trunk connecting the two.

An interesting development was the utilization of standard jeep batteries as the power source for the SB-3614. The batteries proved to be well suited for the power source. The jeep was not running during these tests. At one time though, the jeep was started when the SB-3614 was operating. There was no effect on the operation of the switch. All totalled, the tests provided approximately 2-1/2 hours of solid operation utilizing the multichannel radios.

APPENDIX B: INSTALLATION AND TESTING OF THE SB-3614/TT ABOARD USS BLUE RIDGE

by
S Sgt Goulet, USMC, MWCS 18

The SB-3614 switchboard was installed aboard USS BLUE RIDGE for automatic call processing capabilities. Telephones from the switchboard were installed in the ship's SYSCON (Marine Det), Military Operations, Landing Force Command, and the techshop. The switchboard was installed near the vhf techshop aboard ship. A commercial power supply was used to change the ship's power from 110 V ac 60 Hz to 28 V dc required by the switchboard. After the switchboard and telephones were tested, four PABX type trunks were installed and connected to the TH-85 of an MRC-135.

Communications were established over the MRC-135. With the MRC-135 shot working, an AN/TTC-38 and an AN/TSQ-84 at MCAS Futema were added to the MRC-135 shot. The AN/TSQ-84 conditioned the lines by amplifying and attenuating as necessary until parameters for both switchboards were met.

With parameters established, calls were made to the BLUE RIDGE from Futema. No problems were encountered. Calls were then placed from the BLUE RIDGE to MCAS Futema. Again, no problems were encountered.

Next a preset conference call was tried with two parties aboard USS BLUE RIDGE and three parties at MCAS Futema, with the call originating at MCAS Futema. The conference call was established with no problems.

Next tried was a progressive conference call originating aboard USS BLUE RIDGE. Three parties at MCAS Futema were added on, and a party aboard the BLUE RIDGE was added on as the last conferee. Again, no problems were encountered.

Finally, a call was made from the BLUE RIDGE to the AN/TTC-38 operator at Futema, where the AN/TTC-38 operator extended the call on a commercial line to the ASST CEO of III MAF. Again the call was completed with no problems.

APPENDIX C: AN/TTC-38 — AN/PRC-77 RWI EXPERIMENT OF 15 OCTOBER 1978

by
Gy Sgt R Cappadona, USMC, 1st MAW, MWCS 18

Purpose

Interface a field radio with the AN/TTC-38, using VOX equipment (AN/FTA-28).

Test Results

On 8 October 1978 an AN/PRC-77 field radio was directly linked to a line circuit on the AN/TTC-38 at MWCS 18, 1st MAW. This enabled the field radioman to receive calls and place calls directly through the AN/TTC-38. An AN/FTA-28 was used as a VOX interface device between the AN/TTC-38 and the local AN/PRC-77. The AN/TTC-38 was programmed for SF signaling into the AN/FTA-28 and SF signaling from the AN/FTA-28 to the AN/PRC-77. The wiring on the AN/FTA-28 to the AN/PRC-77/GRA-39 was through a modified connector plug, as shown in figure C1.

The first test runs showed a workable circuit, but the VOX keyer was too sensitive to background noise and signaling was weak.

For the second test run, amplifiers and attenuators could not hold the VOX unit in the circuit because of excessive amplifier feedback.

For the third test run a set of VE-5 delay equalizers was used to selectively filter the SF signaling on the transmit side. This test proved successful, with the distant AN/PRC-77 operator receiving a double burst of SF to signal an incoming call. An outgoing call is initiated by the distant AN/PRC-77 operator "tone whistling" to trip the incoming ring circuit of the AN/TTC-38, giving access to the switchboard operator. "Tone whistling" may be accomplished by a small handheld "tuned" whistle capable of 1600 Hz. Figure C2 shows the final equipment layout.

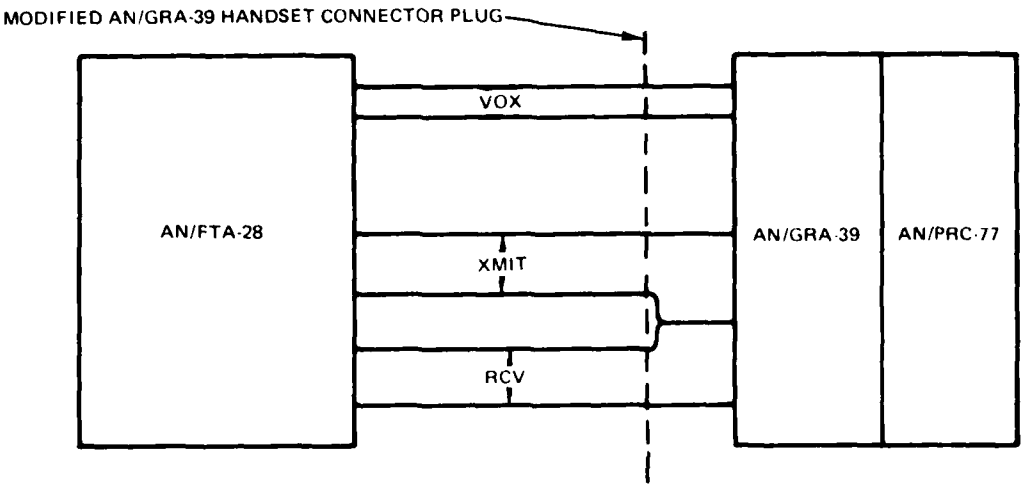


Figure C1. Wiring between AN/FTA-28 and AN/PRC-77/GRA-39.

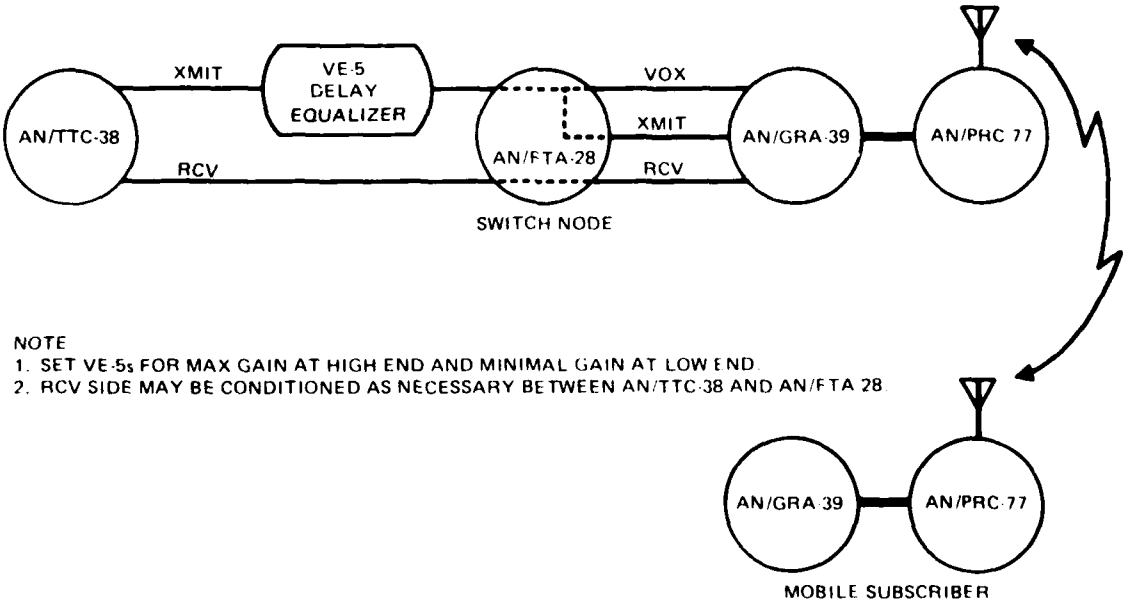


Figure C2. Net radio interface experiment.

APPENDIX D: ROLE OF TECH CONTROLLER IN EFFECTIVELY INTEGRATING AN/TTC-38, AN/TSQ-84, AND RADIO RESOURCES

by
Gy Sgt R Cappadona, USMC, 1st MAW, MWCS 18

Background

During the recent MAFLEX 1-78 at MWCS 18 a new concept in equipment planning and circuit routing was established. This involved the recently acquired AN/TSQ-84 technical control facility. A smooth and efficient form of communications control was developed in which the TSQ-84 was used as a center of planning and control. The following is a brief on the planning and execution of the operation.

Planning Phase

The tech controller receives all planning information regarding multichannel, radio, telephone, and TTY circuits. Every rf and af circuit will pass through his facility, so all information on activation, restoration, and users must be supplied. The AN/TTC-38 supervisor/technician supplies a listing of interconnecting cables and the type of terminal programming for each. This is NOT by circuit, only by cable, as follows:

Signal 1A — 4-wire DTMF
Signal 4F — SF signaling
Signal 3B — 20 Hz
Signal 2A — 2-wire DTMF

The tech controller then proceeds to draw his cable routing plan and build his cable record sheets (cut sheets) using the telephone directory and the communications plan developed by the CEO. Particular attention is paid to the multichannel and single-channel radio circuits. Generally a cable is mixed with radio and telephone circuits. Telephone circuits are planned as normal-through patching on the AN/TSQ-84, with the radio circuits patched as required. (See exhibit D1.) Hf radio circuits are always kept on a separate cable, with no intermixing of telephone circuits caused by hf override from pair to pair. Hf will not override from cable to cable, only from pair to pair within one cable.

With his cable records complete, the tech controller gives the AN/TTC-38 supervisor/technician a copy of his interconnecting cutsheets so that the AN/TTC-38 programming may be done to facilitate the normal-through patching of the AN/TSQ-84.

Circuit Initiation

With the wire chief's help, the tech controller assigns personnel to install cables, phones, and remotes as his cable records require. No installation is authorized without the tech controller's knowledge. The tech controller has access to all major comm sites by the use of his manned hot-lines. These enable him to direct circuit activation and equipment installation.

SIG 45
TACC OPS

PR	XC	SUBSCRIBER	TERMINAL	CKT NO
1				
2	N.T.	TACC OPS	2-wire 938	7348 308
3				
4	N.T.	Brief tent	2-wire 938	7348 359
5				
6	N.T.	Hdqtrs	2-wire 938	7348 317
7				
8	N.T.	MAG-36 C.O.	2-wire 938	7348 311
9				
10	N.T.	MAG-36 S-1	2-wire 938	7348 301
11				
12				
13				
14				
15				
16				
17	49-17	Rcv DIV to MAW	TTY 100 WPM	BBAI
18	48-18	Xmit FDUX	TTY 100 WPM	
19				
20	72-16	L.F. TAC-1 (P)	(W-71)	
21	72-17	L.F. TAC-1 (S)	(W-72)	
22	72-18	Comm coord net	(W-73)	
23				
24	SB-22	Tech control hut		
25		to TACC		
26				

Exhibit D1. Interconnection cut-sheet.

GLOSSARY

AN/FTA-28 — Telephone Terminal

AN/GRA-39 — Radio Set Control Group

AN/MRC-135 — Radio Terminal Set

AN/PRC-75 — Radio Set

AN/PRC-77 — Radio Set

AN/TRC-97 — Radio Set

AN/TSC-15 — Radio Teletypewriter Set

AN/TSQ-84 — Communication Technical Control Center

AN/TTC-38 — Automatic Telephone Central Office

AN/VCC-2 — Telegraph-Telephone Terminal Set

ASRT — Air support radar team

C^3 — Command, control, and communications

CEO — Communications Electronics Officer

CG — Commanding general

COMM BN — Communications battalion

DASC - Direct air support center

DC - Dial central office

Div - Division

DTMF - Dual-tone multifrequency

EOW - Engineering order wire

FDUX - Full duplex

FSSG - Force service support group

LCC - Amphibious command ship

LOS - Line of sight

MAF — Marine amphibious force

MAFLEX – Marine amphibious force landing exercise

MAG – Marine air group

MARDIV – Marine division

MASS – Marine air support squadron

MAW – Marine aircraft wing

MCDEC – Marine Corps Development and Education Command

MWCS – Marine wing communication squadron

NTS – Naval Telecommunication System

PABX – Private automatic branch exchange

RWI – Radio-wire integration

SAC – Strategic Air Command

SB-3614/TT – Manual Telephone Switchboard

SF – Single frequency

SYSCON – Systems control

TA-838 – Telephone Set

TACC – Tactical air command center

TAOC – Tactical air operations center

TAS – Tactical automatic switch

TH-85/GCC – Telegraph-Telephone Terminal

TRITAC – US Joint Tactical Communications Program

TTY – Teletypewriter

VOX – Voice operated transmitter keyer

WD-1/TT – Wire

WD-1A/TT – Telephone cable

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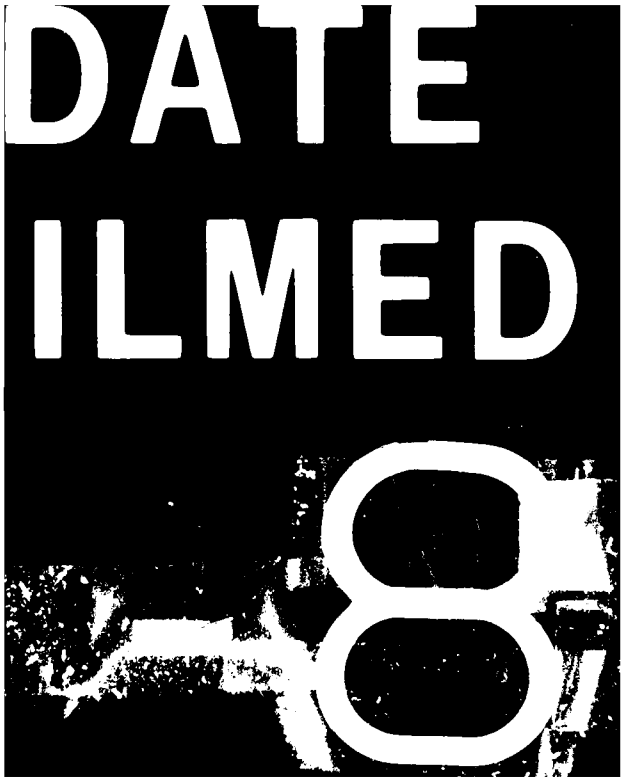
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